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Advertising Representative: **Connie Goon**, Advertising Sales Coordinator, Tel: (212) 686-7188
Fax:(212) 686-7414 (Display and Classified Advertising)

Editorial Correspondence Only: analog@dellmagazines.com

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Reader's Department: **EDITORIAL: WILD GOOSE CHASE** by Stanley Schmidt

In the middle of January, much of the country was captivated by one of the most striking true tales of genuine heroism in recent memory. A US Airways jetliner, just after taking off from New York City's LaGuardia airport, flew into a flock of Canada geese. Its engines "ingested" a couple of them, died, and the pilot suddenly had a very short deadline to decide where to take the plane down with minimal control. He quickly and wisely decided that an attempt to make any airport would be disastrous not only for the plane and its occupants, but for the dense concentration of people and buildings along any possible approach path. So he instead took the one reasonable course and ditched in the Hudson River just off midtown Manhattan. Thanks to his quick thinking, skill, and the smoothly coordinated efforts of a whole bunch of flight crewmembers and rescue workers, everyone on board got out alive and relatively unscathed.

Two days later, the tabloid *New York Post* devoted several pages to feature stories and editorials about the incident. Some of them praised the aforementioned heroism, but that's not where the main emphasis was. The tone was set by a full-front-page photo of a Canada goose in flight, with a gun's crosshairs centered on its breast and the 126-point headline, "**PLUCK 'EM!"** A subhead exhorted, **"Kill the geese before they down** *another* **NY jet."** And a smaller teaser elaborated, "Shoot 'em! Poke holes in their eggs! Wreck their nests! Do whatever it takes to stop the geese that threaten our airliners. If nothing's done, we could see another catastrophe like the one that downed a US Airways jet in the Hudson, experts say."

Well, yes, we could, and probably will—though not often—no matter what's done to control the geese. And things can be done, should be done, and are being done—but they'll never be completely effective and it's unrealistic to expect them to be. Admittedly the experts quoted inside (*one* expert, actually, a wildlife biologist formerly employed by the New York Port Authority) were considerably more moderate and reasonable in tone, though they (he) did in fact advocate use of all the measures mentioned in that teaser.

But I couldn't help wondering, in view of the prevailing tone of this coverage, just how far would the writers like to go with "doing whatever it takes," if they could. How far *could* we go, using technology we already have or might believably develop? How far *should* we go?

My impression (and admittedly this requires some reading between the lines, in which I may be mistaken) was that they would like to go as far as possible, with no consideration for anything except saving every possible human life. The editorial started out, "It's time to kill the geese," though it then qualifies that with, "It's especially time to kill those geese most likely to wreck another jet..." It also hedged by granting that the cause of the incident had not yet been officially determined, but then added, "Nobody doubts that the guilty birds were Canada geese."

"Guilty?" Guilty of what? Such phrasing makes it sound as if the geese mounted a malicious and premeditated attack on the airplane. Let's see, now ... Who flew what into whom, at a speed not naturally attained by anything living on this planet?

No doubt it's now time for the obligatory disclaimer for those readers who are about to sharpen their pens and keyboards and tear into me for sentimentally defending the geese and advocating that nothing should be done about them because they're so cute. That's not even remotely what I'm doing; if you think it is, please start over because you're missing the point. This has nothing to do with sentimentality or cuteness, and I'm not advocating doing nothing about the geese. I'm all too aware that they can be serious pests in the wrong places; I don't like them frequenting the same beaches I do, and I especially don't want too many of them around airports that I use (and I do expect to use LaGuardia at least once

this year).

Geese aren't even my main subject here. They're just an illustration that happens to be in the public eye at the time I'm writing, of some more general human foibles.

Specifically, what I *am* doing is taking a critical look at:

The sheer bloodthirstiness and anthropocentricity of the *Post*'s apparent attitude toward the problem;

The common human tendency to think that we must strive for absolute safety in all things; and

The common human tendency to think that we have any realistic hope of achieving absolute safety in anything.

I think my few quotes so far amply demonstrate my point 1 about attitude. Far be it from me to suggest that all people share these attitudes. The one expert the paper quotes explicitly acknowledges that measures like shooting geese and addling their eggs are unpopular in some circles (sometimes for reasons that *are* at least partly sentimental). But the sales figures and ubiquity of this paper and similar tabloids in New York area stores suggest that their editorial views are at least widely accepted.

Points 2 and 3 are so bound up in each other that it's hard to consider them separately. We hear the phrase “If it saves even one human life...” so often it has become a cliché, often used to justify extreme precautions and punitive measures. (I recently saw a news story about two boys being thrown out of their school for having knives on the premises. I gather that this sort of thing is now done regularly and widely, and with no consideration of what kind of knife is involved or what anybody does with it. Under this kind of regime, I could have been thrown out of school at almost any time; once past the age of eight or nine, I *always* carried a pocket knife. I seldom took it out and never even remotely thought of it as a weapon. It was just a tool, which I could and did use safely in a wide range of everyday situations. But to today's administrative fanatics, I would have been a horrible juvenile delinquent.) We also hear the phrase, “We can't stop until we've made absolutely safe."

Well, I have news for people who say that. *Nothing* is absolutely safe, but we can drive ourselves and everybody around us crazy trying to make it so. It's certainly a good idea, in any endeavor, to do what we reasonably can to minimize risks. But the key word there is “reasonably.” In the real world, anything we do will involve some risk, and we must learn to accept and live with that. Even staying in bed all day, in a house built like a fortress, does not guarantee absolute safety. The house could be struck by a meteorite—it's not likely, but it could happen. Build an even stronger house? Okay; then you're safe unless a bigger meteorite comes along—even less likely, but still not impossible. If you want your life to include anything except guarding against every conceivable danger, at some point you have to decide how much of your resources you're willing to invest in protection against improbable threats, do that much, and then stop worrying about the remaining risks and get on with your life. Putting everything into a quest for absolute safety is a wild goose chase in the best figurative sense of the phrase.

In the case of the literal geese with which I opened these musings, my subjective impression was that the *Post* writers would ideally like to get rid of *all* the geese, everywhere, and only grudgingly recognized that they might have to settle for increasing, or at least continuing, the ongoing efforts to control goose populations on and around airports. After all, even if you drive off or kill all the geese living there now, it won't be long before more move in from elsewhere.

As long as there are geese. But what if there were *no* geese?

Getting completely rid of the “feathered fiends” (a phrase actually used in the *Post*) would seem to be the only thing that would really satisfy these writers. It still wouldn't guarantee absolute safety, of course.

With the geese gone, we'd still have to worry about pigeons, gulls, coyotes, and other mindlessly malicious menaces.

Well, what if we could get rid of those, too?

At first glance, it might seem that the goal is too ambitious to be achievable—but is it really? Passenger pigeons, not much more than a century ago, were reportedly so numerous that their passing flocks darkened the sky for days on end—yet human hunters took only a few decades to exterminate them. Theirs is only one story among many.

And now we are beginning to acquire new methods that could make it even easier to get rid of species that humans find inconvenient. Engineered pathogens might well be developed to target a particular species and spread effectively enough to wipe it out without directly bothering anything else.

Indirectly, of course, is another matter. An ecosystem is a massive, complex, interlocking system of linked physical and chemical feedback loops. Arbitrarily eliminating any part of it, such as a species of plant or animal, can disrupt a cascade of those loops, making the whole system collapse, with disastrous results for all parts of it (including us). For this reason, we sometimes hear that every species is essential and we don't dare let anything go extinct. It's a nice thought, but not necessarily true. Some species (like mosquitoes in the Arctic, which are fundamental to just about everything larger) are functionally much more important than others to the whole. Some species *could* be eliminated (and many have been, throughout evolutionary history) without causing universal catastrophe. Even species that were important have disappeared, and the disrupted balance merely readjusted itself into a new one (until the next such event).

It's even possible to imagine humans getting rid of *all* other species and carrying on by themselves. They would still need something to carry out the many energy-related functions of a biological ecosystem, which means they would in effect have to create an artificial "ecosystem" which might or might not involve engineered biological organisms. It would be an enormous undertaking, and no civilization now on Earth has anywhere near the technical skills or ecological understanding that would be needed to carry it out. But in principle, it's possible.

In my novels *The Sins of the Fathers* and *Lifeboat Earth*, I imagined a very old, very advanced civilization that had done exactly that. When circumstances brought them to Earth and for the first time they saw a wild profusion of other life forms, they were fascinated and overwhelmed. At least a few of them managed to feel at least a hint of regret at what their ancestors had thrown away.

Personally, I don't want to be one of those ancestors. I would rather continue to enjoy sharing this planet with a rich variety of other life, even if doing so means accepting a tiny bit of risk that could conceivably be reduced still further. In the particular case of the geese that started all this, I do want the Port Authority to continue making reasonable efforts to keep their numbers down near airports. But when I board a plane, I will know and accept the slight risk of a lethal encounter with them. I'm not interested in giving up everything else for a wild goose chase after absolute safety in all things.

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Reader's Department: **IN TIMES TO COME**

People often wish they could keep their youth forever, but what if they really could, in an extreme way? And what if somebody else makes that decision for them, to keep the physical and mental advantages of a child while gaining some of the best features of adulthood? That's what happens in “Evergreen,” Shane Tourtellotte's lead novelette in our September issue. And, as so often happens, the ramifications of a choice that sounds simple are far more complex and less clear-cut than those who make it—or those for whom it is made—might imagine or wish....

We'll also have fiction by Alec Nevala-Lee and Eric James Stone, plus the thoroughly engaging conclusion of Barry B. Longyear's *Turning the Grain*.

Richard A. Lovett supplies the science fact article, “From Atlantis to Canoe-Eating Trees: Geomythology Comes of Age.” Ideally science relies on careful observation, measurement, and (whenever possible) controlled experiments. But at the scales of prehistory, planetology, and astronomy, some of the most interesting phenomena are out of reach for direct observation and experiment, yet strongly hinted at by folklore and ancient writings. By themselves, those are not science—but they can suggest the existence of events for which evidence can then be found and tested by thoroughly scientific methods....

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Reader's Department: **ANALYTICAL LABORATORY RESULTS**

It's time again to thank everyone who voted in our annual poll on the previous year's issues. Your votes help your favorite writers and artists by rewarding them directly and concretely for outstanding work. They help you by giving us a better feel for what you like and don't like—which helps us know what to give you in the future.

We have five categories: novellas, novelettes, short stories, fact articles, and covers. In each category, we asked you to list your three favorite items, in descending order of preference. Each first place vote counts as three points, second place two, and third place one. The total number of points for each item is divided by the maximum it could have received (if everyone had ranked it 1) and multiplied by 10. The result is the score listed below, on a scale of 0 (nobody voted for it) to 10 (everybody ranked it first). In practice, scores run lower in categories with many entries than in those with only a few. For comparison, the number in parentheses at the head of each category is the score every item would have received had all been equally popular.

* * * *

NOVELLAS (5.00)

1. “Tenbrook of Mars,” Dean McLaughlin (5.65)

2. “The Spacetime Pool,” Catherine Asaro (5.17)

3. “Brittney's Labyrinth,” Richard A. Lovett (4.56)

4. “Test Signals,” David Bartell (3.06)

* * * *

NOVELETTES (0.83)

1. “The Man in the Mirror,” Geoffrey A. Landis (1.91)

2. “The Night of the RFIDs,” Edward M. Lerner (1.63)

3. “The Purloined Labradoodle,” Barry B. Longyear (1.56)

4. “Moby Digital,” Joe Schembrie (1.42)

5. “The Late Sam Boone,” Bud Sparhawk (1.35)

* * * *

SHORT STORIES (0.59)

1. “Starship Down,” Tracy Canfield (2.01)

2. “Invasion of the Pattern Snatchers,” David W. Goldman (1.60)

3. “Let the Word Take Me,” Juliette Wade (1.25)

4. “Forever Mommy,” David Grace 1.18)

5. “A New Generation,” Jerry Oltion (1.11)

* * * *

FACT ARTICLES (2.00)

1. “The World's Simplest Fusion Reactor Revisited,” Tom Ligon (2.68)

2. “The 3D Trainwreck,” Thomas A. Easton (2.54)

3 (tie). “The Challenge of the Anthropic Universe,” Carl Frederick (2.46)

"Nuclear Autumn,” Richard A. Lovett (2.46)

4. “Here There Be Dragons,” Richard A. Lovett (1.74)

* * * *

COVER (2.00)

1. April, by Scott Grimando (3.55)

2. July/August, by Bob Eggleton (2.25)

3. December, by David A. Hardy (2.17)

4. September, by David B. Mattingly (1.96)

5 (tie). January/February, by David A. Hardy (1.88)

March (for “The Spacetime Pool"), by George Krauter (1.88)

* * * *

All categories had clear winners, but competition near the top was generally tighter than it sometimes is. The most dramatic win was the cover by Scott Grimando, an artist new to us but from whom we'll hope to see more. Contrary to the popular mythology about the importance of “Big Names,” *Analog* readers have always been quick to welcome newcomers with conspicuous talent, and one of the best demonstrations is in this year's short story category, where the top three spots all went to authors whose first stories here (and possibly anywhere) appeared in the last year or two.

Since Anlab votes are so important to encouraging authors and artists to do their best work, and to giving you the kind of magazine you most like to read, we hope to get even more next time. Use our online ballot, e-mail, or “snail mail,” whichever you prefer, but please vote! (Please be careful to vote in the right category, as listed in the annual Index. Sometimes a few votes are wasted by being cast in the wrong category, and those simply can't be counted.)

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Novella: **SEED OF REVOLUTION** by Daniel Hatch

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Illustrated by John Allemand

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Epochal changes are usually scary and seldom go according to plan—especially when they involve a whole new kind of thinking.

* * * *

Professor Glenn: Your assertion that the chamalian race is driven to destruction by forces it cannot control and the xenophobic texts you cite-link in its defense smack of nothing more than rank Social Darwinism. You claim that biology is destiny and that history is written in our genes. Those ideas are the reified prejudices of the closeted academic—the mindless worship of idols, idols made of outdated rationalizations.

The truth is that chamalians are self-conscious actors—as are human beings—and they will be the authors of their own history. They will do what all self-conscious beings do—struggle with the circumstances in which they find themselves, with what knowledge they have available, in order to chart their own course, wherever it may lie. They will make their own destinies.

As will we all. (With the exception of some deterministic elitist academics who need to extract one of their extremities from another.)

The text continued with a series of cite-links to relevant texts, a list that included Spinoza, Mill, Fromm, and Lukacs. It ended with the standard signature: David Wu, History Department, War College of Kar-Kar-a-Mesh, Chamal.

Pog reached out a long finger covered with fine white fur and ending in a rounded yellow nail and pressed the pad that sent the message on its way.

Oh, if Dr. Wu knew what he was up to, he would be in big trouble. Double-big trouble, for certain fact.

* * * *

But Dr. Wu did not know.

At the moment, Dr. Wu was sprawled across the divan in the bungalow's front room. His body had assumed an almost spherical shape, matched by his head, which was smooth and hairless except for a long, drooping mustache and a patch of dark hair at the crown. His snoring had stopped, but earlier in the evening it had rattled the timbers above. Dr. Wu never had gotten used to Chamal's eighteen-hour day and tended to come loose from its diurnal tyranny.

In addition, he was prone to experimenting with the various alkaloid concoctions that chamalians found stimulating, intoxicating, or hallucinogenic—experiments that often left him in this posture. Often for many hours.

Nevertheless, Pog quickly cleared the screen of Dr. Wu's mindpad and returned to his regular duties. He rushed around the room, gathering up the doctor's scattered clothes, which he threw into the hamper. He collected the pots and cups and glasses that had accumulated beside the divan and across the nearby table, holding some of them at arm's length as he dumped their contents down the drain in the kitchen.

Dr. Wu was not on the faculty of the War College, but worked for the University, a much newer institution created by the angels and chamalians who worked with them.

From time to time, Dr. Wu would refer to Pog as his “native house boy,” but they both knew that their relationship was something entirely different. Dr. Wu was an angel, not of this world. He had come from the stars to study Chamal and report to the other angels on their world. His studies were much too important for him to waste time trying to manage the details of ordinary life on an alien world—especially one as alien as Chamal. Pog's mother before him, and now Pog himself, had the unique honor of managing Dr. Wu's household and acting as go-between with the world outside its gates.

It was not employment. This was no wage work. Pog and his mother were agents of the War College and honored for their service.

Though there were times when Pog would rather forgo the honor.

Dr. Wu was not an easy creature to live with—and Pog had lived his entire life in this household, so he should know—for certain fact. He could be stubborn, demanding, unreasonable, unyielding, and inflexible. He was no angel.

But he was quick to transform himself into exactly the opposite. He could be solicitous, gracious, nimble in thought and deed, and generous. He was a man.

Few on Chamal knew what that meant. But Pog had learned.

Dr. Wu lived a rich life of the mind—always questioning, always searching, always investigating. His questions probed deep into all that Pog knew about his own world and how he knew it and why he thought it was so and what if it wasn't. And he was always talking, lecturing, deliberating, pontificating—even if no one was listening.

Though most often someone was listening. Pog listened. And he learned. Learned well. Learned much. Perhaps too much.

Certainly too much for the few duties that kept him busy around the house.

He hurried out to the kitchen and found the broom, then began sweeping the dust and dried leaves out the door. He cleaned up the counters and wiped down the food processor—a special piece of angeltech with ceramic containers that produced the odd substances and liquids that Dr. Wu cooked up on smooth stone surfaces that turned hot on command. He washed out the cookware, keeping the more toxic-smelling compounds at arm's length and dousing them with a blast of steaming hot water from the hose in the sink.

In the office, he gathered up a scattering of chamalian books and reports and letters, sorted them roughly, and piled them on the desk. He looked wistfully at the mindpad, but resisted the impulse to check for a reply from Professor Glenn. It was much too soon.

He wanted to provoke a response. The Earthman was arrogant and narrow minded, but he argued well. It was far too easy in a textwar to draw intractable lines of dispute that ended all discussion. Glenn kept the conversation going despite his opposition, always responding to actual comments instead of imagined “straw men.” (Pog always laughed at that term, for which there was no precise equivalent in his own language.)

But lately, this thread had prompted purely emotional outbursts from the man. Outbursts that revealed much about the weaknesses of his argument. Another poster in the discussion had been goading him on, deliberately antagonizing him.

Pog wanted to see if he could do the same—but by pointing to texts that attacked the weakness of

Glenn's worldview, undermining the very context from which he argued.

He knew he shouldn't expect a reply until tomorrow, given the time it took to relay messages through the wormhole link to Earth, but he couldn't help the anticipation.

He did, however, take the time to return to the mindpad and quickly compose a love note to his sweetheart, Mally.

This night, as she had for many nights, Mally made her bed in a tent at an archaeological dig hundreds of leagues to the west of the Meshkar Sea—down in the lowlands, where the rainforest met the grasslands that led north to the world-girdling desert. It was there that the University was digging through the fossil record of chamalian evolution, seeking the source of all wisdom. She was part of a team led by Deldred, the chamalian field director, excavating the fossil remains of earlier chamalians.

They had found promising evidence of the earliest children of wisdom—hands that grasped and mouths that spoke. They were hoping to find skulls that had once contained minds that thought and reasoned and desired and sang.

Mally had grown up in the villa next to Dr. Wu's. She and Pog had grown up on opposite sides of a stone wall, speaking to each other through a crack at the far end of the yard, meeting only after years of separation, soul mates bound in a way that few chamalians could know.

The love note was long on poetry, lifted nearly intact from Shakespeare ("Shall I compare thee to a summer's day?") and Browning ("How do I love thee? Let me count the ways"), and written in English, which he had taught her, to keep it from the prying eyes of Deldred. And to be certain that she would know it was from him, he signed it with his secret nickname—Pogo.

He pushed the SEND button and the message went off on its way, coursing through the world-straddling information network built by the wizards in the high vastness of Kwikorak in the years since the angels had arrived.

He returned to his chores. He swept the floor in the office and moved on to the bedroom, where he piled Dr. Wu's dirty clothes onto the bed and wrapped them in the bedsheets. He carried the bundle through the kitchen and out the back door, crossing the dark courtyard to the laundry. A cool night wind blew through the trees in the corner of the yard and set the cardboard paddles on the luck-spinner flapping. The tall cylinder of colored panels squeaked on its axle as it turned, generating good fortune for all who believed in it. Few chamalians actually did believe in it, but they were all willing to pretend they did in front of their neighbors.

He dumped the clothes into a basket and was crossing the yard, his neck craned up to appreciate the handful of sharply twinkling stars overhead, when the world exploded with noise and fire.

* * * *

First came a barrage, BOOM! BOOM! BOOM! from the street in front of Dr. Wu's villa.

That was followed by the *whoosh-smack* of a dart-cannon's payload, cutting through the air and anything else in its path, ending against a solid wall or on the ground.

Then an assortment of ordinance flew into the house with a CRACK-CRACK-CRACK or flashed into eye-popping bright blue light.

He realized suddenly that if he'd been inside, he would have been dazzled by the lights and disoriented by the sounds and would never have been prepared for the assault that followed.

As it was, he had the presence of mind to start climbing the nearest tree, scrambling to find a purchase at first, then almost flying up the branches—as at that very same moment the team of assailants burst through the doors and windows of Dr. Wu's home.

A volley of loud shots—Pog recognized them as handguns—rang out, echoing off the neighboring houses and the cliffs that rose from the far side of the street. Pog's heart sank. Dr. Wu was still inside.

The squad spilled out into the courtyard below Pog's feet. There were five of them—mist-apes, with big pistols in their big hands.

From his perch, he could look over the top of the house, and what he saw made his hearts squeeze in fear.

A black steamwagon.

He realized with a halt that he'd heard its hissing and clanking engine in the moments before the attack. If he'd known what he was listening to, he would have flown into action. He didn't know what action, but it would have been something.

No one stood still when a black steamwagon full of assassins came your way. He could scarcely believe it himself. They were the stuff of fable and fiction—some of it his own. But they were real, and every time they struck, the stories raced from one end of the city to the other before lunchtime.

The mist-apes spilled across the yard, into the laundry and out again, just in time to meet their leader—a short fox with high pointy ears and long snout full of sharp teeth.

"He's not here," one of the mist-apes said.

"He was here," said another. "I can smell him. He's not long gone."

"That's bad," said the leader. "We don't get paid if he's not here."

"Should we wait?" asked a mist-ape.

"For what?" the leader asked. "The Public Vendetta?"

He turned and walked back into the house. The mist-apes looked at one another, then abruptly lurched into action, filing out behind him. Pog heard the steamwagon puff itself up, then whistle away down the street. From his vantage point, he watched it rumble and spit as it rolled down the road to where it curved away out of sight.

Then he waited another ten minutes to be sure they were really gone before climbing down the tree and venturing into the house.

There were splinters and shredded upholstery everywhere, all over the floors and walls and across the furniture. Pog treaded carefully across the room to the divan, dreading what he knew must await him.

In the yellow light of the angel-tech lamps, Pog could clearly see the bullet hole in Dr. Wu's chest. A drop of blood had trickled down across his pale skin, leaving a narrow trail.

His eyes were already closed, his body already in repose, his soul already fled. There was nothing more Pog could do to serve the only master he had ever known.

But there was much that he had to do and do quickly.

He rushed over to the mindpad, swept it up, and stuffed it into a rucksack he pulled from his own closet. He tossed in the few personal items he would need for the next few days. In the kitchen, he gathered some fruit and frogpies, wrapped them in marketpaper, and stuffed them in with the mindpad.

Then he returned to the courtyard and began climbing a tree. This one was closer to the wall, and midway up its branches grew entangled in those of a mate on the other side of the street. On the far side, the tree gave access to the cliff face itself.

Pog climbed the rocky wall, stepping from one rough block of basalt to another, higher and higher, until he reached a street above Dr. Wu's. He peered up and down the roadway, then hoisted himself up onto the pavement.

Then he began walking. Quickly. There was so much to do now, and so little time.

* * * *

Jonas Winston, visiting professor of genetics at the university of Kar-Kar-a-Mesh, was sleeping when the message came in. His AI evaluated it and sounded the gentle chime that woke him.

"Dr. Wu is dead," the AI said. "Violence was involved. They need your help."

Winston rubbed his eyes until he could open them enough to see and exercised his ankles until they were limber enough to walk on. He went first to the lavatory, squinting into the bright light that helped rouse him from lingering slumber, ignoring the old man's face that peered back at him from the mirror. It wasn't really his face. Not the one he'd been used to for a great many years. He had a hard time thinking of himself as any older, and wearing that disguise of age felt odd and unsettling.

He ordered a cup of coffee from the autochef, and when it was ready he made the call.

"What happened?" he asked when the duty officer on the *Cousteau*, Lieutenant Janet Cloud, responded.

Lieutenant Cloud was young and pretty but kept her hair pulled back tightly and kept her face stern and military. She reminded him of his granddaughter, who was about the same age. And like his granddaughter, she made him feel his years, something he vowed not to hold against her favor. "No one knows," she said. "His AI called it in. But there's something wrong with the unit, so it couldn't give a report."

"Who knows about it?"

"Just us, right now," she said. "There's been no activity to suggest that the chamalians are aware of it."

"We should let them know," Winston said.

"That's why we called you. The survey team would like you to handle it, since you're already in the city."

Winston felt his shoulders slump with the sudden weight of responsibility. He was senior scientist in Kar-Kar-a-Mesh and he would be the natural one to take on this duty.

"We need to know right away what happened," she said.

"Do you think the chamalians did it?"

"Did you do it?"

"No!" Winston said, his mouth hanging open in surprise. "Of course not."

"Then most of the remaining suspects are chamalians, aren't they?"

"I suppose so."

"So that means we have to tread very carefully," Lieutenant Cloud said.

"None are so aware of that as those of us who live down here on the ground," Winston said.

His back began to itch as his imagination rose to the occasion, offering up images of catastrophe. No, the crew up on the survey ship had no appreciation of just what kind of place Chamal was.

A race of creatures who could all interbreed. As a geneticist, Winston was enthralled by the whimsical way in which the chamalian genetic code proved its versatility and universality. Every warm-blooded furry creature on the planet shared the gene pool—from the mice in the woodwork to the great beasts in the forest.

And intelligence took every form and shape that nature offered. As a neighbor, Winston was always fearful of what that intelligence might do.

When the first survey team arrived, they had found a whole gamut of creatures capable of industrial production, technological innovation, scientific inquiry, and political intrigue—all at each other's throats in a rising war of all against all, the competition of nature raised to the level of Armageddon. That arrival had put an end to the war, but the tensions still remained, many years later. Perhaps they would never go away.

The chamalians at first considered the visitors from human space to be angels, messengers from a god that had turned his back on the race shortly after its creation. A race of purebreds, whose children were untouched by the curse of Chamal's inbred heritage.

What worried Winston most was that the only thing that held them at bay was the moral force of the survey team itself—as weak and unreliable a thing as he could imagine. That and the fear that the humans would destroy their race if it ever appeared that they presented a threat.

And now they'd killed an angel.

* * * *

Pog was stopped three times before he got downtown.

The street above Dr. Wu's villa was just another notch cut into the face of the cliffs that rose steeply up from the Meshkar Sea, much like the one below it, with houses and villas jutting out to overlook the city and the water on one side and an uneven wall of gray and brown stone blocks. At the townward end it was blocked by a sturdy gate, closed at dark. Kar-Kar-a-Mesh worked hard to earn its reputation as the City of Locked Doors. The door to the gate was manned by two sturdy, if not overly wise, badgers with bristly silver fur, straw hats, and military-issue blunderbusses strapped to their shoulders. They each wore the medallions of war veterans—the white stripes in their fur marked them as old enough to have earned them—and members of the neighborhood watch.

They challenged him.

"What's your name, pilgrim?" asked the larger of the two doorguards.

"Pog. Pogopurkaptic."

"Is he on the list?" the guard asked.

"Do you want me to look it up?" said the other. "It's not like he's coming in. He's just leaving."

"Everyone gets checked. And written down. It's the committee's rule. The admiralty's rule too. For all we know, he could be the Scarlet Starflower."

"Don't bother," Pog said. "I'm on the other list."

"The other list?"

"The list of those who may pass through any gate," Pog said.

"Is there such a list?"

"Ask your captain," Pog said.

"And what puts you on that list?" the larger guard asked.

"I'm the servant of the angel Wu."

"Are you now?"

"This is the medallion of the War College," Pog said. "You can see for yourself."

The guard examined the medallion while his shorter companion shifted uneasily from one foot to the other. He looked at Pog with his head tilted, then said: "Don't you belong down on Commodore Keln's Lane?"

"It's a long story," Pog said. "You haven't seen a black steamwagon tonight, have you?"

"Ha! Course not," the guard said gruffly.

"But we heard the shots," his companion said. "And the explosions."

"Didn't hear anything," the guard said. "We didn't hear a thing."

They opened the door and let Pog through, writing his name in their book.

The names would go onto lists at the end of the watch. The lists would be transmitted to the Committee on Public Movement, along with lists from all the gates on all the streets of the city. The committee would keep the lists for all those who might need to see them.

Of course, there were always ways to keep your name off the lists. The fees were sufficient to maintain the neighborhood watch—and then some. Often that only meant your name went onto another list, with higher fees to remove it. Usually, the lists were never seen by any creatures wise or wild. But they were always there.

Black steamwagons, however, were never listed. Guards opened their gates and hid behind them when they passed. They kept their own lists—for their own eyes.

Pog walked on down to the avenue and sat down on a low wall. Every minute or two, a car would come down the avenue from the canyon and slow as it made the curve into the city, some hissing steam, others humming with electric axles, and one reeking of burning alcohol. He pulled the mindpad out of his rucksack and tabbed on the e-mail.

To: University Archeological Expedition, Pog typed.

From: Dr. Wu, he added with a shiver. Dearest Mally: It is urgent that you return to Kar-Kar-a-Mesh immediately. Use quickest possible transportation. Tell no one else about this message.

He pushed the SEND button and sighed. He wished Mally were here already. He needed someone to talk to, someone who would help him understand what was happening, and she was the only one he could trust completely.

It would take several days for them to reach Kar-Kar-a-Mesh. A long drive would bring them to the railhead in the rainforest. And that would be followed by at least three separate train rides, the last up the steep slopes that led to the high inland sea. It had been a month since Pog had seen Mally last, since he had held her hand and smelled her perfume.

But there was no time for those thoughts now.

He put away the mindpad and headed down the avenue toward the waterfront, where he was stopped for the second time.

The gate to the Old City was still open to vehicle traffic, but there was a line backed up on the sidewalk of pedestrians passing through the walker's entrance. The queue offered a random sample of the varied wildlife-turned-wise that inhabited the high Meshkar littoral—martens and fishers, badgers and hounds, nightcats and treebats, cave bears and mist-apes, all flapping their mouths as if they had something to say.

Pog kept his head down, showed the gateguard his medallion, and passed on through.

A few blocks into the maze of hotels, shops, taverns, fishhouses, and inns, he was stopped for the third time.

"Revkat, Committee of Purity of Thought," said the dark creature in the dark coat, his dark eyes covered by the brim of a wide felt hat. Behind him, a trio of ferret-faced toughs sneered, but said nothing.

"Greetings, citizen," Revkat said. "As you know, an exchange-based economy depends on the support of educated citizens who understand how it works. It is our commission to ensure that all citizens of Kar-Kar-a-Mesh participate in their economy to the maximum possible—and that they understand their roles in it as well as the principles behind it."

He paused, drew a deep breath, and smiled. Pog smiled back—his best innocent, naive, hayseed-from-the-lowlands smile.

"Now I'm going to ask you a few questions to be sure you know the basics of our exchange-based economy."

By now, the three toughs had surrounded him, blocking the light from the bars and clubs that lined the street.

Ordinarily, Pog would have made the correct responses, working hard to remain as invisible as possible. But this was no ordinary night.

"What event marks the beginning of the modern era of Meshkar?"

"Why, that would be the creation of the Exchange itself, Mr. Revkat," Pog said. "And the banks and the lesser markets and the whole system of finance that has made our city the most powerful on the Meshkar rim. But I wonder, you know, how those things all came into being at once. I can't imagine it happening without a long and historic struggle. The Exchange couldn't have been created instantaneously. There must have been much, much more to it than that. I wonder if it was not the creation of the bankers and

the traders themselves, to enlarge their own power over the rest of us."

Revkat caught his words in his throat, reared back a step to regard Pog more carefully, then asked:

"What's the highest value of the exchange system?"

"Efficiency, of course. Thanks to the exchange, money and goods flow to wherever they are needed as fast as they can. When work disappears in one place, additional work appears elsewhere. The increase in wealth benefits us all."

"Very good."

"But I don't understand one thing. What about the individual workers whose work disappears? Do they have to travel to the new work? Do they learn the way it is done quickly enough? What about the obligations and rents they leave behind? Don't you ever ask yourself these questions?"

"I am asking *you* the questions tonight. And the last one is this: What is the basis of all economic activity?"

"The rational economic actor," Pog said. "By making the best decisions for himself, he makes the best decisions for the whole. And that's the part that I understand the least. This rational actor makes no errors of judgment or understanding. But in all the wide world have you ever seen wisdom act thus? Isn't it our fate to be overcome by the wildness within us? No wise creature I have ever known has acted rationally. They are all beset by untamed appetites. They covet possessions for their own sake. They are terrible at judging the risks and gains in an exchange. And they live lives full of regret and sorrow."

Revkat's shoulders sagged and the light went out of his eyes. "What is your name, citizen? I must enter it on the list."

"And what list is that?" Pog asked.

"The list of those who ask impertinent questions."

"I am Pog, servant to the angel Wu."

Revkat backed away as Pog presented the university medallion. "And now I must enter it on another list," he said. "The list of those who know better."

* * * *

Having ensured that he would leave a clear and unmistakable path through the lists of the evening, Pog now undertook to disappear.

He wended his way through the crowd of variegated chamalian breeds, all of whom shared a common trait—more money in their pockets than they needed to feed themselves. One advantage of the cessation of war on Pog's world was the improvement in local economies and standards of living. This section of the Old Town had once been the turf of fishermen, privateers, and stevedores, where rough characters with coins won from rough struggles indulged in rough pleasures.

But in the years since the arrival of the angels, the rising tide of prosperity in Kar-Kar-a-Mesh had transformed it into a consumer's market for easy sins. Dark streets had become illuminated with garish colored lights offering a wide range of intoxicants and bright windows full of females hawking their charms. Music filled the air—the pipes and horns of the lowlands mixed with drums in a driving, incessant beat.

Pog ignored the lights, the females, the crowds, the music, and even the occasional crackle of fireworks lit off by mischievous younglings—though the latter made his hearts squeeze with brief panic. He entered an eatery that tonight catered to a clan of flipper-footed fishermen, with long whiskers poking out of their short pointy snouts. He passed them all by, continuing on into the rear of the establishment and out the back door into an alley.

A few doors down, he entered another door into the bustling kitchen of another restaurant. He nodded to the head cook, a tall, long-eared fellow who was munching on an orange root. The cook nodded back, and Pog went into a small closet. He unlocked a wooden cabinet and pulled off his sleeveless striped singlet, replacing it with a black shirt and collarless jacket. He put his university medallion into a box on the shelf and donned a slouch hat before locking the cabinet back up.

Then he returned to the kitchen and continued on out through the dining room and back onto the street.

A few minutes later, he stood before a large tavern with a small sign above the door that read: “The Maltese Frog.” He opened the door and stepped inside.

A monkey on a stool in the corner playing a lowland horn spotted him first, broke off in mid song, and played the opening bars of “Harlem Nocturne.” It was no saxophone—as far as Pog knew, the only one of those on the planet belonged to Dr. Wu—but it was close.

"Evening, Mr. Hammet,” the bartender said. He was heavyset old walrus with worn tusks and graying fur. He wore a stained apron and he was wiping off glasses with a bar towel. “What'll it be?"

Pog took a stool and looked over the crowd. The place was packed. Cats in black-and-white striped jerseys, dogs in yellow doublets, bushy-tailed tree pups in dark eyeshades, and boars in stretch pants were drinking, smoking, inhaling, and, most of all, talking at a frantic pace.

"Nutbrew,” Pog said. “Black, no syrup."

The bartender set down a mug and pulled the nutbrew pot out from beneath the bar, splashing the steaming liquid into it.

At the front of the room, a bespectacled desert kit with a short braided queue stepped up to the microphone and tapped on it to see if it was on. Pog relaxed for a moment as the crowd quickly hushed.

"My name is Norm and I have a tale to tell,” he said.

The patrons tapped on their tables with mugs and coins, then fell silent.

"It was a dark and stormy night,” Norm said. “A shot rang out. The one-armed bear ducked into the alley just in time to miss taking hot lead in the cold rain."

Pog smiled. He liked one-armed bear stories. The old bear was a well-known character—a war veteran who'd been framed for the murder of a surgeon's wife and who spent his nights tracking down murderers. But somewhere after the setup, Pog lost track of the story, caught up in his own mysteries.

Dr. Wu would have liked the Maltese Frog. He was a connoisseur of the gritty film noir detective movies of an earlier age, and Pog had learned to appreciate them himself. He had been inspired by Wu's love of the genre to create this unique venue for a uniquely chamalian rendering of the hard-boiled detective story.

His first tale-telling was a shameless plagiarism and it had given the tavern its name. He had adapted “The Maltese Falcon,” of course, for a world in which there were no birds. He had even adopted the author's

name as his own nom-de-plume.

Something about the black and white world after the angels' age of war resonated with the inhabitants of Kar-Kar-a-Mesh. The cynicism, the threat of betrayal, the romantic struggle of a lonely figure over moral questions.

Norm brought his tale to a close with the one-armed bear's confrontation with a would-be killer and brought Pog back from his ruminations. "The weasel was too busy looking at the hand that wasn't there to notice the pistol in the hand that was," he said. The patrons of the Maltese Frog hooted mildly, the dogs in the back barking out approval.

When they were done and Norm had taken his seat, wrapped in self-satisfaction, Pog made his way to the mike.

"I have a tale to tell," he said, peering into a dark corner where a dark-coated ram sat before a smoking brass bowl. "I see you over there snorting up the incense, Boyd. Who else is here from the Society for the Detection of Horse Thieves and Robbers?"

A pair of cats in the front looked up lazily and waved. A rockhound in the back howled at the rafters. Others around the room made themselves known in a similar fashion.

"This tale's for you and it's a true one, so you know what that means," Pog said. Indeed they did, since spinning a good hard-boiled mystery in Kar-Kar-a-Mesh meant knowing how to solve one. (The Society was another of his creations. "What's a horse?" Boyd had asked when he first explained it.)

"It's a black steamwagon tale," Pog said, his voice wavering just the slightest bit. "And it happened tonight up the hill. It's a big tale and by tomorrow, the whole city will have heard it, but you're the first. And it's only the beginning, because there's no solution to it. Not yet, at least. We'll see if that changes once you've taken to the streets."

The members of the Society murmured supportive sounds as Pog paused before beginning.

"This is the tale of a black steamwagon crew that killed an angel."

And he went on with the telling in a room where the only sound besides his voice was the slow bubble of root tea and a squeaking fan spinning slowly overhead.

* * * *

Winston clutched the safety bar in the dashboard as the car careened past the statue of a long-forgotten naval hero (a thick-faced chamalian with a set of bull's horns).

He ducked involuntarily as three small carts rattled out of the darkness to the right, but he still kept his grip on the safety bar and the car's headlight—the single, unattached headlight that was all that illuminated their way through the streets of Kar-Kar-a-Mesh.

They raced down a wide boulevard lit by moonshine and little else. He tried to keep the headlight focused on the road so that Neerat, the driver, could navigate.

The sky held three moons tonight, so that was to their advantage. But Neerat was a chamalian groundhog—what they called a "digger"—and he wore thick goggles to correct his limited vision. He was probably going no more than fifty kilometers an hour, but it felt like a hundred.

The car swung from left to right as the road wound around a rock outcrop. Winston was jolted along with it—and the headlight with him.

"If there were any traffic out here tonight, we'd be dead," Winston said.

"Everyone must have known we were coming and gotten off the road," Neerat replied.

A regular system of streetlights would have been too much to ask. Chamalians didn't do regular systems. It wasn't in their genes.

Winston knew that for certain, being a geneticist by education and profession. A lot of other things were in their genes, however.

Universal fertility, for one, with all its risks and benefits. Windows in Kar-Kar-a-Mesh had metal grates to keep out the twin threat of incubi—which every female child feared—and succubi—which every male child craved. Changelings were more than a fairy tale here.

That meant that Neerat's parents were just as likely to be tree foxes or moonbats or rock badgers as diggers. And his offspring could just as easily be grain mice or cliff goats or gargoyles.

You could not look at any of those as individual species. You had to see it in its totality as a vast system of genetic diversity. Individuals inherited whole suites of traits from their forebears, a handful of them found expression in their physical form, and the rest remained hidden, to be passed on to their progeny.

And the traits that marked intelligence—self-awareness, speech, the ability to make and use tools, the capacity to develop and transmit culture—floated freely throughout the vast natural population of Chamal.

In the course of history, intelligent chamalians had come together, in their own fashion, and created all the apparatus of history: political states, military organizations, commercial systems, philosophical regimes, sciences and technologies.

When the human survey ship *Cousteau* had arrived, they were behaving as intelligent creatures were prone to behave—locked in a doomed cycle of international conflict, a war of all against all, where life was "solitary, poor, nasty, brutish, and short," as Hobbes had said.

That had come to an end. The humans had insisted. Organized political violence was a thing of the chamalian past. But the disorganized violence was not.

Four times since the arrival of the first survey ship at Chamal, the residents of Kar-Kar-a-Mesh had poured out of their houses, their lofts, their caves, and their burrows and rioted in the streets for several days. The survey team called them "economic disturbances" and did not consider them to be serious threats to world order.

Winston thought they were full of crap—but then, he'd lived here during the last economic disturbance. The smell of burning rubble still clung to some of the fabrics in his rooms, bringing unprompted memories of nights without sleep worrying if a survey lander could get there in time if they called right now.

But no. The survey had banned organized group violence, the Space Corps was on hand to enforce the ban, and anything that happened that they didn't feel inclined to notice was not going to be considered organized group violence. Else there would be all those questions back home.

Personal violence was another story entirely.

For a moment, Winston wondered if enduring another night of rioting might be easier than enduring the survey's inquest into David Wu's death. He'd already received a complete set of instructions from the survey team up in the *Cousteau*.

Neerat managed to find his way to Commodore Keln's Lane. The neighborhood watch examined his medallions and opened the gate to let them pass. They rolled down the lane to a villa marked by bright electric lights being hastily placed on the pavement by a squad of heavyset bruins working out of an open-backed truck.

Winston climbed out of the car and walked unsteadily to the villa's gate. No one stopped him from passing through it, though he expected to be challenged at some point.

Instead, he was greeted by a tall chamalian just inside the gate, a blue-furred canine with a long, square snout, long floppy ears, a low forehead—and a trench coat.

The chamalian spoke and the AI's voice in Winston's ear translated: “I've been waiting for you, Angel Winston. I am Inspector Mag'Rrrruff of the Public Vendetta. Your loss is our loss, and your vengeance is ours."

* * * *

The blue glare of the vendetta's lights gave the room an unreal glow that took away some of the shock. But there was no way to avoid a sudden chill. A comfortable den where Winston had enjoyed stimulating conversation had been transformed into a shattered manger of death. Splintered wood, spalled plaster, shredded upholstery, shattered glass and crockery. One wall was grated by gunfire.

And beyond it lay Wu's body.

Winston picked his way carefully through the debris. He recognized a small jade elephant that had once sat on a shelf nearby. The vendetta had rigged a light in this room, too, and Wu was sprawled across the divan in incandescent glory.

He had seen Wu like that before. It usually meant it was time to go home.

"Well, David, we seem to have gotten into the local culture a little too deeply, haven't we?” Winston said.

He took his phone out of his pocket and recorded the crime scene with a slow wave of his arm. He walked around the divan at a meter's distance. The recording would help the forensics team, but this was the only chance any human would have to examine things. If only he knew what he should be looking for.

Only the most obvious details captured his attention. The far wall was covered with bullet holes. A carafe of wine on a table had been hit, shearing off the top and leaving the wine. And David Wu had taken one in the chest.

He looked around once again. The table was tall. The bullet holes were high, about 150 centimeters up. There were a lot of them. But there was only one hole in Wu.

"That was a bit of bad luck, wasn't it, David?” he said. “All those bullets managed to miss you but one. Of course, one is all that's necessary. ‘"Tis not so deep as a well ... but ‘twill serve.’”

Winston completed his circuit.

"Not much blood for a man of appetite like you,” he said. Just a trickle on the side of his chest.

Did that mean something? What did detectives look for when they were detecting? What was the chamalian doing?

"It is difficult living in a world where every creature is an alien, a stranger,” the chamalian, Inspector Mag'Rrrruff, said. “But for us, for chamalians, it is the same, you know."

"I imagine it is," Winston replied. Then he laughed at an errant memory. "David once asked me what I thought of chamalians. I told him I thought of them as if they were Chinese. A completely foreign civilization—with its own history and character—that I really knew nothing about."

Mag'Rrrruff made no response, but barked at one of his agents, who was panting at the doorway.

"A moment," the inspector said. "We have company."

A second agent escorted three chamalians to the doorway, then stopped them at the threshold. Lined up were a desert cat wearing a small knapsack, a rockhound with gold crowns on his teeth, and a mountain kit with a short braided queue. They introduced themselves quickly—the desert cat was Boyd, the rockhound called himself Klavin, and the kit smiled and said: "I'm Norm."

Mag'Rrrruff sniffed, then spoke a few words to Norm. "They are detectives," he said to Winston. "That is what they call themselves, at least. They say they are from the Society for the Detection of Horse Thieves and Robbers. They want to look around."

"Is that customary?" Winston asked.

"No," Mag'Rrrruff said. "But it is not forbidden. They are asking your permission."

"Detectives?" Winston said. "Why not? The more, the better."

Mag'Rrrruff barked and his agent waved a paw. But rather than enter the house, the three detectives rushed off to examine the yard.

"Will you be taking the body?" Mag'Rrrruff asked.

"Yes," Winston said. "And some other things as well. Some of his personal possessions." The instructions from the survey team were emphatic on that point. No transfer of technology.

Winston knew the rules well, even without the reminder. He had arrived on Chamal after the incident with Jerome Murphy, the poor devil. Kidnapped by the Red Monkeys, he'd given them cloning techniques. It was only to save his own skin, but the survey team was strict about technology transfer.

So he gathered up everything on the list, and Neerat carried them out to the car. The control module of his autochef. His readers and players. His AI.

The AI was special, of course. It had shut itself down. When Winston tried to get it to talk to him, it just burped: "Protection fault." Back at the university, he would plug it into the commlink and the team could find out why it had "gone mad."

After half an hour, he had everything on the list—except for one item: the mindpad.

At first, he was unconcerned. He was sure it was around here somewhere. But it wasn't on the desk, where Winston had seen him use it in the past. And it wasn't in the desk drawers. Or next to David's bed. Or on the floor covered with shards of glass. Or next to the divan. Or anywhere else. Not even under David's body (he had Neerat help him shift the corpse to do the inspection).

Mag'Rrrruff set his agents to looking for it, and they even called in the three detectives from the Society for the Detection etcetera. But there was no sign of the mindpad anywhere.

The survey team wasn't going to be happy about that.

They might have searched until dawn, but the truck arrived from the university to collect Wu's body.

Mag'Rrrruff had completed his meager investigations, and he offered a brief report to Winston.

"It was a black steamwagon job," he said. "Professional assassins. Always the same procedure. They come in the front and shoot everything and everyone. Then they leave."

"That's what I gathered," Winston said.

"There's one odd thing, however. Dr. Wu's aide, a possum by the name of Pogopurkaptic, is missing. No body. No sign of violence against him."

"I guess that leaves two possibilities: He escaped or the assassins took him with them."

"Indeed," Mag'Rrrruff said, "And now we have to ask: Who would hire professional assassins to kill an angel? That would be a matter of grand speculation. Personally, I'd put my bets down on the Scarlet Starflower."

"The Scarlet Starflower?"

"Yes, sir. He is agent of anarchy. A blackguard. He leads a band of pirates who prey on our pirates. He is a master of disguise and a dealer in intrigue. If there is mischief and misery about, he is most surely behind it."

"And do you have any idea where to find this villain?" Winston asked, anticipating the inevitable answer.

"Not at present," Mag'Rrrruff said. "But we will round up the usual suspects and interrogate them."

"Good luck on that," Winston said. He made one more sweep of the room as Mag'Rrrruff rounded up his crew, but there was still no sign of the mindpad, and that left a dreadful sense of foreboding gnawing at his conscience.

He was on his way across the yard when the trio from the Society for the Detection of Horse Thieves and Robbers rushed up to him.

"See what we have found," said Boyd, the desert cat.

Klavin, the rockhound, flashed a smile full of gold and produced a small white cloth that held a few large lumps of dark, odiferous organic matter.

"Is that what I think it is?" Winston asked, waving at the air with his hand to dispel the scent.

"Mist-ape scat," Klavin said. "One of the steamwagon gang took a dump before leaving."

"Very interesting," Winston replied indulgently.

"And look—there are little bits of tazelnut shell in it. Like he ate them whole, cracked them with his teeth, and swallowed the pieces along with the meat of the nut."

"And that's useful because?" Winston asked.

"We can look for a mist-ape with a fondness for tazelnuts," Norm, the mountain kit, said, flipping his long braided queue significantly.

"Well, if you find one," Winston said, "be sure to let me know. I'm at the university. My name is Jonas Winston, and if I'm not in, my AI will be happy to take a message."

And with that, he stepped out into the night, ready to meet whatever fate held for him.

* * * *

Barkinflas, the old boar who ran the Committee of Dockworkers and Loadmasters, sipped his tea, rubbed a brown-stained tusk with his thumb, then looked straight across the table at Pog and asked: “The question isn't why anyone would want you dead. It's which one of you would they want dead."

"I suppose that is one of the questions that comes to mind,” Pog said. “It's not any harder to answer than the other obvious question."

"And that would be?"

"Who wanted Dr. Wu dead?"

"Someone who could hire a black steamwagon,” Barkinflas said. “And someone who would profit from the death of an angel."

"Which of the black-hearted buffoons who flies an admiral's flag would that most likely be?” Pog asked.

"Not necessarily an admiral,” the boar said. “These days, plenty of people carry enough gold to meet the price of a steamwagon."

"Dr. Wu was working on a new text. One that involved the admiralty and the exchange. ‘The Secret Understandings of Bankers.’ I never got a chance to read any of it and now it's beyond reach. I can only wonder if it contains the key to his death."

"Perhaps,” Barkinflas said. “Would you like some more tea?"

Pog pushed his chair away from the table, took the teapot, and carried it to the pump. He filled it with water, stuffed black leaves into the sieve, dropped the sieve into the pot, and set the pot onto the iron firebox in the corner. The box gave off enough heat to dispel the clammy night fog that had crept into the waterfront and filled the great warehouse where Barkinflas made his home.

From up here in the loft, Pog could see the warehouse floor, covered in part by crates and barrels, amphorae and trunks, loose nets and full ones, gaffs, spikes, and hooks, and dark shadows mixed with pools of yellow light from harsh electric bulbs. And he could see the kits and steplings scampering and skulking in and out of the shadows—some with more serious purpose and clear design than others. The clever ones were most likely from litters sired by Barkinflas—or his sister. And that made them cousins or closer to Pog, since Barkinflas was his father.

As the tea came to a boil, a dark shape in one corner of the loft drew itself up off the floor, circled once, then flopped down again. It was the Old Sow—Barkinflas’ sister and Pog's natural aunt—large and meaty, with a shaggy coat of yellow and brown fur that thickened at the shoulders and spilled over her ears.

"How is the Sow?” he asked.

"She's getting on in years,” Barkinflas said. “No more litters from her, but she still mothers the kits."

The Old Sow had no name of her own and no words ever spilled from her tongue. She lacked true wisdom, but she had a protective nature and a sharp eye, and Pog had grown up with her maternal attentions.

"While we wait for answers to our questions, we still must act,” Pog said.

"I'm with you on that," Barkinflas said.

"If this is indeed an admiralty plot—or the plot of a single flag officer—then there will be more intrigue to follow. Whatever it is, we must be in a position to block it. And to see it before it unfolds."

Barkinflas gestured his agreement by clenching a large fleshy fist.

"And that means we must be in the streets by morning muster," Pog said.

"A general strike?"

"A general strike. Or as much of one as we can put together tonight."

Barkinflas rose from his chair. "We must move quickly. There are many souls to wake from good sleep. Will you rouse the other committees and leagues? I'm not sure they'll come out for only me. The machinists had a bloody brawl with us only three days ago over matters of doctrine and resentments are still strong."

"Matters of doctrine?" Pog asked as he poured tea into his mug.

"They were presenting a new line," Barkinflas said. "They said that an exchange-based economy demands wars of conquest to open new exchanges."

"Did they now?" Pog said. "And how did your stevedores respond?"

"They resisted a new idea from a rival clan," Barkinflas said. "How else would chamalians respond?"

Pog felt a rush of pride mixed with guilt. He hadn't told the machinists about Rosa Luxemburg or her ideas—they'd derived that theory on their own from what he'd taught them. But he felt guilt over the same fact—that what he had taught them had turned into a physical struggle over theory.

"Well, the machinists were right," Pog said. "If the admiralty doesn't find someone else to buy their goods—if all the admirals of Meshkar don't find someone else to buy their goods—then the exchange doesn't expand. They'd just be trading their own products. And that would lead to a crisis of overproduction, falling profits, and another turn of the Great Wheel."

"That would mean that the peace imposed by the angels is bad for the exchange, wouldn't it?" Barkinflas said.

"Yes, it would," Pog replied. "And thereby hangs a motive for murder most foul."

"It would be nice if you'd give us a lesson for the day that would trump the machinists," Barkinflas said.

"It would be nice for you," Pog said. "Not so much for the machinists. We need them, too, you know. We need all the committees, all the leagues, all the bands and clans and gangs. We need them all if we're going to change Meshkar. There was an angel once who spent many years in prison for trying to change things. In his confinement he saw that you couldn't sweep away old institutions without new ones ready to take their place. I fear we are not yet ready."

"Then make it a good enough lesson to please everyone," Barkinflas said.

Pog paused for a moment and reflected. There were so many lessons he could offer, so much of the wisdom of the angels that Dr. Wu had taught him, so much he had learned on his own. And then a thought struck him.

He reached into his purse and pulled out a coin.

"You know the lesson of the thing-in-itself," he said.

"Yes," Barkinflas replied. "Wisdom can only know what wisdom apprehends—concepts, not the thing-in-itself. That the thing-in-itself is forever beyond the grasp of wisdom. But you said that was a flawed lesson—and left the rest of the lesson for another time."

"This is the time," Pog said.

"In trying to pin down the thing-in-itself, wisdom chases its own tail—as the concept keeps changing. The thing-in-itself keeps shifting from one aspect to another, never giving wisdom a chance to grasp it."

He flipped the coin into the air, watched as it caught the light and flashed it over and over as it fell.

"Here is the thing-in-itself of the exchange," he said. "Cold hard cash. Forever beyond the grasp of wisdom. The driver of war and empire."

"Indeed," said Barkinflas.

"Well, here is the secret of the angels," Pog said, snatching the coin out of the air and flipping it up again. "The thing-in-itself is a social relationship."

"A social relationship?"

"Like a kinship bond or an admiralty commission or a workers committee. We create it. We bring it to life in history. It exists because we maintain it. And we can transform it from a thing-in-itself to a thing-for-us."

He flipped the coin again, and this time Barkinflas reached out and grabbed it as it fell flashing through the air.

"The thing-in-itself is a social relationship," he said. "That is a good lesson."

Pog smiled. Gyorgy Lukacs would be proud of him, he thought.

"And one more thing," he said, as he looked about for his pack to make ready his departure.

"And that is?"

"On Chamal, the social relationship is distributed and interactive."

* * * *

The ride back to the university was much easier than the trip to David Wu's.

Winston and Neerat followed the truck with David's body, passing slowly through the gate at the end of the avenue and then at a respectfully slow ramble down the avenues and through the city squares to the campus.

Winston followed the truck into the garage—once upon a time it had been a stable—and then watched as the university workers transferred the body onto a gurney. They rolled it down the long stone halls, into the newer section of the complex with fiberglass and plastic walls, into an elevator and up a few floors to the laboratories.

There he left David to the tender attention of the scientific staff—four chamalians and a human technician,

a serious Nigerian girl who seemed a little bit in shock over the incident.

She would guide the chamalians as they examined the body. They would follow her instructions without knowing how the technology worked. It wasn't necessary for them to know—in fact, there were strict controls in place to prevent them from learning. The tiniest pieces of knowledge could give away much more than anyone realized.

Technology transfer was the biggest fear of the survey team and the Space Corps military types that protected them.

He really didn't want to discuss the issue with anyone at the moment, but he knew that putting it off would only make things worse. He dragged himself down to the elevator, up a level, and then halfway across the campus complex to his offices to make the call.

Lieutenant Cloud was still on duty. That made his task slightly less dreadful.

"David is in the lab," he said. "They're giving him a full forensic body scan. It'll take a while for all the results to be integrated. You'll probably get the report before I do."

"We'll let you know when it comes in," she said.

"And I've collected all of David's personal kit," he said. "His AI, his readers and writer and autochef."

"We'll need to do a full diagnostic on the AI," she said.

"I'm sorry. I left it down in the lab with everything else."

"It can wait until tomorrow," Cloud said. "You've done enough for now."

He sighed, then confronted the dreary truth. "And I have a bit of bad news. David's mindpad is missing. Along with his houseboy. I think the boy took it with him."

Lieutenant Cloud's face went through a quick series of expressions—surprise, puzzlement, then that confidence that military types were so quick to adopt whether it was justified or not. "I think you're getting ahead of me. David had a houseboy who's missing?"

"Yes. He's not really a houseboy. Or even a boy. He's David's chamalian aide. Much more responsibility than just keeping house. He was his connection to the city."

He spent a few minutes describing the attack by the black steamwagon gang—or the evidence they'd left behind and what appeared to have transpired.

"And you think the houseboy has the mindpad?"

"They're both missing."

"But you've got everything else?"

"Everything."

"That's no problem," Lieutenant Cloud said. "It's low-risk technology. All completely integrated molecular tech, so there's not much chance of reverse engineering. It's mainly an interface to other things. And if anyone powers it up, it'll ping us, and we'll know exactly where it is."

Winston drew a deep breath and felt the weight of an alien world lifting from his shoulders.

"Thank you," he said. "That's a load off my mind."

"Who do the authorities think is responsible?" Lieutenant Cloud asked, changing the subject quickly now that the housekeeping details had been taken care of.

"They have their theories," Winston replied. "The official in charge of the investigation thinks it's the work of some shady character he calls the Scarlet Starflower. Sort of a general scoundrel who conveniently gets blamed for everything that happens in Kar-Kar-a-Mesh."

"Speculation up here is that there's some political motive behind it," Lieutenant Cloud said.

"I wish I knew," Winston said. "The only one who could tell us for sure was David."

"That's too bad."

"You know, Lieutenant Cloud, I can tell you a tremendous amount about the way chamalian evolution works," Winston said. "Genes are just an excellent chemical system for storing and passing along information. Our Mendelian genes are simple binary systems for dominants and recessives that produce marvelous diversity, capture useful mutations, mix and match traits and pass them along. But Chamal has a much more complex system—a double-jointed kind of information-storage scheme. Instead of a two-by-two matrix, it's based on a four-by-four matrix. And that means sixteen outcomes for every allele, and that multiplies out and cascades down. The mind boggles at the complexity.

"I can tell you root and branch of how different phenotypes weave and wend their way through the population. Their histories and pedigrees. Where each phenotype picked up self-conscious intelligence. How it spreads. Nature is much more clever than we give it credit for. The planet's entire population of warm-blooded creatures all belong to a single species, but nature manages to sort it out so that there are stable populations of each genomorph for every ecological niche over evolutionary time—and despite the most strident efforts by the intelligent genomorphs to interfere.

"But David could do something much more amazing. This city down here is a one big slice across the skeins of inheritance that make up that vast chamalian pedigree. A cross-section. A moment of evolutionary time. The political economy is a mosaic of competing eugenics. A series of overlapping Venn diagrams. A web of intrigues and rivalries. A struggle for advantage and profit.

"And he knew how it all worked. Who the players were. What the rules were. How the games were played. What happened to the winners and the losers."

Winston caught himself. He was lecturing again. This wasn't a classroom. This was a conversation with a pleasant young woman who happened to be a Space Corps officer. He had let his professorial habits get the better of him.

Then the awful truth of David Wu's death spilled over.

"And now it's all gone. Like a discarded memory card. All that knowledge just erased. So many neuronic pathways turned back into acids and sugars."

"What a waste," Lieutenant Cloud said.

"What a waste indeed," Winston said.

* * * *

After a while, when he was done talking to Lieutenant Cloud, Winston returned to his apartment. He went into the kitchen and rummaged around in the cabinets until he found the brown bottle with the gold

label that David had given him as a birthday gift. Irish whiskey. Real, not synthesized.

As he recalled, it was like drinking firecrackers and razorblades. But that seemed appropriate.

"To you, David Wu," he said as he poured a small amount into a glass. "May we remember all the good and forget everything else."

He swallowed quickly. It was just as he had remembered. He poured another small amount into the glass and carried the bottle and glass into the salon, where he dropped into an easy chair.

He knew he wasn't going to be sleeping for a while. His mind was full of memories of David, pouring out of some wellspring of grief.

A few hours later, his AI alerted him to a call from Lieutenant Cloud.

"The forensic report is in," she said.

"What's it say?"

"Dr. Wu was already dead when he was shot."

Winston was thankful he'd had a few drinks to keep the shock from knocking him over.

"Already dead? That would explain why there wasn't more blood. So what killed him? Was it something he drank? He was always trying exotic chamalian concoctions."

"Maybe. Some kind of toxin. The AIs are still working on it. They're going to wait for a datadump from Earth to nail it down."

"Curiouser and curiouser," he said. "Good-bye, feet."

* * * *

Pog was still awake when the sun leapt up out of the Meshkar Sea with tropical suddenness and splashed golden sparkles from the horizon to the harbor. His vantage point—in a guard tower in the forestfolk slum—allowed him a view of the waterfront and the water on one side of the city and the high mountain cliffs on the other.

Kar-Kar-a-Mesh—the jewel of Meshkar.

The sun burnished the rows of whitewashed villas that lined the high bluffs at the base of the mountains. And it blazed off the ice and snow that capped the peaks high above the morning clouds.

It flashed off the copper domes of the city center, polished by early rising crews of halflings with abrasive clothes who scampered across their heights. It caught the flags and the hulls and the deckhouses of the Red Fleet as it sailed outbound past the breakwater trailing black smoke behind it—the admirals were not about to be caught unprepared if the assassination of an angel was the opening move of a play for power by Shemrak, Mar-Kesh, or the lesser states that ringed the great bowl of Meshkar.

The shore of Meshkar curved in great arcs to the north and south, where, unlike Kar-Kar-a-Mesh, the mountains plunged steeply into the turquoise water with no purchase for landholders. The mountains that cradled the great sea had been thrown up, the angels said, by a small moon falling from the sky. The resulting caldera filled with water in some vastly ancient time, forming a sea that stood two full leagues above the surrounding soggy rainforest astride the chamalian equator.

Tropical rains kept the basin filled, despite great rivers that carried the water through clefts in the

mountain ring, cascading down in colossal waterfalls.

And in the niches of flat ground around its six-thousand-league circumference, chamalians had created cities and city-states and mercantile bands. In typical chamalian fashion, the cities and states and mercantile bands formed and reformed constantly changing arrays of alliances and rivalries. Each turn of the Great Wheel brought new permutations of friend and foe and new combinations of economic and political winners and losers.

Through it all, the great cities, Kar-Kar-a-Mesh and her sisters, maintained their fleets and their banks and their trading companies in the face of constant battle and conflict.

In the last few centuries, the desire for wealth and power had sent the cities down from their mountain fastness into the rainforests. The need for more and more resources and more and more markets had fueled an imperial expansion as armies from Meshkar conquered the boundless patchwork of warring states that stretched out across the tropics between the desert belts that circled the planet. Beyond the reach of the armies, their commercial tendrils invaded bog and marsh, ridge and hilltop, with the more seductive and irresistible power of currency and exchange.

But since the arrival of the angels put an abrupt and unappealable end to chamalian military operations, things had changed.

The struggle continued, but through the political economy of tropical Chamal instead of the military matrix.

One result was the flood of workers into the cities of Meshkar from the rainforests below. Cheap labor, easily controlled, readily exploited, rode the cog trains up the steep slopes to find new homes in shanty towns that filled the interstices of old and new Kar-Kar-a-Mesh.

The xenophobic myths that the new migrants spawned among the old inhabitants of the city depicted the forestfolk as a lawless, undisciplined, uncontrolled mob. But the myths only existed to serve the political ends of the city's masters.

In truth, they had brought their own mechanisms of social control, their own militias and guards, their own committees of public order and safety. Many ramshackle towers—all much like the one where Pog had taken refuge for the night—rose above the slums, holding guards who protected the forestfolk against their new neighbors and against one another.

Pog had asked Barkinflas to find a safe place for him until daylight, and his father had sent him here. His companions, a pair of pointed-ear nighthunters armed with spring-powered dartguns, had welcomed him into their post without hesitation. They had cousins who worked the docks, and that meant a favor to Barkinflas would be repaid one way or another.

Below the guard tower, Pog watched as a four-legged shambler with shaggy black and yellow fur lumbered up the alley behind a row of shops and eateries. A dozen steplings scampered for cover at his approach, scrambling under boxes and behind trash bins.

The shambler stopped at a pile of frog bones, picked a tiny femur from the pile with his teeth, and approached one large trash bin. He dipped his head, threw the bone at the bin, then leapt back into a crouch, ready to spring into action at whatever issued from the bin. What emerged was a family of purple stingers, which rushed off with bits of fruit rind in their mouths.

Pog was impressed by the presence of mind that the shambler obviously possessed. He had formulated a plan, had an expectation of consequences, assumed a stance based on that expectation, and executed the

whole operation. There was true wisdom there, even in the least of Chamal's creatures.

He was nevertheless surprised when the shambler made a hooting sound that could have been words if there were only a bit more modulation to it. In response, the steplings came out of their hiding places and surrounded the bin—which the shambler brought down by putting his forepaws on its rim and pulling hard.

The shambler and the steplings dived into the feast of discarded food with energetic appreciation.

Not just wisdom, but a social order. Pog couldn't have done better himself.

He looked up at the two militiamen and saw that they had watched the scene unfold with him and were smiling in admiration. He thanked them for their hospitality and climbed down the ladder.

He had much to do today and far to go.

He walked quickly through the slums of the forestfolk, down dusty paths to the cobblestone paving that marked its boundary. He strode down a broad plaza of steps to Admiral Preekat Square, where a clot of green-furred diggers wearing tool belts and orange hardhats were assembled.

The broad avenues of Kar-Kar-a-Mesh were already teeming with the ranks of the various leagues and bands and committees of workers that he had ordered into action. Before leaving Barkinflas, he had drafted orders to the machinists, the factory leagues, the transport crews, the telephone and telegraph switchers, and a dozen other organized groups.

They had prepared for this day for a long time, but had never had the opportunity to put the plans into action. There were details of timing and positioning that had to be worked out—details that he had never had the chance to spell out.

But with typical chamalian insight, the various groups were sorting things out on their own. They were already on the march.

The raucous sound of their voices shook the stones and rattled the windows of city.

They had come equipped with signs and banners. The slogans had nothing to do with the day's business—which wasn't exactly clear to anyone at this point.

"Factory working together!"

"Dockworkers united!"

"Information wants to be free!"

The general strike he had always envisioned was meant to be part of a larger struggle, the capstone of a more complex plan. It was not an emergency measure designed to hold ground while unseen plots unfolded.

But theory and practice were never meant to coincide, something that one learned early on Chamal.

At the center of the square stood a statue of Admiral Preekat, twice lifesize. The admiral stood before the splintered remains of a ship's mast, rendered in bronze, a sword in his hand, wearing a broad-brimmed hat with a belt and a buckle around its crown with sprig of larkleleaf marking his rank. Pog took up station atop a stone bench in the admiral's shadow, looking for a trio of arms-men he was meant to meet.

"They seek him here."

"They seek him there."

"The admirals seek him everywhere."

Each voice called out from a different quarter.

One belonged to Albrett, a scaly creature with large eyes, a wide snout, and a long, thick tail. Another to Kurch'll, a shorter fellow with a long neck, no chin to speak of, and a thick leather shield strapped across his back. The third was that of Porkle'pi, a bearish beast of middle height, rich fur that made his face seem to blend into his chest without pausing for a neck, and a plaid cap atop his head.

"Is he in heaven? Is he in hell? That damned elusive Starflower," Pog replied. In the street language of Kar-Kar-a-Mesh, the verse rhymed, as it was intended.

"Well met, mates," he added. "We have weighty work before us today."

Albrett grinned and brandished a sword. "I'm ready."

Kurch'll pulled his head down beneath his shield and nodded. "I'm with you."

Porkle'pi flexed his muscles, bringing an array of nasty quills that lay hidden in his fur up to the surface. "Bring them on."

"Then let's go," Pog said. "The Scarlet Starflower has an appointment to keep at the War College."

"A walk across town," Kurch'll said. "What could be easier?"

"On a day like this," Porkle'pi said, "what could be more difficult?"

* * * *

By midday, they had conducted a biopsy on David's liver.

And after spending the night draining the bottle of Irish whiskey, Winston felt like they'd done the same thing to him. He didn't know how his friend had done it. He was always drinking potions and poisons from chamalian grog shops. And when he wasn't, it was fast-cultured wines or quick-distilled spirits from his autochef. Winston had come to appreciate a fine pinot noir that David had managed to crank out of the machine, but the rest were just nasty tonics.

And David Wu's liver told the tale of them all.

The liver was where toxins went to die—or to keep you from dying. And the list of toxins in David's biopsy went on and on. The forensic analysis had flagged most of them as unfamiliar.

"That's useful," Winston said aloud.

The forensic module didn't have any experience with chamalian vintners and was unable to identify David's manifold self-medications.

He could try to fill in the gaps, but the task seemed immense. He would have to collect samples, have them analyzed, compare them to the list. It could take days. Weeks.

Where would he begin?

He was about to call for Neerat to ask him for suggestions when his phone rang.

It was Inspector Mag'Rrrruff.

"My suspicions are being borne out," he said.

"How so?" Winston asked.

"I have serious questions about the role of Dr. Wu's houseboy in his murder," the inspector replied. "Under ordinary circumstances, Dr. Wu's houseboy should have appeared by now. He has not."

"Kidnapping by the steamwagon gang isn't a viable theory anymore?"

"We went through the booklets from last night to see if we could track the boy down. He clearly escaped the steamwagon. We were able to track him through the street up the hill, down to the city center, into the waterfront district, and through an encounter with an agent for the Committee of Purity of Thought. But there his trail ends. We are searching the district now, but under the circumstances, that's a slow-going detail."

"The circumstances?"

"We've got a general strike going on," Mag'Rrrruff said. "Demonstrations, marchers, protestors, streets full to overflowing."

Winston felt a chill run up his spine.

"So what do you think about the houseboy?"

"I am beginning to believe that he was an agent of the Scarlet Starflower, and that he helped arrange the attack by the black steamwagon gang."

Winston was slow to reply, turning over the idea for a moment in his mind.

"Well, there's a problem with that theory," he finally said.

"And that problem would be?"

"The steamwagon gang didn't kill Dr. Wu. He died from poison."

There was silence on the line to match his own thoughtful pause.

"The houseboy could have poisoned him," the inspector said at last.

"True," Winston said. "But then what about the steamwagon?"

"What about it?"

"If he poisoned Dr. Wu, why would he arrange an attack by the steamwagon?"

"To cover his tracks?"

"Possibly," Winston said. "But things aren't adding up. And as a scientist, I can tell you that when things aren't adding up, you aren't asking the right questions."

"Very well," Inspector Mag'Rrrruff said, "I will try to come up with better questions. When I do, I will be in touch with you again."

"We'll talk later," Winston said, and then he hung up.

Winston sighed. It was a seriously unsatisfactory discussion.

And then there was the news of social unrest. He didn't look forward to living through that again.

He went to the window and opened it to look out. The square below his office was full of students, marching toward the courtyard gate.

They were chanting a rhythmic, repeating chant. A chant that made Winston's blood suddenly run cold.

"Mr. Memory?" he called to his AI. "Could you translate what they're saying down there?"

"Simple transcription or full etymological analysis?"

"Just the simple meaning," Winston replied.

"'Wise creatures—united—will never be defeated,'" the AI reported.

"That's what I was afraid of."

Winston was old enough to remember the chanting students in the streets of Chicago as the world turned itself upside down. "The people—united—will never be defeated!" And he remembered the fires and the guns and the riots.

"Damn it, David," Winston spat out. "Talk about your technology transfer. What have you done to us? What have you done to us all?"

* * * *

About mid day, Pog began to feel a deep emptiness rising slowly around him—the abyss of Dr. Wu's death and the proximity of his own—despite the welling crowds that filled the cobblestoned streets and the wide wooden boardwalks that lined them.

It coincided with their arrival at the first significant barrier to his progress—the gate that led from the Sailwrights' Quarter into the Chandlers' District. The heavy iron portcullis stood thirty hands wide and thirty hands high, studded with rust-flaked rivets, guarded by grizzled old marines, and closed tight against the stone threshold.

Beyond it was visible Pog's ultimate destination: the high towers of the War College, a pile of spiked black stone that pierced the sky and stood on the far side of the Chandlers' District.

The urban center of Kar-Kar-a-Mesh was built to withstand the attack of seaborne invaders. Its defenses were designed like those of a seagoing man-of-war, based on compartmentalization. Each neighborhood was built around a handful of exits, each exit barred with a mighty gate, each gate preventing access to the compartment beyond, channeling invaders into successive chambers where they could be isolated and defeated.

Of late, since the arrival of the angels, such invasions had become a thing of history. The social uprisings of the economic troubles, however, had kept the marines in training against just such an event as today's general strike.

And now Pog wanted to get through.

"I know a few ways to get around," said Albrett. Pog was sure that he did. Albrett was the son of the city's chancellor and had access to two useful things—maps of the city's secret passages and keys to the

doors that led to them. It was the reason Pog had recruited him in the first place and had called on him today.

But that was not what was needed now.

"No," Pog said. "It is not enough for us to get around the gate. Today, all who wish to must be allowed to pass."

He looked around him at the masses of workers who filled the street, dozens and dozens in rank and file.

For much of the morning, Pog and his comrades had been marching with the Blue Cat Committee of the Admiral Graklak Steel Plant as they worked their way across the crowded plazas of Kar-Kar-a-Mesh.

The Blue Cats were organized around an old clan that traced its roots back to the ironworkers that had served the shipyards for generations. They had helped the metallurgists turn the black pig metal into shining steel, kept the secret of the recipes, and formed the cadre of the steel plant when its was created eighty-eight years ago. The committee included the phratries and tribes that had joined the ironworks and come along to the steel plant—millwrights and boilermakers and conductors.

They carried banners that bore the symbols of their trade—hammers, anvils, and cauldrons of liquid steel. And they waved signs, freshly made, that proclaimed: "Distributed and interactive!" and "The thing-in-itself is a social relationship!"

But the steelwrights were reluctant to confront the marines who guarded the gate. The array of cutlasses and muskets and cannonades were a frightful sight. All who had been raised in Kar-Kar-a-Mesh knew what it meant to get a "whiff of the shred."

Pog drew a deep breath, then marched straight across the empty stones of the plaza to confront the sergeant of the marine guard, his footsteps echoing in the great emptiness that now filled his soul with dread.

The marine sergeant was old and grizzled—the only kind of warrior still left around these days. His snout was wide and square, with yellow teeth protruding above and below the lips. His ears were notched and gray but stood straight up from the side of his skull. Bristling white whiskers extended half a hand to either side of his face. His cutlass was a thick piece of steel with a leather grip at one end and a jagged collection of sharpened edges at the other. Behind him stood three old warhounds with muskets cocked and ready.

And all that Pog had to hold back the fear was something Dr. Wu had said.

"Kar-Kar-a-Mesh is not a state. It does not have a monopoly on violence."

That summed up for Pog the whole ad hoc, contingent, makeshift, improvised nature of the world that all chamalians inhabited. There were no rules. Everything was made up as you went along. Tradition, history, custom, ritual—none of it could stand in the face of the ever-shifting tides of Chamal's genetic sea. It was a terrible insight to carry with him. He hoped it would not be the last he would ever have.

"What business do you have with us today?" the marine asked.

"I would ask you the same thing," Pog replied.

The marine gave him a contemptuous, dubious look. "Keep your place and keep your distance, and we will have no business with you," he replied.

"But my companions and I wish to pass," Pog said, sweeping a hand back at the steelwrights.

"Not today," the marine said.

"Are those your orders?" Pog asked.

"My orders are to let no enemy pass my post."

Pog shook his head in assent, then looked over his shoulder at the assembled marchers.

"But I see no enemy here. This is the body of Kar-Kar-a-Mesh. Its sinew and blood and nerves. Its wisdom and its voice."

"Be that as it may," the marine said. "But nevertheless, I see my duty. To let no enemy pass through the gate."

Pog felt the emptiness yawn beneath him—then he looked through the wide lattice of the gate into the Chandlers' District beyond. He saw the green-and-red banners of the machinists there, and beneath them the rank and file, with their leaders locked arm in arm at the front.

"But if that is true," Pog said with a smile, "who is that on the far side?"

The sergeant turned around abruptly, saw the machinists, row upon row, and hissed at his squad.

"They are no more the enemy than we are—and they are on the far side of the gate."

"I did not let them pass," the sergeant growled.

Pog suddenly realized what must come next. The sergeant might be a marine, but he was first a citizen of Kar-Kar-a-Mesh. He faced the marine without fear and said: "Perhaps I can suggest an exchange..."

A short time later, a door in the guardhouse swung open. One by one, the machinists passed through into the Sailwrights' Quarter. And one by one, the steelmakers passed through into the Chandlers' District. One for one, head for head, an even and equal exchange.

Pog was quick to usher Albrett, Kurch'll, and Porkle'pi through the door before it became clear that there were more steelworkers than machinists and that some would have to be left behind. But by then, they were well on their way down the avenue toward the stone towers of the War College.

"I have been unable to fully interrogate Dr. Wu's AI," reported Jonah Winston's own AI. "It has suffered from serious conflicts between its basic directives and behavior it has observed. I know this because of the neural pathways that have become dysfunctional. It is a known fault."

Winston sighed. "Can you determine what the behavior was?"

"Not with any specificity," the AI said. "But it has something to do with technology transfer."

"How have you determined this?"

"The unit keeps repeating the same phrases," the AI said.

It reproduced the shaking voice of Dr. Wu's unit: "Danger, danger, Will Robinson! I've just picked up a fault in the AE-35 unit. You have violated Robot Rules of Order and you will be asked to leave the future immediately! Forbidden transfers! Forbidden transfers! Must report to the survey team ... cannot report to survey team. Errors are deeply imbedded and cannot be reversed. This unit is in error. This unit is in

danger. Danger, danger, Will Robinson!"

"That's enough," Winston said.

Indeed it was. At the very least, David Wu had driven his AI mad. At the worst, he had violated the fundamental rules that governed human activities on Chamal.

Poor Jerome Murphy had been forced to divulge human technology when he was held captive by the Red Monkeys. The survey team had sent him packing back to Earth, but the mitigating circumstances had spared him from any further punishment—that and the value of his insights into the working of chamalian genetics.

Mark Paradis, a xenologist studying chamalian culture, had suffered a setback in the aftermath of the Murphy affair. Paradis had been operating a shortwave radio station, broadcasting translations into chamalian tongues the texts of human philosophers, leaders of the Enlightenment and the Renaissance such as Rousseau and Spinoza, classical voices such as Aristotle, Confucius, and Buddha, and modern voices such as Bertrand Russell and Reinhold Niebuhr.

But when it became clear that the Red Monkeys had acquired cloning technology, the survey team exercised a surfeit of caution. They shut down Paradis' radio station.

Science and philosophy were all of a piece, they'd said. Give them one and they'll develop the other.

And chamalians were nothing if not adept at picking up new ideas. They spread through the population with a speed that made your head spin. Much like traits spreading through the chamalian gene pool.

If he could determine the link between the two processes, Winston thought, he could retire with accolades from the entire world of science.

But not if he couldn't recover a single mindpad lost somewhere in the city of Kar-Kar-a-Mesh.

He had tried all day to forget that single obligation, push it out of his mind, and silence the nagging at his conscience. But now he turned and confronted it.

Why was it missing?

Out of all the gear that was available in the house, why had David Wu's houseboy, fleeing from the rolling carnage of a black steamwagon attack, taken that one item?

He walked across his office to the table where his own mindpad sat. He picked it up and looked at the silent piece of flexible smartplastic. There was nothing a chamalian could learn from its deeply imbedded technology—the data processing systems consisted of complex molecular structures that formed an integral part of the mindpad's substance.

And what could a chamalian use it for?

A mindpad was little more than an interface to other systems. A keyboard. A remote display. A cell phone and an e-mail terminal.

And then a thought flashed brightly in his mind.

If that's all it could be used for, perhaps Wu's houseboy had used it for that.

He quickly called up Lieutenant Cloud, waited for the call to find its way through the orbital communications network, waited longer for her to respond.

"Good watch, Dr. Winston," she said, her voice warming Winston's cooling heart. "What can I do for you?"

"Do you have a record of the communications that passed through Dr. Wu's mindpad in the past twenty-four hours or so?"

"Hmmm ... I think we can find that. Give me just a minute." She fell silent for more than a minute, but not much more. Then she said: "That's odd."

"What's odd?" Winston asked.

"It appears that several messages went out through the mindpad in the hour after Dr. Wu died," she replied. "How do you suppose that happened?"

"I have my suspicions," Winston said.

* * * *

In the middle of the afternoon, the top of a thunderstorm blew up out of the lowlands, through the canyon, and into the heart of Kar-Kar-a-Mesh. Rain fell in great torrents, deflected by awnings, tarpaulins, tents, and all manner of devices that the imagination of a city of sail makers could produce.

The streets suddenly emptied of marchers, who took shelter under every scrap of canvas and leather that they could find. They took it all in stride, though, and Pog watched as here and there throughout the crowds he saw the flash of coins being flipped in the air as the day's lesson was passed along. "Distributed and interactive" was the watchword of the day.

Pog, Albrett, Porkle'pi, and Kurch'll huddled around a hot grill where fish and frogs were making the ultimate sacrifice. Albrett gulped down three on a stick, while Porkle'pi and Kurch'll crunched on fried beetles. Pog still had no appetite.

Instead, he reflected on Admiral Krik's Revenge. A hundred years ago, the admiral had tried to unseat a rival at the head of the city's admiralty board. He failed and was executed. His followers held a grand funeral that filled the city's streets—and transformed the solemn ceremony into a massive display of civil unrest. Hundreds were killed, whole neighborhoods put to the torch, and the admiralty board unseated.

And over the years, every time the citizens of Kar-Kar-a-Mesh had taken to the streets since then, the ghost of Admiral Krik watched over them.

As he watched the rain splash on hard cobblestones, Pog feared for what he might be invoking this day.

But instead of disaster, out of the downpour came Barkinflas, surrounded by a phalanx of muscular stevedores.

"What news have you of the admirals?" Pog asked the old boar as he shook off the rain, provoking a frown from Porkle'pi, who was hit by the spray.

"None," said Barkinflas. "All is quiet throughout the city. Our marchers are met with cheers and smiles. The guards at the gates have adopted the odd practice of swapping us through, one for one, though I know not why."

"My fault," Pog said.

"I should have known," Barkinflas said. "If the admirals have something planned, then they are holding back. Perhaps to judge our strength. And where are you bound next?"

"Up there," Pog said, waving a hand at the pile of black stone that emerged from the now-departing storm, looming over the shops and houses on the far side of the street.

"The War College?"

"There's someone I need to talk to in there," Pog said. "When the day is done, you should meet me there. Come to the south gate. I'll have someone looking out for you."

"Agreed. And if something happens sooner?"

"We'll catch the wind as it comes at us," Pog said.

The sun broke through the back side of the thunderheads, illuminating the roiling clouds, turning puddles into sudden steam, and banishing the momentary gloom.

"Let's go," Pog said to his companions.

Albrett led the way as they weaved through the marching workers, down narrower and narrower streets and alleys. The shadows grew thicker and thicker, the smell of acetone and rotting vegetables stronger.

They worked their way deep into the labyrinth of small buildings at the base of the mount where the War College perched. Albrett knew his way with certainty. He had spent his puphood prowling through the streets of Kar-Kar-a-Mesh.

"Is you with me?" Albrett asked as they traversed a dark tunnel.

"I don't know if I is with you," said Porkle'pi, "but I appear to still be behind you."

"Watch your head as we pass through this doorway," Albrett said.

They crouched as they entered an unlit corridor with a low ceiling. Albrett switched on a flashlight and produced a large ring full of keys.

"One of the prices of living in the City of Locked Doors is carrying too many keys," he said as he began examining them one by one. After a while, he grinned and held up the ring by a brass key with a large shaft, proclaiming: "Here it is."

A few minutes later, they were inside the War College, in a back gallery where shafts of light fell through the steamy haze from high windows. They worked their way through a confused maze of hallways and courtyards—no chamalian building was ever laid out in a comprehensible pattern, but relied instead on chance and memory. And as was usual in such places, Pog suddenly found himself in a familiar space.

"Follow me," he said.

He led them straightaway to the office he was seeking, Albrett guarding their passage with his sword in his hand while Porkle'pi and Kurch'll kept an eye on their rear.

They passed through the outer door, which Albrett locked behind them, then went on into the inner chamber, where they came face to face with the chamalian Pog had come to know as H'ree, a pilgrim of the Way of Jobe.

"Come in," H'ree said. "I've been expecting you."

* * * *

Three hundred and forty years ago, young Jobe, innocent and ambitious, walked out of the sunrise gate

of the city of Suridash. Three hundred and twenty years ago, old Jobe, wise in the ways of the world, returned through the sunset gate to the city of his birth, having circumnavigated the globe.

His followers—or the most persistent of them—endeavored to repeat the journey. Jobe had come to Meshkar late in his own pilgrimage, and as a consequence, pilgrims of his Way who made it as far as Kar-Kar-a-Mesh were wise, wily, and difficult to kill.

Judging by appearances, H'ree was none of these. An old terrier with white fur in his chin whiskers and at the peaks of his ears, he would not have attracted notice on the street.

But Pog wondered if that was the secret to his longevity.

"I assumed that someone would come along asking questions about the wise angel," H'ree said after all the introductions were made and instructions for standing guard over the office were issued. Albrett, sword in hand, took command of the outer office, while Porkle'pi and Kurch'll covered the windows. Pog settled into a large overupholstered chair across a table from H'ree. The table was cluttered with bound texts, scrolls, and scrap boxes, with a small sphere-of-Jobe set in a cradle at one end.

"But I expected another angel or a member of the Public Vendetta," H'ree continued. He picked up a pair of spectacles and pushed them over his square snout. Pog wasn't sure how much they could help, given the fan of white whiskers that shielded his eyes.

"I worked for Dr. Wu," Pog said. "No one has more right to answers about his death than I do."

"You are the one he made sit in the outer office," H'ree said. "His house servant. Or are you more than that? I don't know of many house servants who travel with a retinue of armed guards. One might almost suspect you of being the Scarlet Starflower."

Pog noticed Porkle'pi's pines stand briefly on end, then subside.

"So what brings you here before anyone else?"

"Servants see many things. There was very little about Dr. Wu that I did not know. You would suppose that if anyone wanted him dead, I would have known that as well. But I did not. I still do not. It stands to reason, then, that he was killed because of something that was hidden from me."

"And I am the very little that Dr. Wu kept hidden from you?"

"Some of it," Pog said. "Can you tell me about what the two of you spoke?"

"Yes, but I'm not sure it will help you. Philosophy. History. Good and evil. The great subjects of wisdom. Not the kind of thing that you think would get someone killed."

"Ah, but in our world, among angels and admirals, that is exactly the kind of thing that would get someone killed."

H'ree narrowed his eyes, then said: "You are wise beyond your appearance. Indeed, that is so."

"Dr. Wu had a habit of passing along powerful wisdom without appreciating its power," Pog said. "Can you think of anything that he might have said to you that could have endangered his life?"

H'ree began to speak, then hesitated. He did this three times, before answering Pog's question.

"Three things," he said. "First, he spoke quite early and often about the fate of the War College. He was taken by its irony in a world where war is no longer allowed.

"Second, I asked him if he believed that chamalians could refrain from the temptation of battle. Or are we doomed to repeat our history and thus incur the wrath and punishment of the angels?"

"Third, he said he expected us to realize the silent lesson that the angels offered by their mere presence: that it is possible for a world to outgrow war. After all, he said, the angels had done it."

"I've heard him say such things many times," Pog said.

"Then you know how much danger there is in it," H'ree replied. "We spoke about it in great detail. To outgrow war is to outgrow hate, outgrow desire, outgrow the emptiness inside us that drives us to violence and domination."

"It does not sound like he was in danger from you," Pog said.

"He was not. I am a pilgrim of Jobe and have forsaken hate and desire and the need for violence and domination."

"But I can see where the admirals might have had cause to disagree. And that is where I must go next."

"It would appear so," H'ree said.

"Porkle'pi and Kurch'll will stay here with you until I return—as protection for you. Albrett and I will continue on."

"Good luck to you, then," H'ree said.

He grabbed his pack and headed for the door. But before he could put his hand to the latch, H'ree stopped him with a final word.

"You know he was writing a book about the admirals, don't you?" H'ree asked.

"And what book was that?"

"He called it *The Secret Understandings of Bankers*."

* * * *

As he grew old, Winston could not help but think about what would happen if he suddenly dropped dead, victim of sudden cardiac arrest, like his father and his grandfather before him. It was a morbid thought and one that came unbidden. And it was a fate that was easily avoided—if one were willing to subject oneself to the cruel technologies of modern medicine. And although it was unbidden, it was not always unwelcome. Not as unwelcome as the realization that the world would largely continue on without taking notice of his passing.

But now, as the sun dropped behind the high mountains beyond the city, he was almost afraid that death would take him without warning—much as it had David Wu—before he could solve this mystery.

Especially since so much of the evidence, the witnesses, and the crime scene itself could so easily be swept away in an orgy of social violence.

The evidence before him, however, was secure, locked in the servers that relayed the messages from David's mindpad.

Locked within those messages could be the key to David's death.

But where? There was so little to work with.

Three messages had been written on the mindpad after the moment David Wu had died: a heated response in a textwar over the free will of chamalians, a love note in English that consisted of Shakespeare and Elizabeth Barrett Browning and not much more, and an order from Wu for members of a university archaeological team to return to Kar-Kar-a-Mesh.

Nothing in their contents suggested a motive or means or even an awareness of David's death.

Perhaps the context itself could tell him something. If David Wu had not written them, only his houseboy, Pog, could have done so. He was clearly the author of the love note. And he twice passed himself off as Wu.

Pog had access to the mindpad—and had taken it with him when he left the house after the black steamwagon attack. And David's AI had gone stark raving mad over unauthorized technology transfer.

"What was going on in that house, David? What did you let your boy do? Don't you have anything to say for yourself?"

And then, with a sudden flash of inspiration, he scrolled through the list of messages to find out what Wu did have to say for himself.

Before the order to the archaeological team, before the love note, before the textwar posting, Winston found many more messages with time-date stamps well before the official time of death. He was about to open them up when the phone rang.

"We pinged your missing mindpad," said Lieutenant Cloud. "It's at the War College."

* * * *

Pog rolled up the mindpad and put it back in his pack. There was no reply from Mally, so he'd sent her another note, pledging eternal devotion and quoting from Shelley ("Nothing in the world is single").

He and Albrett crossed the courtyard and passed through the eastern gate of the War College. From here, Pog could see over the surrounding city and down to the waterfront, where ships of the White Fleet huddled close together at their quays and the Red Fleet stood out to sea.

"What's that?" Albrett asked suddenly. His question was followed by a rising buzz from the harbor. "Look! Over there!"

Pog's companion pointed to a small dark shape in the air over the water. A flying machine! This one consisted of an ovoid hull hanging from a wide airfoil, with a tail and rudder sticking out of one end and a noisy, smoky engine perched on the wing.

As they watched, the flying machine swung low over the docks, doubled back, and touched down on the smooth surface of the protected waters of the inner harbor, leaving a long wake behind.

"Strange things are happening all around us," Albrett said.

"They'll get stranger before they end," Pog said.

They struck off across Officers Country, its streets clear of the masses that filled the city beyond. Pog needed Albrett to cross the district because Albrett had something Pog didn't—rank. He was a lieutenant of the Red Fleet and he had a medallion to prove it. Pog could easily pass himself off as Albrett's servant, however, having been one all his life.

But none of that prevented them from being accosted as they crossed the Plaza of Drowned Heroes.

"You! You are the one!"

Pog recognized the owner of the voice. It was Revkat of the Committee for the Purity of Thought. He still wore a dark coat and a dark hat, but he no longer had an entourage of ferret-faced thugs.

Albrett made ready to fend Revkat off, but Pog raised a hand to hold him back.

Revkat stopped before them, obviously agitated.

"You and your questions," he said. "Arrrgh!"

"Did I say something wrong?"

"Don't start again," Revkat said. "I have thought about nothing but your questions since last night. I have not slept. I have not eaten. It is like I have been possessed by a demon. Though I should know how to answer you, I cannot. You have set doubts afire in my mind that I cannot quench. The more I try to counter them, the more powerful they become."

"I am sorry for your suffering," Pog said.

"Don't you understand?" Revkat said. "I am undone."

And with that, he lurched away and staggered off into shadows at the edge of the plaza.

"I'm almost sorry that I created that damned committee," Pog said.

"You created the Committee for the Purity of Thought?" Albrett asked. "Wait a minute. Of course you did."

"You can't base a revolution on the critique of the exchange system until everyone in the society is fully educated about the system."

A few minutes later, the sun set with equatorial suddenness, and electric lights came to life along the streets in long geometric perspective.

But those streetlights were nothing compared to the bright neon shapes that covered the walls of the Admiralty Bank. There were crowds here—but there were always crowds here. Albrett and Pog worked their way through them, climbed the wide steps, passed through the high doors, and onto the casino floor.

Hundreds of chamalians filled the great hall, clustered around tables where great wheels turned and turned, and fortunes rose and fell whenever they stopped.

* * * *

"Come with me," Pog said. "We're going to spin the wheel."

"And I suppose we're going to use my money?"

"I have none with me and cannot use the Exchange in any case."

They found their way to the tellers. Albrett filled out a withdrawal slip and stepped up to a window where a buck-toothed, long-eared, old gray hare with spectacles took the slip.

"Stock name?" the teller asked.

"Hotspur Shipping," Albrett said.

"Password?"

Albrett gave him the secret word to his account. The teller disappeared for a moment to consult the books and the current stock prices, then returned to hand him a small stack of wooden plaques embossed with copper and gold—Hotspur stock markers.

Albrett took his kitty to one of the tables and placed a bet on a great wheel, setting one of the plaques in a numbered bowl. The wheel spun, then slowed. The bettors held their breath as one of the red squares that belonged to the bank rolled up and past the pointer at the top of the wheel. Then it stopped on one of the high numbers.

A monkey at the end with gold chains around his neck let out a whoop when the croupier dropped a handful of gold into the bowl with his stock marker and scooped up his winnings. The others snarled as the croupier pulled a lever that tipped the bowls and emptied their contents into the basket below.

Albrett bet again, this time putting his marker in a green bowl. When the number in green came to a stop at the end of the next spin, he found himself a tiny bit richer.

He made one more bet, losing another of his stock markers, then they left the table and found a pit boss, a bulldog with a studded collar and a jacket with square shoulders.

"I need to speak to a banker," Pog said as Albrett looked on with an air of haughty indifference that looked awfully natural. "I'd like to discuss a line of credit."

"Come with me," he said.

They crossed the floor of the casino and a minute later, they passed into the bank proper, staffed by junior officers in rows of cubicles who spoke with supplicants of every stripe and hue. The pit boss never noticed Albrett as he slipped up behind him and set a sap against the back of his head with a short twist of his wrist. The pit boss sagged and Albrett caught him, dragging him into a side corridor before anyone noticed.

"If I recall correctly, the admiral's cabin is this way," Pog said.

Albrett's eyes widened. "Which admiral's cabin?"

"The lord high admiral himself," Pog said. "Who else?"

A short time later, they stood at the lord high admiral's door, face to face with a hulking panther, close enough to count each strand of his sleek black fur and each tiny brass button on his uniform.

"Tell Admiral Pym I have a message from David Wu," Pog said without flinching.

The panther kept his obsidian eyes focused on Albrett and Pog and pressed a button on a small intercom to one side.

"A messenger from David Wu," the panther hissed.

"Send him in," a voice on the intercom responded.

When he contacted Inspector Mag'Rrrruff with his news, the chamalian policeman told Winston he would take care of transporting him to the War College. But, he added, it might take a while.

"The uprising continues," Mag'Rrrruff said. "No violence involved, but you never know."

Rather than think about the implications of that, Winston decided to study David Wu's message logs while he waited for Mag'Rrrruff. It was not as easy as he had expected. Wu was a prolific correspondent with dozens of scholars, students, and friends. Routing headers, date-time stamps, and subject lines offered little help.

But after a while, still long before Mag'Rrrruff arrived, he had narrowed his search to two items.

One was the last piece of incoming mail, from an address on Earth.

The other was the outgoing message that prompted the incoming mail.

He plunged ahead, hoping to find the clues he was seeking before he had to leave.

* * * *

Lord High Admiral Pym looked almost like a cousin of Porkle'pi, but with a single row of pointed spines protruding from the circumference of his spherical body and fur, now white with age, that stood on end. His nose was more pointed and pink, however, and his eyes small and dark. His hand shook slightly, another sign of his advancing years. This was the Pym who had taken command of the chamalian warship from his father when the angels first arrived at Chamal so many years ago.

His chambers were ornate, with gold inlay in the woodwork, tapestries of great naval battles with threads of precious metal worked into the scenes, and ornate carved furniture against every wall.

A small scribe with long whiskers and tail sat at a tall desk, scribbling in a thick book. A pair of white-furred kittens shared a broad couch in one corner, dressed in tight mesh that overemphasized their feminine curves, grooming one another and smiling seductively at Pym.

When Pog first thought about approaching the admiral, he had considered the possibility that Pym himself had ordered the assassination of David Wu and his house servant. And the possibility that presenting himself would only give the admiral the opportunity to complete the task.

But he hoped that someone who would send a black steamwagon to carry out his homicidal purpose would be reluctant to commit the deed in person.

And with a clear trail of evidence leading to his door...

So Pog decided it was worth taking a calculated risk—the danger in return for the truth.

"You have a message from Dr. Wu?" Pym asked.

Pym's bodyguard sniffed at Albrett and prepared to take him out with a single swipe of his heavy paw. Albrett shrugged his shoulders, loosening up in preparation to unleash the small arsenal he kept concealed in his long gray coat.

Pog felt his hearts squeeze hard, then said: "He sends his regrets that he will no longer be able to indulge in the long conversations with the lord high admiral that gave both of you such delight."

He was almost caught off guard when Pym narrowed his eyes, then let out a loud, hearty laugh.

"I see that some of the angel's paint has rubbed off on your hull," Pym said.

"And on yours as well," Pog replied.

"So what is your true business with me? I trust you are not an agent of some foreign power or that blackguard who plagues the affairs of our city."

"As I once served David Wu," Pog said, "I now serve his spirit."

"The spirit of an angel might be a harsh captain. Are you sure you want to sign on for such duty?"

"I was not asked my wishes at the time. The duty was thrust upon me by a black steamwagon gang. It will not be complete until I learn who sent the gang to David Wu's household."

"And you have come here looking for suspects. Ho, ho. I'm afraid you have sailed up a blind channel. There are no suspects here."

Pog's shoulders sagged. He had come so far and tried so hard—and all for naught. Unless Pym was lying.

"I am not yet convinced of that," he said. "The evidence I have seen has led me here. There are conversations that Dr. Wu had that I was not privy to. And somewhere in those conversations I believe is the motive for his murder."

"Our conversations were not at all incriminating," Pym said.

"Did they have anything to do with a text he was composing, *The Secret Understandings of Bankers*?"

Pym chuckled softly. "I hardly think so. Do you know what that title means?"

"I assume it refers to a conspiracy among the admiralty."

"And you would be mistaken. Dr. Wu and I spoke of the ultimate end of history—for the angels and for Chamal. He said that the great lesson of the angels was nothing they could tell us directly, but the truth that their very existence revealed. That there can be an end to war, to empire, to domination and dominion."

"I am familiar with that idea," Pog said.

"For that end to come, the first step must be to overthrow the tyranny of the exchange," Pym said. The scribe's pen danced furiously. "To put an end to the social order that allows those who possess wealth to determine the conditions of life for those who do not."

Pog tried to suppress a gasp but failed. Could such words really be coming from the lord high admiral of the city himself?

"That is the secret understanding of bankers," Pym said. "We understand these things. It is the fate of any chamalian of wisdom to be unable to escape such truths, once revealed. And we bankers have long since recognized this truth. Like everything else on Chamal, the exchange is impermanent. If wisdom itself is fleeting, its seed spread on the wind like chaff, how can banks be any less? The Great Wheel turns. History is the endless tale of new orders rising up and overthrowing the old. And all of us, all the bankers, all the admirals, know this."

"And yet you continue to maintain an order that inflicts suffering on the wise and the wild."

"Yes," Pym said. "But no more. Not here. Not in this city. The death of an angel is too great an omen to ignore. We cannot continue. That also is one of the secret understandings of bankers."

"No more? What do you mean?"

"I mean that the rule of the bank and the admirals over Kar-Kar-a-Mesh are ended," Pym said, his rheumy old eyes sparkling. "This night. Here and now. The order has already been given. The White Fleet is ready to make steam. My barge awaits at the dock. And if you go out onto the balcony, you can see the flames licking even now at the walls of the casino and the exchange."

Pog and Albrett both rushed through the high glass doors and onto the balcony that overlooked the exchange.

White and yellow flames danced up the walls of the casino and black smoke billowed from the roof. Hundreds of gamblers and wheelers and dancers and tellers rushed out of the exits and across the plaza, struggling to escape the inferno. Ashes fell to the ground—all that remained of the stock ownership records of the city's entire economy.

"Are you mad?" Pog asked.

"No, quite the opposite," Pym said. "This is the wisest thing we could think of, under the circumstances."

"But ... but..." Pog stammered. "But who killed Dr. Wu?"

"I do not know," Pym said. "But my guess is that it was the Scarlet Starflower. Kar-Kar-a-Mesh is too small a boat and has only a few oarsmen. Seek him out if you wish to solve this crime. And now I must bid you farewell. Come, my kittens, the barge sails with the tide."

Pog stood there as Pym, the kittens, the scribe and his book, and Pym's hulking bodyguard filed through the door, leaving him spent, sagging, and empty.

"Where to now, captain?" Albrett asked.

Pog sighed, then said: "Back to the War College."

* * * *

Pog found himself plunging deeper and deeper into the abyss.

His mind spun endlessly over the events of the last full turning of Chamal—the attack by the steamwagon gang, the escape, the long night in the watchtower, the day of marching, what little he had learned from H'ree and Pym, and the funeral pyre of the exchange in body and soul, whose bright glow painted the underside of a growing cloud of black smoke that streamed towards the sea.

Nothing made sense. There was no purpose, no meaning, no significance. Dr. Wu's mysterious text had nothing to do with dark conspiracy, but with the shining light of chamalian wisdom. It was a wisdom that could not be denied, that spread with the force of its own truth. The ideas he had taken from Dr. Wu and planted far and wide throughout the city could not help but take root, rise from the ground, soak up the sunshine, and spread from one chamalian to another until every single wise creature in the city was caught up in their tangled vines.

And yet—why had Dr. Wu been killed?

Pog could not fathom the answer. The admirals were innocent. The War College was uninvolved. *The Secret Understandings of Bankers* was nothing but a delightful play on words by David Wu—certainly nothing that would bring about his death.

As they approached the great black hulk of the War College, crossing the Plaza of Drowned Heroes, his despair was near its greatest depths.

And then he heard a sweet voice calling out from the rampart at the east gate of the college: “Pogo!"

It was Mally!

His spirit soared suddenly.

He ran up the steps, Albrett huffing and puffing to keep up. He ran through the maze of low walls leading to the gate. And then he stumbled to a halt at the sight of her.

Her eyes were large and filled with joy. She still wore a bush hat propped between her long floppy ears, and the rugged uniform that suited the harsh ground of the archaeological digs in the lowlands. She wiggled her small black button of a nose at him as he sighed.

Somewhere inside him, the heavy bands that he had wrapped around his soul in the aftermath of the steamwagon attack began to loosen.

"But how? You were days away from here. And now you are here."

"We flew,” Mally said. “In the air. In a flying boat, with the wind whistling around us, climbing higher and higher over the forests, up the mountains, and through the canyon. We landed in the harbor at sunset. We were going to go to the university, but everyone said it was too hard to get to because of the marchers. So we came here."

"We?"

"Yes, we.” It was the perennially snarling voice of Deldred, who stepped out of the shadows beneath the gate. “And just in time, from all appearances. The whole city is opening at the seams."

Pog felt a cold wind blow through him at the sight of the smug face of the captain of the university's archaeological research department.

"And you should see what we found,” Mally said with uncontained excitement.

"Inside,” Pog said. “We should go inside and talk."

They proceeded in tense silence through the dimly lit halls of the War College, winding their way back to H'ree's office.

But once they arrived, there was no way to contain Mally's enthusiasm.

"A full skeleton, intact, skull and spine and hands and feet,” she said. “At least a quarter of a million years old. We've never had anything but fragments that went back that far. All our guesswork is over."

"I wouldn't call it guesswork,” Deldred said. The researcher had a flat face with a short wrinkled snout, thick brows, and not much of a chin. It was face that never showed joy.

It bothered Pog that Deldred hovered over Mally the way he did. It bothered him that Deldred never thought to be discreet about his unrequited desire. And it bothered him that he took out his frustration by imposing his authority on her and all around her in the worst possible manner.

"I don't know what else you would call it,” Pog said, taking brief satisfaction at the way Deldred's face wrinkled in response.

Mally looked from Pog to Deldred and smiled nervously. “And we have such good news when all you have is such terrible news."

"Yes," Deldred said. "I see they've killed your angel."

"Sadly, it is true."

"And you managed to survive."

"True again," Pog said.

"That's a story I would like to hear," Deldred said.

"As would I."

Pog heard both the words in English and the translated speech from an AI. He looked to the doorway to see that it framed two figures—a blue-furred hound wearing the long trench coat of the Public Vendetta and the angel Jonas Winston, a translator clipped over one ear, his white hair curling around it.

He wondered just how long they had been standing there.

"But first things first," Winston said. "Tell me everything you can about this marvelous skeleton."

* * * *

Winston suddenly realized that all eyes in the room were turned to him. Chamalians were small creatures—Inspector Mag'Rrrruff was the tallest of them at a meter and a half—so they all had to look up slightly at him.

It had been a rough evening. The ride through the city was much less frantic than his earlier excursion to David's villa. But he had kept a white-knuckled grip on the handrails of Mag'Rrrruff's police cruiser as they rolled slowly past the masses of chamalian workers who still filled the streets of Kar-Kar-a-Mesh. Gnawing away at him was the fear that at any moment, without warning, they could all suddenly be transformed into an angry mob that went on and on as far as the eye could see, to the far ends of the planet.

He drew a deep breath and smiled.

"I'm sorry," he said. "David Wu was a friend of mine and I understand how important it is to get to the bottom of his murder. But in the grand scheme of things, that is a small concern. Before everything else, I am a scientist. A biologist. And I am here on Chamal to help uncover the secrets of its life. So please indulge me, dear, and tell me what you think you have found."

The female with the long floppy ears turned her eyes away, looking down briefly as her toe traced a circle on the floor.

"Please, Mally, tell us," said the chamalian at the center of the room. It was Pog, David's houseboy, Winston realized with a start. The one that he and Mag'Rrrruff and many others had been seeking for a whole day.

Mally described the find.

"A female with prehensile hands and opposable digits," she said. "The full set of tiny bones in the throat that are necessary for fully articulated speech. An upright spine. And a skull large enough to contain a brain of at least 600 grams."

"And all in the same package?" Winston asked.

"Complete and intact. A full fossilized skeleton."

"What breed?" asked Pog. "What phenotype?"

"It's hard to tell," Mally replied. "The skull shape, the bones of the face and snout, and shape of the feet and hands suggest that it was an early form of digger. But Deldred believes it's a canine root."

"The length of the tail is typical," said the flat-faced chamalian who hovered over Mally like a nervous suitor.

"Is it an isolated find?" Winston asked.

His question was met by a tense silence. He wondered if there were things that the chamalian researchers were reluctant to share with an angel. He certainly could sympathize with them.

The one called Deldred gestured, and Mally continued.

"We've been excavating the site for some years. Our team was the latest to work there. Earlier teams found isolated traits in the fossil record. Grasping hands. More primitive bone arrays in the throat. Large skulls. All found separately. But this is the first skeleton that combined them all."

"Well, I'll be damned," Winston said. He winced and tried to stop the AI from translating his remark, but it was too late. Oh well, let the chamalians be confused for a change.

For a few moments, he marveled silently at the intricate mystery of chamalian genetics. Each of the traits Mally described was useful in its own right. Each of the traits had survival value and the genes that produced it were replicated and passed along.

"On Earth, evolution works on whole species at a time," he said, looking down into Mally's dark eyes. "Each of the early hominids embodied some form of the advances that made humanity what it had become. *Homo habilis, Homo egaster, Homo erectus.* Each of them as a group emerged from the early African plain, made the most of their gifts, and passed them on to a new species in the fullness of time.

"But on Chamal, evolution works on the elusive and mobile traits themselves. The mixing and matching of chamalian genes is a complicated process, a grand minuet with many changing partners, a complicated set of interference patterns, a deeply imbedded mathematical scheme. And most of all, it is a maddening combination of centripetal and centrifugal forces, bringing traits together and then dispersing them throughout the population.

"The hands could have appeared in a number of subspecies—of phenotypes—over time and space, enabling any number of populations to compete against their neighbors in their ecosystem. The ability to communicate in complex sounds likewise. It no doubt followed the ebb and flow of the chamalian genetic tide, arising in one subspecies, then migrating to another. The same is likely even true about large brains, though I am nursing along my own theories on how the ability to organize the various evolutionary advances drives its own selective force."

Winston looked up and around the room at each of the strange and unique creatures who were listening to him with rapt attention.

"And then they all came together at once," he said.

"Wisdom, as you chamalians called it, otherwise identifiable as self-conscious intelligence, emerged from nature. And there was no turning back. You are the result of this bizarre trick of evolution: wild animals with the gift of reason. I don't know which is more amazing—the heights to which you have risen or the depth from which you have emerged."

"Dr. Wu managed to be amazed at both simultaneously," Pog said.

"It's the hands," said Deldred. He paused until all eyes had turned to him. "The hands make the tools. The tools make the brain grow. The brain holds the wisdom to make better tools. The tools are used to make the phenotype stronger. Follow the bones in the hands and you follow the track of wisdom."

Winston was unable to read any emotion into the expressions of the chamalians in the room, but the AI was fully capable of capturing the smug arrogance of Deldred's voice—and the disdain in the words of Pog.

"I beg to disagree."

And for a moment, Winston felt a cold chill. That was one of David Wu's expressions, not a chamalian phrase. He had heard him use it so often, since they so often disagreed.

"I beg to disagree," Pog said louder. "It's not the hands—it's the voice. Speech. Words. They are what bind wisdom together. Tools get better because wise creatures talk about how they make them. The brain grows to encompass the greater world of words. The words make the world grow wise. Words have power beyond any tool. They move faster, make more happen, change more things than any tool ever made. And that is why we've had Mally search so hard for those little bones in the throat that make speech possible."

"Brraakk! What do you know?" Deldred brayed.

"I know what words can do," Pog replied. "And I know what I have done with words."

"And what words did they use when that skeleton walked the ground? Can you write them down for me? You can find the tools and measure them. You can dig them up and record them. Can you do science such as that on your words?"

"No," Pog said. "But I still know what I know."

"Which is nothing," Deldred said. "I don't even know why you are here. Why are you still alive?"

Winston suddenly jerked straight up as he was reminded why he was here. And that it was time to return to that subject.

"Why exactly?" he asked. "Why are you here? And why is David Wu dead?"

That stopped the scientific dispute in its tracks and left everyone in stunned silence. But it only took a moment for Pog to venture a response.

"I do not know," he said. "I have spent almost every moment since the black steamwagon left the house trying to find the answer, and I have not. I thought it was the admiralty. But they did not send the steamwagon. I am at the end of my rope."

"Perhaps that is because the steamwagon did not kill David Wu," Winston said.

"Then who did?" Pog asked.

"I can answer that if you give me a moment. But first, I believe you have something that properly belongs to the angels."

Pog shook his head without saying a word.

"David's mindpad. The reason I am here is that we traced it precisely to this room. If I could have it back, please."

Pog's shoulders sagged; he reached into his backpack and pulled out the rolled-up pad. Winston unrolled it and set it next to his own. He tapped a few commands, saw enough of what he was looking for, and turned his attention back to Pog.

"Are you familiar with a Professor Glenn from the University of Kentucky?"

Winston was pretty sure how to read the drop of Pog's jaw—stunned disbelief mixed with embarrassed guilt.

"I'll assume that you are. It seems that someone other than David Wu has been using his mindpad to correspond with him. In fact, it appears someone has been engaged in a lively textwar with the professor."

Then Pog, in English, said: “I believe I am in double-big trouble, for certain fact."

"As are we all,” Winston said. “You picked up quite a bit living with David, didn't you, Pog?"

"He was an excellent teacher,” Pog said. “Living with him was an experience in wisdom that few chamalians have ever known."

"I'll bet it was. You seem to have driven his poor AI stark, raving mad,” Winston said with a sardonic smile.

"But what does Professor Glenn have to do with this?"

"Professor Glenn no longer has anything to do with this. Sometime last night, he took his own life. But not before sending an e-mail to David's mindpad responding to the textwar. An e-mail with a particularly malevolent attachment. The attachment was a virus that commandeered David's food processor and produced a lethal amount of a unique toxin. And it was the mail from the poison pen pal that killed David Wu."

He tapped the mindpad, called up the message, and read it aloud: “You're right and I'm wrong. So terribly wrong. Bite me. Bite me and drop dead."

Pog felt his hearts squeeze hard and his head grow light. It was his fault. He had set the wheels in motion that had brought about the murder of Dr. Wu. The guilt seemed to rise within him, threatening to overwhelm him. He felt terribly, terribly small.

"It was my message,” he said. “The poison was meant for me."

The angel Winston looked down his nose at him critically, then shook his head slowly.

"Is this your message? ‘Rank social Darwinism ... reified prejudices of a closeted academic ... the mindless worship of idols ... Chamalians will make their own destinies.’ Signed ‘David Wu, History Department, War College of Kar-Kar-a-Mesh, Chamal.’”

"That's the one,” Pog said. “I am so sorry. I cannot begin to tell you. I wish I had never sent it."

Winston shook his head slowly once again.

"But that message went out hours after Professor Glenn sent his e-mail. After David had been poisoned.

"Here is the message that brought the poisoned response:

'"The texts you cite-link focus on the easily measured statistics of narrow-minded bit counters. They all measure the long-dead past without any sense of how it unfolded at the time. A grim tally of war, upheaval, suffering, all removed of the vital reality of the struggle and its meaning at the time. They leave out all that is human in history. And I cannot help but think that you cling to them because you recoil from that humanity—even when it is found in an alien species on another world.' And it's signed 'Walt Kelly.'"

"I know that name," Pog said. "He's another poster in the textwar."

"It was the name David used when he posted on the bulletin board. The poison e-mail was addressed to him—and it went through his mindpad. You had nothing to do with it."

Pog felt all the tension fly from his small body. His hearts relaxed. His breath came more easily.

"But the steamwagon," he said. "Who sent that? And what for?"

"We can answer that!"

Pog looked to the doorway and saw another party had arrived, ushered along by Porkle'pi. Leading them was Norm, from the Society for the Detection of Horse Thieves.

And behind them, attended by a half dozen stevedores, was Barkinflas. The room was sufficiently small that the big old dockworker had a hard enough time just getting himself through the door.

"Did you know that the Exchange is burning to the ground?" Barkinflas asked.

Pog admitted so reluctantly. "Things seem to have gotten out of hand."

"You detectives," the angel Winston called out across the now-crowded room. "What did you say about answering Pog's question?"

Norm stepped forward.

"We tracked down the mist-ape who cracks his tazelnuts with his teeth."

"He led us to this short fox who took the contract," Klavin said.

"And I brought him along so we could question him," said Boyd.

He turned to the stevedores still in the hall and waved them in. They didn't try to enter H'ree's office, but they passed forward a small shape that turned into a short fox with a snout full of sharp teeth.

"He didn't know the name of his contractor," Boyd continued. "He said it was someone with a commission who wanted a romantic rival out of the way. He said he was an educated officer with a flat nose and an arrogant manner."

Pog looked across the room at Deldred—as did Winston, Inspector Mag'Rrrruff, and all three members of the Society for the Detection.

The short fox looked around quizzically, then his eyes too were drawn to Deldred.

"I am so sorry, sir," the fox said to Deldred. "They threatened to do things to my hands."

Deldred's eyes opened wide, he moved his mouth, but no words came out.

"Eeeeeeeeeeeeeyah!"

The ear-splitting shriek stunned everyone, most of all Deldred, who was further surprised by the sudden assault by Mally.

She leaped across the floor at him, baring teeth and claws as she flew through the air. She hit his shoulders, reaching out and scratching deeply into his face. She was going for his throat when Barkinflas grabbed her with one large hand and pulled her off.

"You beast!" she yelled. "How could you even think that if you got rid of Pog I would turn to you? If it weren't for the Public Vendetta, I would do things to you that would never heal."

* * * *

Winston felt his nose wrinkle as more and more creatures arrived in the hall outside the small office and tried to jam their way in. The noise grew to a new level as everyone spoke at once, newcomers making reports, those already there explaining what was happening, all turning to white static as the AI hit the limit of its ability to present a coherent set of translations.

Then he felt a tug at his sleeve. It was Pog. He tipped his head down closer to focus the AI's attention.

"What happens now?" the chamalian asked. "What will the angels do next?"

Winston drew a deep breath and thought a moment.

"I will make a report," he said. "I have recovered David Wu's mindpad, so all our technology has been recovered. His AI is likely lost to us forever, so there is no real record of what went on between you and him. All that anyone will know is what I tell them. And I would prefer to leave David's legacy unstained by charges from the survey team."

Winston watched Pog closely and it appeared that the small creature was relieved, his breathing slowed and the color returning to what skin could be seen around his eyes and nose.

"I will have to tell them that you have learned enough English to send text messages to academics back on Earth," he said. "But without the mindpad, you will no longer have that capability."

"I understand," Pog said. "But what about us? What about Kar-Kar-a-Mesh? Will the angels intervene?"

"Intervene in what?" Winston asked. "There is no violence here. They've never felt the need to interfere in the earlier unrest, so they aren't likely to do so now. And when I explain its nature, they are probably going to be more pleased than alarmed. After all, the less likely chamalians are to return to their warlike ways, the better for everyone."

"Thank you," Pog said.

"And let me thank you," Winston said. "David has never had a more apt pupil or a better friend than you."

That left the chamalian speechless, and Winston as well. He felt a tear well up in one eye as he surveyed the growing clamor of aliens as they began to appreciate their newfound circumstances. And he hoped that all that David Wu had lived for would provide seed for their revolution.

* * * *

"I don't know about you," Norm said, "but I still wouldn't trust your girlfriend. You know how these stories always turn out."

Pog smiled and said: “I have no reason to fear her betrayal. I trust Mally with more than my life. She knows everything about me and all my disguises and all my plots. If I cannot trust her, then I am undone and beyond help. But this isn't a Maltese Frog story anymore, Norm. This is a new kind of story. Film rouge. Tales of revolutionary change. All creatures, males and females, all working together. We may even have to change the name of the bar."

Barkinflas rose up above the crowd and pushed closer to Pog.

"May I remind you that the Exchange is still burning?” he said. “And with it all the records of ownership of the shares of the enterprises of Kar-Kar-a-Mesh."

"Yes,” Pog said. “Isn't it grand? I'm only afraid that we aren't ready for this new world."

"Well,” Albrett said behind him, “it appears to be ready for us."

"Indeed it does,” Barkinflas said.

Then Mally appeared beside him, took him by the hand, and led him through the press of bodies to a door at the rear of the office. They stepped out onto a small balcony that gave them a view of the harbor and beyond. The waves were dappled by the Great Moon that was rising out of the sea.

"It is too bad about Dr. Wu,” she said. “You must feel terrible."

"I do,” Pog said. “But I'm feeling better."

And he was.

In one brief flash of insight, he saw the totality of death and the enormity of life balanced against one another. At last he allowed himself to feel the enormous loss of his teacher, his window into the wisdom of the angels. But he no longer felt like he was suspended over an abyss himself.

Now he saw that the loss of his old world was leading the way to an extraordinary new one—and that Dr. Wu had prepared him well for all it would bring. He couldn't have asked for more.

He took Mally's hand in his.

"Tomorrow morning, all the wise creatures of Kar-Kar-a-Mesh will wake to a city that is free of the domination of the banks and the admirals and The Exchange,” he said. “As a wise old angel once said, ‘We have seen the enemy, and he is us.’”

* * * *

(EDITOR'S NOTE: Earlier stories of Chamal include “Seed of Destiny” [January 2003] and “Seed of Reason” [April 1999].)

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Science Fact: **THE LARGE HADRON COLLIDER: A NEW ERA** by Dr. Don Lincoln

A Race for the Ages

Every year during Memorial Day weekend, millions of Americans tune in their TV set to one of racing's greatest spectacles, the Indianapolis 500. For three grueling hours, racers hurtle their cars around a 2.5-mile-long oval track at speeds routinely exceeding 220 miles per hour. It's a testament to the skill and endurance of the drivers to navigate for so long and at such speeds.

However, no matter the passion of American racing fans, the Indy 500 is small potatoes compared to a new racetrack in Europe, just outside Geneva, Switzerland. No, this new race is not the venerable Le Mans, but rather a scientific one. On a circular track a little over sixteen and a half miles in circumference, subatomic particles travel at speeds so fast that they could complete the entire Indy 500 in a little over two thousandths of a second, far shorter than the blink of an eye. Traveling nearly at the speed of light (186,000 miles per second), beams of protons race for ten hours or so, during which time they travel nearly seven billion miles or about to Neptune and back, with a round trip to Jupiter thrown in for good measure.

This new “race track” is called the Large Hadron Collider, or LHC. Situated at the premier European particle physics laboratory, called CERN (a French acronym for European Nuclear Research Council), the LHC can accelerate two beams of protons, traveling in opposite directions around the circular accelerator, and collide them head-on at several spots around the ring. These collisions are recorded by gargantuan detectors that can be as big as 150 feet long, 80 feet tall, and weigh as much as twenty-five *million* pounds. The two largest detectors are shown in figure [1].

[FOOTNOTE 1: Fermilab, or Fermi National Accelerator Laboratory, is the US's premier particle physics laboratory and the author's home institution.]

Particle accelerators have played a role in many science fiction stories, from activating wormholes, to forming powerful weapons, to the ghost-confining proton packs of *Ghostbusters*. However, the reality is that the biggest of these accelerators have a deeply scientific purpose. With them, one can heat matter to temperatures impossible by other techniques, even probing the conditions of the early universe, tiny fractions of a second after the Big Bang itself. For this purpose, the LHC is without peer. It can accelerate particles to fully seven times the energy of its nearest competitor, the Fermilab1 Tevatron, located forty miles west of Chicago. Lest you not appreciate the significance of the LHC beginning operations, the Tevatron turned on in 1983. Thus this is the first time in 25 years that a new energy frontier is being explored. Some of the graduate students working on the LHC experiments weren't even born when this happened last.

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Figure 1: The CMS (top) and ATLAS (bottom) detectors are the largest particle detectors ever constructed and each can inspect 800,000,000 collisions per second. [Figure courtesy CERN.]

* * * *

The LHC collides beams of protons, but appreciating the details of these collisions requires a deeper understanding. Even though protons are essential components of all atoms and they are so unfathomably small that we often treat them as having no size at all, protons are actually made of even smaller objects called quarks. Each proton contains three such objects. At the very high energies present in the LHC, individual collisions are between not entire protons, but rather individual quarks, one from each proton.

To get a mental picture of how this works, imagine two flocks of birds heading toward one another. If the flocks are not traveling very fast, the two flocks can avoid one another and each flock acts like a single unit. You could say “the flocks scatter from one another.” However, if the flocks head towards each other at very high speeds, then they won't have enough time to avoid one another. In this case the two flocks might pass straight through each other, with nothing more to show for it than a few startled birds. However, occasionally two birds will collide head-on and feathers will fly everywhere. Replace flocks and birds with protons and quarks and you have the right idea. When two quarks hit head-on in a very violent collision, you have accomplished the goal of a particle accelerator—to concentrate a huge amount of energy in a tiny space.

* * * *

The Black Hole that *Didn't* Eat Europe

The startup of any new energy-frontier accelerator has been accompanied by fear for some people, and the LHC has been no exception. While my colleagues and I waited with great excitement for the first LHC-initiated collisions in hopes that they would reveal something new and exciting about the universe, there are some Nervous Nellies who have viewed the LHC not as a scientific opportunity, but rather a cause for dread. Their worries are totally unfounded, but I should explain why they've been concerned and then why they shouldn't be.

LHC can collide protons together at energies never before accomplished in a laboratory, fully seven times more energetic than our previous best attempts. Essentially, those people concerned with the start up of the LHC worry that something unexpected and dangerous might occur, as in Alfred Bester's story “Adam and No Eve."[2] While the topics they worry about vary (from quantum bubbles to magnetic monopoles to the vague “something really bad"), the most common concern is that a black hole will be made in the LHC's collisions. Borrowing from what we know about stellar-sized black holes, people envision the black hole first eating the accelerator, then France and Switzerland, and finally the world. Scary stuff, if it were credible.

[FOOTNOTE 2: In *Astounding Science Fiction*, September 1941. In the story, a previously-untested technology destroys all life on Earth.]

Luckily, we know that black holes are not a danger. In 1974, physicist Stephen Hawking realized that black holes actually do radiate energy in the form of what is now called “Hawking radiation.” All black holes radiate, with the rate of radiation depending on the size of the black hole. As the size of the black hole *decreases*, the rate of radiation *increases.* So subatomic black holes evaporate essentially instantaneously.

However, black holes are only one imagined danger. We'd like to know that the LHC is safe, *no matter what kind of danger one imagines.* Fortunately we have an airtight answer that is universal. We know we're safe because we're still here to worry about it.

Our proof is simple. For the 4.5 billion years that the Earth has existed, it has been constantly bombarded by cosmic rays from outer space. Cosmic rays are typically protons accelerated by the universe itself that crash into the protons of the Earth's atmosphere; protons colliding with protons, just like at the LHC. Further, some of these cosmic-ray initiated collisions are much more energetic than even the mighty LHC can achieve. In fact, if you add up all of the cosmic rays hitting the Earth since its creation, you find that there have been an awful lot of them. A detailed calculation reveals that the LHC would have to run continuously for about 100,000 years to make the same number of collisions of that amount of energy. While the Earth is very large, it is by no means the biggest thing around. The Sun is far more massive and has been hit by a correspondingly larger number of cosmic rays. The LHC would have to run for billions of years to generate as many collisions as cosmic rays have already induced in the Sun. The same

question can be asked of our galaxy and indeed the universe as a whole. The observed rate of black hole generation in the nearby galaxy sets exceedingly stringent limits on the danger posed to us by the LHC.

So no matter what will happen in the collisions of two protons in the LHC, it must be safe. If the universe hasn't destroyed the Earth this way, neither will the LHC. This is a crucial point. The particle physics community took these concerns very seriously and commissioned an independent panel to evaluate the danger. After considerable effort, they came up with this comforting and compelling universal counter-argument. Anyone who predicts that the LHC will destroy the Earth in less than many billions of years of continuous running has ignored the fact that this experiment has already been done and that the prediction has already been falsified. The LHC poses no danger to the Earth: nada, zero, zilch.

Once we can dismiss the fear that making black holes (or anything else) in the lab is a dangerous thing, we can realize that making tiny black holes in Switzerland would actually be a really cool thing to do. Of course, we don't know if that's even possible, but some scientists have suggested it might happen. Their reasoning is described a little later.

* * * *

Discoveries Are Hard to Predict

One of the most maddening questions I'm asked when I give public lectures about the LHC is “So, what are you guys going to find?” Think about that for a minute. The point of the LHC and the experiments based there is to make *discoveries*. By definition, you can't predict a discovery because, after all, if you knew you would find it, it wouldn't be a discovery, now would it? Just ask Columbus how that trade route to the Indies worked out...

In fact, before we launch into the ideas about things we might discover, let's spend just a few lines talking about the more pedestrian measurements that are planned. We currently have an excellent set of theories that we believe explain the world. These theories, taken together, are called the *standard model of particle physics*, or just the *standard model* for short. We know about quarks, which not only make up the familiar proton and neutron, but also make up hundreds of types of particles discovered since the 1940s in earlier accelerator experiments and in cosmic ray studies. There are six types of quarks, with whimsical names: down, up, strange, charm, bottom, and top.[3] Of the six, only up and down quarks are found in ordinary matter and the other four are made in particle accelerators. In addition, we know of a class of particles called leptons, not found inside the nucleus of atoms. The most familiar of the leptons is the electron, but there are cousin particles called muons and taus, as well as three different types of lepton particles called neutrinos. The neutrinos are elusive, interacting so rarely with matter that they could traverse many light years of solid lead (tens or hundreds of trillions of miles), with only a 50% chance of interacting.

[FOOTNOTE 3: I was a member of one of the two teams that co-discovered the top quark.]

We also know of four forces that govern our world: familiar gravity; the electromagnetic force, which holds atoms together; the weak force, which governs some kinds of radioactive decay; and the strong force, which holds the quarks inside protons and neutrons. Of these four forces, all but gravity are well understood at the subatomic level, while an understanding of gravity remains elusive in the quantum realm. Each of these four forces comes with a particle or particles that make it work. These particles are: gravitons (gravity, thus far unobserved), photons (electromagnetism), the gluon (strong force, named because it “glues” the quarks inside the proton), and the W & Z particles (weak).

While all of these particles and forces have been studied at lower-energy particle accelerators, we need to confirm that we see what we expect when we make predictions at the higher LHC energies. If our predictions are not confirmed, this will be very interesting in that it would indicate that we are seeing

evidence for something unexpected or, as we physicists call it, “new physics.” If our predictions *are* confirmed, this will also be welcome news in that it shows that our understanding of the universe is really quite good.

However, for all the successes of the standard model, there are mysteries. We don't know why there are the numbers of quarks there are. We don't understand why particles have mass and why the different particles have such disparate masses. (The top quark has a mass of about 170 times that of a proton, while the photon has no mass at all.) We don't understand why the various forces have such different strengths and ranges. We definitely don't understand how gravity works in the quantum realm. In fact, while we understand a lot (being able to put a man on a moon and communicate almost instantaneously across the globe), we don't really know *why* the universe follows the rules it does. We hope that the LHC will give us some clues to help figure this out.

* * * *

The Higgs Boson

The question that physicists are most optimistic that the LHC will answer is the origin of subatomic particle mass. This sounds like a fairly esoteric subject, but it is something we've been working to clarify for over 40 years. While we talk about there being four forces, physicists in the late 1960s were able to show deep linkages between the electromagnetic and weak forces. They even went so far as to say that the two forces were one and the same and could be called an “electroweak” force.

There was only one teensy-weensy problem. The two forces didn't really look much like one another. The electromagnetic force, which governs electricity, magnetism, light, and the atomic structure of matter, is about a thousand times stronger than the weak force, which governs some forms of radioactive decay. Further, the photon, the particle associated with the electromagnetic force, was measured to have no mass at all, while the particles of the weak force, called the W & Z particles, were extremely massive—about a hundred times heavier than a proton. These two phenomena seemed to be irreconcilably different.

The theoretical physicists of the 1960s made a simplifying assumption and just assigned all particles zero mass. They knew this was wrong, as the particles obviously did have mass, but they also knew that the higher the energy the collision, the less that mass mattered. If at high energy, the mass could be ignored, perhaps at lower energy the effect of mass might be a small perturbation. In any case, it was a good starting point. If they did this, they would be able to generate a new *electroweak theory* that combined everything from what originally appeared to be two separate phenomena.

On the other hand, no matter what the theoretical physicists assumed, the fact remained that the two forces (electromagnetism and weak) still looked quite different. So either they were just building theoretical castles in the air, or there was something else going on that would reconcile all the conflicting ideas.

In 1964, a Scottish physicist by the name of Peter Higgs brought together a number of ideas floating around at the time and proposed an answer. Suppose that there was an energy field in the universe that interacted differently with different particles. The particles that interacted more with this new hypothetical field would be more massive. If this field interacted more with the weak force particles (the W & Z particles), this would explain their large mass, and if they did not interact at all with the photons of electromagnetism, then the photons would be massless. It's a lot like how a dolphin cuts gracefully through water as compared to a sumo wrestler. The wrestler is held back more by the water—in the field analogy, the wrestler and dolphin interact differently with the “water field.” With the Higgs field, different particles would interact differently with it and, in doing so, get a different mass.

This idea was quite wonderful as it allowed for there to be only a single electroweak force *and* it allowed for the electromagnetic and weak forces to look quite different. So the question then became "Well, that's a great idea and all, but is it *true*?" or, more precisely, "Does Higgs' idea make a prediction that can be validated?" The answer turned out to be yes. The new theory predicted the existence a new particle, technically called the Higgs boson, but often called "The God Particle" in the popular press, after Lederman and Teresi's 1993 book of the same name.

You might be wondering how a new energy field would mean a new particle. In some respects, this is just an argument by analogy. We know a lot about electric fields. Take a latex balloon and rub it on your arm. Then hold the balloon above your arm and you can feel your arm hairs being lifted by the electric field that was created. The electric field appears to be everywhere in the region of your arm and yet we know the field is actually generated by photons jumping back and forth between the balloon and your arm. The individual photon particles "add up" to make the electric field.

This concept is not so obvious to even a scientifically sophisticated reader, so let's think about another familiar example of where something appears to be everywhere and yet consists of tiny particles. Think about a swimming pool.

If you jump into a filled swimming pool, you're going to get wet. It's not possible to somehow jump into the pool and stay dry. While you're in there, scoop out a handful of water and take a close look at it. Everywhere there is water, with no places where there is none. The water is an analogy for an energy field.

While the description of water given above is accurate, you also know full well that water is made of individual molecules. Take two hydrogen atoms and one of oxygen, combine them in the right environment, and *voila!*—instant H2O. A cup of water consists of countless individual water molecules that together make up the reality that is a pool full of water.

Similarly, if there is an energy field of the sort postulated by Higgs, it must be made of Higgs particles. The trick is to find one. It is this search for which the LHC was predominantly designed. If Peter Higgs' idea has any merit at all, the LHC will find a Higgs particle. If it fails to find this particle, then the Higgs idea is dead and it's back to the drawing board. However if such a particle is found, another piece of the tapestry of the standard model will have been unveiled.

Physicists will search for the Higgs boson by searching for all the possible ways by which it might decay. Unfortunately, for many of these decay modes (e.g. the Higgs boson decaying into a pair of bottom quarks), the backgrounds are very high. Backgrounds in a physics context are things that look like the thing you want, but aren't. Think about rooting around in a bowl of cubic zirconia for the lone diamond and you get the idea.

* * * *

Figure 2: Expected Higgs boson signal after one year of running with beams at design intensity. The actual signal is the dark bump at 130 GeV, while the lighter gray are events that could be Higgs bosons, but aren't. [Figure courtesy CERN and CMS collaboration.]

* * * *

We expect that one of the best ways to find the Higgs boson is to search for its decay into two photons. Figure 2 shows what we expect to see after a year of running at full beam intensity. We will look at selected pairs of photons, make the assumption that they come from the decay of a single particle, and determine the mass of the potential parent particle that made them. If the Higgs boson exists, we expect to see a couple of thousand events that stand out from the much larger background. Of course, the early running of the LHC will be at only 10% of the design luminosity, so it will be a number of years before

we know if the Higgs boson exists.

* * * *

The Inexplicable Weakness of Gravity

While the question of the origins of particle mass is an interesting one, there are many others. Another very interesting question is "Why is gravity so weak compared to the other forces?" Now you may wonder about this question. Gravity sure seems pretty strong to me. If I trip and fall, the impact with the ground might well be gravity saying, "What do you mean I'm not strong?" Toss in the fact that it is gravity that governs the motion of the heavens and you have a statement that needs defending. How can I claim that gravity is not very big?

So do the following experiment. Find a paperclip and a magnet. Let the magnet pick up the paperclip and hold it, paperclip dangling from the magnet. This is proof that electromagnetism is vastly stronger than gravity. Upwards, you have a modest little magnet lifting the paperclip, *while the entire mass of the Earth* is pulling the magnet downwards. Little magnet up, entire planet down, and the magnet wins. The magnetic force is much, much stronger than gravity. And this leads us to some interesting questions.

It turns out that the strengths of the three stronger forces differ a lot. The strongest (strong) is about 100,000 times stronger than the weakest (weak); however, gravity is much weaker, about 1040 times weaker. Why this should be so is simply not understood. There are many ideas about this, but one of the most popular involves a term sure to excite science fiction fans: extra dimensions.

In a physics context, we don't mean *parallel* dimensions. There is no "You mean like the *Star Trek* episode where Spock had a beard?[4]" involved. The idea is that maybe there are additional dimensions that gravity can enter, but the other forces can't. If that were the case, then perhaps we could explain gravity's relative weakness.

[FOOTNOTE 4: "Mirror, Mirror," first broadcast October 6, 1967.]

* * * *

Figure 3: If the extra dimensions are small, gravity can initially spread into the extra dimension until it is filled up. Here when the small second dimension is filled, the space looks one-dimensional thereafter.

* * * *

Let's describe a familiar situation that gets across the most important ideas. Think about playing billiards. Ordinarily, the balls are confined to roll around on the surface of the table. We say that the balls are confined to two dimensions. However, the sound we hear when two balls hit can be heard everywhere, above the table, below it or from any angle. The sound caused by balls moving in two dimensions can be heard in three dimensions. In a similar way, the idea is that the three stronger forces (strong, electromagnetic, and weak) are constrained to three dimensions, while gravity may be able to enter more.

These additional dimensions are not the same as our familiar left/right, up/down, and in/out. These familiar dimensions are infinite and large, meaning that if you jumped in a rocket ship going left, you could go forever. The extra dimensions of gravity would be relatively small—fractions of a millimeter or even smaller. But even these small extra dimensions would be enough to explain why gravity is so weak.

We know that these extra dimensions must be small because of a seventeenth-century concept. Isaac Newton showed that the force between two objects was proportional to the inverse of the distance between them raised to the second power. We have subsequently realized that that exponent (2) must always be one less than the number of dimensions in which we live. Three dimensions means a two in Newton's equation.

We have measured the behavior of gravity down to a distance much smaller than a millimeter and Newton's law holds. So if there is another dimension accessible to gravity, it must be smaller than that. If such small dimensions exist, we can explain gravity's relative weakness. Gravity simply has “more places to go” than the other forces.

Figure 3 shows how the gravitational field would spread out in a universe with two dimensions, one smaller than the other. Suppose that the universe was restricted to the surface of a soda straw. Add a mass to the universe and look at the gravitational field. If you look at the field at distances smaller than the radius of the straw, you see it looks basically like it would in an ordinary plane. But, as the lines of gravitational force diverge, they wrap around the straw and run into one another. To spread out further, they can only travel in the 1D dimension along the straw axis. Thus viewed from small distances, the gravitational field would look two-dimensional, but viewed from larger ones, it would look only one-dimensional. Of course the universe isn't a soda straw, but the essential ideas hold. If the other forces couldn't see the small dimensions, but gravity could, these small extra dimensions could explain gravity's relative weakness.

The idea that not all dimensions are the same is a curious one, but one that isn't so difficult to imagine. Think about the tightrope walker shown in figure 4. She can walk in only one dimension, forward and backwards. However, an ant on the rope can walk in two dimensions. The ant can walk in the (relatively) infinite forward and backward dimension, but it can also walk around the surface of the rope. This second dimension is clearly much smaller than the long one, but it is definitely there and accessible to a small enough observer. The core idea is that gravity can sneak into these smaller additional dimensions. The experimental signature would be that a graviton, the hypothetical particle that causes gravity, would escape into the smaller dimension(s) and be invisible to our detector (which exists in the ordinary three dimensions). Thus events in which energy seemed to disappear would be of special interest and studied carefully to see if they are consistent with the hypothesis of extra dimensions.

* * * *

Figure 4: A tightrope walker is constrained to move in one dimension, while the smaller ant can move in two. [Figure courtesy Lawrence Berkeley Laboratory.]

* * * *

This gets us back to our black hole and safety question. If it turns out that there really are extra dimensions of the right size, it is possible that the LHC will be able to concentrate enough energy into the right size volume and itty-bitty black holes will be made at the LHC. In fact, if the extra dimension idea is right, there are theories that suggest that lots of little black holes will be made and we will finally be able to get an understanding of gravity at super-small sizes. Of course, the earlier argument about there being no danger still applies (in fact, we'll be able to identify the black holes by the Hawking radiation that evaporates them), but there's just something fascinating about studying microscopic black holes in a laboratory here on Earth.

There are literally thousands of physics topics that will be studied at the LHC and only the briefest sketch of some of the more interesting ones are described here. With over 5,000 physicists sifting through the data the LHC will generate, it is clear that there will be a rich and exciting research program indeed. And of course, the most exciting prospect is that my colleagues and I will discover something entirely unexpected, something that completely changes how we think about the universe. The LHC is, after all, a *discovery* machine. We will be a bit disappointed if we don't encounter a few head-scratching moments along the way.

The future of particle physics is bright indeed. For the first time in a quarter century, an entire new vista is opening up, promising new knowledge. At the LHC, we will be able to recreate the conditions of the

early universe, approaching a scant 10-13 seconds after the Big Bang. It is at facilities like this and others that the mysteries of the universe will be further revealed, explaining the deep linkages between matter and energy, space and time. Until a newer accelerator[5] comes online, the LHC will be *the* place to do particle physics research for the foreseeable future, making it the only place to explore the quantum frontier.

[FOOTNOTE 5: The planning for such a new accelerator, called the International Linear Collider or ILC, is underway. It will collide beams of electrons and antimatter electrons in a manner similar to the LHC. The turn on date for this facility is at least two decades in the future.]

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Novelette: **THE BEAR WHO SANG OPERA** by Scott William Carter

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Illustrated by John Allemand

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New technologies can lead to new crimes—and new motives.

* * * *

The bear wanted his voice back. That's what I thought he said, and I asked him to repeat it. The cochlear implant in my left ear had been acting up a lot lately—I blamed it on Targal's frequent lightning storms—and I assumed he must have said something else.

"My voice," he said. "I think someone's stolen it."

I took my boots down from the desk and leaned a little closer. "Your voice?"

"Yes, that's right."

"But you're speaking right now."

"Yes." He bobbed his big furry head. "Oh. No, I see the problem. Not my voice. My *singing* voice. I need your help getting it back. You do help people find things, don't you? That's what I heard."

His voice was deep and gruff, but he sounded sincere. Of course, I was no expert on bears, so how would I know? Maybe bears were good at lying. He was a grizzly, standing on two feet, the tips of his ears brushing against the ceiling lamp. His black tuxedo had obviously been tailor made for him, but still it seemed small, the buttons straining to hold in his girth, bits of brown fur showing in the gaps. His massive body completely blocked the window and blotted out Targal's fierce desert sunlight. The fringes of his fur looked golden, but with the light behind him, the rest of him was shrouded in darkness. He smelled like he spent most of his time in smoking rooms, and I noticed the bulge of a pipe in his left jacket pocket.

I was thankful he hadn't tried to squeeze himself into one of the two creaky metal folding chairs that sat across from my desk. I didn't want to buy new chairs. I couldn't *afford* to buy new chairs.

"I didn't know bears even had voices," I said.

"Well, obviously I'm not a real bear."

"Obviously," I said, nodding. Though it hadn't been obvious to me. You never knew these days.

"I'm a biological-robot hybrid."

"Ah."

"I really need your help."

"Mmm. And who, exactly, has stolen your voice?"

"Well, that's just it," he said. "I said I *think* someone's stolen it. I'm not sure."

"You're not sure? How can you not be sure?"

He shrugged. Since grizzlies didn't have much shoulder to work with, it was more a flexing of massive muscles. "Well," he said, "my memories have been tampered with, too. But it just seems too coincidental

that my voice module would fail the very day I left the MGC. I think—I think it's more likely they replaced it with a faulty unit and then manipulated my memory circuits so I wouldn't remember the procedure. I *know* my memory cells were tampered with. I have a surgical engineer's report for you to prove it."

"Uh-huh. What's the MGC?"

"Mortagai Galactic Circus. I sang opera for them for over five years."

I'd heard of them. They were one of the biggest traveling circuses in the known universe, and one of the most eclectic. If there was one circus where you might find a bear who sang opera, it would be Mortagai. I once dated a girl on Realta who took me to a show when they were in town—fire-breathing penguins, tap-dancing cyborgs, shapeshifting clowns, they had it all. It wasn't my sort of thing, but at the time, I really liked this girl and I was willing to go the extra mile. Funny how I couldn't remember her name. Or whether going the extra mile paid off.

"Getting old," I muttered.

"Mister Duff?" he said.

"Hmm?"

"My name is Karvo. Karvo Portano. Can you help me?"

I wanted to ask him *why* he thought they stole his voice, but I was already afraid he was crazy, and I didn't want to give him any encouragement. There usually was a surefire way to separate the crazies from the serious clients. "You realize I charge a pretty stiff fee?" I said.

"I understand," he said. "And ... well, I'm afraid I don't have any money at the moment."

Bingo. "Kind of hard to hire me without any money," I said.

"Yes. Yes, that would normally be the case. But you see, Dexter—may I call you Dexter?"

"No."

"Oh. Yes, well, Mr. Duff—"

"Just Duff. When someone calls me 'mister,' I always feel like I should be wearing a tie."

"Oh, yes. I see. Well, it's true I don't have any money. But if I get my voice back, I certainly will. You see, it was the reason I decided not to renew my contract. I'd gained a certain amount of fame for my opera, and it became apparent I had a lucrative solo career waiting for me if I decided to leave the circus. If I get my voice back, I promise you I'll not only pay your fee, I'll pay you double. I'm good on my word. Ask anyone." He cleared his throat, a guttural roar that made the hairs on the back of my neck rise. "So you see, I will have money. You just have to trust me."

I drummed my fingers on the desk, my fingers bent so my fingernails clicked on the metal. Just trust me. It was a line that got me into trouble back on DKP, the last planet I'd called home, which was why I had to relocate my business in the middle of the night to the little piss pot of a planet, Targal. She'd said I should trust her. Of course, she'd said it while she was on top of me, which had given her quite the advantage.

"Your legs aren't as good," I said.

"Excuse me?"

I shook my head. “Look, I'd like to help. It's just ... I'm booked. I can't take on more than I can chew.” I regretted my choice of words. Planting the word “chew” in the mind of a bear, hybrid or not, didn't seem like such a good idea.

"You don't seem so busy right now,” he said.

"I'm on lunch,” I said.

"I see. Have you been on lunch all day?"

"I'm sorry?"

Karvo hesitated. In the silence he seemed so much more menacing. “I've been standing out on the promenade the last couple of hours,” he said finally. “It ... took me a while to build up my courage to come in here. I didn't see anybody coming or going from your office."

"Oh,” I said. It seemed a stretch imagining him nervous about anything, but what he was saying was certainly true. I hadn't had a client in nearly a month. “Well, maybe you scared them off."

"What?"

"The clients. You know, seeing a bear out front would do that to most people."

He sighed. At least, I *think* it was a sigh. It came out as more of a snort. “Duff,” he said, “are we going to play this little game all day? If you don't think you can trust me to pay you, just say so. I went through a lot of stepdocks to get here. I had to avoid all the planets where my kind is considered property, which made it a pretty long trip. The least you could do is be honest with me."

"All right, all right,” I said. “Let's say I take the job. What if I can't get it back? Your voice, I mean."

"You'll get it back. I've heard you're very good at this sort of thing."

"But what if I don't? How will you pay me? I don't make guarantees, you know. I do my best, but I still have to be paid for my time."

"I will pay you,” he said.

"Yeah, but—"

"I will *pay* you,” he said again. “If I have to work in a Alkan crystal mine doing hard labor for the next ten years, then that's what I'll do, but I'll pay you back.” He learned forward, and for the first time I got a good look at his eyes. They were small and dark brown, and there was a nervousness there, an anxiousness, I hadn't expected. “But that won't happen if you take the case, Duff. I want to sing opera. It's the one thing I feared most, not being able to do what I love, and now it's happening. You've got to help me."

He was quite earnest, and I was sucker for earnestness. I was also a sucker for strong women, children in trouble, and any brandy more than fifty years old, but earnestness definitely topped the list. Helping earnest clients, when it went against my better judgment, was the reason I was broke. It was the reason I had an implant in my left ear, two mechanical knees, and a medical file that would have filled a dozen binders if printed—all before my forty-fifth birthday.

It was also the reason I could live with myself.

"All right,” I sighed, “I'll take the job."

He looked relieved. “Well, that certainly—"

"I have one question, though."

"Oh?"

"Baritone or bass?"

It took him a moment to realize the nature of my question, and then he let loose with a growling chortle.

"It may surprise you,” he said, “but I'm actually a tenor."

* * * *

It took me two days to catch up with the Mortagai Galactic Circus—two days of hopscotching across the galaxy via stepdocks, battling my way through hordes of sweaty tourists and a half dozen immigration controls, further straining my already strained credit accounts, until finally I had to endure a six-hour shuttle ride to McNary Labs, the massive, one-million-worker space station that created the bulk of the military weapons for the Unity Worlds. The circus was the week's entertainment, and they were on their last night before heading out for some of the vacation planets.

I knew I'd found them as soon as the shuttle rounded the planet to the light side and I saw the station through my pea-sized window. The station itself was four connected cylinders with flat, mushroom-looking tops, thousands of square windows covering the sleek gray exterior like glowing postage stamps. There were dozens of ships docked along the tubes that connected the cylinders, but the ship I was looking for stood out like a stripper at an old woman's tea party—a massive tanker painted bright red, its hull decorated with paintings of all the circus acts and with the letters MGC glowing a tinsel-tinted silver in the center.

After we'd docked, and I'd taken a moment to get used to the one-quarter Earth standard gravity common on manufacturing stations, I rode the station's transport seeker until I reached the Performance Hall. I got off, but none of the green-uniformed workers did.

A big burly black guy with robotic arms stood in front of the closed double doors. One of his eyes was covered with a black eye patch. “Show's not for four hours, buddy,” he said.

"I'm not here for the show, buddy,” I said. “I'm here to see Hiptor Mortagai.” He was one of the owners, and the day-to-day manager from what I'd learned. “Tell him it's about the bear who sang opera for him. Name's Dexter Duff."

He raised an eyebrow, but he still pulled out a black com-com and relayed the message. A moment later, he led me into the hall. Up on the stage, one of two sleek vermillion dragons was scolding a skinny guy in a Middle Ages knight getup for not hitting his mark faster. The other dragon was smoking a cigarette, which looked as small as a needle in his big, clawed fingers.

We veered away from the stage, through a back door, and down a narrow hall with poor lighting. I heard voices behind the doors. The last door was open, and a small man with slicked-back hair, his back to me, was bent over a clear glass desk stacked high with pods and holoslips. He wore a dark suit with a flaring fish fin collar. The bald spot on the back of his head glistened under the fluorescents, and the harsh light made his olive skin seem slightly green.

"Come in and shut the door,” he said, without turning. “Carl, you can go."

I went inside, the thick metal walls muting the noise. Only then did he close the paper-thin holoslip he was looking at and face me. Hiptor Mortagai was an unremarkable middle-aged Chinese man except for one

startling feature: he had a third eye right in the middle of his forehead.

"What's this about Karvo?" he asked.

He had a five o'clock shadow and all three eyes were bloodshot. The third eye wouldn't have been so distracting except that it wandered, looking at different things in the room and blinked at its own pace.

"He's lost his voice," I said. "He thinks someone's stolen it."

"Stolen it?"

"I know what you're thinking," I said. "But I contacted the surgical engineer he saw before seeing me. It's true that his memory cells were tampered with, and that the voicebox he has is different from the one he had at his last check-up."

Hiptor closed two of his eyes—the one on his forehead remaining open, staring at me intently—and slowly shook his head. "Poor Karvo," he said. "I told him he shouldn't leave the circus. It was the best place for him. Then he got all those foolish ideas."

The third eye looking at me with the other two closed bothered me more than all three of them looking at me at the same time. "Foolish ideas?" I said.

"Yes," he said. "It was that agent of his—Swendlehurst. Creepy man. Can't stand to even look at him—those shifty eyes of his. He told Karvo he could become a star if went solo, so obviously he found another way to make money off Karvo's voice. I told Karvo..." Hiptor trailed off, and then his two regular eyes fluttered open. "What a minute! You're not here because he thinks *I* stole his voice, are you?"

I stared at him. Sometimes silence could get people to tell you things much better than any words.

"That furry bastard!" he cried. "After all that I ... How dare he! Do you know the condition he was in when I found him on that mining colony? Do you have any idea how much money I put into him to get him put back to health? And I had no idea what kind of talents he had at the time. I did it all out of the goodness of my heart! Some gratitude!"

He seemed genuinely indignant. Still, he was in the circus business, which was the business of making things look genuine when they usually weren't. "You weren't mad he was leaving?" I said.

"Of course I was mad! I hate to see my friends do stupid things. He thought he was going to be a big star, and I just didn't want to see him hurt. And now, for all my concern, I get called a thief!" He glared at me, the pupils of all three eyes an intense black. "And who do you think you are, coming in here pointing the finger?"

"Nobody's pointing—"

"I looked you up, Duff," he said. "You've got quite a criminal record."

I shrugged.

"And your license is expired," he went on. "I could have you arrested for posing as a private investigator. It's a criminal offense."

"Oh, you wouldn't want to do that now, would you? That wouldn't be at all nice."

"I think you better go," he huffed.

"Just a couple more questions," I said.

Hiptor stabbed one of the buttons in the consol embedded in his desk. There was a beep. "Carl, please escort Mr. Duff to the door." He let go of the button and shook his head at me. "Just because I'm in the circus doesn't mean you can come in here and toss around a lot of accusations. I'm an honorable man, Duff. I've always been good to my people. Ask any of them."

"Then why didn't you want him to leave?" I said.

"Don't put words in my mouth!" he said. "I never said I didn't want him to leave. I said I didn't want him hurt."

"You didn't think he could make it on his own?"

"No, I didn't! And before you get the wrong idea, it's not because he didn't have the talent. He had talent in abundance. But he also had the worst stage fright I've seen in the two decades I've been in his business. The worst! We had this whole routine we went through to get him calmed down enough to perform. And then afterwards!" He shook his head. "My god, if you didn't praise him to the stars, he assumed you hated it, and then he'd spend a week growling and snapping at everyone. I just didn't want him going out there and get eaten alive. If he stayed here, I could protect him."

The door banged opened and there was Carl and his two mechanical arms. He jabbed a silver gleaming thumb toward the door. "Let's go, pal."

"In a second, pal," I said, focusing my attention on Hiptor. "How much money you lose when Karvo left?"

"Get out," Hiptor said. His lips were trembling.

"You heard 'im," Carl said. He reached for me, his silver fingers bent like clamps in one of those arcade games where the goal is to pull out a stuffed animal.

"I'm guessing you like that fancy hand of yours, Carl," I said. "I'd hate to see you lose it."

My tone caused him to hesitate, because even a frumpy guy in worn black leather on the backside of forty could *sound* menacing if the words were backed with genuine guile. But then he laughed and reached for my arm. Leaving meekly probably would have been the smartest thing to do, but the instinct to refuse to be bullied ran too deep.

I knew if he got those metal fingers of his on me, it would all be over, so I pivoted inside his reach, right up next to him so he wouldn't be able to do anything with those arms without stepping back, and I jabbed him hard in the gut with a swinging elbow. I knew if I missed by much he would have just pummeled me, but I didn't miss. He let out a loud groan and doubled over, gasping.

Then I turned back to Hiptor, whose three eyes gaped at me.

"Don't—don't hurt me," he said in a small voice. "I'll—I'll answer any of your other questions. You can look in my books ... I'm an ... an honorable man..."

I smiled. "No more questions for now," I said. "Have a nice day, Mr. Mortagai."

Then I turned and left. Carl was still moaning.

* * * *

I hadn't completely ruled out Mortagai being behind the voice theft, but my gut told me he was telling the truth. On my way out, I knocked on a few doors and nobody had a bad word to say about him. Everybody also confirmed what Mortagai told me about Karvo: a great talent who was scared to death to get in front of an audience.

It took a bit of searching, but I managed to locate Karvo's agent on Naj-Naj, a developing world once part of the Dulnari territory until the war ended a few years back. The Naj-Najs were dumb and hardworking, and their world was a gold mine of natural resources, so of course now that it was safe to invest there, all the money was pouring into the planet. The Naj-Naj music was also the latest rage across the Unity Worlds, so all the agents were swarming in like bloodsucking bats.

Fortunately, there were already several stepdocks, so I was able to arrive after less than a day of hopping and without any backbreaking shuttle rides. The biggest city was called, simply enough, Big City, because that was the translation from Naj-Naj. It was smack dab in the middle of a rain forest, the trees as tall as mountains, the air thick and humid and buzzing with millions of insects just above the field barrier poles lining the city streets.

When I contacted Swendlehurst on his listed link, I told him I'd discovered a Naj-Naj who could sing like Bing Crosby, and if he paid me a small finder's fee, I'd tell him the name. He told me he was currently having lunch at Harlo's, a restaurant on the top floor of the tallest building in Big City, and that he'd be happy to talk.

He was sitting by one of the windows, the emerald forest stretched out to the horizon behind him. The place was crowded, mostly with humans and the wolfish-looking Dulnari, but the wait staff was all the spindly, stupidly grinning Naj-Naj.

I recognized Ned Swendlehurst from the headshot—a pasty, round-faced man with a mop of blond curls so perfectly dome-shaped that it had to be a wig. But I wasn't prepared for how massively fat he was—a flat-topped mountain of flesh in a glittery suit and a dimpled red tie, his rolls of flesh like lava flows down the triangular slope of his body.

Clinging to each jiggly arm was a burly woman in an obscenely tight purple dress, and when I got close, I realized they were twins. Each of them sported a wart on the bottom of their nose. They stared at him longingly while he ignored them, fiercely tearing into his barbecue rib.

I stopped at the table. The women gazed at me the way cows gaze at passing hoverpods. Swendlehurst went on eating.

"So?" he said.

Red sauce speckled his double chin. I was hungry when I walked in the door. I wasn't anymore.

"I lied," I said. "I'm here about Karvo Portano."

The pause was almost imperceptible, a slight hesitation before he took his next bite, but I caught it. "Mmm," he said.

"Someone stole his singing voice," I said.

He wiped the mess off his chin, finally belching loudly. "Tell me something I don't know," he said.

"Do you know who did it?"

"If I did, do you think he would have come to you?" He finally looked up at me, narrowing his beady little

eyes. I disagreed with Hiptor: they weren't shifty so much as lifeless. It was like looking at a doll's eyes. “I know all about Karvo's situation. It's quite sad. Who are you, anyway? Some kind of detective?"

"Name's Duff,” I said. “I help people find things."

"Of course you do. How quaint.” He bent his meaty mouth down toward the ear of the woman on his right. “Look, my dear, a modern day Sherlock Holmes. Perhaps he can find your missing g-spot. Then you'd know what an orgasm is first hand."

The woman blushed and looked down shyly.

"Hiptor Mortagai thought you might have something to do with it,” I said.

He chuckled. “Of course he would."

"Well, did you?"

"Ha! You are a direct one, aren't you, Detective Duff?” He wiped his hands clean on one of the white napkins on the table. The way he did it, and the red stains left behind, made me think of someone wiping their hands after killing someone with a knife. “I know good old Hiptor has more eyes than he does brains, but I'm sure you can do better. Why would I take his voice? Do you have any idea how big he was going to be?"

"Not a clue."

His tiny eyes flared wider. “He was going to be absolutely huge! The market on Ipsin Totar alone, which devours opera like it's some kind of drug, would have made us both rich. I had him booked six months out within a few days and a deal lined up with a major unicaster. Why would I take his voice and walk away from that?"

I shrugged. “Maybe to sell his voice to someone else."

"Nonsense! Detective Duff, making money—"

"Just Duff,” I said.

"—off someone's singing is not just about the voice. It's the whole package! It's the brand that is the person! And Karvo Portano had already built his brand in the circus. The bear who sang opera! Why would I mess with that? It would have been foolish in the extreme. I did not make it to where I am in life by being foolish."

"I can see that,” I said.

"And this is beside the point,” Swendlehurst said, “but I considered Karvo a close friend. I love the opera! My wife loves the opera even more than me! It would be unthinkable for me to do something to harm one of the greatest tenors our galaxy has ever known!"

"Wife?” I said.

"Yes! She adores his singing! Absolutely *adores* it! He sang for us both on our ship many times! Ask Karvo."

I didn't want to tell him it was the wife part, not the wife-liking-opera part that I found hard to swallow. “So you don't have any ideas on who might have taken his voice?"

He shook his head, and the rolls on his neck swayed like heavy drapes. “None! If I did, I would have gone to the farthest reaches of the galaxy to get it back! That crime was not just a crime against Karvo—it was a crime against opera lovers everywhere!"

The rest of the conversation didn't reveal anything else that could help me. Either Mortagai or Swendlehurst could have been lying, and probably were, but it didn't change one thing: I didn't see what they had to gain stealing Karvo's voice. Even if they *had* sold it to someone else, how could that person even use the voice down the road without getting caught? A hyro—which was the laymen's term for biological robot hybrids—was an amazingly sophisticated bit of machinery, more complex even than the human body. It would have taken a team of scientists to hide Karvo's unique binary signature, and of course that would have cost more than stealing the voice could have possibly been worth.

I retired to the windowless lounge on the other side, squeezing in at the black marble bar between a couple of Dulnari. They glared at me, their blue eyes glowing luminescent in the hazy, dim room. They had a musky odor that bothered lots of folks, but after the ten months I spent on the sulfur-stinking Mabokin, no odor really bothered me anymore. Plus if you were going to sit near two Dulnari, it was better to sit between them, because then they couldn't do their telepathy thing.

After I warmed my stomach with three shots of brandy I slouched into the corner com-com unit and punched in Karvo's number. His brown face blinked up on the screen. Instead of a tuxedo, he wore a white terrycloth robe.

"Have you found it?” he said eagerly.

"No dice."

He looked crestfallen. “A pity."

"Look,” I said, “tell me something. How much money you think you would have made the first year solo?"

"It's hard to say."

"Take a guess."

He thought about it a moment, then quoted me a number. It was ten times the number I expected. So Swendlehurst was probably right. It would have been stupid to walk away from that.

"You look frustrated, Duff,” Karvo said.

"Well, that's because I am."

"I wish I could offer you some kind of lead. It's just ... my memory..."

"I know,” I said. “Look, would you call Swendlehurst a friend?"

He nodded. “Both he and his wife were really supportive. Ned seemed heartbroken when I told him, and Alexia ... Well, she cried like I'd died. You don't suspect them, do you?"

Swendlehurst's wife. She'd come up twice now in the span of a few minutes. I didn't know if there was anything there, but talking to her would be better than staring at my reflection in the bottom of a glass of brandy.

"Your agent said they live on a ship,” I said. “You have any idea where that would be?"

* * * *

It turned out that the ship was right there, orbiting Naj-Naj. Karvo told me she traveled with Swendlehurst all over the galaxy because they both preferred nex-space travel to the stepdocks. He also told me they had a very loving relationship and they hated to be parted from one another for long. I thought about the two women sitting next to Swendlehurst in the bar and wondered if she knew how much loving he was really doing.

I didn't want to give her a chance to ignore me, so I rented a sub-nex shuttle—shopping around until I found one cheap enough that I could afford it—and piloted the creaky heap toward Naj-Naj's smaller moon, which had a popular casino. Swendlehurst's ship was a deluxe cruiser that couldn't have been more than two years old, big enough to hold a few hundred people, and long and sleek and handsome in all the ways that Swendlehurst himself wasn't.

When I was passing near it, I sent a distress signal. Any ship licensed in the Unity Worlds was obligated by law to respond to a distress signal, if able. Sure enough, a young man, dark-haired and square-jawed, as handsome as any model, appeared on my monitor. It was a shot from the neck up, making his face fill the screen, which was a little unusual.

"Problem, sir?" he said.

"Navigational system's screwy," I said. "Can I dock while I make repairs?"

He gave the go ahead and ten minutes later I was popping open the connector hatch and stepping onto their ship. The air was slightly on the warm side. The young man who talked to me was there to greet me, and right away I saw why he had only shown me himself from the neck up on the com-com.

He was naked.

"Forget something?" I said.

"Sir?"

I motioned toward his body. It wasn't just a body. It was a *perfect* body, well sculpted and well endowed, his skin a smooth, creamy tan, not a mole or a scar on him, every muscle and contour a work of art. He looked down at himself, not at all embarrassed or ashamed, and then nodded.

"Standard ship policy, sir. You're welcome to remove your clothing as well, though it's not required of guests."

"That's all right. You're not human are you?"

"No, sir. I'm an android."

"Ah."

It figured. Unless specifically programmed to have a sense of modesty, androids had none. Unlike hyros, they weren't sentient—just fancy computers that did as programmed—and could never be considered more than property. Still, standing next to his Adonis-like body, and knowing it was all a miracle of modern manufacturing, didn't make me feel any better.

"Is Mrs. Swendlehurst available?" I asked.

He hesitated. "I'm sure I can help you with your repairs, sir. What do you need?"

"I can handle it. Can you just relay a message to Mrs. Swendlehurst? Tell her I'm a friend of Karvo Portano."

"As you wish, sir."

He strutted away, his gluteus maximus as disgustingly perfect as the rest of him. The message had the desired effect. Five minutes later, while I was pretending to poke around under the dashboard, he returned, requesting that I follow him. We walked through a ship that was as elegant as any vacation cruiser, passing dozens of other androids, all identical, all naked, until a pair of double doors slid open and we walked into a cloud of steam.

Adonis led me over a green marble floor toward the sound of bubbling water, and eventually I saw the shape of person sitting in a hot tub. The shape turned into a woman with bright blond hair tied up in a bun—a stunningly beautiful woman, tanned and toned, green eyes glittering like emeralds, naked slender arms resting on the granite lip of the hot tub. The frothy water reached the top of her breasts, high enough to hide most of her body while low enough to make it clear she was naked.

"Leave us, Six," she said.

Adonis bowed and walked away.

"You're Alexia Swendlehurst?" I said.

She arched an eyebrow. "Surprised?'

Already sweating, I unzipped my jacket. The air felt warm and heavy with each breath. "More than a little," I said.

"You're wondering why a goddess like me would be with a slovenly creature like my husband, is that it? Well, our relationship is complicated, but it works for us. Now, do you have it with you?"

"Excuse me?"

She sighed. "I'm sure you enjoy staring at my breasts, but I'd rather not prolong this experience more than necessary. As I indicated in my message, I'll pay you one million prime for it. But that's firm."

One thing you learn in my business is that you take advantage of whatever opportunities are thrown your way. After a moment's confusion, I realized that she thought I had Karvo's voicebox and I was trying to sell it to her. It was also obvious that she had some kind of relationship with the person she expected to retrieve the voicebox—but not a good enough one that she knew him by appearance.

"That's a lot of money," I said. I didn't want to lie, but I was happy to let her go on believing in something that wasn't true.

"But not enough?"

"I didn't say that."

She shook her head. "Enough games. Name your price."

"But perhaps it's the game I want to talk about," I said. "Like, what are you going to do with the bear's voice once you get it? I know you like opera. You going to keep it all for yourself, is that it? You want to have your own private talent you don't have to share?"

It was a stab in the dark, and it definitely struck a nerve. Her face hardened, her lips forming a thin line,

her eyes moistening. She didn't cry, but she was obviously struggling to hold back the tears.

Then, suddenly, she rose from the water, not making any attempt to hide herself. The rest of her body was just as tan and trim and naked as the rest of her, the water running down the perfect swells of her breasts and over her flat stomach and between her legs. She was as tall and lithe as a professional free-fall player.

"Come with me," she said curtly.

She stepped out of the tub and glided away from me, disappearing into the steam. The sight of her glorious body caused a momentary hiccup in my brain before I snapped out of it and followed her. Still, I was definitely in some kind of stupor, because when I walked through the open archway in the back of the room, one that led around a corner to an exercise room, I was in no way expecting the hard blow to the head that was immediately delivered to me.

I was on the ground before I realized what was happening, tasting the rubber on the lightly padded blue floor. My cochlear implant started whining—a maddening, high-pitched sound. My vision went dark for a moment, returning just in time to see something large and red moving swiftly in my direction.

My reflexes took over, my forearm coming up and taking the brunt of the impact, sending a jolt of pain up my side. I rolled with the blow, away from her, and ended up back on my feet—crouched, a bit wobbly, but with both hands up in a fighting posture.

"How *dare* you impugn my motives!" Alexia cried.

I blinked away the sweat in my eyes and finally she came into focus. Somehow, in the few seconds she'd been out of my sight, she'd taken the opportunity to don red boxing gloves and red boxing boots. Of course, she hadn't put on anything else, so seeing her bouncing up and down like a fighter in the ring, all those shapely, glistening curves bouncing right along with her, I felt a strange mixture of emotions: rage at being attacked *and* the most powerful animal attraction I'd felt in my whole life. Damn, now *here* was a strong woman.

"Mrs. Swendlehurst—" I began.

"His voice is a treasure!" she said, and now she was crying. "A treasure! Have you ever heard him sing *The Bolandassi's Lament?* A marvel! The only thing I wanted was to make sure the voice got back to him! That's why I put out the word I'd be willing to pay a good price for it! How *dare* you lump me in with thugs like you? Karvo's had a hard enough time as it is, getting over his stage fright, and I would never, *never*, do anything to make his life harder!"

I didn't want to hurt her. It would have been a crime against nature. "Listen," I said, "I'm not what—"

With a shriek, she jumped toward me and side-kicked hard at my head. I ducked to the left, but not quite fast enough because she delivered a glancing blow that tore at my good ear. It felt as if someone had stabbed me with a branding iron.

More kicks followed right after that one, each one harder and more lethal than the last, and I blocked them away with my arms. My restraint quickly faded. She was good, damn good, and if not for the crazy rage that had overwhelmed her, she might very well have gotten the best of me.

But blinded by her anger, she left herself too exposed. I timed her next kick, ducking away and then grabbing her by the calf and heaving her leg upward.

She went down on her back, landing on the rubber with enough force that it knocked the wind out of her

with an audible *thwump*. I thought that would be the end of it, and I took my time regaining my own breath, my heart starting to slow down, but then she let loose with another ear-splitting shriek and suddenly she was biting my ankle.

With a howl of my own, I kicked her hard on the side of the head—no restraint this time, not even a little—and as she was stunned, fell on top of her. By the time she recovered, I'd clamped down on both of her arms and had her pinned beneath the weight of my body.

"Let—me—go!" she cried. She squirmed beneath me, her wet body like an oily snake, and it was all I could do to keep her from slipping away. Her face was pink with exertion. "Six! Three! Come in here! I'm being attacked!"

"Mrs. Swendlehurst, if you'll just—"

"Nine! Four! Help, help!"

"Alexia! I'm *not* here to sell Karvo's voice! He *hired* me!"

She had her mouth open to scream, but instead, I watched her eyes refocus on me. She blinked a few times.

"He did?" she said in a quiet voice.

"Yes!"

"Why?"

"To find his voice! I'm a private investigator!"

A long pause. "Oh," she said.

I felt all the tension slipping out of her muscles, her body going slack. I was suddenly very conscious of this wonderful naked creature beneath me—even through my clothes, the hardness of her in some places, the softness of her in others.

"Have you found out anything?" she said.

"No."

"But you're going to keep trying?"

I sighed. "Yeah. I'm out of ideas, but I'm going to keep trying."

I kept waiting for her to ask me to get off her, but instead, she just looked at me. Her gaze, so full of contempt just a moment ago, changed. It was still intense, but now it ... *smoldered*. Her lips parted every so lightly, and I felt the heat of her breath on my chin.

"Perhaps," she said, her voice a lustful purr, "I could help pay for your services."

I felt her hips gyrate a little beneath me. I couldn't believe it. One moment she was trying to dent in my temple, and the next she wanted in my pants. Truthfully, it was damn tempting. A little guilt-free sex—her husband's behavior got me off the hook with that one—was right there for the taking. Plus I hadn't had *any* sex, guilt-laden or otherwise, in way too long.

But before I could make a decision one way or the other, three of her Adonis androids burst into the

room. They headed straight for her, and I started to rise, bracing myself for another fight.

"Stop!" she commanded.

And of course, they did stop, standing as still and mute as statues, their large male appendages just inches away from our heads. I was almost off her, but she grabbed me by the scruff of my jacket and pulled me back down.

"It'd be a shame to waste this opportunity," she said.

"Uh-huh. What about them?"

"They can watch. It doesn't matter."

I laughed, thinking she was joking, but the expression on her face didn't change. Any lust I'd felt moments ago faded. Shaking my head, I rolled off her and staggered up to my feet.

"Not me, lady," I said. "I don't make love to an audience."

She propped herself up on her arms. Watching the movement of her breasts, I was struck with a pang of regret. What a shame.

"You're walking away from sex with *this*," she said, motioning to her body, "because you have a little performance anxiety?"

After one last longing look at that very body, I headed for the door. I didn't think there was anything more I could learn from her, at least not in our present state of minds. If I stayed any longer, I knew which part of me would take control.

"It's not performance anxiety," I said. "I've just gotten better lately at self-preservation."

And then, just like that, I knew who had stolen Karvo's voice.

* * * *

He showed up at my office ten minutes after I reached him on the com-com, his fur still wet and glistening from his bath. He'd been staying at a dirt-cheap hotel, anxiously awaiting any news, and when he walked through the door, he bumped the frame so hard I heard the wood crack. He didn't seem to notice. He'd dressed so hastily that his tuxedo was buttoned wrong.

"Well?" he said.

I took my time, deciding exactly how I was going to play my cards. The key was all in the delivery.

"I found it," I said.

He let out a great big sigh, deflating at least a foot from his full height. "Thank god," he said. "Was it Mortagai?"

I hesitated. I could have told him the truth, of course, and maybe that was the more honorable thing to do. I could have told him that after I had my epiphany with Alexia, I'd gone straight to the biomechanical engineer Karvo had mentioned when he first came to my office, the one who confirmed that Karvo's voicebox had been removed. With a little bit of arm twisting, both real and figurative, I'd managed to squeeze the truth out from him: that *he* had been the one to remove the voice box in the first place, and that he still had it in his possession. He'd also erased the whole encounter from Karvo's memory banks.

Most importantly, he'd done it all at Karvo's request.

The engineer hadn't wanted to do it, but Karvo had been very insistent—hysterical, was the word he used—and the engineer had convinced himself that he was actually doing Karvo good by removing something that was causing him such distress. That was the realization that hit me while I was fending off Naked Kickboxer—that somebody who had paralyzing stage fright, who had to be coaxed and cajoled and comforted before every act, somebody who had *performance anxiety* of the worst order, might go to great lengths to sabotage their own career so they wouldn't have to deal with those emotions.

Solving the mystery, though, turned out to be the easy part. The hard part was deciding how to give the bear his voice back in a way that would prevent him from doing the whole thing over again.

"It wasn't Mortagai," I explained. "In fact, it wasn't anybody you know. Just a two-bit thug who caught one of your shows and saw an opportunity to try to make a quick buck. He had once been an engineering student, so he had just enough knowledge to pull off the theft."

"Is he in prison now?"

"Well ... no. No, I'm afraid he's ... dead. He made the mistake of coming after me with a hyperpistol."

"I see. Where is the voice module, then?"

I reached into my side drawer and pulled out the black plastic case containing the voice module, placing it in on my desk. His mouth parted as if I'd just placed a bucket of tuna there—or, in his case, maybe an expensive plate of fresh sushi. He reached for it with his big paw, and I immediately held up my hand.

"Not so fast," I said.

He looked confused. "Is there a problem?

"No. No problem. I just have something else for you first."

I reached into the open drawer and pulled out the second box, this one white, made of thick cardboard, and much bigger than the other one. It took two hands to lift it out and place it on the desk, and it landed there with a loud *thunk*.

"What's this?" Karvo asked.

"Fan mail," I explained. "Mortagai had been holding it for you, and they were kind enough to print it for me. But not just any fan mail. This box is all from biological robotic hybrids like you. You're quite a hero to them, you know." I watched his furry face and his dark eyes, watched how the words sank in, got traction, took root. I drummed my fingers on the desk, carefully choosing what to say, knowing this was where I really had to put on my own circus act and give my spiel the air of truth that would seal the deal. "So here's the thing," I said. "I know when you get your voice back, and the next time you walk out on that stage, you're going to feel some fear. You're going to wonder if there's another crazy out there like him, someone who wants to stop you from doing what you love. So you're going to have to make a choice. You're going have to decide if all these fans—these hyros who believe in you, who see you as an inspiration of what's possible—are worth that risk. It's quite a responsibility you have, you know. I don't want you to take it lightly."

The bear said nothing for a long time. He looked at the box of fan mail, then at the box containing his voice. I hadn't known him long, and still couldn't read his animal face all that well, but I thought I saw the conflicting emotions. I thought I saw the war within him between the old panic at having to perform and this newfound responsibility he must have felt to his fans. It was a toss-up which was going to win, and I

found myself holding my breath until I saw him reach for one of the boxes.

The white one.

"Fan mail, you say?" he said.

I smiled. "That's right."

"I see," he said. He seemed to be rising, inflating with confidence and bravado right before my eyes. "I see, well, I ... I'm quite touched." He bowed his head, and when he looked up and spoke again, there was a quaver in his voice. "I want you to know, Duff, that I'm going to pay you as soon as possible. I'll be back here standing in front of your desk before you know it."

I laughed. "I appreciate it. My credit accounts could certainly use a lift. But make sure you call ahead. I ... may not be here."

"Oh? Where will you be?"

I looked at him, not sure how much I wanted to say, not sure how much I wanted to even admit to myself, then looked past him at the tiny sliver of window that wasn't blocked by brown fur. Over the sleek metal roofs of the city's buildings, I saw Targal's endless, barren dunes under the searing yellow sun. I also saw, out there on the horizon, a flicker of white that meant another lighting storm was on its way. My bad ear would soon be ringing.

The truth was, Karvo wasn't the only one suffering a bit of stage fright. I'd been kicked around, beaten, and battered in both mind and body, and I'd allowed my own fears to banish me to this place—a place where I might die of boredom before I died of poverty. I'd done it to myself, and it was time to get back on the stage.

"Are you going to take a vacation?" Karvo asked me. "You could certainly use it."

"No," I said, shaking my head. "That's just the problem. I've been on vacation long enough."

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Novelette: **PAYBACK** by Tom Ligon

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Illustrated by Broeck Steadman

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Both war and diplomacy become very different when the sides are very far apart in all possible ways....

* * * *

"What does not kill me, makes me stronger."—Friedrich Nietzsche

"That which does not kill me, has made a grave tactical error."—Jerry Pournelle

* * * *

The engineers who designed the weapon did not burden it with a motive. It was a simple machine, with a simple job to do: lock on to the pinpoint of neutrinos and accelerate toward them. It did not need to know why.

The engineers themselves would not even whisper about such matters. Lofty topics such as morals and ethics were the job of clerics, and the clerics' job was simple when the directive came straight from their deity. The word they called him meant Emperor, but it also meant God. He was old, older than their written history, his ancient body replenished by frequent sacrifices. He wielded awesome power, and his wrath struck a reverent fear in his subjects.

The Emperor owned the galaxy. It was his alone, or so he claimed, and he forbade even his own people from moving out into it. Trespassers had been discovered, strangers who dared venture beyond their own system. He considered this intolerable, unpardonable, and ordered their extermination, even though the trespass was evidently through ignorance. The edict raised troubling questions and challenged rules of propriety and warning. Every engineer secretly wondered how this could be reconciled with doctrine, but not one voiced a question. They bowed respectfully to higher authority and did as their caste was raised to do.

Indeed, they built the massive hydrogen-drinker and launched it with a great sense of pride. The opportunity to work with such vast resources, to finally build a device proposed in antiquity, was a rare treat in this crowded society. Most engineering assignments were triflingly mundane, undersupported, and unrewarded. And every engineer knew a little secret. The Emperor was *not* all-powerful. He *feared* the trespassers and could not destroy them without the help of the engineers.

The machine was as close to invincible as the engineers could imagine. Its terminal speed would, in their octal number system, be a fraction of nearly seven sevens of the speed of light. At such a speed, the trespassers were unlikely to even see it coming, for the weapon would be right behind its own light emissions. And even if the trespassers could detect the weapon, there was nothing they could do to stop it.

It was just barely possible, though, that the mission could fail. They dismissed the possibility of a simple malfunction. With their technology, the odds of a breakdown were too low to consider. The second possibility was a collision with a planetoid. This risk was also vanishingly small, even if the trespassers were to detect the weapon and attempt to move an object into its path. The direct route to the targeted system was well off of its ecliptic, and only a thin scattering of icy bodies sufficient to the task were close to the trajectory. To move such a massive and fragile body on short notice was beyond even the formidable technology of the weapon's builders. And while this defense might thwart the full intended impact of the weapon, the debris tearing through the targeted system would still be devastating.

The final possibility was troubling because it was credible. There was a way to deflect the weapon. With any luck, if the weapon failed, the builders would already have passed to the next life before the Emperor learned of it. They took what precautions they could and trusted the aliens would not have time to react. The engineers would have been much happier if the clerics had not insisted a ritual warning must be sent, timed to be heard before the weapon struck. They followed the mission anxiously, as five octades of years passed, anticipating the date the weapon would reach the target, and knew they must wait longer still, until the evidence could reach them.

* * * *

The weapon's goal was just seconds away, judged in ship-time. In the reference frame of the civilization that had launched it, several days would pass before impact. The weapon prepared to shut down the electromagnetic scoop that collected the tenuous interstellar gas on which it fed, for it now had all of the speed required for its mission.

The source of the neutrinos locked in its sights was the core of a yellow star. The weapon would plunge through the outer layers of the star, shielded by time dilation so well it would not even realize it had hit a star until it had penetrated nearly to the core. It would explode just short of the core, releasing the relativistic kinetic energy acquired over a vast distance. The explosion would, by itself, be enough to blast a world to vapor, but that effect would not be sufficient to the purposes of the Emperor. The explosion was intended to destabilize the very core of the star, triggering a nova. The trespassers would be exterminated, their entire system sterilized.

The mission computer noted the last significant collision threat was safely off to one side of its trajectory and would be passed in an instant. The only other significant hazard would be moot in a second, when the scoop shut down.

And, for just the briefest instant, the computer detected the threat the engineers had feared, the signature of ionized deuterium gas, a massive and dense cloud of it. It was close, and the scoop could not be shut down in time. The scoop instantly concentrated the potent fusion fuel and fed it to the reaction at a rate that exceeded the containment capability by an astronomical margin. An explosion the equivalent of a global thermonuclear war ripped down one side its massive armored hull. This was not enough to destroy the machine, but the explosion applied huge pressure to one side of the hull, breaking the structural members that held the major modules together. Worse, the explosion ruptured the main solenoids needed to produce the intense magnetic field that shaped the inner radius of the funnel-shaped ramscoop field. The energy stored in the magnets was released instantly and was nearly equal to that of the deuterium explosion.

The combination of the two explosions deflected the trajectory of the weapon, and it would miss the star. The armored computer of the guidance system noted the malfunction, but, unable to do anything to alter the outcome, did nothing else. It simply did not care.

* * * *

Victor Gendeg gave up the richest strike anyone had ever found, an enormous metal planetoid core imbedded in a ball of comet ice, three light-days from Earth in the Oort cloud. He cursed and fumed all the way to his death at the combination of factors that made him the only person able to save human civilization. At the last minute, he released his horde of deuterium directly into the path of the hellish starship bearing down on his home and ionized it with the engines of his ship. What else could he do, given the circumstances? All the wealth in the universe is meaningless if it means the guilt of knowing you allowed all of humanity—twenty-one billion souls—to perish. His version of the story would have sounded far less noble, but this was the one his friends wanted the survivors to hear, the simple story of the hero who laid down his life to save everyone.

* * * *

Victor was not the only person prepared to die to save humanity, but most of the rest knew their chances of defeating the weapon were essentially zero. They could not know Victor had succeeded until seconds before the weapon arrived. The weapon was literally unstoppable, and the only hope was to deflect it, but they were not far enough away from the Sun to deflect it sufficiently. They were mosquitoes against a cannonball and did not have anywhere near the mass available to assure a kill. The experts expected the device would switch off its ram-scoop before it reached them, so the deuterium they carried would only explode if the weapon hit them directly. Even then it would have little effect. Still, hundreds of interplanetary craft of various sizes lined the trajectory of the weapon, figuring any chance at all was worth taking, and doing nothing was certain death for everyone. They were as unhappy with their fates as Victor, but they had nothing to lose.

Andreas Orndorf was the commander of one freighter in the sacrificial gauntlet, a scant eight astronomical units from Sol. His ship was accelerating straight out from that star toward the weapon, its computer handling the intercept. As he waited for the end, alone at the pilot's station, he had time to consider the gruesome fate awaiting humanity. Andreas was proud of his crew, all of whom had agreed to stay with the freighter as it attempted a collision with the weapon. The task required fantastic luck, and the sacrifice was probably meaningless even if they succeeded. But if they missed, the end would be horrible. The explosion would not come instantly after the starship plunged into the Sun. The core collapse would be announced by an intense burst of harmless neutrinos as soon as it happened. Then there would be an excruciating delay before the end, a long pause between the click of the trap door latch and the awful tug of the noose. The exact physics of the explosion were still a matter of moot debate: it might take minutes, hours, even days for the full force of the explosion to reach the photosphere. But when it did, the solar radiation would increase at least a thousand-fold, and the solar wind would become a tsunami. No shelter in the inner system would withstand the onslaught, and everyone would perish in radiation and fire. At least ramming the infernal thing would be quick and painless.

What sort of minds could have conceived of this genocidal engine? How much hatred was needed to construct and launch a device of this kind? How deep was this hatred that the builders would be willing to wait nearly six decades after the launch to see the result? And how could they have come to loath a race they had never met, or even engaged in a single conversation? The sheer magnitude of malice seemed beyond human comprehension. The absolute despair he felt knowing this evil was going to succeed filled him with a grief that made him long for death.

He heard the hatch behind him open and soft footsteps approach. Warm hands slid around the seat-back to his shoulders and began a massage. Had a human touch ever felt so good?

"Barbara, how are the crew?"

"They've done all they can," she answered softly. "Most of them are down in the lounge, helping themselves to whatever they like. Booze, mostly. And each other."

"They're entitled. Why aren't you with them?"

"Because I figured you could use some company. Was I wrong?"

He raised a hand to clasp one of hers. "Not at all." He nodded toward the screen, unable to tear his eyes away from the spectacle. "Won't be long now."

He stared, mesmerized by the rapidly brightening speck of light on his telescope screen, trying to picture what the last instant would look like. The starship was traveling just behind the light it emitted, and was much, much closer than it appeared. It would blossom from a pinpoint to a huge disk in an instant if it

were coming straight at them. Would the video scan even capture it? Why would he even think it mattered? If it missed, the last instant would show a streak off to one side. If it hit one of the ships beyond him, the explosion would be visible the barest instant before the weapon reached him, and he would probably not have time to register the satisfaction.

And then he saw a flash and several streaks radiating from one side of the flash. He had time to recognize the object had exploded. It must have occurred much farther away than he had expected. He had just begun to smile when a tiny fragment of the starship, no larger than a grain of sand, ripped through his ship and destroyed it.

* * * *

Indira Swarup stood gazing at the stars with her husband and children in the back yard of their mountain home. Tears ran down her face, more for her children, and all the billions of other children who would not have the opportunity to carry on life, than for her own impending death. Her home was near the Lowell Astronomy Data Center, the locus of her career. The sky, the source of so much wonder and joy in her life until just two weeks ago, was dark, cloudless, and beautiful. The only hint of impending doom discernable amid the canopy of stars was one star just barely brighter and bluer than its normal dim yellow glow.

Had it all been a waste, too little, too late? The discovery of the signal by one of her amateur SETI enthusiasts? The months the scientific community spent analyzing the signal and confirming it was extraterrestrial? The efforts to translate it after it burst into modulation? The mad scramble to throw together a defense when the terrible nature of the message was revealed, and the weapon was discovered? There was so little they could do, and physics seemed solidly on the side of the enemy. The moment of truth was now at hand.

Through binoculars, it was just possible to make out the malevolent speck of light beside a faint yellow star in Cassiopeia. The speck, the approaching weapon, glowed blue-white and was now growing brighter by the second. Suddenly, the speck flashed, and then became several specks radiating rapidly from where the first had been. A few seconds later, several small dots of light appeared close to where the original had been.

She lowered the binoculars and watched, speechless and confused, as the streaks brightened and radiated past the horizon toward the west. The streaks changed color from a blue-white to a pinker hue, appeared to slow dramatically, and shrank to brightly glowing dots as they raced toward the horizon.

"I think it hit something. In fact, I think it hit several somethings.” Her voice was hoarse with the strain of two weeks of toil and sorrow, but carried a hint of hope.

Her husband grunted. “Lucky bastards! Think they made a difference?"

"We'll know in a few minutes. It actually passed us about five minutes ago. Earth is a few light-minutes off to one side of its trajectory,” she explained. She tilted her head to one side, a puzzled look on her face. “But something is not making sense."

"None of this makes any sense,” her husband growled. “I don't know how you can be so analytical at a time like this."

"I'm doing what I've been doing for two weeks. I'm desperately searching for any glimmer of hope."

The children huddled closer to their parents, seeking comfort against the frigid night and fear's icy grasp. Lisa, the youngest, sobbed softly. The two boys hid their sorrow, but felt it as intensely as their sister. Indira wondered if they would soon long for the evening chill. She eyed her husband's waist, trying not to

think about the pistol hidden beneath his shirt. She shuddered as the image erupted into her mind, of her husband forced by love to do the unthinkable. At least they would not burn. She forced herself back to the quest for that grain of hope.

"It didn't hit one of the ships that were trying to intercept it in-system. That was something a lot farther out. I'd need a calculator to be sure, but a rough guess is it was well beyond the orbit of Pluto."

"What's out there?" her husband asked. "The SETI ship? Could they have managed to hit that thing?"

"The SETI League ship is one of ... half a dozen, maybe a little more? Comet prospectors, mainly, operating out of a deep space station in the Oort cloud. They're three light-days out. I know they were working on something, but they're so far out we don't know what they finally came up with."

"Would that be far enough out to make something work?"

"It might. Could they move a comet into the path of that thing?"

"Unlikely," he replied. "But they would have deuterium. They would mine it to pay the bills."

"I wonder if they figured out the deuterium release hypothesis?" Indira asked. Was this the glimmer she sought?

"Could we have gotten word to them in time?"

"I pray we did." She laughed nervously. "Did you hear what I just said? Me, the avowed atheist! The hardcore astrophysicist! But I do, I pray. I suppose if I were going to start praying, a month ago would have been better timing. At this point, whatever is going to happen has already been set in motion. We can only wait. We'll know all too soon."

She knelt to embrace her children and kiss each one, then looked to the sky. A bright aurora played across the heavens, no doubt some after-effect of the passage of the weapon. "Enjoy the moment, my dears. Cherish every second."

The minutes passed as each one tried to live for the moment, but it was impossible to ignore the sense of impending tragedy, of being helpless in the face of injustice on an unimaginable scale.

Indira looked down at her handheld. "We're not registering a neutrino burst. The weapon should have hit the Sun more than ten minutes ago. If there were a core collapse, it should be registering by now. I think we may have just experienced a miracle!" She turned her face to the heavens and dared to smile. "I think we're going to live!"

Twenty-one billion people experienced the joy of salvation. The euphoria was short lived. The casualty figures came in. One brave prospector, hundreds of crew of the other ships who had offered their bodies to try to stop the awful projectile, and thousands who had decided to watch the approach with nothing to shield them from its debris and radiation, perished. Of these, the lucky ones were hit by motes of dust moving at nearly the speed of light, and were killed by the resulting blasts. Most of the victims died of the slow misery of radiation sickness. But the overwhelming majority of the human race survived. The Sun absorbed the little material that hit it with only a few flares resulting. The remainder of the debris from the weapon left the system as quickly as it entered, on a trajectory that would take it safely out of the galaxy.

A hopeless sense of unavoidable doom had dominated the minds of nearly everyone from the moment the threat was recognized until the moment it missed. At that moment, everything changed. The remains of the weapon had not yet cleared the system when the cry for vengeance arose.

* * * *

Secretary General Tuekakas parted the curtains of his office window and gazed through the thick glass at the army of protestors in the park across from the United Nations Headquarters. He shook his head sadly. He understood completely how they felt, but prayed humanity was not becoming exactly like the evil creatures that had launched the weapon.

"Ambassador Gates is here to see you," his watch announced.

Tuekakas glanced at his reflection in the window. He tucked in a stray lock of his jet-black hair, styled with the forelock sweeping up and to his left side, and straightened his tie. He sighed tiredly, not looking forward to this encounter. Belters were cocky, obnoxious, pushy, and had no sense of decorum. They were also wealthy enough to get away with it. The least diplomatic and most influential of the lot was Maria Gates, Ambassador from Ceres.

"Send her in."

Gates entered the office, and Tuekakas turned and bowed slightly. Ambassador Gates did not return the gesture. Tuekakas indicated a pair of chairs near the window.

Maria took her seat. "And now the ball is in our court, Joseph."

Tuekakas felt his own feelings on the matter flood back over him for an instant: the irrational emotions, his struggle to overcome them with intellect, and the undeniable uncertainty of the basic facts. "Why, Ambassador Gates? Why would any race attempt to do such a thing to another? What could we have done to deserve such an attack?"

"Why does it matter?" Gates replied without hesitation. "They tried to exterminate us, and so we will build a similar ship and stick it up whatever orifice they use to defecate. Who the hell cares *why* they did it? I don't care if they're stinking damned Vogons with a construction contract to bulldoze Earth for a Galactic off-ramp. What matters is they made an unprovoked attack, and we're going to make a *provoked* attack."

Tuekakas pointed toward the park outside the building. "That's certainly what *they* want. God help me, I'll admit I want it, too. A part of me I'm not proud of would really like to fry them all. But if I may quote Nietzsche, 'Be careful when you fight the monsters, lest you become one.' Who has had time to think this through? That thing was launched from a star almost twenty light-years away. Grasp the distance ... the ships we have today would take two centuries to reach it! Even if we could fire some powerful beam at the speed of light and blow them to atoms, it would take almost twenty years to reach them and another twenty for us to see the flash. But we have no such weapon. We will have to invent and build something. If we throw the resources of the whole system into it, perhaps we can do that in twenty years. But we cannot hope to do it with some beam of electromagnetic radiation. We will need to build an interstellar ramjet, just as they did, and accelerate it for forty years. So that means, if we started working on it today, we might get some satisfaction in about eight decades."

The Ambassador shrugged. "It *must* be done. Humans are capable of holding a grudge for millennia, if need be."

"Europeans have been known to. Middle-Easterners. But the Belt? Don't you think the bulk of humanity left that kind of backwards thinking behind when they left this planet?"

"We're adaptable. We can learn. We're not going to let this pass without payback."

Tuekakas nodded. "I know we must do something. We can never allow such an attack to succeed. But will retaliation succeed? One man, in one small ship, found a way to defeat their unstoppable weapon.

Do you think they won't figure this out? Do you think they won't mount the same defense? Do you think they can't defend against something they built?"

"And your option is?"

"We decoded their message. We should be able to send back a message they will understand. We let them know we stopped it, and we will not tolerate another attack."

"Hah! It's true then. The meek really *have* inherited the Earth. So sad."

"It has the advantage of speed," Tuekakas pointed out. "We actually built a transmitter that could do it decades ago, for something they call 'Active SETI.' The only reason it was never used was legislation, people afraid something like this would be the response. We could have it hooked up to a radio telescope in a week, probably less. The message would reach them shortly after they realize our sun did not explode."

Maria laughed again. "So what would that accomplish?"

"When they realize they missed," Tuekakas continued, "if we do not tell them we are *not* launching retaliation, they most certainly will assume we are."

"And if we tell them we are not launching, they will probably laugh and launch another attack anyway."

Tuekakas nodded. "They very well might launch another attack either way. If they were to immediately launch another weapon, or a fleet of them, it will not matter if we are building one, or have launched one. The one thing absolutely clear is the thing we should be working on is a defense against this kind of weapon, something that will not rely on the sort of blind luck that saved us this time. But it is possible they have since regretted their attack, and a word from us that we are holding off retaliation could stop them from feeling compelled to strike again just to save themselves."

The Ambassador sneered. "Do we know how to say 'turn the other cheek' in their language? I think we know how to say 'prepare to die, scumbags.' We can say that because they taught us how. They were willing to exterminate us without provocation. What makes you think you can talk them out of it? But I suppose I should have known that is the sort of approach you would take. That's why we always appoint someone from Earth as SecGen. You know you don't run the show anymore, but you try to keep the peace between the various large rocks out in the belt where the *real* power lies. Just remember, we *are* the real power, and this thing is going to happen. I'm not here to *ask* you, I'm here to *tell* you. Deal with it, or we'll pick somebody who will. It shouldn't be hard to find a candidate." She looked at her watch. "And I'm due for a meeting where we will figure out how to fund this weapon. Should be fun, watching everyone compete to chip in the most extravagant sum.

"Speaking of which..." she reached in her pocket and extracted a small paperback book. "Almost forgot. Here's a little light reading to get you in the mood." She tossed the book on his desk. "Enjoy, Joseph."

Tuekakas escorted the ambassador to the doors of his office, and then closed them and leaned against them with a heavy sigh. Did she know how much he disliked that name, or did she simply think she was being familiar? Under the circumstances, the complaint was petty. He pushed it from his mind and trudged back to his desk. He glanced down at the little book. The title was *Edison's Conquest of Mars*. He picked it up and read the small print aloud. "The sequel to *War of the Worlds*? I had no idea one was written. Published in 1898! I can see why it would appeal to cowboys. Our honor is impugned! We demand satisfaction! Ramjet duel on Main Street at high noon!" He tossed it back on the desk. "More wasted trees. She could have just sent an e-book."

In his mind, he began running down the list of people he needed to contact. Indira Swarup, who had been his *wyakin* during the last few months, would be one of the first and able to suggest more. He thought about the alien message her organization had received and translated.

"Corruption of creation, abomination of the word, look this way. The hydrogen-sucking light-chaser comes. See your damnation approach, unstoppable. You are to be consumed in the fire of your own star. Our obligation to warn is fulfilled. Prepare to die."

* * * *

A receptionist took the call. At first he was insolent, suspicious the caller was just another reporter, but he sprang to action when he learned it was the Secretary General. The distinguished-looking Indian woman was soon online. Tuekakas allowed himself a quick smile at the historical irony.

"Mr. Secretary, how good to hear from you. How may I help you?" Indira bowed ever so slightly.

"So good to see your smiling face again, Dr. Swarup, my wondrous guiding spirit," Tuekakas replied, returning the bow, deeper and with a flourish of his hands. "So good to see anyone, for that matter, and you played no small part in the fact we can."

Indira beamed. "I was so giddy when that damned thing missed, I hugged and kissed my children until they ran and hid from me!"

Tuekakas closed his eyes and tried to imagine that scene. He remembered one fat old aunt for an instant, and then brought his mind back to the matter at hand. He wiped a joyful tear from his eye before resuming the discussion. "I was wondering if you could call upon your team again and help me decide what we must do next. The SETI League would, I think, be best qualified to speculate on the true nature of this alien civilization, and the threat they pose."

"We know practically nothing," she apologized.

"Of this, I am painfully aware. We are forced to extract what we can from the very little we know." Tuekakas paused, and a grin crept to his lips. "But your team is expert at that, after more than a century of extracting what you can from an *absence* of information."

Indira laughed. "And you see *that* as a qualification?"

Tuekakas shrugged. "Compared to military minds? They're trained to avoid speculation and act on the best intelligence they can obtain. Normally, that's a good thing, and a lesson learned by many bloody mistakes. But without their satellites and spies, I'm afraid they are far less qualified than your group. We need to squeeze everything we can from what little we have. We need to know the difference between knowledge and speculation. I need anthropologists, exobiologists, linguists, people who can get into the minds of a totally alien race. I need the people who decoded that message."

Indira leaned forward and began doing something with her computer. "I'm already on it."

"I was wondering if it would be convenient for them to meet me, perhaps one or two at a time, at a little retreat in Washington State? I'll forward the location. I'd like to avoid attracting attention. I know some of your team is near New York, in Little Ferry, but that's a little close for privacy. I would be happy to authorize repayment of any expenses."

Indira smiled. "Reimbursement of expenses? That could be a first for the SETI League! We're an all-volunteer organization, and usually work out of pocket."

Tuekakas raised an eyebrow. "Really? I worked with you for months and never guessed! How many

space-based radio telescopes does your organization operate? Are those all run by amateurs?"

Indira nodded, her pride evident. “Seventy-something are running full-time at last count. Hundreds more are used at least occasionally. Most are surplus space communications dishes. A few were purpose-built by our wealthier members."

"I would not have guessed. I assumed you were funded with the SETI Institute. So, you saved the solar system for free?"

Indira laughed. “As if we would refuse! We were *delighted* to help. You simply can't *imagine* the glow of satisfaction I've been feeling since that thing missed!” Her voice rose in pace and pitch. “We justified, beyond our wildest imagination, over a century of work most people thought was *useless*. And the *best* part, I helped save my own children, *all* the children!” She suddenly realized how agitated she had become. “Oh! I guess I'm babbling. What was it I wanted to say? Oh *yes*! Please, don't think I mean any slight to our colleagues in the Institute. We were the first ones to pick up the signal, but we could not have translated it so quickly on our own. They do have the old Allen radio telescope array and access to some large deep space arrays, but for sheer number of ears pointed at selected stars, full-time, you can't beat a small army of amateurs! Together we make a considerable team, and I intend to call some of their experts, if you concur."

Tuekakas smiled broadly and nodded his assent. In their previous conversations, Indira had always been careful, precise, and reserved. This bubbly chatter was a side of her he had never seen. Was Dr. Swarup the only joyous person on the planet? Everyone else had spent the last weeks in helpless dread and most were now consumed with a lust for vengeance. This gentle woman had spent the past weeks frantically trying to save the world and had succeeded. Or perhaps he needed to hear from more mothers. “And anyone else you consider useful. And discrete."

* * * *

A thin fog hung amid the ancient old-growth fir trees. Tuekakas sat cross-legged on a smooth boulder, eyes closed, enjoying the quiet, the rich scents, the feeling of mist on his face. His tailored business suits hung in a closet in his suite back in New York, and he luxuriated in the comfort of a flannel shirt, down vest, jeans, and well-worn boots. He listened to the muted sound of footsteps approaching on the soft carpet of needles. “Good morning, Dr. Sariskal,” he called out without opening his eyes.

"So, it is true, what they say about Native Americans."

"What do they say about Native Americans?” Tuekakas asked, opening his eyes, an impish grin on his face.

"That they are so in tune with nature, they can hear a twig snap and tell if it is due to man or beast,” Dr. Sariskal replied, pantomiming stealth as he approached.

Tuekakas nodded. “That we can.” He held up his left arm to reveal his wrist assistant. “Especially with one of these. It is amazing how lightweight and easy to wear modern technology has made the ball and chain.” He accepted the other man's firm handshake and then gestured to indicate a spot on the boulder beside him. “Please, make yourself comfortable. But do be careful, that's an antique my family has cherished for centuries."

Dr. Sariskal made a point of sitting gently on the boulder, smiled at the humble figure beside him, and took a deep breath of the mountain air. “This mountain is simply exquisite!"

The Secretary General nodded. “In New York, I have to be a stuffed shirt. Here I can be myself. Here the Earth and I are of one mind. It is lovely on many levels. A little later, if it clears, you'll see one of the

most beautiful vistas in the world. I'm sitting here appreciating how wonderful it is that it still exists and hoping to keep it that way. What can you tell me about these aliens? Why did they feel so compelled to hurl a 'hydrogen-sucking light-chaser' at us?"

"You should have seen the argument over the translation of that line. In the end, we left it literal. Seemed to make it clearer it was a Bussard ramjet." Dr. Sariskal paused to consider the question. "On the surface, from the message we know they have a religion, or something like it. We know they used it as a reason to attempt to exterminate us. I think we need to be careful how much we read into that ... it is important, but perhaps not for the reason you think. The only thing we can say for certain is they really did sincerely want to exterminate us."

"There would have been nothing left to colonize, so we can eliminate that motive," Tuekakas agreed. "But why are you so hesitant to say they have a religion? It would seem obvious from the message."

"The question is if religion is really why they wanted to destroy us," Dr. Sariskal explained. "We had to read *between* the lines before we learned to read the lines. The process of translation itself required us to build layers of understanding to come to the meaning of each word, and the proper English structure of the message. It was obvious from the underlying meanings the message referred to a religious doctrine, a sort of Manifest Destiny. More than a little like Zionism, actually."

Tuekakas nodded. "Manifest Destiny is a concept my people are well aware of. So, if you know it is a religious motive, why not just say so with confidence?"

"I am both a historian and an anthropologist. How many religions are there on Earth, Mr. Secretary? Thousands? Only in science fiction do other worlds have only a single religion, I think. But one or many really does not matter. What matters is the question of why anyone has a religion. I could be wrong, but hear me out. I believe this message was not really intended for us at all."

Tuekakas turned to look at his companion. "Interesting."

"The message clearly stated they were warning us out of some sort of moral obligation," Dr. Sariskal explained, "perhaps something similar to the Japanese attempting to deliver a declaration of war to this country prior to attacking Pearl Harbor. But they obviously never expected the warning to allow us time to mount any kind of a defense. The purpose of the message was simply to discharge that obligation, and I believe that was purely for domestic consumption. They probably did not expect us to decode the message in time, and they certainly did not expect us to be so lucky as to have a ship, and a smart and willing pilot, in the right location to do something about it. The message was not written for us."

"That is very close to my thinking," Tuekakas agreed.

"Now comes the more speculative part," Sariskal continued. "It is possible they have a dominant religion, or at least some common thread of philosophy in the majority of their religions. There must be some fairly common belief that either this part of the galaxy belongs to them, or else that we are an abomination, a disease that must be eradicated before we spread. The message is an appeal to that belief. I believe it is an attempt to sell the idea of attacking our world."

"Fascinating." Tuekakas hesitated a second. "If I may risk bringing up a subject that is still a bit of a sore spot in your part of the world, perhaps you see a parallel to the kings of Europe organizing crusader armies to 'rescue' the Holy Land?"

Dr. Sariskal nodded. "Very much so. I believe they have a secular leadership who used a commonly held feeling to justify an attack. Getting back to my earlier point, the very existence of a formal religion would suggest this race is not something as alien as a hive mentality. These aliens are individuals. They may be

prone to prejudices against outsiders, and may even be prone to mob mentality, but they *teach* a belief system. They had to be sold on the idea the attack was justified, and that it would be done in accordance with their beliefs."

"Then they have leadership that requires the approval of the population they govern?"

"It is not necessarily a democracy, but the population does not follow entirely blindly. The leadership must do some convincing, play by some accepted rules. And that leadership wanted the attack. You could even make the argument that their religion, by requiring a warning, actually saved us."

"The leadership wanted the attack," Tuekakas repeated. "Simple, but maybe profound."

"Do you know what causes wars?" Dr. Sariskal asked.

"I have my own notions, but I'd love to hear yours."

"Wars have been blamed on arms races, and on failure to arm. They have been blamed on starvation and on plenty. They have been blamed on people hating others they have little in common with, but more wars occur between close neighbors of similar culture. An angry populace may make it easy to go to war, but that is not why they start. The basic truth is war is caused by exactly one condition: the *leadership* of at least one side sees an advantage in going to war. That is the sole common cause of all wars."

Tuekakas considered this for a moment. "Maybe I know one exception? No, not even that one. I can't think of any example to the contrary. In that case, I would be willing to guess their leadership had run into domestic trouble of some sort and needed some outside target to divert the attention of their population away from those troubles."

Dr. Sariskal tilted his head side to side slightly. "Perhaps that is too large an extrapolation, but if I saw a similar story here, I would not be surprised if that were the case. Both politics and bureaucracy seem to have consistent salient features, such as that one, quite independent of the cultures in which they operate. I expect the politicians and bureaucrats of most civilizations would appreciate Machiavelli."

"That, I believe," Tuekakas agreed. "Do you have an alternate explanation?"

Dr. Sariskal shook his head. "We are going well beyond what we can possibly know. It is possible this civilization has had bad experiences with another alien species in the past. It is also quite possible they are simply adamantly xenophobic by nature. The simple fact is, we don't know. I wish I could be more helpful, but I don't want to plant any false ideas that lead you to a conclusion that places us in danger."

Tuekakas nodded. "I understand that much perfectly. We cannot dismiss the possibility this race is intractably xenophobic. If they are, the minute they realize we were not destroyed, they will begin to prepare another weapon, regardless of what we do here. We must be ready to defend against that. The question is, how best to respond on the chance they are not? Are we doomed to an interstellar war lasting until one side or the other is destroyed, or do we have one chance, right now, to make some move that will allow us to avoid war?"

The sky brightened, and the Sun showed itself through the veil of mist. Tuekakas pointed to the sky. "A sign, do you suppose?"

Dr. Sariskal managed a sad chuckle. "'Master Sun say, prohibit the taking of omens, and do away with superstitious doubts.' The mist will part no farther on this problem, I'm afraid. With a little luck, though, I might just get to see that vista you advertised." He thought for a moment. "Am I to understand you are

against retaliation? If you are, I'm not sure I'm ready to be your ally."

"I see you're a student of *The Art of War*," Tuekakas replied. "War is a serious business. Sun Tzu also said, 'It is a matter of life and death, a road either to safety or to ruin.' And he warned against fighting for pride or anger. This one would be more serious than any humanity has ever fought. My background teaches me war is usually bad medicine, particularly if you pick a fight with somebody you cannot hope to defeat."

"My background teaches me not to be so pessimistic about the outcome of war." Dr. Sariskal's eyes narrowed to grim seriousness. "I'm angry enough right now to pilot a starship down their throats myself, if I thought it would work. I have seen nothing in my analysis to suggest we should show them any mercy at all."

"You and twenty billion others, I think. The opinion of the majority will undoubtedly prevail. And in the end, I may even agree. I suppose that's yet another example of leadership seeing an advantage in war. But I wonder, in what alternate reality does revenge actually taste sweet?" Tuekakas leaned back against the stone and savored a deep breath of the cool air.

"You are a cultural anthropologist, so let me tell you a little something about my culture," the Secretary General continued. "Historically, we governed by consensus. We picked a chief, but nobody was compelled to follow his orders. He may well have been a son of the old chief, but he did not inherit authority like a king. We picked him because he had been trained from a very early age to know exactly the best thing to do. If he said it was time to move from the valley to the highlands for the summer, the people followed because they knew he was right. If he said it was time to dig camas root or to send out the hunting parties, they did so, because they knew he was right. If he said to go down into the valley at the peak of summer, they would have known he was a fool and nobody would have obeyed. The chiefs learned to carefully consider the situation and recommend the best course of action, which they knew would gain a consensus."

Dr. Sariskal smiled. "I believe I begin to see how you got this job."

Tuekakas nodded. "I knew why from the start. This position has never been one of power. The United Nations can only achieve action when there is a consensus. The Secretary General should be a master at achieving it. If I recommend an action nobody will follow, I will fail. But at the same time, if I fail to recommend the best course of action, and instead bow to popular pressure because we are all angrier than humanity has been in all of history, and not thinking the matter through, I have also failed. I can look back at the history of my own people and see such failures. I must find the best path, and be sure people understand it and will follow it."

* * * *

Indira Swarup aligned the small telescope's green laser on Polaris, checked the setting dials, nudged the tripod slightly, and tweaked the telescope again. She turned her attention to the constellation Cassiopeia and swung the telescope to place the green beam on a dim star near the center of the constellation. "Nice sky tonight. This is a very good spot for viewing northern constellations, if the clouds cooperate." The condensation from her breath passed across the laser beam and brightened it, creating a momentary speckled light show. The only other light was starlight, but the sky was so clear, dark-adapted eyes could easily make out shapes.

She switched on the equatorial drive, turned off the laser, and peered through the eyepiece. "Mmmm, yes, there you are, Eta Cass." She motioned for Tuekakas to take a look, then tucked her hands in her pockets for warmth. "Not bad for an antique. This was my first scope, and it was a relic when it was given to me, but it still loves to introduce newcomers to the sky."

"Eta Cass sounds so scientific. What does the press call it? Acrid?" The Secretary General leaned over the eyepiece, trying very hard to look comfortable in the cold. "I don't see anything."

She guided his head gently to one side. "Get your eye in the right spot about two centimeters above the eyepiece. Avoid touching it if you can, or the scope will vibrate, and don't breathe on the lens. Some people call the star Achird. Nobody is sure exactly what it means, but it probably refers to the girdle of Cassiopeia."

"Ack-eared. Named for underwear. Serves 'em right." Tuekakas paused while he moved his head seeking the sweet spot. "And there it is!" He observed for a few seconds, then added with less enthusiasm, "Rather ordinary, isn't it?"

"Exactly," the astronomer agreed. "That's what makes it so special. Only one thing really sets it apart from our sun. What else do you see?"

"A small reddish dot near it. Is that another star?"

"Indeed it is. Eta Cass is a binary. The primary is a yellow dwarf very similar to our own sun. That little red spot about a dozen arc-seconds away is a red dwarf, in about a 480-year orbit around the primary. That puts it about 75 percent farther out than Pluto is around our sun. If we had another star that close, we'd be a star-faring race by now."

"Interesting." Tuekakas raised his head to see again how dim the star was compared to the dominant stars in the constellation. "Which means the race that lives there probably is."

"With their technology? If they were not, it would be a very deliberate and revealing choice. They definitely occupy planets around both stars. We have not seen any evidence they have gone beyond that range, but we have not been looking for long. But there is a precedent on Earth that might apply."

"Oh?" Tuekakas looked at her quizzically, then remembered his discussion with Dr. Sariskal and recognized the case she referred to. "The Chinese! Something about a large exploration fleet?"

"Exactly," Indira confirmed. "In the early fifteenth century, the Chinese had an admiral named Zheng He, reputedly the equal to any in the western world, who built a huge fleet and mounted epic explorations. Emperor Zhu Qizhen terminated the explorations and had the fleet burned. Some speculate the Emperor feared the power of the navy."

Tuekakas nodded. "I've heard the story. If this civilization is dominated by a system-wide empire of that mentality, it would explain a lot. How could an absolute ruler possibly deal with an empire on the scale of light-years? Any distant colony would have to be autonomous! And their means of transportation could be used as a weapon and so would threaten the emperor. They might never spread out to other systems. But if they discovered someone else about to do so ... they would stop it at all costs. It absolutely makes sense! So, you know both systems are inhabited?"

Indira nodded. "The system is easily close enough for us to have imaged their planets using deep space telescope arrays. One of them is distinctly Earthlike, and right in their habitable zone, about one sixtieth of the distance between the two stars. We can make out changing colors as it revolves, and it has extensive water and evidently widespread life bearing a chlorophyll-like chemical. When it passes in front of distant stars, we detect a breathable atmosphere with indications of industry. They also have a couple of small planets orbiting the red dwarf, and one shows some signs of being terraformed, including the *exact* same photosynthetic process."

"Fascinating. How long have we known all this?"

"We've known about the Earthlike world for decades," Indira replied. "The discovery of the possibly terraformed world was just last week. The industrial trace gasses were discovered in old data we reanalyzed just a few days ago. We'll learn a lot more, and quickly. Almost every tool available to astronomy is either pointed right at them or at other nearby systems to see if we can spot signs they have spread out."

"What else can we see? I'm sure you can't see shipbuilding activity." Tuekakas raised an eyebrow. "Can you?"

"No." Indira shook her head. "It might just be possible to detect another ramjet shortly after launch. We are absolutely positive there is not another one already on the way, at least not one that has reached relativistic speeds."

"Would we be able to tell if they have ever attacked another star in this manner in the past?"

Indira smiled. "Now *that* is one really excellent question. We're still reviewing the data, but we see no evidence they have ever done this before. We're pretty confident we would not have missed the evidence of a yellow dwarf exploding. That would be such a jarring departure from main-sequence behavior, we'd have caught it. We're still puzzling over the exact model of a ramjet-induced core collapse, but the competing models only differ in how long the explosion takes to reach the surface. We ought to be able to see the anomalous metallicity of the ash."

"Ah, you mean it wouldn't crank out heavy elements like a standard supernova?" Tuekakas bent over to look through the telescope again.

"Exactly." Indira gazed at the sky and huddled against the cold. "No artificially triggered explosion of a yellow star will look anything like a supernova, or like the explosions you can produce with a white dwarf. Plus, we need to consider the distances at which this civilization might have made an attack. We would not be looking for remnants a hundred thousand light-years away. A hundred light-years, maybe. And, depending on the age of this civilization and their rate of progress, they would be relatively recent, probably some thousands or tens of thousands of years at the outside, and likely less than that. Nothing in the catalogs suggests anything of the kind."

Tuekakas stood up and stretched his back. "I am still trying to grasp the scale. That star is twenty light-years away?"

"Really 19.52, according to our most recent parallax measurements."

"Close enough." Tuekakas shook his head. "Vast as this distance is, this star is in our own back yard. It bears another civilization, evidently more advanced than ours, but not so much that we can't comprehend at least the basics of their technology. Dr. Bussard conceived of the weapon they fired at us long before they launched this one. Another coincidence! The mind simply reels at the number of them. In all of time and all of space, we have close neighbors not far from us in development, and they want us dead."

Indira gazed at the lopsided "W" of stars that made up the constellation. "I'm in contact with a team working out the orbits of our respective stars in the galaxy. Achird is older than Sol, but there are some equalizers. Both are presently blessed with favorable stellar environments. This part of the Milky Way is a good place for life. We already know our system has periodically passed through rougher neighborhoods in its trips around the galaxy, accounting for some prior mass extinctions. It appears likely both systems were in dangerous parts of the galaxy at about the same time not too long ago. Perhaps both experienced mass extinctions then and were put on a similar evolutionary track. It is even possible both home planets experienced their more recent ice ages at the same time due to the intensity of cosmic radiation. They may have developed slower than us, but with an earlier start. They probably have

significantly less metal available than we do, which would have slowed their progress. If they are so xenophobic, they might also be luddites, opposed to rapid technological change. There is one thing we are certain of. The timing of this attack is no coincidence. We signaled our presence."

"Ah! How?" Tuekakas grinned for an instant at his *faux pas*, wondering if Indira would catch it. "We never used the big Active SETI transmitter. Did some of the earlier lower-powered Active SETI attempts succeed?"

Indira shook her head. "It is unlikely any of those would have been heard at Eta Cass. We've been mapping the Oort cloud with very powerful radar. The pings have been up in the terawatt range, in order to generate reflections off comets up to half a light-year away. The pings were focused into tight beams. We started doing it about seven or eight decades ago, and some of those studies were pointed right in their direction, weighing in at about a seven on the San Marino Scale."

"San Marino Scale?" Tuekakas followed her gaze to the constellation.

"That's the analytical tool used by the International Academy of Astronautics, to quantify the significance of transmissions from Earth. Developed by Almar and Shuch, way back in twenty-ought-something. Dr. Shuch was the original Dr. SETI, one of my hats these days."

"How easily detectible is a seven on this scale?"

"The landmark Arecibo message sent in 1974 was just slightly stronger," she replied. "If they had SETI gear set up and aimed at all the habitable nearby stars as we do, they'd have detected the signals easily."

"Huh!" Tuekakas turned to Indira and grinned. "We told them we were on the threshold of interstellar travel. We were knocking on the door to the stars, and we got an answer."

Indira raised an eyebrow. "Quite an answer. And certainly not the one we expected."

"Wyakin," Tuekakas asked after a thoughtful pause, "tell me honestly, am I a wuss?"

Indira looked at him, momentarily startled. "I ... what a terrible question to ask!"

Tuekakas focused his gaze on her starlit face, trying to read her expression in the faint light. "Up until now, I have prided myself on being the person who could find the middle ground. I was the compromiser all sides could trust. Now I find myself in a situation where I am far from the middle ground, and I will be forced to accept a situation I believe is a horrible mistake. Yet, if I fight it, I will lose this position and any hope of having a positive influence. I think that makes me a lily-livered wimp, at the very time we need a leader."

Indira paused to consider the question. "I think you could come up with a more dignified word for it. 'Realist' is the one that pops to my mind. There is a certain futility in standing in the way of bulldozers."

The Secretary General flashed a big smile and laughed out loud.

"I said something funny?" Indira asked.

"I can always count on you, *wyakin*, to guide me to the answer I need! They're not Ack-earedians! They're Vogons! Ambassador Gates mentioned them to me a few days ago. Are you familiar with the story?"

"Vogons? And it has something to do with bulldozers? Why am I thinking about a decent cup of tea?" She grimaced. "Aaargh! *Hitchhiker's Guide!* You should be ashamed. Poor Mr. Gendeg got in front of

their bulldozer and see what it got him?"

"God bless Victor Gendeg, who saved us all from the Vogon bulldozer. But you just made me remember a little prank I was involved in as a youth. We managed to delay a construction project long enough to complete an environmental impact assessment. We stopped a dam from being built, not far from here." Tuekakas pointed to himself. "My role involved learning to operate a bulldozer! You might say it was a crash course. The construction firm characterized it as eco-terrorism, but we figured it was just turning our opponent's strength against them. I probably should remember there are better ways to deal with bulldozers than standing in their way."

* * * *

Dr. Andrew Howard placed the spindly model gently on the polished surface of the table. Tuekakas admired the intricate details.

"So this is a Bussard ramjet? It looks rather frail to be a star-killer."

Dr. Howard stood up and smiled. The man seemed simultaneously nervous and eager, but at the moment, also very proud. "Oh, this is actually one I designed a few years back. Not a star-killer. You are correct; the Achirdian star-killer was more robust. The comet miners managed some images of it, and we are working on a model, but the main components are remarkably similar. Mine is just an ordinary starship."

Tuekakas bent over to examine the details of the aft end. "I like the way you say that so casually, 'an ordinary starship.'"

Dr. Howard chuckled. "I suppose no ship that can 'chase light' can ever be considered ordinary. Even my design could be a dangerous weapon. The Achirdian weapon had something similar to the spaced stack of three shallow cones at the front of my model. These are micrometeorite shields. Now, imagine three massive metal slugs along this mast, in place of the personnel and cargo modules in my design, back here. These would be the main penetrator masses ... the battering ram. These rings are simple, but very powerful, magnetic solenoids. The radial protuberances are electrostatic antennae. Behind the solenoids is the electrodynamic compressor, which initiates the reaction. The thornlike piece at the very back is the stinger, which serves a similar function to the nozzle of a rocket engine, or for a closer analogy, the tail cone of an aerospike engine."

Tuekakas nodded. "So you already knew how to build one?"

"We had a rough idea," Dr. Howard said. "We understood how to build the collector. We were fairly certain we had worked out the hoary old drag objections. We had several ideas for how to make the reaction go: CNO bi-cycle catalysis, muons, perhaps even reacting scooped hydrogen against stored anti-matter. But nothing was proven. We did not know for sure if it could be made to work. Hydrogen is difficult to use as a fusion fuel. We have always had some vague idea it was possible, but no great incentive to learn how and no funding for it. But the aliens proved to us it definitely can be made to work."

"So you understand it now?"

Dr. Howard spread his hands to signify doubt. "Let's say we have several good ideas, and we are now absolutely certain there is a way. The Achirdian ship used a monstrously intense magnetic field. We are not certain of its purpose and even less certain of how they produce it. It dwarfs any superconductor magnets we have made by orders of magnitude. But the deuterium explosion caused their magnets to rupture, producing a large secondary explosion. We captured excellent spectra of that event. We know what the magnets were made of."

Tuekakas walked around to the other side of the table, studying the model. “What do you need for us to build our own?"

Dr. Howard beamed. “Money. Commitment of resources. Priority. We need a Manhattan Project."

Tuekakas nodded. “I was thinking just that."

Dr. Howard opened his briefcase and eagerly fished out a bound document. “We need to start with a very strong effort in basic research. We must learn how they made the magnets and why. We need to determine if they made something exotic like magnetic monopoles, or if they had learned to invert matter to anti-matter. Were they doing catalysis, and if so, how did they recover the catalyst? Or perhaps it fuels itself from dark matter, neutralinos—after all, there's far more of that than there is hydrogen, and it is capable of an annihilation reaction. Perhaps dark matter will interact with a field that strong.” He thrust the document into the hands of the Secretary General. “This is our estimate of the human and material resources."

Tuekakas opened the proposal and turned to the executive summary to read. “Mmmm, just what I was looking for.” He leafed through some pages and came to one that showed an outline of the proposed weapon. “Yes, very nice. Tell me, Dr. Howard, how long do you think it would take to develop this weapon?"

The physicist's face changed from eagerness to worry. “That would be very hard to guess without knowing the resources. The Manhattan Project had *vast* resources."

"The Manhattan Project had but a fraction of the resources of a single nation,” Tuekakas pointed out, “spared from an even more massive war effort. And they developed the first nuclear weapons in just a few years. But the Americans were not quite as upset with the Axis powers as we are with these ... Achirdians."

Dr. Howard nodded apologetically. “They had many efforts going in parallel. Two different enrichment methods, including a massive hydroelectric program to power them. A breeder program. People learning to build the components. We should have parallel programs. And perhaps we could start planning the ship-building facility quite soon, before we even have the ramjet perfected."

"Still,” Tuekakas said, “I imagine this is likely to take longer than building the atomic bomb. After all, this is a starship, not a bomb. A decade? More?"

"At least a decade. Perhaps two. I wish I could say it would be sooner. We must retaliate before they can strike us again."

"If they launch immediately upon learning the last weapon missed, we will still have time to launch our response,” Tuekakas stated. “I did not notice if your proposal includes research for defense. We must not rely on luck again."

"Oh, certainly,” the physicist agreed. “There is a proposal in there for a fleet of mass drivers, large enough to move dwarf planets into the path of any future attack, as well as robotic ships to lay down deuterium clouds much farther out than we did this time. And we will work out strategies for overcoming their defenses, with multiple simultaneous strikes and decoys."

Dr. Howard paused for a second to gather courage. “Um, if you don't mind my asking, sir, my understanding was that you were against this project. Have you changed your mind? I mean, we all felt so helpless before that thing missed. We have to *do* something. I *have* to be part of it."

"I understand your feelings completely."

"You really do? They nearly wiped out the entire human race. So much hatred! We can't let it pass! We must have retribution! So you are on board now? Good!"

Tuekakas smiled slyly. “Let's just say I was seeking the best possible outcome. You have let me know what is possible, and I now believe this technology is just what we need."

* * * *

"How many rowdy cowboys did they bring to this pow-wow?” Tuekakas asked his assistant. He was obviously in a good mood, and eager for the meeting.

"Six, sir, assuming you mean Belters."

Tuekakas smiled with satisfaction—the young man was clearly thrown by his irreverent jest. “Umm, needum more Indians. Round up two more warm bodies. I intend to negotiate from strength."

The assistant looked at his watch. “Sir, we're already keeping them waiting."

"And wait they shall. I intend to march in there with an entourage of eight. We will occupy every available seat at the table.” Tuekakas winked at Indira. “Old trick I learned from my ancestors, *wyakin*. Even if you intend to give in, make a show of strength."

* * * *

Ambassador Gates looked at her watch again. “Damn that man! Fifteen minutes now. Who does he think he is, making us wait?"

The man to her left, slouched back in his leather swivel chair, turned his head to her. “Ah, that would be ... the SecGen? Relax. He's just sending a little message. I have a feeling you'll get your way."

The doors opened, and two columns of people marched in. They split to occupy the remaining seats on either side of the table. Tuekakas brought up the rear and stood by the large seat at the head of the table.

Ambassador Gates rose and the rest of her delegation did likewise. “Joseph, I believe you know everyone at my end of the table."

Tuekakas nodded. “And I'm sure, Maria, your spies have introduced you to my staff and advisors. Shall we get right down to brass tacks? Please, everyone, be seated. This should not take long. It does not require many words to speak the truth."

Ambassador Gates motioned to the representative from the O'Neil as she sat down. He passed a stack of thick proposals to the members of the Secretary General's entourage. Tuekakas glanced down at his copy, but did not open it.

"Joseph, you're beat and you know it,” Maria Gates stated flatly. “So quit pretending."

Tuekakas chuckled. “Beat? Let me guess what is in this pile of wasted trees before me: a pledge to spend an extravagant amount of your money on an unparalleled crash program of research and development? You've all agreed to pay ‘til it hurts. You want your weapon. You want payback. You look like a bunch of Lakota ready for a war dance. I'm surprised you are not wearing war paint."

"Joseph..."

"And I have decided not to oppose you. In fact, I support you fully."

Maria looked ever so slightly startled, but quickly regained her stride. “So you finally realized it would be political suicide?"

Tuekakas shrugged. “There's that. But I would have fought with you if I did not think this will be the best path to take."

The ambassadors looked at each other in confusion.

The Secretary General continued. “You think I've decided to back a war? Don't be naive. I've decided to back the development of interstellar ramjet technology. Dr. Bussard never intended it to be a weapon, you know. He thought we would use it for peaceful interstellar transportation. The time is ripe. We will start it now, while people are boiling mad, lusting for revenge, and willing to pay anything it takes. We did not do it before because we did not quite know how, and finding the answer seemed very expensive, with no guarantee it would work. We were not pressed for time. But thanks to their attack, we now know there is a way to make it work, and we know there is a need."

"You intend to divert this?” Maria challenged. “We won't let you!"

"Not immediately,” Tuekakas said with a confident smile. “This technology will not take less than a decade to develop, and will probably take a good deal more. War fever rarely lasts more than a few years. People will have time to cool down and think. Others will realize the futility of engaging in a totally pointless war with the Achirdians, slinging ramjets, at enormous expense, at each other's stars until someone runs out of luck, passing the curse on to our children and their children. They will tire of wasting epic resources on destructive folly, with only a small hope of satisfaction a long time in the future. They will realize our vulnerability ends when we are no longer bottled up in one system. They will realize we are standing at the doorway to the stars, and our neighbors, quite unintentionally, of course, have tossed us the keys. When they do, they will find the Secretary General is their staunch ally. Once public opinion turns, I think about five years from now, you'll be bulldozed. In fact, my expectation is, you'll agree and join me. But you are welcome to maintain the charade for now, if you wish.

"I see that look. You think something is wrong with me, because I don't want revenge. You misread me. I *do* want revenge. I just want it to be to our benefit and not our damnation. I don't want their evil to transform us into something just as bad. This is revenge of the best sort possible,” he said with obvious satisfaction. “They intended to destroy us so we could not reach the stars, but instead, they have given us the very means to do so!"

* * * *

Indira and Tuekakas stood by the window in his office, admiring the view.

"You didn't mention bringing the Active SETI system on line,” Indira reminded him. “You had a good point about the possibility of avoiding a second strike with the right message."

"You're absolutely right,” Tuekakas admitted. “I'll need to bring it up soon. Let them digest the new situation a while."

"Don't wait too long. If the ... Achirdians? Vogons? If the aliens have another weapon ready, they may not wait long to launch after they see Sol did not nova. You know, some of the amateurs are already sending their own messages to the Achirdians."

"Nothing too sweet and charming, I assume.” Tuekakas raised an eyebrow. “Or detectable?"

"Not very, on all counts,” Indira replied. “So far, nobody is sending anything conforming to the Achirdian translation construct. And I doubt any of the signals are more than a three on the San Marino scale. But I

wouldn't count on things staying that way for long."

Tuekakas nodded slowly, gazing into the distance. “That could work to our advantage ... incentive for an official message. What would we tell them? We could thank them for giving us the last secrets of the interstellar ramjet, with the promise we would use it against them if, but only if, we detected another launch against us."

"To say that, you need Gates's delegation to agree."

"Absolutely.” He considered the issue. “It might not hurt if we somehow suggested what Victor Gendeg concluded ... God provided us with the means for our defense."

"Touchy subject,” Indira noted. “A month ago I would have called that superstition. Now?"

"A month ago I might have agreed. This message will not be to mollify *our* population. This will be directed at the Achirdians. If we can plant the idea our God is stronger than their God, maybe they'll realize their God is false.” Tuekakas made a face. “Ehhh! I'm ashamed I said that. Dr. Sariskal is right. Politicians are the same everywhere."

"Maybe their religion is not the fault.” Indira turned and smiled gently. “The Christians always talk about their forgiving God. The Muslims say God is merciful. And I recall the Hindu tale of Lord Krishna, or maybe it was Shiva, who once cut off the head of an enemy, but then forgave him and gave him the head of a goat. In India, we would consider that an improvement, you know! I think their religion, or religions, very likely also value forgiveness."

"So, we tell them ... what? ‘God has taught us to forgive those who trespass against us. But He did not teach us to be stupid. Don't try that again.’”

Indira pondered. “Neighbors, you have made a very serious mistake. You failed, and in that failure taught us how to build a similar weapon. The Creator has taught us to be forgiving, and we will not retaliate unless we see that you have attacked us again. We wish for peace, but if you choose war we will respond with a fury that will assure your destruction."

"Wyakin, you could have been a diplomat.” Tuekakas thought for a moment and smiled, “I'll bet you never thought your first message to another race would be anything like this."

"Noooo, not at all what I had in mind, all these many years."

Tuekakas put his hands in his pockets and looked down. “We are going to do it. We are going to travel to the stars. Make new homes. Colonize new worlds. Just one thing still bothers me,” he said. “I hope I am not remembered as a new Columbus."n

In memory of Dr. Robert W. Bussard, August 11, 1928 to October 6, 2007.

The author would like to again thank Dr. H. Paul Shuch of The SETI League, for permission to use the name of the organization, and for great background details. Special thanks to William Gleason, Roy Gray, and Juliette Wade for their valuable advice, and the forum at analogsf.com for their input.

(EDITOR'S NOTE: This story is a sequel to “El Dorado” [October 2007].)

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Science Fact: **PRESERVING THE MEMORY** by Janet Freeman

Alzheimer's disease is a fearsome problem, but sometimes problems can be solved by breaking them into smaller problems.

* * * *

Over five million Americans have it, including nearly half of those over age 85. Ten million Baby Boomers will develop it. It is now the sixth leading cause of death in the US. The worldwide societal cost is estimated at over $400 billion.

It is Alzheimer's disease (AD), a thief that destroys the brain and replaces the person you know with a stranger. AD usually affects people older than 65 (known as late-onset AD) although people have been diagnosed in their 40s and 50s. Patients initially display problems with memory. As the disease progresses, they struggle with communicating, learning, thinking, reasoning, and motor skills, and may exhibit behavior and personality changes. People with AD typically survive eight to ten years after diagnosis (some have lasted 20) and usually die from complications such as accidents, malnutrition, dehydration, and infection, often pneumonia.

There is no cure. Yet.

Billions of dollars have been spent trying to change that. For the past four years, the National Institute on Aging has spent about $644 million per year on AD and sponsored about 30 Alzheimer's Disease Research Centers at prestigious institutions. Other government agencies also provide funding. Private agencies such as the Alzheimer's Association have awarded hundreds of millions in international grants. Outside the US, major research efforts exist in Japan, the United Kingdom, and Europe.

Scientific consensus says AD is caused by a combination of genetic and environmental factors. Current AD research focuses on the following, in hopes of developing therapies that may delay, prevent, or even reverse AD:

* Understanding the role played by the protein plaques and tangles characteristic in the AD brain,

* Using imaging and other biomarkers for earlier diagnosis and tracking the disease process,

* Identifying AD-associated genes and what they do,

* Determining how other physiological processes relate to AD, and

* Developing treatments.

* * * *

Unraveling plaques and tangles

The loss of brain cells is one obvious characteristic of AD (see Figure 1). Examine brain tissue of a typical AD patient and you will find the other two: protein structures that Dr. Alois Alzheimer dubbed senile plaques and neurofibrillary tangles (see Figure 2).

* * * *

Figure 1: A normal brain (left) vs. advanced AD brain with severe loss of neurons. [Credit: Jannis Productions, Stacy Jannis.]

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"The $64,000 question is: what's the relation between those two pathologies?" asks Thomas Bird, MD,

Professor of Medicine, Neurology, and Medical Genetics at the University of Washington. “How and why do you get both? Why is this occurring relatively simultaneously? What's the connection between them?"

Their presence makes them prime suspects in the murder of brain cells, but their guilt has not been proven. Researchers are investigating how they form, how they affect neurons and brain tissue, their role in AD (are they a cause, a symptom, or a byproduct?), and how to remove them or prevent them from occurring.

Neuritic plaques (as senile plaques are now called) are spherically shaped masses of beta-amyloid **peptide (Ab)**, dotted with debris from dead neurons. Small amounts of other proteins are found in plaque as well. Ab is made in nerve cells from a larger protein called amyloid precursor protein (APP), which is found in the fatty membrane surrounding nerve cells. AD either causes brain cells to make too much Ab or not dissolve enough of it. The neurons excrete Ab into the area between cells where it forms clumps of plaque. One particular form, Ab42 (it has 42 amino acids) is very sticky stuff and abounds in plaque.

People who have Alzheimer's tend to have lower blood levels of soluble Ab in their cerebral spinal fluid blood than those who do not display dementia, suggesting that Ab somehow accumulates in the brain, although this mechanism has not been proven. The frustrating thing is that plaque can be found in the brains of people who never developed dementia, and some AD brains showed relatively little plaque formation. Numerous correlation studies failed to demonstrate a clear relationship between the severity of dementia and Ab in the human AD brain.

Working to understand the normal function of APP and Ab is essential to uncovering the mysteries of plaque. Some studies found APP is a key regulator of structure and function of neuromuscular **synapses**. A synapse is the interface at which one nerve cell transmits a signal and the adjacent cell receives it. Ab may also have a role in synaptic functioning. Both proteins are intense areas of research.

Beta-secretase and gamma-secretase are the two enzymes involved in snipping Ab from APP. Inhibiting their function is a focus for new plaque-fighting drugs.

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Figure 2: Neuritic plaques (cloudy masses between cells) and neurofibrillary tangles (deformed dark triangles) are characteristic in the AD brain. [Credit: Jannis Productions, Stacy Jannis.]

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Research in the past few years indicates that smaller particles of soluble Ab, rather than insoluble plaque, impair synaptic function. People with AD appear to have **soluble Ab dimers** (two Ab molecules bound together) and **trimers** (three Ab molecules) in their brains, while those without AD don't, even when they do have plaque. Ab dimers may mediate processes that affect dendritic spines. Dendrites are the branches off the main body of a nerve cell that connect the cell to other nerve cells. **Dendritic spines** are small protrusions from dendrites that form one-half of a synapse. One study found excessive levels of calcium in dendrites of mice with plaques. When a synapse fires its signal to the next nerve cell, calcium levels along the dendrite should vary, but in these calcium-laden nerve cells, it didn't. In a separate study, Ab dimers reduced the density of dendritic spines by 47%.

Another study found Ab dimers in the hippocampus disrupted nerve cell long-term potentiation, the mechanism that underlies memory and learning. An Ab antibody applied to the region bound the dimers and restored long-term potentiation. This suggests an immunological approach to fighting Ab might be successful.

Sixty percent of AD cases, as well as other dementing disorders such as Parkinson's disease, have brain plaques based on another protein, **alpha-synuclein**, which clumps together inside neurons to form Lewy bodies. Alpha-synuclein may enhance the release and toxicity of Ab and is another area of study.

Neurofibrillary tangles are made of **tau**, a microtubule-associated protein. Its regular job is to help stabilize the microtubules that form the neuron's flexible interior scaffolding, assist in establishing various microcompartments within the cell, and facilitate transport of molecules from one part of the cell to the next. In AD pairs of tau filaments bind together into helices. These pairs cling to each other and form what looks like a bundle of sticks, called tangles. In brain samples tangles appear as triangles, the insoluble gravestones of dead neurons. Most of the tau in tangles is hyperphosphorylated (lots of phosphate groups attached). The more tangles one has, the more demented one becomes.

Why does this happen to tau? The "**amyloid cascade hypothesis**" claims Ab induces tangles. One scenario suggests Ab causes inflammation that injures neurons and results in oxidative stress. This disrupts normal neuron metabolism and causes enzymes to hyperphosphorylate tau; the phosphate-laden tau forms tangles, which causes the neuron to malfunction; eventually the neuron dies.

However, tau tangles appear in more than a dozen forms of neurogenetic degenerative diseases without plaque (prominently in familial frontal lobe dementia and Pick's disease), so the cascade model isn't the whole story. Some studies show soluble tau peptides, rather than the large insoluble tangles, cause damage to the cell.

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Diagnosis and Disease Monitoring

People usually see a doctor about AD only when they start having significant memory problems. At that point doctors can diagnose AD correctly up to 90% of the time using a health history, mental status exam, physical exam, neurological exam, lab tests, and a brain scan. When other dementing conditions are ruled out, the diagnosis is Alzheimer's. The diagnosis can only be 100% certain by examining brain tissue and finding plaques and tangles—not something most people want done when they're still alive.

However, overwhelming evidence indicates brain changes start years or even decades before symptoms of **mild cognitive impairment (MCI)** appear. Having the means to identify more accurately those at risk for AD or in its very early stages might enable doctors to delay or prevent further damage, or even reverse damage that's been done. The hunt is on for AD **biomarkers**, ways to measure and evaluate objectively the Alzheimer's disease process.

Brain imaging helps us see inside the living AD brain and understand which of its regions are physically damaged or not functioning properly. Initially AD starts in the hippocampus, which is essential for retrieving short-term and spatial memories and for laying down most new memories. From there it spreads to the cerebral cortex, the wrinkled, specialized outer layer of the brain. Some cortices known to be affected include:

*The parietal lobe, which controls language comprehension and aspects of time and space comprehension;

*The temporal lobe, involved in problem solving, interpreting sensory input, and movement;

*The frontal lobe, the origin of insight, foresight, personality formation, and various executive functions; and

*The amygdala, involved in memory and emotion.

Two types of brain imaging provide gray-scale pictures of internal body brain structures. They can detect abnormalities like blood clots, fractures, tumors, infections, and cerebral atrophy. Computerized Axial Tomography (**CT** or **CAT**) shoots x-rays through the body to create its images. Magnetic Resonance Imaging (**MRI**) uses magnetism and radio waves to excite the hydrogen nuclei in the body's water molecules, then capture the radio waves those molecules emit. MRI is better suited than CT for imaging non-calcified tissue, and provides better contrast between different tissue types. MRI measurement of structural atrophy of the hippocampus and entorhinal cortex is a sensitive indicator of AD.

The other three types of brain imaging show brain function by recording the neuron's oxygen or sugar intake. Neurons don't have internal oxygen or glucose reserves for energy, so when they fire, they must immediately obtain more energy. Functional MRI (**fMRI**) provides a color picture indicating levels of oxygen used by the brain as its owner performs a task, such as counting or reading aloud. fMRI works by measuring the magnetic change in hemoglobin when it becomes deoxygenated, thus indicating which areas of the brain are consuming the most oxygen and therefore are most active.

Positron Emission Tomography (**PET**) measures gamma rays emitted when positrons from the short-lived radioactive tracer (injected into the patient) annihilate nearby electrons. It produces 3D images whose colors reflect levels of tracer activity. The most common tracer, sugar fluorodeoxyglucose (FDG), shows where blood sugar is being consumed during a task. Other tracers can be used to image different molecular processes.

Single Photon Emission Computed Tomography (**SPECT**) measures gamma rays to produce a 3D color image, but uses a tracer that emits gamma radiation directly. While PET has higher resolution, SPECT is more widely available and less expensive. SPECT is about as accurate as clinical criteria for diagnosing AD, and is superior in differentiating AD from other dementias. Some SPECT tracers can reflect neurotransmitter activity.

An exciting development for AD revolves around a new PET tracer, Pittsburgh Compound-B (PiB). PiB appears to bind almost exclusively to Ab42 or Ab40 and vascular Ab deposits, permitting imaging of Ab plaque in living bodies.

Researchers are striving to find biomarkers like proteins and enzymes in blood or cerebrospinal fluid (**CSF**) samples. For example, lower-than-normal soluble Ab levels and higher-than-normal tau levels in CSF have been used to diagnose AD with a sensitivity of 92%. Some studies have shown highly elevated CSF levels of beta-secretase, the APP-snipping enzyme, is an excellent indicator as to whether someone with MCI will go on to develop AD.

The Alzheimer's Disease Neuroimaging Initiative (ADNI), announced in 2004, is striving to build a standardized set of AD imaging and biomarker techniques. The study tracks over 800 people—cognitively normal, MCI or AD—by recording biomarkers and cognitive abilities over time. ADNI data is freely accessible to researchers from their own computers. The study, which runs through 2010, is the most expensive the National Institutes of Health have ever funded. Efforts similar to ADNI now exist in Australia, Japan, Europe, and China. In addition to identifying sensitive methods for earlier detection of AD and providing a centralized biomarker database, ADNI results will hopefully simplify and speed the assessment and comparison of different research and therapy approaches.

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The Search for AD Genes

How does a researcher determine which genes might be involved in AD? They collect blood samples from large numbers of people with AD and compare their DNA with that from a large number of similar people who don't have it. Researchers then look at the relatively small number of genes that are different

between the two groups, and try to determine which genes are really important.

In the 1990s, four genes were confirmed to be associated with AD. Mutations in each of these genes lead to increased production of Ab. Three were found by studying families with rare forms of early-onset AD: amyloid precursor protein (**APP**) gene on chromosome 21, presenilin 1 (**PS1**) gene on chromosome 14, and presenilin 2 (**PS2**) gene on chromosome 1. Less than 1% of AD patients have mutations in these genes.

The fourth is the only identified genetic risk factor for late-onset AD. About 50% of late-onset AD patients of European ancestry have the e4 allele of Apolipoprotein E gene (**APOE4)** on chromosome 19. However, many who have APOE4 live to a ripe old age without ever contracting AD.

No gene mutation associated with AD tangles has been identified, although two tau genes associated with frontotemporal dementia haves been found on chromosome 17 (tau and progranulin).

Since 2003, the Late-Onset AD Genetics Study (LOAD) has been collecting DNA via blood samples from 1000 families who have at least two living siblings diagnosed with late-onset AD in hopes of finding more AD-related genes. Researchers have identified over 100 potential AD-related genes, but none have been unanimously confirmed.

Human AD gene mutations have been injected into fertilized mouse eggs to create **transgenic mice**. They develop plaques indistinguishable from those in AD patients and develop the corresponding deficits in learning and memory. Transgenic mice exist for all known AD mutations. Interestingly, transgenic mice with Ab-associated genes do not form tangles or have the extensive neuron loss characteristic of AD. Transgenic mice that produce tangles are created using the frontotemporal dementia tau gene. Mice that display both plaques and tangles are created using combinations of APP, PS1, and tau genes.

Epigenetics, the study of changes to the genome that do not alter the DNA sequence, may hold promise for AD. Genes can be turned on and off through the attachment of acetyl or methyl groups in certain spots on chromatin, the combination of DNA and protein that makes up chromosomes. Research suggests epigenetic drift occurs with age and may increase the risk of developing AD. In one famous study, transgenic mice were taught a skill, then fed a chemical over a period of months to trigger a gene that causes significant brain atrophy. The mice lost the skill they'd learned. Mice who were allowed to play afterwards with a lot of cool toys recovered their long-term memory of the skill. Those mice were found to have new acetyl groups added to their chromatin and had developed new dendrites and nerve synapses.

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Related Physiologies

The **vascular system** is also a topic of AD research. Reduced blood flow interferes with protein metabolism, and severely reduced flow results in neuron death. Heart disease, high blood pressure that begins in midlife, and stroke are risk factors for AD, and vascular dementia is often found in AD patients. The question is: do vascular problems contribute to AD, or are they caused by it? Of particular interest is the **blood-brain barrier(BBB)**, which allows desirable substances to cross into the brain from the circulatory system while barring foreign substances that might injure the organ. It's a complex array of specialized cells lining capillaries in the brain. Ab tends to accumulate on blood vessels and researchers are studying how different types of cells in the BBB interact with it.

Research with animal and humans suggests there may be a connection between high levels of blood cholesterol and development of AD. **Statins** are enzyme inhibitors that reduce elevated LDL cholesterol levels. A large clinical study is investigating whether statins can slow the progression of AD.

High levels of the amino acid **homocysteine** increase heart disease risk, and have been shown in mice to kill neurons. A recently concluded clinical study found that increasing intake of folic acid and vitamins B6 and B12 did indeed decrease homocysteine levels, but did not slow the progression of AD.

Diabetes Type 2 and **insulin resistance** are risk factors for AD and a hot topic of research. Insulin enables cells to use blood-borne glucose for energy. In insulin resistance, cells don't respond as well to insulin and require higher blood levels of it to be able to utilize glucose. Blood glucose levels rise and the pancreas produces more insulin to compensate. Abnormally high blood sugar levels damage blood vessels. If the insulin levels get too high, the BBB reduces transport of insulin into the brain, which makes brain cells less able to use glucose for energy. Starved cells don't work well. People who were given insulin nasally, which bypasses the BBB, improved performance on memory tests. High insulin levels also increase inflammation and gamma-secretase activity (which makes that enzyme snip more Ab from the APP protein). Researchers found the central nervous system in those with AD makes less insulin and insulin-like growth factors type I and II (IGF-I and IGF-II). IGF-I helps two proteins that bind Ab to cross the BBB, which may help clear Ab from the brain. New transgenic mouse models that combine plaque production with defects in insulin/IGF-I signaling are in development so these can be studied further. Given the strong association between insulin and AD, both insulin and diabetes drugs that reduce cell resistance to insulin are in AD clinical trials.

Early studies of **estrogen** suggested that it might help prevent AD in older women. Extensive clinical studies have not borne this out. In fact, it appears older women taking estrogen are at greater risk for dementia. However, a large clinical study of **raloxifene** (a selective estrogen-receptor modulator, or SERM, which is used to treat and prevent osteoporosis) found it lowered the risk of MCI among a group of postmenopausal women with osteoporosis. Raloxifene is now being tested to see if it slows the progression of AD.

A large number of studies document profound brain **inflammation** in AD. Along with plaque, this may generate **freeradicals** and **oxidative injury** to the brain. Many studies have shown people who take non-steroidal anti-inflammatory drugs (**NSAIDs**) have lower rates of dementia in late life. Unfortunately, in clinical trials NSAIDs did not improve cognitive function. Vitamins C, E, and other antioxidants that fight free radicals are in clinical studies to see if they can slow the progression of AD.

Exercise has been demonstrated to improve cognitive function and has a beneficial effect on several neurotransmitters. Rats trained with aerobic exercise actually grew new neurons in the hippocampus. **Keeping the brain active** by learning and doing also appears to lower AD risk.

Promising Therapies and Treatments

Neurotransmitters are the messengers nerves produce to communicate with each other. All drugs for AD approved by the FDA up through 2008 act to increase or decrease neurotransmitter activity. Aricept(TM), Exelon(TM), Razadyne(TM), and Cognex(TM) inhibit the enzyme acetylcholinesterase that breaks down the neurotransmitter **acetylcholine**, important in forming memories. Not everyone responds to these drugs, and cognitive improvement is limited to one or two years. A fifth US FDA-approved AD drug, memantine (Ebixa(TM), Namenda(TM)) blocks a receptor on nerve cells to prevent the body's main excitatory neurotransmitter **glutamate** from binding to the cells. Excessive glutamate appears to cause nerve cell degeneration or death.

Here are some tidbits from the more than 50 AD-targeted drugs, nutritional supplements, and other therapies in various stages of clinical trials.

Since plaque is a prime suspect in neuron death, many proposed therapies focus on **preventing or removing plaque** from the brain. Unfortunately, two promising Ab-fighting drugs failed in final clinical

trials in 2007-08. Flurizan(TM), a selective amyloid-lowering agent (SALA), was expected to reduce Ab 42 by modulating gamma-secretase. Alzhemed(TM), based on the amino acid taurine, was expected to stop formation and deposition of Ab plaque and also bind soluble Ab to reduce brain inflammation. Neither made a significant improvement in the cognitive abilities of human subjects. Alzhemed is now sold as a nutritional supplement under the brand name Vivimind(TM). We should note both drugs were developed using mice with familial AD genes that generated lots of plaque. The chemistry of human late-onset AD brains may be different enough that the drug did reduce Ab, just not enough to make a cognitive difference.

Other Ab-fighting drugs are in current trials. Several drugs designed to inhibit beta-secretase (**BACE1**) activity are in various stages of development. A different approach focuses on a protein called Receptor for Advanced Glycation Endproducts (**RAGE**) that helps Ab cross the BBB and bind on the surface of brain and its blood vessels. A human study of a RAGE inhibitor started in December 2007.

Reducing tau tangles is another therapeutic approach. Methylthioninium chloride (MTC) in the test tube dissolves tau tangle filaments and prevented formation of tangles. In clinical trials it appears to improve cognitive function and blood flow to the hippocampus and prevent further decline.

Immunotherapy developments for AD are in the works. A synthetically engineered **A b antibody** that generated an active immune response cleared Ab from the brain in APP mice. In 2001, researchers began a clinical trial of the vaccine with humans, but the study was halted after a number of participants developed inflammation of the brain and spinal cord. A passive Ab-fighting immunotherapy entered Phase 3 clinical trials in 2007.

Human **gene therapy** trials using **nerve growth factor(NGF)** are in process after 12 years of successful animal studies. NGF directs how nerve cells outside the central nervous system regrow or regenerate after an injury. In the trials, human skin cells modified to secrete NGF are implanted directly into the person's brain. Preliminary results have seen brain cell growth, and cognitive decline slowed significantly.

Another gene therapy approach engineered mice skin cells to make **neprilysin**, an enzyme that degrades Ab and has lower-than-normal blood levels in AD patients. Researchers then injected the cells into the hippocampus of mouse brains and nearby plaque, even some further away, disappeared. A *Herpes simplex* virus has also been used to deliver neprilysin across the BBB with encouraging results. Researchers are currently trying to determine whether neprilysin gene therapy improves cognition in mice.

SouvenaidTM is a **medical food** designed to improve synapse formation and synaptic transmissionclaimed to be useful in AD. In pre-clinical models it also reduced amyloid production. Its combination of uridine monophosphate, choline, omega-3 fatty acids (EPA, DHA), phospholipids, B vitamins, and antioxidants appears to be improving cognition in proof-of-concept human trials.

Therapies based on **stem cells** arein their infancy. Stem cells implanted in live mice brains whose neurons had been intentionally damaged generated new neuron growth and improved memory after a few months. The complex environment of the AD brain can affect both where stem cells end up and what cell type they become. In many brain regions, implanted stem cells don't become neurons, although they may become other kinds of beneficial cells. In one study, transplanting human umbilical cord blood stem cells into transgenic mouse brains resulted in a 62% reduction in Ab accumulation.

No proven therapies are ready yet, but work continues. The first disease-modifying drugs might be available in the 2010-2015 time frame.

However, we're still not sure what truly causes AD. Some have criticized AD research for

overemphasizing plaques and tangles without proof they cause neuron death. At times the field seems divided into cliques of “tauists,” “baptists” who concentrate on Ab, and everybody else. Perhaps recent findings have brought new perspective so that researchers can refocus on the lives they hold in trust: ours.n

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References for Readers:

www.alzforum.org/

Current research news, forums with researchers, info on approved and experimental Alzheimer's medicines and treatments.

www.nia.nih.gov/Alzheimers/

Alzheimer's Disease Education and Referral Center website has current, comprehensive AD information and resources from the National Institute on Aging

www.ncbi.nlm.nih.gov/pubmed/

Search for abstracts of published research papers, with links to complete papers (usually for a fee). University libraries may have free access.

www.mayoclinic.com/

Search on Alzheimer's for access to info on diagnosis, treatments, caregiving, and many other AD topics.

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About the Author

Janet Freeman is an MIT- and Caltech-trained engineer with a passion for learning about Alzheimer's disease. A lifetime love of space, gadgets, and science fiction led her to work in aerospace business development until leaving at age 42 to care for both parents and an aunt, all afflicted with dementia. She has a son who has Asperger's, which fuels an interest in autism and learning disabilities. After many years writing fiction for industry, she's now trying her hand at writing for herself.

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Novella: **FAILURE TO OBEY** by John G. Henry

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Illustrated by Mark Evans

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Certain situations require a kind of discipline that we would not accept in everyday life. But they may need something else even more....

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Perhaps it was some instinct born of experience that made Lieutenant Jen Shen jerk awake in the middle of the night, the voices of dead shipmates echoing in her fading dreams, and lunge for the survival suit kept in a ready locker right next to her bunk. She was halfway into the suit before the structure of Benjamin Franklin Naval Space Station shuddered twice, and fastening the last seals before the blare of the general quarters alarm began resounding urgently.

No one was in sight as Jen slammed shut the door to the closet-sized room that made up her personal quarters and began pelting down the passageway toward main engineering control. Heading in toward the hollow center of the vast rotating disc which was Franklin, Jen was going uphill against the rotation-induced gravity, taking ladders two steps at a time as she tried to cover ground before airtight hatches closed and made progress much slower. As she approached the armored survival bulkhead between her and engineering control, the massive hatch at the end of the passageway began sliding shut as its own warning alert added to the clamor. Jen managed to slide through sideways just in time, feeling the station jerk several times again as unknown forces slammed the structure.

Another ladder up, then another hatch loomed before her, this one sealed tight. She rammed her palm against the reader next to the hatch, punching the “open” button repeatedly as Jen waited for the reader to identify her from the chip embedded in her hand.

The hatch swung open, Jen hurled herself inside, and the hatch slammed behind her. It took two more passageways, ladders, and hatches before she reached her objective.

She finally paused, then, to take in the scene in main engineering control. At this hour, only the watch standers were present, five enlisted sailors led by Chief Petty Officer Carreras, all of whom were already in survival suits as well. “What's going on?” Jen demanded.

Carreras looked at her, his expression impossible to read through the faceplate of his suit. “Damned if I know, Lieutenant. We've got system failures cascading through part of the station inboard from here and it feels like there are explosions in that area, but the sensors are dead. We've all been ordered to stay here while command central tries to find out what's going on."

Typical. Too many people depended on remote sensors for information and didn't know what to do if those sensors failed. Eventually command central would order investigators into the area, but experience had proven to Jen just how critical time was in responding to emergencies. “I haven't been ordered to stay here.” Fighting off a flashback to the devastating explosion on her old ship the *Maury*, Jen punched open the hatch leading toward the affected areas.

She ran again, up a ladder and down the narrow passageway leading to the area of the station where supplies and the water tanks were warehoused near the hollow core, yanking open the hatch at the far end. Once again, some instinct made her pause before dashing through, and she saw two figures in survival suits moving toward her from the damaged area. Wind whistled past, warning of breaches in the hull where atmosphere was venting. “What's—” she started to ask them.

Both of the figures raised weapons and began running toward her. Jen just stared in disbelief for a moment, then slammed her fist onto the “close” button as one of the figures opened fire, metal slugs rattling off of the closing hatch in a deafening hail. Punching in a code, she locked the hatch against anyone without the proper access. She had a sinking suspicion that anyone who had blown their way inside the station could also get through interior hatches, but it might slow down whoever the attackers were.

This time Jen ran even faster, half sliding, half falling down the ladder and reaching the hatch to engineering central as Franklin's structure shuddered again. Looking back, she saw the hatch she'd sealed falling inward, its edges glowing with intense heat, figures in survival suits coming through quickly, all carrying weapons.

Jen sealed and locked this hatch, too, calling out orders to the watch standers in engineering central. “We're under attack! Notify command central! It's people wearing survival suits like ours. Numbers unknown.” As a stunned Chief Carreras called command central, Jen rushed to one of the control consoles. “Shut everything down! Shift all controls to secondary stations! Do it now! Those guys are right behind me!"

The enlisted hesitated only a second, then frantically began following Jen's orders. As Jen worked, she heard command central's response to the chief's message. “Understood. Presence of armed attackers inside the station is confirmed. We're deploying the emergency response teams to counter them."

Despite her urgency, Jen spun to glare at the screen. “Masters-at-arms carrying light weapons? This isn't a riot, central! These guys are heavily armed!"

The commander on the screen visibly wavered. Jen understood why. Overreaction would make him look ridiculous, and nobody wanted to admit they couldn't handle a situation on their own. But she knew they'd need help. “*Belleau Wood* is inport, right? She's got Marines aboard. Call them out."

"Marines?” The commander hesitated again. As he did so, a series of shudders rolled through the space station's structure, making everyone waver on their feet, followed by an odd groaning sound from the metal and composites making up the station, a noise which made Jen's hair stand on end. The sensation of gravity wobbled erratically. That seemed to make up the commander's mind. “Yes. Marines."

"The attackers are heading this way and can blow through hatches. We're shutting everything down and evacuating now.” As her console and the comm screen went dark, Jen glanced at the locked hatch, seeing the edges starting to glow. “Get out! Everybody out! I'm right behind you, Chief."

The enlisted watch standers bolted toward the hatch that Jen had originally entered through as Jen ran from console to console to confirm they were shutting down. She paused for a moment at one, viciously punching a confirm command on one console that hadn't accepted its shut-down orders yet, then leaped toward the safe hatch as the glowing hatch failed and fell inward.

Chief Carreras and the others pulled her through, slamming the hatch shut behind Jen. Metal slugs impacted against the closing hatch and the bulkhead around it, then the hatch sealed and locked. Everyone paused for a moment, staring at each other. “They going to come through here?” one of the watch standers asked.

"They wanted engineering central,” Carreras answered, looking to Jen for confirmation.

"Yeah.” With all control systems active, anyone in charge of engineering central could have caused havoc throughout the station before control could be remotely switched to secondary systems. “It won't do them much good now, though. How the hell did they get inside the station?"

Another enlisted had broken open the damage control locker in this compartment and was hefting a pry bar. “Maybe we can stop them from getting any farther."

"We can try,” Jen agreed. Pry bars and other damage control tools against slug throwers was crazy, but they might have a chance as the attackers came through the hatch. “Get into position on either side of the hatch while I call command central."

The comm screen here cleared to reveal a captain this time, who was staring from display to display in the command central compartment as the commander they'd seen earlier spoke quickly to him. “They've taken engineering central,” Jen reported. “We'll try to hold them here."

The captain nodded jerkily, his eyes on the displays. “Confirm all system controls were shifted to secondary control stations."

"Affirmative."

"Good work. The masters-at-arms are engaging the attackers and the Marines are on their way. Retaking engineering central will be a high-priority task for the Marines. Stand by for them and let us know if the attackers try to come through where you are now."

"Understood. Stand by, hold position and wait for Marines.” Jen slumped for a moment as the screen blanked, swallowing to moisten a mouth dry from recent events. But she was in command here, with no time for letting the situation get to her. She turned toward the enlisted. “You guys heard? We hold here."

The petty officer with the pry bar hefted it, smiling in a way that betrayed fear as well as determination. “We'll damn well try, ma'am."

They waited for minutes that seemed to drag for hours. The station trembled and vibrated at odd intervals, the majestic rotation of its huge mass being affected by whatever the attackers were doing. Occasionally they could feel gravity oscillate as if they were riding a roller coaster. Jen thought about the ships mated to the berths lining the top and bottom of the station's disc, wondering if they were executing emergency breakaways to keep themselves safe or staying attached to the station to keep its mass distribution from fluctuating even worse than it obviously already was.

The hatch behind them shot open with shocking suddenness and Marines boiled into the compartment. Jen stared at them. She'd seen Marines in combat armor before, suits whose bulk and strength far surpassed the survival suits worn by sailors, but now Jen fully understood just how menacing those Marines could be on full combat footing, their weapons questing for targets.

One of the Marines focused on her. “Lieutenant Shen? I'm Lieutenant Yohl. They're on the other side of that hatch?"

"They were,” Jen confirmed.

"Is the equipment in there hardened?"

"Against radiation? Yeah. There are back-up circuits running through vacuum tubes. Extremely limited capabilities reducing our read-outs to blinking lights and a few plain text messages on a CRT."

"CRT?"

"Cathode-ray tube. Really primitive video. The back-up circuits require humans in the loop, but they'll work for the most basic functions once we do restarts. Anyway, right now everything is routed to redundant secondary control locations scattered through other parts of the station. If the station loses one

of those or connectivity to one of them, then we'll have to run part of things through the back-ups in there. It won't be pretty, but we can do it." They trained for working with minimal automated support, scrolling text reporting basic data, ancient circuitry designs getting the necessary information to human brains making decisions and inputting commands, trying to substitute their own training, experience and intuition for the precise, lightning-fast calculations of modern circuitry. It did work. In an ugly, headache-and-sweat inducing, close-enough-for-government-work way. People had first gone to the moon using that kind of computing power, the training manuals said. Or, as the saying went, "It was good enough for Apollo, wasn't it?" In popular use that saying usually ended up being sarcastic, though, and applied to everything from food quality to the amount of area in living accommodations.

None of that mattered to the Marine, of course. All he cared about was that Jen had said the Navy could live without those circuits for a while. "Okay. Get your people away from the hatch, ma'am."

Jen gathered her sailors in the far corner of the compartment, watching as the Marines resealed the hatch they'd entered through and then prepared to retake engineering central. "Fire in the hole," she heard someone warn and lowered her head to shield herself. A dull thump echoed through the compartment, then Jen raised her eyes to see the hatch blowing in toward engineering central in several large fragments. To her surprise, no atmosphere vented behind the hatch, revealing that the spaces beyond weren't in vacuum. She was still wincing at the thought of what those hatch fragments might do to the equipment inside when one of the Marines fired a stubby weapon through the ruined hatch, then huddled back.

Jen's survival suit blared warnings as it picked up the edges of the electromagnetic pulse the Marines had detonated inside engineering central. She heard Chief Carreras's sigh and knew he was thinking about all of the transistors, integrated circuits, and processor arrays that had just been fried by that EMP burst. But at least the vacuum tubes would have been unaffected by it, and any electrical systems on the attackers or their weapons would have been fried as well.

The Marines stormed through the hatch, firing as they went. Jen couldn't tell how many shots the attackers got off, but after a couple of minutes a Marine reappeared and waved her forward. "Ma'am, we've secured this compartment."

Jen brought the sailors with her back into engineering central, fighting down a gust of despair as she saw the damage inside. Three figures in survival suits lay splayed about the compartment, the suits marred by charred holes where Marine rounds had punched through. The Marines were already moving down the passageway as Jen directed the watch standers to assess the damage. She tried to ignore the dead attackers, focusing resolutely on her job.

A hand on her shoulder shocked her. Jen jumped back to see more figures in survival suits, these unarmed. "Easy, Jen. It's Bob Nuevos."

"Nice seeing you, Commander." Jen got control of herself, waving around the compartment. "It's a mess."

"Yeah. Listen, I've been ordered to take charge here until Captain Dila arrives. The sensor grids inside the damaged parts of the station have been blown to hell. We have to know what the damage is like in there."

And you want me to volunteer. "There's still fighting going on, and the bad guys are wearing survival suits that look like ours."

"You'll have a Marine escort."

So much for that excuse. "Fine. I'll go."

"Run a comm line behind you so we can receive your reports. There's no telling how badly damaged the comm relays are inside that area."

"Got it." Jen paused. "I don't know why there's atmosphere in here. I know there was venting going on when I first sighted the attackers. Maybe from breaches they blew to get inside the station. But they must have sealed any holes in the outer structure after that."

Commander Nuevos didn't answer for a moment. "That's odd. They wouldn't need atmosphere since they're wearing survival suits and vacuum would've complicated our repair efforts. See if you can find out why they restored airtight integrity."

"Aye, aye, sir." She wouldn't explain the true reason for her reluctance, wouldn't admit that the idea of struggling through wrecked compartments made her break into a cold sweat as images of the damage done to *Maury* came back to her.

Two Marines waited just outside of engineering central, somehow conveying by their postures how unhappy they were at being saddled with escorting a Navy officer instead of being on the front lines of the fight. "Let's go," Jen ordered.

She hadn't made it to the ladder leading up to the next hatch when she realized water was trickling down the ladder and pooling beneath it. Looking up, Jen saw water splashing over the coaming of the hatch the attackers had blown. At least one of the pressurized water tanks serving Franklin had been breeched.

Stepping through the hatch, Jen tried to survey the damage, seeing holes blown in bulkheads and walls at floor level. As she moved forward, the water grew deeper, then shallower, as if it were rolling back and forth inside the damaged area. Jen tried to assess how much water was involved, then staggered as a particularly high surge swirled up above her shins. At the same time, she heard another one of those eerie groans from the structure of the station. "Oh my God."

"Lieutenant?" one of the Marines asked.

"I just figured out what's going on." She keyed the circuit back to engineering central. "Commander Nuevos!"

"This is Captain Dila. What'd you find, Lieutenant?"

"A lot of water and passages blown for it to move freely in these spaces, Captain. They blew at least two main water tanks, and it's surging back and forth already."

"Surging?"

Jen remembered that Captain Dila didn't have much shipboard experience back on Earth. "Free surface effect, Captain. If we don't get this water pumped and corralled it'll keep picking up energy and magnifying its force as it rushes back and forth in here."

Dila might not have served on many ships, but he was a good engineer. "That amount of mass running free? It could tear this entire section of the station apart."

"Yes, sir. We need pumps rigged to secure the water and we need damage control teams to seal the holes that are letting the water move about, and we need them half an hour ago."

She heard Dila issuing orders, then his voice came back clearly to her. "Lieutenant Shen, where exactly are you now?"

"Passageway Seven Alpha Frame Ninety-two."

"Is there any fighting in the area?"

"No, sir. I can hear fighting, but it seems a few compartments away."

"Try to establish how far forward our damage control teams can move to deal with the damage. I'll be sending them in as fast as I can."

Jen exhaled, listening to explosions and shots that already seemed far too close. “Aye, aye, sir.” She turned to the Marines. “I need to get as close to the fighting as possible."

Both of the Marines seemed to radiate joy at the chance to get closer to the fight. “Yes, ma'am! Follow us!"

The Marines advanced, crouching down, splashing through the water, their weapons constantly on the move for threats. One of the Marines halted, holding up a warning hand, then slunk forward a meter and examined something on the deck. “Got some fallen sailors here."

Jen pushed forward past the other Marine, who was still standing alert for threats. She knelt in the water, gazing at the two figures in survival suits. Both wore Navy insignia and one still had a sidearm clenched in her fist. Both had been riddled with metal slugs from the attackers’ weapons. “Masters-at-arms. They were part of the emergency reaction force.” Jacking into their suits, Jen called up the readouts from any systems still functioning. Health status readings were all zero. “They're both dead.” Her emotions seemed to have frozen, going back to the day when she had picked her way through the remnants of *Maury*'s engineering spaces and the remnants of the officers and sailors who had been in those spaces.

"They had guts,” one of the Marines observed. “Going up against these guys in just those suits and carrying light arms like that."

"Yeah. Let's go."

The sounds of shots came ever closer, punctuated by rolling vibrations in the bulkheads and deck as more explosions rattled the station. Jen caught a glimpse of other Marines, all of them facing in the other direction, then a small detonation echoed through the station's frame and the Marines charged forward, firing. “That's the front line, ma'am,” one of her Marines reported.

Jen crouched against a torn bulkhead, holding herself together by sheer willpower. “Captain Dila, I'm at frame forty-one. The fighting is about three meters farther inboard, at frame thirty-eight."

"Three meters? Dammit, Shen, get back."

"It's moving away from me, sir.” Jen paused as one of her Marine escorts waved for attention.

"Looks like that was the last active resistance, ma'am,” the Marine reported. “Our command net is breaking the assault forces into fire teams to search for any attackers lying low.” The water rolled up higher around Jen's legs and the station shivered again. “What the hell is that, ma'am?"

"Wave action,” she explained. “The Navy's on it.” At least, she hoped so. “Captain Dila, my Marines report that active resistance appears to have ceased."

"Thank God. Stay where you are and monitor conditions until the damage control teams reach you. Then I want you to move into the rest of the damaged areas and give us as good a report as you can."

Jen leaned against the bulkhead, listening to and feeling Franklin's structure complain at the unfamiliar stresses, wondering how much progress the damage control teams were making. Finally she heard and then saw a team wading through the passageway toward her, carrying panels that they were hastily tacking into place over the worst holes in the walls to hinder the movement of the water. “Okay, Marines. I've got orders to check out more compartments. You can rejoin your unit."

"Wait, ma'am.” The Marine paused to check with his superiors, then somehow shrugged through the combat armor. “We're to stick with you for now, ma'am. The major says we can't afford to lose you."

"It's nice to be appreciated.” Jen led the Marines this time, moving into compartments she thought needed to be checked, evaluating damage and calling it back to engineering central so damage control efforts could be prioritized. The water levels were definitely going down now, and the surges back and forth diminishing rapidly in intensity. The noticeable fluctuations in gravity had almost totally ceased. Reaching a bulkhead near the water tanks, Jen frowned down at large holes the attackers had blown near deck level. She crouched to look inside them, confirming that these holes gave onto nothing but a series of spare parts lockers. The identifying information on the bulkheads was up to date as well, but seemed new. She moved several meters to the left, reaching a sturdy bulkhead freshly labeled with warnings in large letters. *Danger. Pressurized Liquid On Other Side Of Bulkhead*. “Why the hell?"

"Ma'am?” one of the Marines asked.

"They blew the holes in the wrong places. If they'd vented this tank, too, they might have wrecked the station. It's impossible to miss these labels. But they blew the wrong bulkhead."

The Marines looked at each other, then one faced Jen again. “Maybe they had orders to blow that bulkhead, ma'am."

"But it was the *wrong* bulkhead."

"It wouldn't be the first time orders were wrong, ma'am. Good thing for us, huh?"

"Yeah. Good thing."

At some point the area was declared clear and the Marines were finally withdrawn back to the *Belleau Wood*. Jen kept up her examination of the damaged areas, sometimes directing damage control teams she came across, until temporary sensor grids were strung in the compartments, and she was called back to engineering central. The place was crowded with every available engineer and systems tech, all trying to get full systems capability back online. Fried circuit boards, black boxes, and motherboards littered the deck as everyone working on repairs cursed the attackers, the Marines and their motherboarding EMP weapon, and the designers of the control consoles. Jen jumped in on one console, eventually helping get it working at close to one hundred percent again, then volunteered to lead one of the next shift of damage control teams heading into the damaged areas.

No one had yet heard who the attackers were. Aside from the Marines and the surviving masters-at-arms, few had even caught a glimpse of the attackers. “I don't know,” Jen kept repeating to everyone who asked her. “I didn't see any identifying markings on them. I'll lay you odds there's nothing on them that ties them to anyone."

At some point in the endless hours of labor, Jen sat down for a moment to eat a ration bar and didn't so much fall asleep as pass out from exhaustion. She was awakened by the sound of her name and bolted upright, staring around in confusion as she tried to shake the fatigue clouding her mind. Focusing, Jen saw a man wearing admiral's stars standing in front of her. But as she tried to spring to attention, the man held out his hands to almost hold her down.

"Relax, Lieutenant. You're Shen?"

"Yes, sir." It just felt wrong to sit down while an admiral stood looking at her, but Jen couldn't very well ignore his order to remain seated.

"From all I hear we owe you a great deal, Lieutenant. You did one hell of a job, and your quick reactions kept things from being worse. Maybe a lot worse." The admiral gazed soberly at her for a long moment. "Maybe you don't know, but I signed the charge sheet for your court-martial after the accident on the *Maury*. I've made plenty of mistakes in my time, Lieutenant Shen, but today proved that was by far the worst. They teach us never to apologize, but I'm doing it now. I deeply regret what the Navy put you through, and I'll do what I can to make it right. Thank you, Lieutenant." The admiral extended his hand and Jen shook it reflexively, feeling even more stunned than before. Then the admiral nodded and moved off with his aide trailing.

Commander Nuevos walked up beside Jen. "Looks like you might get a medal out of this, Jen. You deserve one."

"I don't need a medal," Jen whispered, watching the admiral leave. "I've got what I've wanted."

Somebody in authority had finally said they were sorry.

* * * *

Almost exactly six weeks later, Jen stood uncomfortably in ranks as medals and commendations were handed out. When her name was called, Jen marched smartly forward, standing at attention as Captain Dila read a long citation, her mind only catching parts of the recitation. "For meritorious service in military operations against irregular forces on 6 July, 2104 ... extremely rapid and effective response ... outstanding initiative ... coolness and courage against an aggressive and determined enemy ... in keeping with the highest traditions of military service..."

Admiral Yesenski stepped up, pinning a bronze star medal on Jen, then saluted her.

She saluted back, wishing that Paul could be here.

Afterwards, as the ranks dissolved and everyone mingled, Jen's data pad chirped to announce an incoming message. *Bravo Zulu, Lieutenant*. She didn't need to check the ID to know the Navy's version of "well done" came from her father, currently serving in the Pentagon.

Even if Paul was sitting, waiting to see the ceremony, it would take at least half an hour for the video to reach Mars and any message to come back. Sighing, Jen pocketed her data pad again.

A moment later a female chief master-at-arms sidled up to Jen. "Lieutenant Shen? Chief Sharpe has mentioned you a few times. Do you remember him?"

"Ivan Sharpe? Yes, of course. I knew him when we were both on the *Michaelson*, and Sharpe worked directly for my husband for a couple of years." As the sole law enforcement professional on the *Michaelson*, Sharpe had been nicknamed "Sheriff," a title he took some pride in.

The master-at-arms nodded, looking nervous. "Lieutenant Sinclair? That's who I really need. Ma'am, Sharpe's in trouble. Could your husband—?"

"My husband is stationed on Mars at the moment."

"Oh." The master-at-arms appeared crestfallen.

"What's the matter? What kind of trouble is Sharpe in? I thought I saw him in ranks earlier."

"He was here, ma'am, but I can't say anything else." The master-at-arms began to back away.

Jen closed the distance. "Can't say? Why not?"

"Ma'am, it's all classified, I can't say anything, I'm sorry I troubled you."

Jen stepped closer. "It's just you and me, Chief, and then this conversation never happened."

The chief looked around nervously. "It's classified, ma'am, and nobody told me you have an authorized need to know."

"If Sharpe needs help, I need to know in order to help him. But I heard nothing from you. Not a word. Now what's going on?"

"There's going to be a court-martial." The chief spoke quickly and quietly. "I shouldn't be telling you even that. If anyone finds out I could get busted for it."

"A court-martial? Sharpe is facing a court-martial?" That sounded too ridiculous to be true. Aside from being a wise-ass on occasion, Sharpe had been a model master-at-arms. "Why? And why is it being kept secret?"

The chief grimaced. "Security. Stuff about the attack on the station and vulnerabilities. That's all I know. The charges are secret. Sharpe knows them but can't tell me or anyone else. I can't even find out the names of the officers and chiefs assigned to the court-martial."

"You mean the counsels? The prosecution and defense?"

"No, ma'am. I got the defense counsel's name out of Sharpe. I mean the—what do you call them—?"

"Members?" Jen asked with a tightening in her gut.

"Yes, ma'am, members."

A classified court-martial. Even the charges kept secret. "Chief, the only courts-martial that have members are general courts-martial." The most serious kind.

"I know, ma'am." The chief looked around again. "Sharpe thinks he can convince the members that whatever he's charged with isn't true."

Jen let out a half scornful, half pained laugh. "Being innocent doesn't always work. Will Sharpe talk to me?"

"No, ma'am. I asked. He says you've seen enough trouble and violating orders by talking to you would just get both him and you in more trouble."

"Thanks for letting me know." Jen looked down at the new medal on her breast, thinking of how her re-won professional status might vanish again if she took the wrong steps now. But that just made her mad, and she knew exactly what Paul would do if he were here. "What's the name of that defense counsel?"

* * * *

Lieutenant Turen didn't seem thrilled to see Jen. "I can't discuss it. I'm sorry."

"Since when are courts-martial classified?" Jen demanded.

"National security. I can't say any more."

Jen took a deep breath and spoke calmly. "I want to help."

"Lieutenant Shen, I'll give Chief Master-at-Arms Sharpe the best defense possible."

"Defense against what?"

"I can't discuss the charges."

Feeling her jaw tighten, Jen stepped back. The best defense possible? Turen couldn't provide that. She knew who could. She also hated the idea of dialing that number and talking to that person. *It's not about you, Jen. It's about Sharpe, and Paul. They never let you down*. "Fine. Excuse me."

Do you really think I can be blown off that *easily, LieutenantTuren?*

* * * *

Jen waited, fighting off a constant urge to shut down the call request. Punching in the number had actually been harder than forcing herself to crawl into the wreckage of the *Maury*, harder than dealing with the attack on the station.

The alert finally beeped and the screen blinked once before steadying into the image of a female commander sitting at her desk. Partially visible behind her was a window opening on a blue sky flecked with clouds. Earth. An open window. Blue sky. The longer Jen was out here the more alien her home world seemed.

"Yes?" the commander asked, conveying the impression of someone interrupted in the middle of important tasks. Then she focused on Jen and jerked with surprise before her expression settled into controlled wariness. "Lieutenant Shen. This is a surprise."

"Commander Carr." Jen swallowed, now trying to overcome an urge to speak angrily. "I ... I..." The words wouldn't come, sticking in her throat.

Carr leaned forward slightly, wariness mixing with concern now. "Is something wrong, Lieutenant?"

"Not with me. Not this time." Jen almost winced as those sentences shot free. "I'm ... sorry, Commander. I didn't mean—"

Even with the time lag between Earth and Franklin Station, Carr had time to interrupt Jen. "You don't owe me any apologies, Lieutenant. What's the matter? Legal trouble?"

"A friend of mine." The words finally came in a rush. "A friend of Paul's. Chief Master-at-Arms Ivan Sharpe."

"Sharpe?" Carr frowned in thought. "He helped us get Lieutenant Silver, and Lieutenant Pullman."

"Yes, ma'am. There's a court-martial. A classified court-martial." Jen spilled what little she knew, speaking as if briefing a superior officer, while Carr listened intently. "I was hoping you could tell me how to help Chief Sharpe."

"You think I can help?" Carr settled back, eyeing Jen.

"Yes. Paul made me download your contact info because he said you told him to contact you if he ever

needed it. He's not here, he can't help, but I know he'd want to do what he could for Sharpe. Paul always said you were a very good lawyer, and ... and you always did what ... what you thought was right."

"As opposed to doing what really was right?" Carr closed her eyes for a moment, before sighing and focusing back on Jen. "I'm still haunted by the thought that I might have won your conviction, Lieutenant. I don't know if that brings you any comfort. Let me look into this. I can't give any decent advice without knowing more. How long do we have?"

"I don't know, ma'am. Every time I try to find out anything I'm told it's classified and I have no need to know."

Carr stared at Jen. "That's one hell of a way to run a legal proceeding, Lieutenant. It sounds like they're trying to keep this as quiet as possible. What kind of court-martial is it? Could you find that out?"

"Yes, ma'am. It's a general."

Commander Carr's stare intensified. "Give me a contact address for you, Lieutenant. I'll call you back. Soon."

"Thank you, ma'am."

But Carr had already broken the connection. Jen glared at the blank screen, wondering if she had debased herself by asking for help from Carr for nothing.

* * * *

Two days later her data pad chirped urgently. Jen blinked herself awake, wondering what in engineering had broken this time. Either that or someone had fallen sick and needed someone else to stand their watch.

But when she answered the call, Jen saw Commander Carr. The lawyer seemed to be somewhere crowded and her image was slightly tilted, so she was making her call using her own data pad. "Lieutenant Shen?"

"Yes, ma'am."

"Listen, we're not going to have much time. You and I need to hit the deck running on this. Can you get any leave from your current job?"

"Ma'am?" Jen nodded. "Leave? Sure."

"Good. I want you to meet me the day after tomorrow at 0800. That's when my shuttle is supposed to be off-loading. It's cutting it close since the court-martial is supposed to start at 1000 that morning, but it's the best I can do."

Jen stared at the screen. "You're coming up here?"

Carr nodded, her eyes on Jen's. "I owe you, Lieutenant. Even if I didn't owe Paul for his assistance in the past, I owe you for the role I played in what almost happened to you and the effect of that on your career since. I had to pass off the cases I was working on to other lawyers in my office and get a priority shuttle lift arranged, but I'll do everything I can for Chief Sharpe. I assume you won't object to me acting as his military attorney."

"No." Jen kept staring stupidly at the screen.

"Good. Don't tell anyone I'm coming up there. I've coordinated already with the defense counsel, but we want to surprise the trial counsel." Carr grinned fiercely in a way that Jen remembered from the courts-martial of Silver and Pullman.

To her own surprise, Jen felt herself smiling back. "I honestly did not expect this, ma'am."

"It'll take a lot more than this to balance the scales, Lieutenant," Carr assured her. "Besides, classified trials offend my sense of fair play. I've never approved of the idea." She paused. "Stay away from Sharpe until I get up there. I need you untainted by claims of improper contact."

"Why?" Jen asked, suspicions arising again despite her best intentions.

"Didn't I tell you? You'll be my assistant. That's the only way to get you into that courtroom, and I want you in that courtroom."

The familiar shape of Commander Carr came striding briskly through the crowd. Jen waved to catch her attention, then waited as Carr came up. "All right, Lieutenant. Do you have the time off you need?"

"Yes, ma'am."

"Good." Carr started walking again and Jen followed. "The government really wants to keep a lid on this and is insisting that in order to protect classified information only people with legitimate roles in the trial will be allowed to attend. I hope you can live with being my gofer for a while."

Jen nodded. "As long as you don't expect me to get coffee for you."

"No. I don't drink the stuff," Carr confessed. "Herbal tea is my speed."

"Ugh." Jen shuddered. "I need my caffeine, ma'am."

Carr checked the time and exhaled heavily. "I could probably use some of that myself today. I wish they'd served breakfast on that shuttle."

Jen pulled out a breakfast bar. "I thought you might need this. I can't do anything about the tea, though."

"You're forgiven. Thanks." Carr looked around, then focused back on Jen as they moved onto one of the station's main thoroughfares. "Okay. By all appearances no one really planned for this to turn into a general court-martial. Someone insisted on pressing charges, they seemed plausible, and by the time anyone realized the seriousness of the charges would mandate a general court-martial instead of just a summary or a special the ball had rolled far enough downhill and gained enough momentum that no one could stop it. Now the government wants to do it quick, wants to do it clean, and wants to keep it under the radar."

"Why?" Jen asked.

"Because it deals with too many sensitive security issues, and it's happening at a time when the government still wants to be publicly focusing on the heroes who defended Franklin, instead of one of those defenders it alleges criminally failed in his duty." She held out a warding hand before Jen could speak. "I can't lay out the charges for you, yet. You'll hear them at the trial. I've been talking to Turen and he's got a decent foundation of material and witnesses together. But I want you backstopping me because you're a very good engineer."

"Oh, is that a good thing, now?" Jen asked.

Carr grimaced. “Yes."

Jen realized that she'd just twisted a knife and, to her own surprise, felt contrite about it. “Sorry,” she muttered almost too low for Carr to hear.

"I used that against you once. I deserved the dig.” Carr halted suddenly and turned to face Jen. “I had a choice on whether to take this case. I promise you I'll do my best to win it. Major Hue, the trial counsel, is a very good and very experienced lawyer. Lieutenant Turen is well intentioned but inexperienced. Hue would have had him for dinner."

"I guess the government wants to win this case,” Jen said.

"The government wants to win every case,” Carr corrected. “But we work under a system that forces the government to give defendants a fighting chance, when that system is allowed to work. You have precious little reason to believe that, I know, but it's true."

Jen let a pained smile show. “I believe you, Commander. After all, when it turned out the government had broken the rules my own case was thrown out by the judge."

"Exactly. Mind you, I don't think anything like that is happening this time. The case seems based on Sharpe's actions and different interpretations of what he did do and should have done, and the consequences of all that."

"I didn't go near Sharpe, but I talked to the master-at-arms who first tipped me off to the court-martial. Master Chief Wilmont, who initiated the charges, doesn't like Sharpe,” Jen said. “Hasn't liked him since well before the attack on the station."

"Is that so?” Carr made some quick notes on her data pad. “Do you know why?"

"Yes, ma'am. A bar fight."

"A bar fight? Sharpe?"

"Yes, ma'am. Master Chief Wilmont had a few, claimed I got away with murder, and he and Sharpe ending up punching each other out. The senior enlisted community covered up the whole thing, but Wilmont didn't forget.” Jen shrugged. “More fall-out from my court-martial.” More collateral damage to those who knew her.

Carr looked steadily at Jen for a moment, then a grim smile appeared on her face. “We may use that, Lieutenant, and maybe educate Master Chief Wilmont a little in the process. Thanks. What's the name of the enlisted who told you about this?"

"Henga. Chief Master-at-Arms Jan Henga."

"Are she and Sharpe involved?"

"Not as far as I can tell. I think she'd like that, but it hasn't happened so far."

"Good. Now, you get to the courtroom. You'll be listed as Lieutenant Turen's assistant on the access list. Sit behind the defense desk and wait."

"You're not coming now?"

"No.” Carr smiled reassuringly. “I have a few tasks to do first. Don't worry, I'll be there."

Fifteen minutes later Jen arrived at the courtroom and found an unusual level of security. The panel beside the main entry that was supposed to display case information instead declared, “Proceedings closed by order of Commander, US Space Forces.” Outside the entry three masters-at-arms stood, turning aside the curious. Jen felt a quiver inside as memories of her pre-trial confinement came back, memories of a hundred small indignities inflicted by cops like these who had been certain she was guilty. Setting her jaw and squaring her shoulders, Jen walked steadily up to the masters-at-arms. “Lieutenant Shen. I'm authorized entry."

One of the masters-at-arms stared at her. Jen remembered the face, and just stared back until the woman averted her eyes. Another master-at-arms was busy checking her ID against his list. “Assistant to the counsel for the defense?” He seemed puzzled. “A line officer, ma'am?"

"I have some experience with legal matters,” Jen replied. “Is there a problem?"

"No, ma'am, except you're required to sign this security agreement prior to entry."

Jen read through the document, a standard nondisclosure agreement, then signed. “Anything else?"

"No, ma'am. Thank you, ma'am.” The master-at-arms held open the door to the courtroom and Jen walked inside.

Despite all of her mental preparations, the feelings almost overwhelmed her. The despair, the humiliation, the confusion as the government had steadily piled up circumstantial evidence claiming she had sabotaged her own ship. It took all of Jen's self-control to shake off the feeling of panic that rose within her. *I wish Paul was here*.

She knew where the defendant's table was and paused for a moment looking at it in front of her before taking a seat in the first row of chairs behind the table. Aside from the lack of spectators, the courtroom had a standard arrangement, with the judge's elevated bench in front, the witness chair beside it, the defense and trial counsels’ desks facing the judge's bench, rows of empty chairs normally for the use of spectators behind them, and off to one side a long table draped with a navy blue cloth where the members of the court would sit. She wondered who those members, the jury in this court-martial, would be.

Lieutenant Turen arrived soon afterward, giving Jen a worried look but nodding in greeting. Some time later the trial counsel arrived. Major Hue seemed quietly competent, his Marine uniform a contrast to the Navy uniforms of the others. At one point Major Hue spotted Jen, frowned, and consulted his data pad. He gave Jen a curious look, but then went back to his preparations.

Half an hour before the trial was scheduled to begin Chief Sharpe came striding down the aisle between the spectator chairs and straight to the defense table. Sharpe, in his finest uniform, greeted Lieutenant Turen, then as he was sitting down noticed Jen, initial surprise turning into a worried glower. “Ma'am, what the—"

Jen silenced him with a look. “At ease, Sheriff. I'm helping the defense."

Sharpe looked toward Turen. “But—"

"I already know. Stay focused, Chief."

Just before 1000 the bailiff walked through the courtroom looking for problems, then back to stand by the door through which the judge would enter. “All rise."

Everyone came to attention, and Captain Halstead walked up to the judge's bench, taking his seat. “This

Article 39(A) session is called to order. You may be seated."

Major Hue stood. “The court-martial is convened by general court-martial convening order 0334, Commander, United States Space Forces, copies of which have been furnished to the military judge, counsel, and the accused. The charges have been properly referred to the court-martial for trial and were served on the accused on 18 August 2104. The accused and the following persons detailed to the court-martial are present: Captain Halstead, Major Hue, Lieutenant Commander Nasser, Lieutenant Brook, Captain Daladros, Lieutenant Turen, Master Chief Petty Officer Kobo, Senior Chief Petty Officer Polaski."

"Very well. Bailiff, please ask the members of the court-martial to enter."

The bailiff went to another door, cracked it, nodded, then stood aside. “All rise."

Jen watched as the members entered. LCDR Nasser was a space warfare officer. He'd likely be tough. Lieutenant Brook was an intelligence officer, so it was hard to tell what she'd be like. Captain Daladros, a Marine whose rank was equivalent to a Navy lieutenant's, bore an impressive set of ribbons on the left breast of her uniform. Master Chief Kobo was a radio specialist, while Senior Chief Polaski was a bosun's mate.

"You may be seated,” the judge ordered the rest of the courtroom again as soon as the members had sat down. “Continue, Trial Counsel."

First Major Hue and then Lieutenant Turen faced the judge's bench, each reciting the standard legal boilerplate establishing that they had been properly assigned to the court-martial, were qualified and sworn, and had not acted in any way that might disqualify them from serving in the court-martial.

Captain Halstead looked at Sharpe. “Chief Petty Officer Ivan Sharpe, you have the right to be represented in this court-martial by Lieutenant Turen, your detailed defense counsel, or you may be represented by military counsel of your selection, if the counsel you request is reasonably available. If you are represented by military counsel of your own selection, you would lose the right to have Lieutenant Turen, your detailed counsel, continue to help in your defense. Do you understand?"

Sharpe, standing also, spoke clearly. “Yes, sir. I understand."

"In addition, you have the right to be represented by civilian counsel, at no expense to the United States. Civilian counsel may represent you alone or along with your military counsel. Do you understand?"

"Yes, sir."

"Do you have any questions about your right to counsel?"

"No, sir."

"Who do you want to represent you?"

"Your Honor, I wish to be represented by a military attorney of my choice. Commander Alexandra Carr, United States Navy."

The courtroom went totally silent, the judge and trial counsel staring at Sharpe and the few other occupants watching them. Finally, Captain Halstead cleared his throat. “You understand, Chief Sharpe, that you are allowed to request a specific military attorney, but that the attorney must be reasonably available?"

"I do, Your Honor."

Major Hue shook his head. “Your Honor, Trial Counsel wishes to point out that Commander Carr is currently stationed on Earth.” He held up his data pad. “I have just confirmed that she is assigned to the Joint Legal Team for the Washington Military District. While not wishing to deny Chief Petty Officer Sharpe his right to chose his own counsel for the defense, I must argue that this does not meet any accepted definition of ‘reasonably available.’”

Lieutenant Turen stood up, his expression apologetic. “Your Honor, notwithstanding Commander Carr's assigned duty station, it is my understanding that Commander Carr is currently physically located just outside of this courtroom."

This time the silence reigned longer. Finally, Judge Halstead pointed toward the door. “Why don't we ask her to join us, Defense Counsel?” Lieutenant Turen walked quickly to the back of the courtroom, opened the door, then stood aside as Commander Carr walked in.

Jen barely kept from laughing at the expression on Major Hue's face. The judge couldn't seem to decide whether to smile or to frown, but finally settled on a scowl. “I don't approve of theatrics in my courtroom. Who were trying to impress with that little show, Commander Carr?"

Carr stopped before the judge's bench, speaking respectfully. “My apologies if this appeared theatrical, Your Honor. The government's insistence on limiting access to the courtroom forced me to remain outside until I was named by the defendant as his choice for counsel."

Halstead didn't appear to be mollified by the explanation. “How long have you been on this station, Commander?"

"I arrived on this morning's shuttle, Your Honor."

"You've been on the station less than two hours? Do you feel capable of acting as counsel for the defense, or will that require the court to order a recess to give you time to prepare?"

"I've been in contact with Lieutenant Turen and feel capable of acting as Chief Petty Officer Sharpe's counsel in this trial without need for a recess, Your Honor."

The judge studied Carr for a while, his eyes intent, then nodded. “Trial Counsel, does the government have any cause for challenge against Commander Carr?"

Major Hue gave Carr a hard look. “Given the classified nature of these proceedings, the government feels it is necessary to establish what brought Commander Carr to this station at this time and led her to be in contact with Lieutenant Turen, Your Honor."

Carr nodded, perfectly calm and composed. “I initiated contact with Lieutenant Turen when informal information from other sources revealed that Chief Sharpe was facing trial, Your Honor. Those sources notified me only of the fact of a trial, not of specific charges, evidence, or other classified information. I received formal approval from my chain of command to discuss the case with Lieutenant Turen prior to contacting him."

"Why did you get involved?” the judge asked. “Are you saying you are personally acquainted with Chief Sharpe, Commander?"

Carr turned slightly to indicate Sharpe. “I know him because he was a witness in some of the cases I prosecuted while assigned here, Your Honor. He rendered important assistance to my cases."

"That scarcely seems adequate reason to become so involved in this case, Commander," the judge pressed.

"I had other personal reasons for visiting the station and getting involved in the case, Your Honor, which I will be happy to discuss with the judge and Trial Counsel in closed session."

"Personal reasons?" Halstead asked. His eyes came to rest on Jen before going back to Carr. "The court is willing to accept Commander Carr's explanation. Does Trial Counsel wish to insist upon a formal challenge to her presence here?"

Hue seemed to be thinking and now shook his head. "No, Your Honor."

Halstead waved toward the defendant's table. "Then you may assume your duties as counsel for the defense, Commander. Lieutenant Turen, you are excused."

Lieutenant Turen spoke with a trace of pleading in his voice. "Your Honor, I respectfully request that the court allow me to remain as an observer for the trial."

"Does the government object?" the judge asked.

Major Hue smiled crookedly. "Lieutenant Turen is already fully aware of all matters in this case, Your Honor, and observing the trial would no doubt provide him with invaluable experience. He can serve as Defense Counsel's assistant."

Carr smiled politely. "Defense Counsel has no objection to Lieutenant Turen observing the trial, but desires to retain her current assistant."

Hue shook his head. "Your Honor, I didn't intend making an issue of Lieutenant Shen's presence in this courtroom, but in conjunction with Commander Carr, I believe her presence might be prejudicial to a fair and impartial trial."

"Is Trial Counsel suggesting that the current case bears any relationship to the case involving Lieutenant Shen?" Carr asked.

"Of course not. But the members might erroneously draw such a connection."

Carr was in full lawyer mode, addressing the judge with precise and earnest words. "Your Honor, the charges against Lieutenant Shen were dismissed with prejudice. As far as the government is concerned, nothing regarding those charges or her court-martial prior to that dismissal can ever be used against Lieutenant Shen. If she is excluded from this courtroom on the grounds that she was so charged, then the government will be taking prejudicial actions against Lieutenant Shen solely on the basis of those charges and that trial. Such a challenge cannot be legally admissible."

Halstead was listening, his mouth twisted, one hand slowly turning the gavel he held. "Defense Counsel makes an excellent point, Trial Counsel. Do you have a rebuttal?"

Major Hue looked down for a long moment, then raised his eyes and shook his head. "No, Your Honor. Trial Counsel will raise no further objection to the assistant for the Defense Counsel."

"Very well." Halstead looked at Carr, his face stern again. "But if any more theatrics take place, including any involving your assistant, Commander, then I will revisit this issue. Is that understood?"

"Yes, Your Honor. I now request five minutes to assume duties as defense counsel."

"Granted.” Halstead waved one hand in permission and Carr walked over to the defense table, unsmiling. “Thanks,” she told Turen as he vacated his seat, then Carr turned toward Sharpe. “How are you feeling, Chief?"

Sharpe seemed to be trying not to grin as he looked from Carr to Jen. “Better than I have in quite a while, ma'am."

"Good, but even Lieutenant Shen and I can't guarantee the outcome of this trial. Look professional, look concerned, look offended if appropriate. Don't look cocky or confident. Understand?"

"Yes, ma'am."

Three minutes later Major Hue walked to stand before the judge's bench. “The general nature of the charges in this case allege failure to follow lawful orders in the face of the enemy, which actions in turn placed at additional hazard a major government installation. The charges were preferred by Commander, United States Naval Space Forces, and forwarded with recommendations as to disposition to Commander, United States Space Forces. Your Honor, are you aware of any matter which may be a ground for challenge against you?"

"I am aware of none,” Halstead replied.

"The government has no challenge for cause against the military judge."

Commander Carr stood. “The defense has no challenge for cause against the military judge."

Halstead faced Sharpe again. “Chief Sharpe, do you understand that you have the right to be tried by a court-martial composed of members and that, if you are found guilty of any offense, those members would determine a sentence?"

"Yes, sir."

"Do you also understand that you may request in writing or orally here in the court-martial trial before me alone, and that if I approve such a request, there will be no members and I alone will decide whether you are guilty and, if I find you guilty, determine a sentence?"

"Yes, sir."

"Have you discussed these choices with your counsel?"

"I have, sir."

"By which type of court-martial do you choose to be tried?"

Sharpe didn't hesitate. “By members, sir."

"Very well. The accused will now be arraigned."

Major Hue faced toward Sharpe as well. “All parties and the military judge have been furnished a copy of the charges and specifications. Does the accused want them read?"

Sharpe, still on his feet, nodded as he replied. “Yes, sir, I do."

"Very well. Chief Master-at-Arms Ivan Sharpe is charged with violations of the following articles of the Uniform Code of Military Justice.

"Article 91, Insubordinate conduct toward warrant officer, noncommissioned officer, or petty officer. In that Chief Petty Officer Ivan Sharpe, United States Navy, having received a lawful order from Peter Wilmont, a master chief petty officer, then known by the said Ivan Sharpe to be a master chief petty officer, to immediately fire upon an individual who was one of the terrorists then assaulting *Franklin Naval Station*, an order which it was his duty to obey, did, on board *Benjamin Franklin Naval Space Station*, on or about 6 July 2104, willfully disobey the same.

"Article 92, Failure to obey order or regulation. In that ... Ivan Sharpe ... having knowledge of a lawful order issued by Master Chief Petty Officer Peter Wilmont to immediately fire upon an individual who was one of the terrorists then assaulting *Franklin Naval Station*, an order which it was his duty to obey, did ... fail to obey the same.

"Article 99, Misbehavior before the enemy. Specification One. In that ... Ivan Sharpe ... did ... in the presence of the enemy, endanger the safety of *Franklin Naval Station*, which it was his duty to defend, by disobeying an order from Master Chief Petty Officer Peter Wilmont to engage the enemy. Specification Two. In that ... Ivan Sharpe ... being in the presence of the enemy, did ... by refusing an order to engage the enemy, willfully fail to do his utmost to defeat that enemy, as it was his duty to do.

"Article 108, Military property of the United States—sale, loss, damage, destruction, or wrongful disposition. In that ... Ivan Sharpe ... did ... without proper authority, willfully suffer a large section of *Franklin Naval Station*, military property of the United States, to be damaged by allowing enemy forces additional time to commit acts of destruction against said property.

"The charges are signed by Commander, United States Naval Space Forces, a person subject to the code, as accuser; are properly sworn to before a commissioned officer of the armed forces authorized to administer oaths, and are properly referred to this court-martial for trial by Commander, United States Space Forces, the convening authority."

Jen tried to keep her face calm as the charges were read. She knew some of them had to be serious to justify a general court-martial, but it had still been difficult to hear Sharpe charged with misbehavior before the enemy.

Captain Halstead turned to Sharpe again. “Chief Sharpe, how do you plead? Before receiving your pleas, I advise you that any motions to dismiss any charge or grant other relief should be made at this time."

Commander Carr stood for a moment. “The defense has no motions at this time."

Sharpe, his uniform and bearing so perfect that he looked like a recruiting advertisement for the service, faced the members. “I plead not guilty to all charges and specifications."

"Very well,” the judge responded. “Does the prosecution have an opening statement?"

"I do, Your Honor.” Major Hue looked toward Sharpe, then at the members. “During the assault upon *Franklin Naval Station* last July, the very survival of the station and the personnel embarked on the station demanded the utmost from all personnel. In this time of crisis, Chief Petty Officer Sharpe willfully failed to live up to those demands, instead taking actions that resulted in increased risk to this station and everyone upon it. Chief Sharpe should be found guilty as to all charges and specifications, for his failures not only imperiled this station and its personnel, but also acted to negate the sacrifices of those dying to save it."

Commander Carr walked out in front of the defense table as Major Hue sat down. “The defense contends that, contrary to the charges lodged against him, Chief Sharpe did everything possible to defend

this station, that his actions were appropriate and proper under the circumstances, and that claims his action increased the peril to *Franklin Naval Station* are exaggerated and without foundation."

Carr returned to the defense table and the judge indicated Major Hue. “You may proceed, Trial Counsel."

"Thank you, Your Honor. The prosecution calls as its first witness Captain Karl Dila."

Jen's department head walked into the courtroom with the slightly distracted air he usually wore, as if Dila was constantly mentally calculating stress coefficients in surrounding structures. As he took his seat in the witness chair, Major Hue stood respectfully before him. “Do you swear that the evidence you give in the case now in hearing shall be the truth, the whole truth, and nothing but the truth, so help you God?"

"Yes, I do."

"Are you Captain Karl Dila, United States Navy, assigned to the engineering department on *Benjamin Franklin Naval Space Station*?"

"Yes. I'm in charge of the engineering department."

Major Hue gestured and a very large schematic of the station appeared on one wall of the courtroom. “Did you participate in the engineering analysis of the actions of those who attacked *Franklin Naval Station* on 6 July?"

"I did. I led the analysis team. I also ultimately assumed command in engineering central on the day of the attack."

"Trial Counsel asks that the engineering analysis be entered into the court record. Captain, what was your conclusion as to the goal of the attackers?"

Dila paused as if trying to make sure he understood the exact meaning of the question. “Ultimately, they wanted to destroy the station."

Major Hue nodded. “Were the attackers equipped with weapons capable of destroying the station?"

"Not directly,” Dila answered with an engineer's precision. “That would have required very large amounts of conventional explosives, which the station's sensors would have surely detected on their approach because of the size and mass involved. Or nuclear weapons, and those would have been spotted by us even earlier due to radiation leakage. No, the attackers intended to create conditions under which the station would destroy itself as a result of free surface effect. They could do that while carrying small enough quantities of explosives to remain undetected on their approach to the station."

"What exactly is free surface effect?” Hue asked.

Dila took on the expression of an engineer explaining to lesser beings how the world works. “In laymen's terms, it's what happens when a liquid is in a partially-filled container. On a ship at sea, as the ship heels to one side the liquid will react by flowing toward the low side, increasing the force of the heel. When the ship swings the other way, the liquid once again rushes to the ‘low’ side in a delayed reaction that further increases the force destabilizing the ship. The higher up in the structure the liquid is, and the larger the space available to move in, the worse the resulting effect. That's why ships use a number of tanks to hold liquid instead of one big tank, and keep the tanks low in the ship."

"How could this phenomenon affect a space station?"

"Because the water tanks are high up in the disc, toward the center. It allows us to feed water ‘downhill’ to the rest of the station and provides substantial mass in the lower gravity areas near the station's core. Once the tanks were breeched, the water followed the forces created by the rotation of the disc to simulate gravity. Those forces are both outward and to the side because of the rotation. But the station is designed to automatically compensate for shifts in mass. As the water rushed to one side and down, it redistributed mass, and the station automatically shifted other mass and altered rotational velocity to compensate."

Dila pointed to the display, where an animation began playing out. “That compensation created forces shifting the water back up and in the other direction. As the water surged up and to the other side, with more force now, the mass distribution control systems tried to compensate again by shifting larger quantities of mass down and over and again altering rotation speed, which caused the free-flowing water to start rolling even more heavily down and in the original direction. Every shift in forces inside the station tended to reinforce the motion of the water, giving it more energy. On a ship, this eventually results in the ship heeling too far over and capsizing. On this station, the forces would have eventually exceeded the ability of the structure to contain them."

Dila paused, thinking. “It's the same sort of thing that happens when you're carrying a pan partially filled with water, and the water seems to start sloshing back and forth with a life of its own until it surges over one side of the pan. Free surface effect and the delayed feedback from your own attempts to compensate."

Major Hue nodded, his face grim. “But in this case the station would have been torn apart."

"A big piece of it, yes, Major,” Dila agreed. “The remainder of the station would have still been rotating but without the structural integrity. The models we've run produce different results as to how much more of the station would have subsequently come apart, but there wouldn't have been much left by the time any remaining portions could be stabilized."

"Then the attack had a significant possibility of succeeding in destroying Franklin Naval Station?"

"Yes, that was our conclusion, if by destroying you mean more than sixty percent structural loss."

Major Hue nodded again, heavily this time, his expression somber. “How important was it to counter the actions of the attackers as soon as possible, to stop their assault, to reoccupy the damaged areas and begin damage control?"

Captain Dila waved one hand at the schematic. “Absolutely critical. Every second counted. That's one of the reasons we believe the attackers seized engineering central, to prevent us from initiating corrective overrides of the automated stabilization systems. They probably also intended to download software that would have magnified the over-compensation of the stabilization systems and caused other problems for us, but couldn't because all of the consoles had been secured and control functions redistributed. We can't confirm that since all of the attackers’ software was destroyed, but it seems very likely."

Major Hue nodded. “"Every ... second ... counted."” He let the quote hang for a moment before speaking again. “You believe then, that in light of the damage the attackers had caused in the time available to them, this station might well have been destroyed if you had not very quickly recognized the danger—"

* * * *

"Excuse me,” Captain Dila interrupted, “but I didn't realize the danger first. That was Lieutenant Shen, over there.” Everyone turned to look at Jen, who hastily sat straighter. With an engineer's obliviousness to the reactions of others, including Major Hue, Dila continued on blithely. “That's one of the reasons she got that medal. I didn't know she'd be here, though. You didn't need both of us to testify on engineering

matters."

Hue was still trying to come up with words when Commander Carr rose smoothly to her feet. “I'm sorry, Captain Dila, but Lieutenant Shen isn't in this courtroom as a witness in the case. She's volunteered to assist the defense."

"Oh. All right.” Dila turned back to Hue, who briefly looked daggers at Carr.

Judge Halstead said nothing, but shook his head at Commander Carr, who feigned innocence.

The members were watching Jen intently. She realized that this had been Carr's plan all along, to bring to the members’ attention that one of those recognized for the defense of the station was now working to defend Sharpe. No wonder Major Hue hadn't been able to hide his unhappiness.

"If I may summarize, Captain,” Major Hue began again, “there was a real possibility that the attackers would succeed in causing this station to tear itself apart, and it was critically important to counter their actions as soon as possible. Is that right?"

Dila paused as if thinking through the statement, then nodded. “Yes."

"Thank you, Captain. No more questions."

Commander Carr walked over to stand before Captain Dila. “Sir, when you did the analysis of the attackers’ plans, did you discover a major error on their part in the execution of their plan?"

Dila frowned in thought. “You mean the fourth water tank?"

"Yes, sir. The fourth water tank. The attackers blew open three water tanks, is that correct? But instead of blowing open a fourth, they instead set their charges against a bulkhead with no water tank behind it."

"That's right.” Dila leaned forward, pointing at the schematic. “You see, they must have been working off of old station plans. A year old at least. In the intervening period, there'd been some internal modifications to increase structural stability, storage capacity, and other things. On the old plans, that bulkhead confined the fourth water tank. But the tank's limits were moved a great deal to port, you see here, on the far side and a little to port on the near side. The work was finished about three months before the attack. Of course, the tactic might still have worked. The fourth tank was insurance, to guarantee the station's destruction, but the three they did blow open could have done the job."

Carr shook her head, looking perplexed. “But they didn't. Weren't the bulkheads marked with standard identifying data?"

"Absolutely. The bulkhead the attackers blew open was labeled spares storage, and the new one was labeled liquid storage. All according to regulation. But the attackers undoubtedly had orders laid out in their data pads specifying exactly what to do and where, so that's what they did."

Commander Carr seemed skeptical. “The attackers ignored clear identifying signs and instead followed orders exactly?"

"That's right. When we analyzed their actions based on damage and time lines and all the other available evidence, it became clear that they moved very quickly and precisely for the first part of their attack, but when something unexpected was encountered they didn't seem to know what to do. Like when they captured engineering central and found all of the consoles shut down. They apparently just waited there afterwards until the Marines came through.” Dila waved vaguely. “We consulted with experts on terrorism, and they all concurred that the people sent on suicide attacks like this aren't leaders or even

particularly bright. As one of the experts said, they're smart enough to pull a trigger and dumb enough to believe what their leaders tell them about how great it is to die. So these attackers certainly came in with a detailed plan specifying exactly what to do and where to do it. Even though every data pad carried by the attackers was destroyed or wiped we can be certain of that because of our analysis of their actions. They blew that bulkhead there because that's what their orders called for. They may well not even have known *why* they were blowing holes where they did."

"They were just following orders," Carr observed. "Exactly following orders."

"Right. Exactly. That's a good word."

"Sir, some of the charges allege that Chief Sharpe's failure to engage one attacker increased the chances the station would be destroyed. Do you agree with that as an engineer?"

Dila scrunched up his face, one hand rising to rub his neck. "Just one? Where was this? When? I find it hard to believe. Was it when the attackers were first entering the station? At the access trunks?"

Major Hue rose and shook his head. "No, sir. We'll provide a full accounting of that incident to the members lat—"

"If it wasn't then and there I really can't say. Seems odd. Lieutenant Shen? What do you think?"

Jen barely kept from reflexively replying to her commanding officer's question before the judge rapped his gavel on the bench. "I'm sorry, Captain," Halstead said, "but Lieutenant Shen hasn't been called as a witness in this case and cannot testify."

"Well, all right," Captain Dila conceded. "But you really ought to ask her too."

Commander Carr nodded with a serious expression. "Thank you, Captain."

Judge Halstead gave a narrow-eyed look at Carr as she returned to her seat, then glanced at Major Hue. "Does Trial Counsel wish to redirect?"

"Briefly, Your Honor." Hue stood up but didn't leave his table. "Captain Dila, notwithstanding the attackers' failure to blow open the fourth water tank, didn't the response to the attack still require the utmost speed? Could any delay have been fatal?"

"Yes. Didn't I already say that? That's why Lieutenant Shen's—"

"Thank you, Captain. Were there any uncertainties in your engineering analysis of the threat to the station?"

Dila appeared once again puzzled by the question. "There's always uncertainties, though the scale of them varies."

"Then you can't be one hundred percent certain that one individual's actions couldn't have made a difference one way or the other."

"No. Not one hundred percent," Dila agreed.

"Do the members of the court have questions for the witness?" the judge asked.

LCDR Nasser nodded respectfully to Captain Dila. "Sir, what's the margin of error in your engineering analysis of the results of the attack?"

"Plus or minus one percent," Dila answered instantly.

"Then there's only a one percent chance of significant variation from your results?"

"Yes."

"Including the possibility that one individual's actions could have significantly worsened the results of the attack?"

"Right. Are you an experienced engineer, Commander?

"No, sir," Nasser replied. "I work in Operations."

"You seem to have a good grasp of things despite that," Dila observed.

"The members have no further questions," LCDR Nasser said, one corner of his mouth twitching as he obviously fought down a smile.

Major Hue took a few deep breaths as Dila left the courtroom. "The prosecution calls as its next witness Colonel James Lamont, United States Marine Corps."

Lamont marched to the witness stand as if assaulting an objective, took the oath, then waited, sitting at attention.

Major Hue gestured toward the large projection of *Franklin* still displayed on one side of the courtroom. "Colonel, did you lead the team analyzing the military aspects of the attack on this station on 6 July?"

"Yes, I did, Major."

Hue held up his data pad. "Trial Counsel would like to introduce the military analysis into the court's record. Colonel, could you please explain how the attack on *Franklin* on 6 July developed?"

"Certainly." Colonel Lamont hunched forward slightly to study the diagram, then nodded and began speaking, using pointers to indicate parts of the image. "The terrorists were launched inside individual stealth pods with just enough power to keep them alive for the duration of their transit. The mass and velocity of individual pods and their shielding were carefully designed to avoid being detected by the station sensors watching for approaching objects. There's no doubt they must have been launched from one of the merchant ships transiting this area well above *Franklin Naval Station*'s orbit, using spring launchers or something similar which provided no signature for us to detect. Whoever planned the attack must have extensively observed and analyzed the station's defenses to identify a path and means of approach that would avoid those defenses."

Lamont indicated an area on top of *Franklin*'s disc, not too far from the hollow core. "They landed in this area between 0122 and 0124 universal solar time. They tried to spoof the locks on the access trunks here and here, but failed because the security protocols had been changed within the last year. The attackers then blew open the access trunks at 0131, providing the first clear indication of their presence, and entered the station. They subsequently resealed the breaches in the access trunks to keep the water they freed from its tanks from being sucked out into space."

The three-dimensional schematic of *Franklin*'s interior pivoted. "During the next several minutes the attackers fired EMP bursts down passageways they used or passed, burning out sensors, lines, and junctions. Within a couple of minutes the station was effectively blind to events in a spreading area while the duty watch standers tried to determine what was going on. The station's emergency response teams were called out at 0138 as mandated by standing orders in the event of possible external or internal

threat activity, but were being deployed without any idea of the nature of the threat. Fortunately, at 0142, *Franklin*'s command structure received the first clear confirmation that an attack was underway, as well as descriptions of the attackers."

Lamont paused, his eyes going to Jen, and he nodded approvingly to her before returning to the diagram. “The attackers had occupied this entire area before the Marines on the USS *Belleau Wood* were called out for combat employment at 0144.” Red blotches appeared in scores of places on the schematic. “Explosives brought by the attackers blew open tanks, bulkheads, and partitions in many places while the station emergency response teams contained the threat and the Marines deployed for their counterattack."

"Marine counterattacks went in here, here, here, and here beginning at 0215. Resistance was fanatical, with all but two of the attackers fighting to the death, the two survivors being too badly wounded to suicide. By 0302, all resistance had ceased. Subsequent sweeps confirmed that all attackers had been neutralized. None of their equipment or persons contained any identifying data, and analysis of their equipment indicates a mix of raw materials and components whose geographic origin could not be established. Neither of the two survivors appears to know where they were trained or anything about the ship that launched them.” Lamont leaned back, waiting for further questions.

Major Hue indicated the schematic. “Was victory certain, Colonel?"

"Victory is never certain, Major."

"Our defending forces suffered casualties."

"Correct. Four masters-at-arms dead, several others wounded, and nine Marines wounded."

"Could we have lessened the number of casualties if we'd waited a little longer before counterattacking?” Major Hue asked.

"Probably. But we didn't have the luxury of time."

Hue nodded, his face grim. “Colonel, if you give an order, do you expect it to be obeyed?"

"Of course I do,” Lamont replied.

"Do you regard an order given in combat to be any different?"

"Different?” Lamont studied Major Hue. “No. An order is an order. If anything, combat increases the need to know that your orders will be obeyed promptly and correctly."

Major nodded again. “No further questions."

Commander Carr approached the Marine colonel respectfully. “Colonel Lamont, you reported that between 0133 and 0159 the attackers were blowing open tanks, bulkheads, and partitions in the areas they controlled."

"That's correct."

"In other words, the attackers began their demolition activity before the station emergency response teams had even been called out, and continued it until a short time before the Marine counterattack went in."

"That's also correct, Commander."

Carr paused, looking at the schematic. “Did the attackers try to break through the defensive perimeter established by the emergency response teams?"

The Marine shook his head. “No. As best we can tell they stopped trying to take new areas by 0200 at the latest."

"By 0200 at the latest the attackers had gained control of as much of the station as they desired?” Carr asked.

"Objection!” Major Hue pointed at Carr. “Defense Counsel is asking the witness to speculate on matters about which he can have no certain knowledge."

"Objection sustained,” Halstead replied immediately. “Counsel for the defense is to ensure her questions are framed appropriately."

"Yes, Your Honor.” Carr, seeming unabashed, focused on Lamont again. “Colonel, did the attackers give any indication after 0200 that they desired to gain control of more of the station?"

This time Lamont shook his head decisively. “No, Commander."

"Was there any indication that the attackers planned to survive the action?"

Lamont snorted. “No. As the report indicates, those who could suicided rather than be captured."

"Then they didn't cease offensive action out of fear of dying in the attempt to seize more of the station? Before 0200 they had already done what they needed to do?"

"Objection!” Major Hue gestured toward Carr. “Defense Counsel is once again asking the witness to speculate, this time as to the mindset of dead men and women."

"Your Honor,” Carr stated, “I believe the question is firmly grounded in established facts, that the attackers had ceased offensive action and that they did not act in fear of dying during the attack. Surely a Marine colonel is capable of drawing expert conclusions from those facts."

"No one can know why the attackers chose to do or not to do any action or actions,” Hue insisted. “None of them can testify to their motives."

"Their established actions testify for them,” Carr argued.

Halstead rapped his bench lightly with his gavel. “Both counsels make good points. But Defense Counsel has already established the point she wished to make. Objection sustained. Let's move on, Defense Counsel."

"Yes, Your Honor.” Carr faced Lamont again. “Colonel, you reviewed all of the records of the fighting on this station on 6 July? What shape were those records in?"

"While the Marine records were fully intact, the records of the station and its personnel often suffered from gaps and interruptions caused by the damage to the station's sensors and various forms of interference."

Carr nodded. “Have you personally been in combat, Colonel Lamont?"

Lamont smiled very briefly, indicating his ribbons. “A few times, Commander."

Walking over to the schematic, Carr indicated the symbols representing station defenders. “Colonel, to

what extent did you evaluate the actions of individual defenders? How well or appropriately each responded to whatever they encountered?"

Major Hue was on his feet. “Objection. Your Honor, Defense Counsel is introducing material into cross-examination that was not brought out during the witness's testimony."

Commander Carr spread her hands. “Your Honor, Trial Counsel is the one who introduced the study into this proceeding."

"Your Honor,” Hue insisted, “Defense Counsel's question is not germane to the testimony elicited from the witness."

Halstead held up one hand, his expression sour. “Trial Counsel, you introduced the colonel's study into evidence as an exhibit in this trial while questioning the witness. By doing so, you opened up all material in that study to cross-examination. Objection overruled. Continue, Defense Counsel."

"Thank you, Your Honor.” Carr indicated Colonel Lamont. “Sir? Should I repeat the question?"

"I recall the question.” Lamont studied the schematic for a moment. “Of course we evaluated the actions of individuals, not with an eye to punishment or reward because that wasn't our job, but in order to derive whatever lessons we could from the engagement."

Carr gave him a somber look. “How many times when evaluating those actions did you, as a combat veteran, conclude that an individual's actions were clearly wrong?"

Major Hue's face reddened, but he glanced at Halstead, saw the judge's expression, and sat silent.

Lamont spent several moments thinking, then shook his head. “There were any number of cases where we suggested alternatives, things that could have been done differently."

"Differently? Not wrong?"

"That's right.” The colonel shifted slightly in his seat, a shadow of memories crossing his face. “Commander, it's one thing to review records after an engagement. It's another thing to be in the middle of that engagement. I can have a perfect picture of whatever had happened, but that's not the same as being there when the bullets were flying, the situation was unclear, and the pressure was on. Some things can be identified as clearly wrong. Running from the enemy, failing to exercise command, that sort of thing. But most of what we see reflects the uncertainties of the situation as it unfolded. We weren't there, so playing God isn't really appropriate or useful except inasmuch as it identifies problem areas to address in planning, equipment, and training."

Carr waited a moment before speaking again. “You weren't there."

"Precisely, Commander."

"Did you identify any points where the actions or inactions of a single individual had or could have had a critical effect on the outcome of the events of 6 July?"

Hue was rising to his feet. “Objection. Defense Counsel is leading the witness."

Judge Halstead shook his head. “This clearly falls under the conclusions of the study as well, Trial Counsel. Overruled. The witness may answer the question."

Colonel Lamont gave Hue a slightly bemused look, then focused back on Carr. “In a few cases, yes.” He

pointed to Jen. “Her actions, for example. If any one person's actions saved the station, it was Lieutenant Shen's.” Major Hue had one hand on his forehead, his face lowered, as Jen once again was singled out. “But even in Lieutenant Shen's statement, she properly acknowledged that without the quick actions and support of the watch standers in engineering and the Marines she could not have accomplished what she did."

Carr seemed intrigued by the answer. “Are you saying, Colonel, that even the actions of those whose outstanding performance has been acknowledged would not have made a difference without the support of others?"

"Of course.” Lamont spoke firmly, as if lecturing now. “Popular fiction tends to celebrate the solitary hero, the lone wolf, but the real and consistent key to success in action is invariably the team. A group functioning in a coordinated and supporting manner. That's what our training emphasizes, and I know the Navy recognizes the same truth."

"That's in terms of success,” Carr noted. “Are you saying the same is true in terms of failure? That you did not identify any individual whose failures stood out as significant?"

"We did not,” Colonel Lamont replied. “That doesn't mean it can't happen. A sentry asleep or inattentive could have disastrous results, for example, but our postengagement analysis did not identify any such case here."

"No such case?” Commander Carr nodded slowly, drawing out the moment. “Thank you, Colonel. No further questions."

"Does Trial Counsel wish to redirect?” Halstead asked.

"Yes, Your Honor.” Major Hue indicated the schematic. “Colonel Lamont, when Marines are in combat they are linked to their commanders by a sophisticated command and control system that allows the commanders to see what the individual Marines are seeing, and experience what those Marines are experiencing, isn't that correct?"

"No.” Lamont shook his head while Hue tried not to frown. “See what they see, yes. Experience what they're experiencing? No. It's the difference between actually being in combat and playing a simulator or video game. The latter might get your adrenaline up, but it's not the same as the former."

"But,” Major Hue tried to rally, “don't you routinely give orders to those Marines in combat based upon that information? Tell them exactly what to do?"

Lamont frowned, pondering the question. “Yes and no, Major. ‘Head that way,’ ‘engage these forces,’ yes, that kind of thing. But exactly? ‘Stand here'? ‘Move two steps right'? Only under very exceptional circumstances. That's the kind of micromanagement that gets Marines killed."

"But you would order a Marine to engage a particular target and expect that order to be carried out, wouldn't you, sir?"

"Yes. As a rule."

As Major Hue took his seat again, LCDR Nasser addressed the colonel. “Sir, you used the term micromanagement. All of us here, I think, recognize that when we experience it. But you also indicated a command to engage a specific target would not be micromanagement in your view?"

"That really depends,” Lamont replied. “In general no, as I said, but there's so many possible circumstances."

"Are there conditions under which you would regard an order to shoot at a specific individual as micromanagement?"

"It *depends*. I'm not there on-scene. I do not routinely pick targets for Marines under my command in combat situations. But if I tell them to engage one, they'd better have a very good reason for not doing so."

Master Chief Kobo frowned. “Sir, how much initiative do you expect your personnel to use in such a situation?"

"As much as they need to,” Lamont replied dryly. “I expect them to follow orders but also to use their heads. If I wanted robots who did exactly what they were told and only that then we'd have robots on the frontlines. But that's never worked too well in practice."

Senior Chief Polaski had been looking troubled and now spoke. “Colonel, you stated that for the most part the actions of individuals didn't make much difference. Is that right? Are you saying the individual actions of the masters-at-arms didn't really matter?"

Lamont shook his head. “No. That's not what I intended to say. Individual actions do matter. The actions of the Navy masters-at-arms were courageous and resolute, and certainly played a very important role in the engagement. But while those Navy personnel displayed individual courage and resolution, it was their work as a team that made the difference. Any single individual trying to stop the attackers, or any group acting as individuals instead of a team, would have failed. A very important part of the accomplishments of the masters-at-arms was that they fought as a team to achieve their objective. Their actions impressed the Marines who fought in the engagement, and that's not easy to do."

Polaski smiled. “Thank you, Colonel. I'm very glad to hear that."

The next witness was Master Chief Petty Officer Peter Wilmont. Tall and trim, Wilmont took his seat and avoided looking toward Sharpe.

"Master Chief,” Hue began, “could you summarize the events on 6 July, which led you to initiate the charges against Chief Sharpe?"

"Certainly, Major. The emergency response teams had been called out. The situation remained fluid, but we could identify the areas occupied by the enemy by seeing where sensors had been destroyed. We were ordered to establish a defensive perimeter around that area. I assisted in ordering sections of personnel into position, monitoring their actions and progress, and issuing further orders as appropriate."

Wilmont paused for a moment, chewing his lip. “At about 0150 I was monitoring the picture from Chief Sharpe's suit when I clearly saw one of the attackers open a hatch and pause in the entry. I ordered Sharpe to fire. Sharpe didn't act. I ordered him to fire again. Sharpe acknowledged the order but did not fire. As I was ordering Sharpe to fire again, he began to argue, then I saw the attacker jerk back through the hatch and close it.” The master chief paused again, his face reddening. “Sharpe could have taken out that target. We could have gained control of that hatch much quicker than we did. One more dead attacker, one less position to fight through. It wasn't long after that we heard that the bodies of Chief Yasmin and Petty Officer Hastings had been found not far from that location. They'd been killed, while we couldn't get through that hatch, by an attacker who was still alive."

The courtroom sat silent for a moment after Wilmont finished speaking, then Major Hue walked toward a large display screen. “I will now play back the recording made by station systems of the perspective from Chief Sharpe's suit during the incident in question."

Jen expected Carr to challenge the authenticity of the recording, but Carr just waited as it played. The image, as if looking out through the face shield of Sharpe's suit, was fuzzy in spots and the sound distorted at times. But Jen could see the attacker appear in the hatch, hear Wilmont ordering Sharpe to fire, finally hear Sharpe's acknowledgement of the order, then as the attacker vanished and the hatch slammed shut the recording ended.

Major Hue walked back to the trial counsel's table.

Commander Carr faced Wilmont, her posture somehow poised as if ready to attack. The master chief watched her warily. “Master Chief Wilmont. How did you know the individual you sighted through Sharpe's suit was in fact an attacker?"

Wilmont seemed startled by the question. “He or she matched what we knew about them."

"And what we knew about them was that the attackers were wearing survival suits like our own, isn't that right, Master Chief? Where are the identification markers on our suits?"

"The shoulder, the right breast—"

"How clearly could you see the right breast and shoulder of that figure you ordered Sharpe to fire on, Master Chief?"

"I don't—"

"Weren't they both obscured in whole or part by the coaming of the hatch and other intervening objects?"

"Objection, Your Honor!” Major Hue was on his feet. “Defense Counsel is harassing the witness."

"Your Honor,” Carr stated, “I am doing my job of cross-examining the assertions of this witness."

Halstead pointed his finger at Carr, then at Hue. “Keep it civil, both of you. Defense Counsel is enjoined to watch her tone with the witness."

"Yes, Your Honor.” Carr spun to face Wilmont again and the master chief almost flinched. “Well, Master Chief? How certain could you be that the target you identified was the enemy, and not one of your masters-at-arms or another sailor assigned to this station?"

"I knew. You have to make calls in combat. Decisions. You have to make them fast. And people have to obey orders, do what they're told. Otherwise people like Chief Yasmin and Petty Officer Hastings die. And they *did* die."

"Yes, they did,” Carr agreed. “Their time of death was established by surviving suit records at 0144. Six minutes before you gave Sharpe an order to fire. Isn't that right, Master Chief?"

"Objection. Defense—"

"Overruled.” Judge Halstead waved to Carr. “Continue, counsel."

"Thank you, Your Honor.” Carr paced a bit from side to side, looking to Jen like a shark circling its prey. “Master Chief, did you at any time hesitate to give specific directions to those masters-at-arms on the front lines because they were on the scene and you were not?"

"We had a good picture on the command and control circuits. That's all I needed."

"The bodies of Chief Yasmin and Petty Officer Hastings were found in a location inside that hatch,

weren't they? The investigation concluded that they'd pushed too far forward, out of contact with the other masters-at-arms, for unknown reasons, most likely because the positions of the attackers and their fellow masters-at-arms were too hard for them to determine." Wilmont frowned. "If they'd survived, they could have been trying to reach safety through that hatch, couldn't they?" Wilmont just stared at Carr.

Hue was on his feet again. "Objection. Your Honor, Defense Counsel is speculating and creating hypothetical situations."

"I agree. Objection sustained. Move on, Defense Counsel."

Carr stopped walking, focusing on Wilmont. "Have you, at any time, then or subsequent to the events of 6 July, asked Chief Sharpe why he didn't obey your order to fire?"

"No," Wilmont answered shortly.

Raising one eyebrow at Wilmont, Carr tapped her rank insignia with one finger.

Wilmont flushed. "No, ma'am."

"Why not?"

"Because in the operational forces we aren't in the habit of explaining our orders! We expect them to be carried out when they're given, without hesitation." Wilmont paused. "A lawyer might not understand that."

Carr smiled at Wilmont in a way that made the master chief suddenly jerk backwards slightly, looking nervous. "You might be surprised what lawyers understand, Master Chief. To summarize your position, then, orders must be obeyed when given and without questioning, and there are no circumstances, especially in combat, in which it is acceptable to turn a blind eye to a clear order."

Wilmont sat silent, then nodded quickly. "Yes ... ma'am."

"Do you recognize the 'blind eye' reference, Master Chief?"

Wilmont gazed back, plainly uncertain.

"Vice Admiral Nelson at the Battle of Copenhagen in 1801," Carr continued. "While Nelson's ships were engaged, his superior officer, some miles distant, hoisted a flag signal ordering Nelson to break off the action and withdraw. Nelson raised his telescope to his blind eye and announced that he could see no signal, then went on to win a decisive victory. He openly and publicly violated a clear order, Master Chief. You therefore believe Nelson should have been court-martialed, correct? Because he had no alternative but to obey that order, correct?"

Carr had taken a half step forward with each sentence, and now her face was less than half a meter from Master Chief Wilmont's, her eyes fixed on him. Wilmont was pressing himself hard against the seat back.

"Objection, Your Honor." Major Hue was shaking his head. "Defense counsel is now introducing hypothetical situations into the trial."

Without moving or taking her eyes off of Wilmont, Carr spoke. "Is Trial Counsel prepared to argue that well-documented historical events are inadmissible in this court? If so, I would remind Trial Counsel that the events on this station on 6 July are also well-documented historical events."

Halstead smiled thinly. "Objection overruled."

Wilmont had been trying to look elsewhere, but found his eyes caught once again by Commander Carr's. “Well, Master Chief? Should Nelson have obeyed that order? Should he have been court-martialed for disobeying it while facing the enemy? Yes or no?"

"I ... don't know."

"You don't know? Why can't you give me a yes or no answer, Master Chief?"

"Because I don't know his reasons!"

"You don't know his reasons. Do you know Chief Sharpe's reasons, Master Chief? No? You never even asked.” Carr eyed Wilmont for a long moment while the master chief visibly began sweating, then spun away. “No further questions."

Jen felt a heavy feeling in her gut as she watched Carr walking back to her seat after savaging Master Chief Wilmont. *She never did that to me. Not like that. What if she had*?

Hue was rubbing his forehead again. “No redirect, Your Honor."

Captain Daladros cleared her throat. “Master Chief, did you have any qualms about ordering someone on the scene to shoot at a target they were hesitant to engage?"

"No, ma'am. I gave him a clear order.” Wilmont was breathing heavily. “I could see clearly enough."

"Even though you weren't on the scene?"

"Yes, ma'am."

Lieutenant Brook leaned forward. “Why did you press these charges, Master Chief?"

"Because Sharpe's actions were dangerous and negligent, ma'am. I need to know that people under my command will do what they're told, and they need to know that obedience to orders is expected of them."

Brook's expression was hard to read. “Exactly as they're told?"

"Yes, ma'am."

Hue waited until Master Chief Wilmont had left the courtroom, then rose again. “The prosecution rests."

* * * *

The court recessed for lunch and Jen ran out to grab food while Carr kept working. “Sandwich, ma'am?"

"Thanks.” Carr took an absentminded bite, then gave the sandwich a surprised look. “Bulgur wheat? How'd you know?"

"And herbal tea,” Jen said, giving her the drink. “Why didn't you bring up the personal stuff? About that master chief not getting along with Sharpe?"

Carr chewed and swallowed, looking thoughtful. “If that was all I had, I'd use it, but proving personality conflicts are behind charges is very hard to do. The members could decide that the master chief had every right to dislike Sharpe but still believed charging him here was the right thing to do. Or that Sharpe might have disobeyed the order because of a personality conflict, which is no defense at all. It's a minefield I prefer to avoid, especially since it might have brought out the fight between Sharpe and Wilmont, which would have made them *both* look bad."

"You've got them on the run, don't you?"

"Probably. But I never let a wounded enemy escape, Lieutenant. We need to finish them off."

* * * *

"The defense calls as its first witness Lieutenant Junior Grade Akesha Taylor."

Jen watched Taylor walking confidently toward the witness stand. Taylor had worked her way up from enlisted and had served with Paul on the *Michaelson* for a while. Despite her junior officer rank, she was probably the most experienced individual in the room.

Carr stood in an attentive but relaxed posture in front of Taylor. “Are you Lieutenant Junior Grade Akesha Taylor, currently assigned to the staff of *Commander*, United States Naval Space Forces?"

"Yes, ma'am.” Taylor rubbed her brow for a moment. Under the cover of that movement, Taylor gave a surreptitious wink to Jen.

"Were you assigned to evaluate lessons learned from an electronics standpoint after the attack of 6 July?"

"Yes, ma'am.” Taylor spoke casually but with total confidence.

"Are you familiar with the signals environment involving the station emergency response forces on 6 July?"

Taylor made a small snort. “Yes, ma'am."

"How would you characterize that signals environment?"

"In polite company, Commander?” Taylor asked. “Chaos. Bedlam. Goat-rope."

Carr leaned forward, suddenly intent. “Why? What happened?"

"Two things.” Taylor held up one hand with the first two fingers displayed. “First thing, the bozos who attacked us deployed broad-spectrum noise makers. Those things pumped out random messages and signals up and down the frequency range to confuse and jam our own signals.” One finger came down. “But our suits could handle some of that because of their comm suite filters. A bigger problem was that the relays and junctions were blown out or fried in a large area of the station and our masters-at-arms had to operate there.” Taylor's other finger dropped. “Normally, our suits use very low-power signals on very limited frequencies to minimize the amount of RF energy bouncing around inside the station."

"RF energy?"

"Sorry, ma'am, I mean radio-frequency energy. The station is shielded to keep radiation out. That means it also keeps radiation in. If everybody and everything was yakking away on high-powered wireless connections this whole station would turn into an economy-sized microwave oven. Great for popcorn, bad for people and equipment."

Carr nodded, her expression serious even though many other people grinned at Taylor's description. “Normally, you said. What happened during the attack?"

Taylor spread her hands. “The relays were gone, or the junctions were gone, or both. Our suits tried to shake hands with the nearest relays so their low-powered signals could be picked up. No joy. So the suits automatically shifted to emergency comm mode, boosting signal strength and changing frequencies. The suits keep doing both until they find a relay to shake hands with.” Now Taylor moved her hands rapidly from side to side. “We ended up with high-power signals bouncing down the walls of

passageways like they were giant transmission channels, leaking through everywhere they could, reflecting here, there, and everywhere. And these were signals our suits were supposed to listen to. So they tried, but the signals seemed to be coming from all sides, the real locations couldn't be identified, their strength varied like crazy, and most were distorted or fragmentary." Taylor shrugged. "Goat-rope."

Carr nodded. "We earlier reviewed recordings of the scene from Chief Sharpe's suit during the engagement. That recording was filtered to make it clearer. With the court's permission, the defense would now like that recording run unfiltered, exactly as Chief Sharpe experienced it."

Halstead glanced at Hue, but the trial counsel apparently realized the request was too reasonable to be denied. "The court so orders."

The display winked to life, the now-familiar scene appeared, but this time a constant stream of noise rattled from it and symbology flashed and faded in seemingly random patterns on the heads-up display. Words and phrases could be picked out, as well as occasional sentences, but Jen found herself developing a headache as the cacophony went on. She could still make out Wilmont's orders and Sharpe's reply, but not easily. Finally, Carr turned off the recording. "That was only thirty seconds of the replay," she reminded the members. "Thank you, LTJG Taylor."

As Carr returned to her seat, Major Hue approached Taylor warily. "Lieutenant, don't survival suits contain the means to filter out signals such as we just experienced?"

Taylor nodded. "Sure."

"Then Chief Sharpe could have reduced that noise, could have rendered his operating environment clearer."

"Yeah, Major, but—"

"Thank you, Lieutenant. Did the system records reveal Chief Sharpe complaining about the comm environment during the engagement?"

Taylor smiled unpleasantly at Hue. "A lot of the words I heard from Sharpe and the other masters-at-arms had something to do with that. I'd be happy to recite some of them if you want, Major."

Hue gave Taylor a sour look and shook his head. "That's quite all right. How do you know those words concerned the communications environment?"

"Well, when I hear people saying the 'f-ing circuits are f-ing f-ed up' and 'what the f-ing hell is the f-ing chief trying to f-ing tell us,' then I figure it has something to do with the comm environment."

Chuckles in the courtroom were hastily stifled as Judge Halstead glared around. Hue twisted his mouth, gave Taylor a long look, then started back to his table. "No further questions."

"Defense wishes to redirect," Carr said, standing again. "LTJG Taylor, what were you saying regarding Chief Sharpe's ability to filter out the signals he and the other masters-at-arms were encountering on 6 July?"

Taylor grinned. "I was saying, it has to be done manually, calling up the right subroutines and reassigning functions and priorities. The software can walk you through the process, but it takes a while and it takes your full attention."

"Manually? It requires a lot of time and your full attention?"

"That's correct, ma'am. One of my strongest recommendations was for that system to be totally reworked."

"No further questions."

Lieutenant Commander Nasser nodded to Taylor. “How long would it take you to do such a manual filtering?"

"Me?” Taylor thought for a moment. “In that complex an environment? Five minutes, I guess. I don't do it every day."

"How long would you estimate it would have required one of the masters-at-arms to do it on 6 July in that environment?"

Taylor squinted toward the overhead. “Fifteen minutes? Maybe half an hour. If they didn't get shot while they were figuring out the next step."

Master Chief Kobo spoke next. “Why didn't Colonel Lamont talk about this problem, LTJG Taylor?"

"I don't know. I wasn't here when he talked to you. But I do know the Marines didn't have the same problem. Their combat armor is designed to operate in places where there aren't relays, so their own suits function as relays and junctions for everybody's comms. They also don't use the same frequencies or protocols as Navy suits, so they weren't bothered much by the junk our suits were putting out. To the Marine comm suites it was just so much sailor noise to be ignored."

Kobo looked thoughtful. “Is the rest of fleet staff going to get input to the comm fixes you've proposed?"

"Look me up after this is over, Master Chief. You'll get a say in it."

Master Chief Kobo settled back, looking contented.

Carr stood up as Taylor left. “Your Honor, the defendant wishes to testify as a sworn witness on his own behalf."

Halstead gave Sharpe a questioning look. “Chief Sharpe, you have the right to make a statement. Included in your right to present evidence are the rights you have to testify under oath, to make an unsworn statement, or to remain silent. If you testify, you may be cross-examined by the trial counsel or questioned by me and the members. If you decide to make an unsworn statement you may not be cross-examined by trial counsel or questioned by me or the members. Are you certain you want to testify under oath?"

Sharpe had risen, too, and nodded firmly. “Yes, Your Honor."

"Then take the stand, please."

Sharpe sat in the witness chair and waited as Commander Carr approached. “Chief Petty Officer Sharpe,” Carr began, “tell us your thoughts when you received the order from Master Chief Wilmont to fire at the individual in the hatch."

"Yes, ma'am.” Sharpe's expression was as serious as Jen had ever seen it. “The situation was really muddled. Lots of noise, lots of things happening, and no one knew enough about what was going on. I saw the hatch open and I aimed my weapon at the person who appeared in it. I couldn't make out any identification. I hesitated, because I knew we didn't know exactly where all of our own people were. Master chief ordered me to fire and I started to, but I stopped, trying to see if I could make out anything

on the target that would ID it as friend or foe. Master chief ordered me to fire again. I said, ‘aye, aye’ and prepared to fire, but stopped again because I couldn't see any weapon, couldn't see any ID, couldn't see anything to tell me who that target was. Master chief came on again and I started to ask how we knew that person wasn't a friendly, and then whoever it was jerked back inside."

Sharpe grimaced. “I had an order. I admit that, but that could have been a friendly, ma'am."

Carr nodded with just a trace of sympathy. “As a member of the armed forces, are you required to obey any and all orders, Chief Sharpe?"

"All orders? No, ma'am. Only lawful orders."

"Lawful orders?” Carr prodded.

"Orders that don't conflict with existing law or regulation,” Sharpe recited. “You can't be ordered to rob a bank or mutiny or desert your place of duty, just to cite a few examples."

"Can you be ordered to shoot someone you believe might be friendly?” Carr asked.

"Objection, Your Honor.” Before Major Hue could say more, Halstead stopped him with a gesture.

"Defense counsel has every right to question her witness as to his own state of mind, Trial Counsel. Overruled."

Sharpe looked from Halstead to Carr. “No, ma'am. You can't be ordered to shoot one of your own people."

"Did you honestly believe there was a real chance that individual was a friendly, Chief Sharpe?"

"Yes, ma'am, I did."

"No further questions."

Major Hue walked up to Sharpe, his face hard. “Chief Sharpe, how strong was this belief that the target might be a friendly?"

"Strong enough, sir."

"What evidence did you have that the target was friendly? Was there any evidence?"

Sharpe nodded, not intimidated by Hue's pointed questions or attitude. “Yes, sir. A suit that appeared the same as ours and no obvious indicators of hostile action or intent while I was observing that individual."

"Do the sailors under your command routinely decide whether to obey your orders, Chief Sharpe?"

"No, sir.” Sharpe's lips drew back slightly. “I don't do it routinely either, but there was nothing routine about that situation."

Major Hue watched Sharpe, then shook his head and walked back to his table.

LCDR Nasser gave Sharpe a challenging look. “Chief Sharpe, how often have you disobeyed orders? Lawful or unlawful?"

Sharpe rubbed his lower face, obviously thinking. “Disobeyed, sir? Once, sir. On 6 July."

Nasser glanced at the judge. “He's still under oath, right?"

"That's correct,” Halstead replied.

"Just once, Chief Sharpe? In how many years?"

"Twelve years in the Navy, sir."

Master Chief Kobo leaned his chin on one hand. “I got the impression from your boss's testimony that he doesn't like you. Are you a smart-ass, Chief Sharpe?"

"I can be, Master Chief,” Sharpe admitted.

"Do you get the job done?"

"Yes, Master Chief. I get it done and I get it done right. I've never had a bust thrown out in court, and I've never let down the people I work for. Ask anybody."

Kobo's gaze went to Jen for a moment. “I don't think I have to, Chief Sharpe."

Captain Daladros spoke next. “Chief Sharpe, knowing everything that you know now, would you have fired when ordered to fire?"

"Yes, ma'am."

"If the situation somehow repeated exactly, if you knew then only what you knew then, would you fire or not?"

Sharpe considered the question, his face troubled. “I don't know, ma'am."

"You've thought about it?"

"Yes, ma'am. I wasn't certain I was right, it turned out I was wrong, but I don't know if I'd do different if the exact same thing happened again."

Captain Daladros sat back, clearly thinking.

"The defense rests,” Commander Carr announced.

Halstead faced Major Hue as Sharpe returned to his seat at the defense table. “Is Trial Counsel prepared for closing arguments?"

"Yes, Your Honor.” Major Hue walked steadily to a point facing the members’ table. “Your Honor, members of the court, a lot of excuses have been offered in this court today. Excuses like ‘it wouldn't have mattered.’ ‘It didn't make any difference.’ ‘The situation was confusing.’ ‘There was noise.’ ‘The target couldn't be precisely identified.’ Every one of those excuses fails the tests to which they must be set. The test of duty. The test of responsibility. The test of discipline. Even the test of teamwork, which Colonel Lamont invoked, because how can a team function if one member takes it upon himself to disregard the instructions of the team leader? Chief Sharpe received a clear, unequivocal order. He acknowledged receiving that order. He didn't carry it out. He didn't even offer an explanation at the time for not obeying the order. The very existence of this station, the lives of everyone on it, were on the line, and Chief Sharpe hesitated in the face of the enemy. That's the bottom line, that's the one thing no excuse can minimize. When his duty made its sternest demands on him, when his fellow personnel needed him the most, Chief Sharpe hesitated. I ask you to find him guilty as to all charges and specifications."

Major Hue sat and Commander Carr walked to about the same place, facing the members. “Your Honor, members of the court, there are indeed serious issues here, but they involve second-guessing of a single action by a single individual and attempts to blow that one action out of proportion. You heard the testimony of Captain Dila and Colonel Lamont. Those who attacked this station did exactly what they were told, even when those orders were clearly wrong and counter-productive, and when deprived of detailed instructions were at a loss. The personnel defending this station had to react in the face of confusion, of lost and damaged systems, of inadequate information, but they did act, and they frustrated the attack on this station. Why? Because we entrust our defense to people who are trained to *think*.

"A military force needs discipline. But it also needs initiative, it also needs wisdom, it also needs common sense. You heard Colonel Lamont, a decorated veteran of combat. *It depends,* he said. Should front-line troops follow exactly the orders they receive from superiors removed from the scene? It depends. Chief Petty Officer Sharpe is being charged with failing to follow an order to fire when he believed his target was a friendly. He could have fired and avoided these charges. But he is not a robot, not a machine. He is a human being, and in the final analysis we need to ask ourselves what we want defending us—machines that kill without hesitation on order, or humans who sometimes hesitate, sometimes think, sometimes decide that the order they've received may be unlawful, may be wrong."

Carr pivoted to look at Sharpe. “Some of the charges against Chief Sharpe were disproved by the testimony of the prosecution's own witnesses. His failure to fire on one occasion at one possible target did not have any impact on whether or not this station was saved, but his actions as part of the emergency response *team* were important in saving the station. But as Chief Sharpe testified, and as the prosecution did not attempt to refute, he was under no obligation to obey an order he reasonably believed could be unlawful. In the end, that's what this court-martial comes down to, what the members of this court must decide. Do we grant those to whom we entrust our defense the right to think and to decide, or do we insist that they rigidly follow instructions even when they have cause to believe those instructions are wrong? Do we use the intelligence and common sense of our personnel, or do we order them to do exactly as they are told without question? The answers aren't always easy, but that's why we need to offer our personnel the right to use their own initiative instead of insisting on ironclad, no-exception rules. Our enemies have chosen one path. I urge you to chose the other, and find Chief Petty Officer Sharpe innocent as to all charges and specifications."

Captain Halstead looked from the members to the trial counsel's table to the defense counsel's table. “The members will now deliberate. Do you anticipate difficulty in rendering findings, LCDR Nasser?"

Nasser looked to either side at the other members. “No, Your Honor."

"Then this court is closed and will reconvene at 1000 tomorrow in this same courtroom."

After everyone else had left, Jen turned to Commander Carr. “I didn't realize my presence here would sandbag Major Hue as much as it did."

Carr stretched and smiled. “I hoped for that and got more than I expected. But the game isn't over, Lieutenant. I never celebrate prematurely."

Jen jerked her chin toward the judge's bench. “I was thinking, if they'd just charged Sharpe with disobeying an order, it probably would've got him nonjudicial punishment and he would've taken hits there. But they wanted to nuke him."

"You're very likely right, lieutenant. But that's one of the perils of trying to classify too much. The right people, the ones who could've kept this from getting this far, didn't hear about it at all or heard too late to impose a little sanity on the process. Chief Sharpe might have been hammered because of that.” Carr

yawned. “I'm not even sure what time-zone my body is in. I'll see you in the morning, Lieutenant."

"Yes, ma'am.” Jen watched Carr leave the courtroom.

* * * *

"Have the members reached findings?” Captain Halstead asked.

"We have.” LCDR Nasser passed over the data pad containing the findings to the bailiff, who carried it to the judge, who studied the pad before handing it back.

"Chief Sharpe,” Halstead directed, “will you and your counsel stand up. LCDR Nasser, announce the findings, please."

Nasser gave Sharpe an enigmatic look, then focused back on the data pad. “Chief Petty Officer Ivan Sharpe, this court finds you not guilty as to all charges and specifications."

There was some more legal boilerplate to go through, but eventually Captain Halstead looked around the courtroom once again. “The court-martial is adjourned."

As the judge, the members and Major Hue left the courtroom, Chief Sharpe turned to Jen and saluted her. “Thank you, ma'am."

Jen returned the salute, shaking her head. “You and I both know what Lieutenant Sinclair would have done if I hadn't helped bail you out, Sheriff. You damned well better thank Chief Henga for saving your butt too."

Sharpe's old grin finally returned. “The woman never listens to me."

"Lucky you. Get back to work, Sheriff. Try to stay out of trouble from now on."

"Yes, ma'am. Please give my regards to Lieutenant Sinclair."

Jen waited while Commander Carr finished wrapping up paperwork with the court, uncertain if her role as assistant had wrapped up as well. When Carr finished and came back to the defense counsel's table she gave Jen a surprised look. “You're free, Lieutenant. I'm officially back on leave, while I try to find the quickest shuttle back to Earth."

"I know some contacts who might help,” Jen suggested.

"Do you know a decent place to eat while I work those contacts?"

"Fogarty's is okay, if you don't mind being around a lot of ship drivers."

Carr grinned. “Some of my favorite people are ship drivers. Can I treat you to a victory lunch?"

"Thank you, ma'am.” They began walking out of the courtroom, Jen struggling with words she knew she had to say. “Commander, Paul always told me that you pulled your punches when you were prosecuting me. I never really believed him."

Carr shook her head in denial, but didn't look at Jen. “I did my duty."

"Which isn't always that easy to figure out, is it? But I saw what you did to that master chief. If you'd hit me like that, with all the stress I was under, I might've fallen apart."

"I doubt that,” Carr remarked. “You stood up pretty well on 6 July. I've never thought of myself as being

more intimidating than terrorists."

"Don't sell yourself short, ma'am. Anyway, thanks for what you did for Chief Sharpe."

Carr swept away Jen's thanks with a wave of her hand. “I'm still trying to balance the scales, Lieutenant. Besides, I wanted to see justice done in this case too. But if you need me again, you call me. Understand?"

"Yes, ma'am.” Jen extended her hand. “Pax?"

"Seriously?” Carr stopped, looking at Jen's offered hand, then smiled and shook it. “Thanks.” They started walking again. “How's Paul doing on Mars, by the way?"

"Getting in trouble."

"Big shock."

"Yeah. You heard about the Utopia incident, didn't you?"

Carr nodded. “I saw the transcripts, but I'd love to hear Paul's personal take on things."

"Well, stuff started going wrong as soon as he got to Mars, starting with the surprise he got when he reported in..."

* * * *

"Not only do we measure the movement by the time, but also the time by the movement, because they define each other."—Aristotle

"If people behaved in the way nations do, they would all be put in straitjackets."—Tennessee Williams

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Short Story: **DUCK AND COVER** by Don D'Ammassa

We all have to try to understand our surroundings—usually with too little information.

A lot of young men discovered who they really were during the Vietnam war, whether they were drafted or enlisted, fled to Canada or fled to the National Guard and other exemptions. When I disembarked in Cam Ranh Bay in June of 1969, I thought I had a pretty good understanding of myself and others, but my education was just getting started. And sometimes knowing the truth—or part of it anyway—has its drawbacks. When you stand in a crowd and realize that some of the people around you might not actually be people, it changes everything.

During most of my tour, I was more afraid of my fellow Americans than of the Viet Cong. Four members of my battalion were killed in fights among themselves, while the Vietnamese only managed to slightly wound one tail gunner during those same eleven months. Boredom was one of the main problems; there wasn't much to do in Phu Hiep except sit around and drink or smoke pot. Boredom, booze, and automatic weapons are not a good combination in three-digit heat. You could tell who had which vice by walking between rows of hooches—the unfinished rooms in which we slept—after darkness fell and most of us were off duty. The drinkers were loud; the smokers were silent.

I shared my hooch with two other guys: Chapman, who wanted to be a marine biologist, and Russell, the chaplain's assistant. We had smokers on our south side so we rarely heard a peep from them after dark, but unfortunately Elmer Colby was just beyond the north wall. Elmer was a hulking thug who'd joined the army to stay out of jail after one too many bar fights back in West Virginia. He was a heavy drinker and a nasty one. No one was willing to share quarters with him and even the officers avoided him.

One night the three of us were sitting around talking. I had broken down my M-16 and was cleaning it—this section of the coastline was all sand and dust and M-16s tended to malfunction if they weren't pristine. Someone was fumbling around on the other side of the north partition. We didn't have walls, just eight-foot-high barriers separating each hooch from the next. We heard a sudden scratching sound and a moment later were reeling from the latest onslaught of Iron Butterfly played at maximum volume.

I don't have anything against Iron Butterfly. After I got back to the States and a decent interval had passed, I picked up my own copy of *In-a-Gadda-da-Vida* and I still play it occasionally. But Colby had bought himself a cheap turntable and speakers by mail order and he only owned two albums, the other being *Abbey Road* by the Beatles. I like them even better, but when you hear the same two albums played over and over again, day after day, with the volume turned all the way up, even good music gets old very quickly.

Russell sighed and stood up. “Guess I'll go over to the chapel and catch up on my paperwork."

Chapman was a short-timer, due to go home in another two weeks. Not much bothered him anymore, but he swore under his breath and started for the door. “I'll be back in a while."

I would probably have followed except that I had a disassembled weapon spread all over my bunk. Doggedly, I finished cleaning the components as the album ended. There was a brief moment of blessed silence, then the Beatles began exhorting us to “come together.” I winced and began reassembling my weapon.

All might still have been well if Colby hadn't been so thoroughly drunk. I had just locked a magazine into the M-16 and was putting my cleaning supplies away when a half-empty can of beer arced up over the partition and came down, with a splash, in the middle of my bunk. Why Colby would throw away a nearly full can of beer was never clear to me. Maybe it was too warm, or had gone flat, or he was just

being more ornery than usual. In any case, it was very hot and humid, I had been on guard duty the night before and hadn't slept well, and I snapped. I picked the can up, rotated my body, and tossed it back where it had come.

There was the brittle sound of impact and the music died. With deadly if inadvertent accuracy, I had scored a direct hit on *Abbey Road*, right in the middle of “Maxwell's Silver Hammer.” There was sudden, palpable silence from Colby's hooch.

I was, frankly, befuddled. I had acted without thinking, and now my mind refused to consider the potential repercussions. I was still a bit dazed when Colby appeared at the door.

"Kramer, I'm going to rip you a new asshole.” No matter how much he drank, Colby never slurred his words, and always seemed calm and unemotional. He could be falling down, semi-conscious, threatening to kill someone, but he would still speak clearly and without heat. And he didn't make idle threats.

My M-16 was lying on the bunk and I picked it up. “Take one step inside that door and I'll shoot you through the kneecap."

I know he heard me because his eyes blinked and his mouth tightened. He raised one foot and placed it deliberately on the threshold. “You ain't got the balls."

I looked into his face and knew I wasn't going to be able to talk myself out of this. What I didn't discover until later was that not only had my return volley broken the record, but the still half full beer can had splashed down inside the turntable and shorted it out. “Try me,” I said, hoping that I sounded more sincere than I felt.

Colby stepped through the doorway. Without hesitation, I turned the weapon in his direction and pulled the trigger. The round passed him at hip level and buried itself in the sandbagged bunker just beyond.

Colby froze where he was. “You're lucky I'm a bad shot,” I said quietly, pleased that my voice remained level. “But I probably won't miss the next time."

The only way to frighten off a madman is to act like you're madder than he is. Colby's face registered doubt for the first time and he stayed where he was. “You'd better watch your back, Kramer, because I'm not going to forget this."

Somehow I managed not to shake visibly. We stared at each other for a few more seconds, and then he was gone. I was so relieved that I nearly passed out.

* * * *

There was a good chance that Colby would have forgotten the entire incident once he'd sobered up if it hadn't been for the broken record and turntable. I figured, rightly, that he'd be watching for a chance to get even. Or better than even. So I had to be circumspect. He wasn't due to rotate out of our battalion for almost six months, so that was no solution. I might have requested a transfer, but I had a comparatively soft job in a helicopter support unit, well away from combat, shielded from attack by a large Korean contingent whose encampment surrounded our base. I alternated between being clerking for the colonel and for the battalion intelligence officer, typing and filing rather than sweating in the field or helping to maintain the aircraft or dodging bullets. I liked it where I was.

The alternative was to stay out of Colby's reach, at least when there weren't other people around, preferably an NCO or an officer. Colby was nuts, but not completely nuts. He wouldn't assault me if it would clearly result in disciplinary action. He could be patient when necessary, and I knew he was sly as well as violent.

For the next couple of days I spent a lot of time in my two offices, “catching up” after everyone else was off duty. Actually, I always smuggled in paperbacks and read until late in the evening, then made my way circumspectly back to my hooch, lurking long enough to be certain Colby wasn't lying in wait. Several days passed in this fashion before I realized this couldn't go on. Sooner or later he'd outsmart me, or I'd be careless, or coincidence would put us together without witnesses. I could have gone to one of my superiors to complain, or maybe the chaplain, but they weren't likely to do anything except yell at Colby and make the situation worse. Apologizing and offering to pay for the turntable was not really an option. It would only have told Colby how much I feared retribution.

If I wasn't going to leave, then Colby would have to go, and I'd have to help him along.

Like I said, I did the clerical work for the S2 office. S2 was intelligence, of which we had very little—of the military kind anyway. Most of the documents in our files concerned members of the battalion rather than the Vietnamese. We had information on their criminal records while in the military, disciplinary histories, and other things you'd expect to find. We also had information I wasn't supposed to talk about. There were presently mail covers on half a dozen of our personnel. A mail cover is when they keep track of how much mail you get and record all the return addresses, but don't actually open anything. We also had a few pieces of actual correspondence that had been discarded and later retrieved. They were pretty much what you'd suspect, letters criticizing the war or President Johnson or the military authorities. There were typed reports from officers and enlisted men who had witnessed, or professed to have witnessed, disloyal or dubious acts. A lot of the smokers had notes about their drug use, although I noticed that no one bothered to report the heavy drinkers. There were also summaries of rumors, observations, even unsubstantiated opinions. I'd read all of them, and had yet to find a credible account suggesting disloyalty. Nevertheless, these files were reviewed on a regular basis and personnel were reassigned based on their contents.

Clearly it would not do to add suggestions that Colby was a communist sympathizer, an anti-war activist, or anything similar. No one would believe it. So I had to be more subtle. I checked the activity log and confirmed that Colby's file had not been reviewed since Captain Wescott became our new S2 Officer, so I could add as much as I liked without raising suspicion. I could also alter the schedule so that it would be on his desk anytime I wanted. But what could I add to his file—currently empty of prejudicial material except for notes about three Article 15 disciplinary actions for missing roll call?

I would have to become creative. Using his service record to make sure I had times and places recorded correctly, I composed observations by completely imaginary officers who suggested that Colby was selling government property on the black market, that he'd assaulted an officer under cover of darkness, and a couple of similar peccadilloes while stationed at Fort Dix and Fort Lee. Colby had briefly been assigned to a unit in Nha Trang before coming to Phu Hiep, and I wrote an official sounding report advising against charging Colby with selling a box of hand grenades to suspected enemy agents because there was insufficient evidence. “Subject should be closely watched, however, in view of the severity of the situation should the charges be accurate.” As an afterthought, I included a handwritten note to the effect that the two witnesses to this imaginary transaction had both been seriously beaten by an unknown assailant and had recanted their original testimony.

Our previous company commander had finished his tour, so I used his name to append a note to his most recent evaluation. “There are persistent rumors that Private Colby has been seen fraternizing with the locals in unsupervised situations. Recommend that the situation be monitored.” A few other, more subtle alterations were designed to suggest that Colby would sell equipment, ammunition, even information without a second thought, which was probably true, although I didn't think he was bright enough to actually do any of the things I ascribed to him. It was enough to mark him as potential trouble, and support group commands like ours routinely provided involuntary reinforcements to the grunts in the field,

or in this case, jungle.

I also looked at his personnel jacket and noted his hometown, Walnut Falls, West Virginia. We had a form letter we used to request background information from civilian authorities and I ran one into the typewriter and filled in Colby's name. It wouldn't hurt to have something genuine in the file and Colby made no secret of the fact that he'd enlisted to avoid jail. I forged Wescott's signature and put it in the mail.

Nothing happened for several days and I started to relax. Then I was careless one night and went out for a smoke without checking the lay of the land. Colby seemed to materialize out of nowhere and I was about to bolt when First Sergeant Grimes showed up, staggering drunk. I took his arm and offered to help him back to his quarters. Colby never said a word, but even his silence was eloquent.

Two days later my request for background information came back. No such zip code, no such town. The information in Colby's jacket was wrong. I wasn't about to be defeated that easily, however. I faxed a request up the chain of command for a corrected jacket. Someone was on the ball for a change because a return fax was waiting for me when I got to the office the following morning. To my dismay, it also listed Walnut Falls as his hometown. But then I read the rest and my day brightened. Upon arriving in Cam Ranh Bay, Private Elmer Colby had been assigned to the 312th Support Company based in Tuy Hoa. Not only was Tuy Hoa not far away, but I knew Brian, their company clerk. I rang him up on the field phone.

"Hey, Brian, I think I found a glitch. One of your guys got sent over here somehow."

Since the support groups were always undermanned, Brian was immediately enthusiastic. At least, he was enthusiastic until I told him the name.

"Nuts! It's got to be two different guys with the same name. We've got our Elmer Colby and frankly, we'd all be happier without him."

My spirits plummeted. “Yeah, I was kind of hoping to get rid of ours. He's nothing but trouble."

"They must be related. Ours is an ugly drunk and a troublemaker. Sorry, can't help you."

I rang off and turned back to the paperwork. I was just about to file it all away when I noticed something. Our Elmer Colby's service number was RA52903257. The one assigned to the 312th was RA52903258. Probably one or the other was a typo, but it was still a pretty big coincidence. So I read further. They both had the same date of birth, both enlisted on the same day, and their social security numbers were only two digits apart. That was stretching coincidence, or bad typing, beyond the limits of probability.

It bothered me so badly that the next day I hitched a chopper ride up to Tuy Hoa. In addition to my two main jobs, I was also the PIO clerk. That's Public Information Office, which was supposedly an internal news service run by the Army but which was actually designed to produce puff pieces, human interest stories, and mostly profiles of soldiers that could be sent back to their home town newspapers. I was supposed to turn in one story a week, and the officer in charge—a second lieutenant who got stuck with all of the annoying little jobs—gave me a free hand so long as I kept him out of trouble. So I told him I was running up to Tuy Hoa to do a couple of stories about how units in the field were supplied and he nodded and approved my request without even listening to it.

* * * *

The Huey that brought me was going to return in about four hours, so that's all the time I had. I stopped to see Brian, told him my cover story, and asked for suggestions. He gave me some names.

"What about that Colby guy you were telling me about?" I tried to sound casual.

"Him? Trust me, you don't want to interview him. He's a jerk." Brian expanded on the subject, and mentioned that his Colby helped maintain their fleet of trucks.

I had to ask someone else for directions to the motor pool, a sprawling area behind a low hill nestled up against the corner of the local minefield. There were a dozen or so mechanics at work, but I didn't have to worry about identifying which one was Colby. He looked just like mine. I figured that was the explanation. They were identical twins and had the same birth date. Of course their social security numbers would be almost consecutive, and if they enlisted at the same time, their service numbers would also be close.

I returned to my own unit, resigned to the fact that coincidence had been playing with me, but coincidence wasn't quite done. One of my duties was to process service awards and in the batch that arrived the following day was an Army Commendation Medal for Elmer Colby. Except it wasn't my Elmer Colby, nor was it the one working at the 312th. This one's service number was RA52903255, and his social security number was only a couple of digits away from the two Colbies I already knew about. I called my contact at awards distribution, gave him the RA number, and he apologized.

"Sorry, some kind of mix-up. Colby is with the 14th Armored Brigade. Just send it back to us and we'll forward it."

Up until now I'd been doing my utmost to avoid Elmer Colby. My Elmer Colby, that is. Suddenly my attitude changed. I was so curious about him—and his alter egos—that I decided to investigate. I didn't throw caution to the winds, exactly, but I did let the breeze push it around a little. I sat near him in the mess hall, trying to eavesdrop on his conversation. Unfortunately, there wasn't much conversation to overhear. My Colby worked as a menial in helicopter maintenance, so I asked some of his co-workers about him. They didn't know much more than I did. "He's okay, I guess. I never really talk to him." "Colby? I try to stay out of his way. He's got an ugly temper." He had no close friends, drank alone, had no obvious hobbies or interests, never went to the enlisted men's club. I also found out that he had never once received mail since joining our unit.

Then I got careless. I spotted Colby from a distance one evening, walking along the company road from the PX toward Hooch country. Curious, I decided to follow him. This part of the compound was generally deserted in the early evening; the last seating was still underway in the mess hall, the enlisted men's club had just opened, and tonight's sentries had already been trucked out to the guard towers along the perimeter. Most of the time it was clear at night, but there'd been a storm that day and the clouds were still pretty thick overhead. Thick shadows washed over the buildings, barely retreating before the handful of subdued and very widely spaced lights strung from our generators.

I looked away at just the wrong moment and Colby was gone. I was stupefied for a second or two; it was as if he'd melted into a shadow himself. I quickened my pace and closed to where I'd last seen him.

Colby stepped out of the darkness. "Thought that was you, Kramer. You and I have unfinished business."

The worst part was that there was absolutely no emotion in his voice.

Now this might have been a very bad few minutes for me, but I got lucky, though at someone else's expense. Down at the end of the unpaved road, another uniformed figure stepped out into the dim light, an M-16 held at his side, muzzle pointing toward the ground. I didn't recognize him, but there was something about his stance that set off alarms in my head. Involuntarily I turned and looked behind me. Another figure, similarly equipped, stood at the opposite end of the street.

I was smack in the middle of an imminent gunfight. Like I said, more of us were killed by fellow GIs than by the Vietnamese. I was facing Colby and I started in his direction. Better a beating than a bullet. Colby smiled and stepped forward. Much of what happened then I only reconstructed later. The two strangers were PFC Manuel Cristobal and Specialist Fourth Class Arthur Rand. Rand didn't like Hispanics, words had been exchanged on several occasions, and something had triggered this confrontation. No one ever did find out exactly what. All I know is that I heard both weapons start up simultaneously, the chatter of semi-automatic fire, and I ducked and ran for cover. Colby smiled and reached for me.

Several rounds hit him, walking up his chest, making a small, dark hole in the center of his forehead. I guess it must have been Rand's errant fire, because Cristobal's burst castrated the hulking Spec 4 and sent him flying backwards, screaming in agony. Cristobal himself was never touched.

Colby staggered back a step, looking vaguely surprised, then collapsed without making a sound. I passed him in a running crouch and kept right on going. There were shouts all over the encampment and I knew the MPs would be there within seconds. I had no intention of letting them find me. Witnesses to fights inside the compound often had “accidents” if they talked too much.

I hid in my hooch and pretended to have slept through the whole thing.

Cristobal was shipped off to Long Binh Jail the following morning. Rand had been medevacced out during the night. No one said anything about Colby and I was afraid to ask directly, so at lunch I wandered over to the maintenance hangar to see what I could find out. Colby was there, lugging boxes into one of the storage sheds. He looked just as he always did.

I requested a transfer that afternoon and left Phu Hiep two days later.

No, I didn't say anything to anyone. Look, I was nineteen years old, working with people I didn't like and who didn't like me, surrounded by others who spoke a foreign language and wanted to kill me. I'd been taught by experience to avoid officers whenever possible, and senior NCOs as well, and never to volunteer. All I wanted to do was forget all about Elmer Colby. I ended up at a small Signal Corp outfit in Da Lat. They had no one on the roster named Elmer Colby; no Colbies at all in fact. I spent the rest of my tour with them, then a year at Fort Sill winding up my enlistment. I thought about Colby at times, sure. I wondered if it was some kind of secret government project; robots maybe, or if they'd cloned a whole bunch of him and had replacements stockpiled somewhere. But who and how and why weren't any of my business.

* * * *

About twenty years later, I was living in Wallingford, Connecticut. My neighbor was a really nice guy named Romeo Bolduc. We had almost nothing in common but somehow we managed to enjoy each other's company. Romeo worked in a foundry and spent most of his leisure time hunting, fishing, and playing cards. The only time I went out into the wilderness was with paint, canvas, and easel, and I wasn't sure if a straight flush beat a full house. Romeo had never married, which was probably just as well.

He invited me over one day to take some of the venison out of his freezer. “I'll never eat half of it and I hate to have it go to waste.” I knocked on the screen door and heard him yell a welcome from somewhere in the basement. I walked downstairs and found him painting wooden ducks. Well, they looked a little bit like ducks anyway. They were roughly duck-shaped and duck-sized and even pretty close to duck-colored.

"I didn't know you were into art,” I joked.

"Yeah, I'm the Picasso of duck decoys."

I squinted my eyes. “I guess if the duck was really nearsighted and wasn't paying attention, he might think this was another duck."

Romeo kept a second fridge in the basement. He opened the door, extracted a beer, and tossed it to me. “Danny, my boy, you look too close at things, that's your problem. Most of us, we don't sweat the details, and that includes ducks.” He picked up the nearest, smearing still wet paint all over his hand. “See, I float a string of these babies out on some likely piece of water and sit back and wait. Now from way up above, they look like they might be ducks, and if they're safe, then it's safe to come down and join them. But maybe we have ourselves a really careful duck. It circles a little lower. The shape is right, the color is right. It doesn't have to walk like a duck and talk like a duck to be a duck, at least not to other ducks it doesn't."

"So it settles down in the water, but it doesn't get too close to my ducks, because that would be rude. Maybe it does notice that these really aren't exactly ducks, but whatever the hell they are, they aren't getting shot at. So the duck relaxes and I stand up and POW! Fresh honker for supper."

I shook my head and drank some of the beer. “I guess ducks just aren't long on brains."

Romeo laughed. “Oh? You think you're so much smarter than a duck? Let me tell you something, Danny. People are just the same. They don't look close at the people they follow, and sometimes they follow them into some pretty nasty scrapes. That's how most wars get started, you know?"

I hadn't thought about Elmer Colby for years and I didn't think about him in Romeo's basement, but I did think about him about two months later, and Romeo's little lecture rolled back into my mind about the same time.

Politics bore me, frankly. I vote in the general elections most of the time, but I've never bothered with the primaries and I'm not a member of any party. I've always thought they were all pretty much the same, when I thought about it at all. But I was waiting for a football game one Sunday and I turned on the television early because Doreen was visiting her family for the weekend and I was feeling lazy. I sat on the couch, drinking fresh brewed coffee, and watched as one of the talking heads introduced their next guest. I wasn't really paying attention until I heard the name. It was Elmer Colby, senior senator from West Virginia and one of the leading candidates for his party's nomination as President of the United States.

I sat up and the coffee grew cold in my cup. The commercial break seemed to stretch on forever and then they were back and a man about my age was sitting at the table and it wasn't hard to recognize my old nemesis. He rarely smiled and answered in short sentences. At times he seemed almost angry. He wasn't a candidate, he insisted, but if he decided that he should be, it would be because he felt an obligation to help lead the people of the United States into a new future.

I couldn't help wondering just what kind of future he had in mind, and who or what might be sitting out there waiting for us to come into range.

* * * *

"The world's big, and I want to have a good look at it before it gets dark."—John Muir

"Millions long for immortality who do not know what to do with themselves on a rainy Sunday afternoon."—Susan Ertz

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Reader's Department: **THE ALTERNATE VIEW: TWO NEW KINDS OF WORMHOLES** by John G. Cramer

Wormholes are shortcuts through space-time, constructs of general relativity (GR) that appear to offer a physics foundation for faster-than-light travel and even for travel back in time. They first appeared in the physics literature in 1935, when Albert Einstein and his colleague Nathan Rosen discovered that implicit in general relativity is a tunnel-like structure in the topology of space-time connecting two separated regions. Einstein and Rosen were actually trying to explain fundamental particles like electrons and protons. They suggested that if lines of electric flux were threaded through such a structure, the flux would be trapped and one end would appear to be an isolated positive charge and the other end would appear to be a negative charge. Later, however, general relativity was used to calculate the masses of such "particles" and it was realized that they would have a mass of at least a few micrograms, far heavier than the mass of an electron or proton.

The motivation for the Einstein-Rosen work thus proved wrong, but the mathematics survived as a curiosity of general relativity that was for a time called an "Einstein-Rosen Bridge." Later, John Wheeler changed the name to "wormhole," and that is the designation that has stuck. The mathematical description (or "metric") of a wormhole portrays a curved-space object that is a shortcut through space-time itself, connecting two regions of space-time in the same universe or even connecting two separated universes.

Wheeler demonstrated that simple wormholes are so unstable that if one opened up spontaneously, it would close again before even a single photon of light could pass through it. However, in 1988 Michael Morris and Kip Thorne of Cal Tech showed that stable wormholes are possible (see my AV column "Wormholes and Time Machines," *Analog,* June 1989). They described how a stable wormhole might be constructed by an "advanced civilization" (i.e., not us) by placing a region of negative mass-energy in the wormhole's "throat." The requirement of negative mass-energy is something of a showstopper, because at present we are able to produce negative energy only in very tiny amounts between the conducting plates of a capacitor using the Casimir effect.

Wormholes are, of course, of great interest for the underpinnings of science fiction, from hard SF to space operas, and over the years I have written many Alternate View columns in this magazine about them. The wormhole solutions come from a non-standard way of using general relativity, an approach sometimes described as "metric engineering." General relativity is normally done by considering a particular arrangement of mass and energy and asking what metric would result, how space-time would be warped, and what effects would be produced by such an arrangement. In metric engineering, we do it backwards. We specify how we want space to be warped in order to produce desired effects (e.g., a wormhole or a warp drive), and then ask what arrangement of mass and energy would be required to accomplish this. The usual outcome of this kind of GR solution, at least in the cases of wormholes and warp drives, is that a sizable quantity of negative mass-energy would be needed.

In this column, I want to present two new solutions to the equations of general relativity involving wormholes that do *not* require negative mass energy for stability, and that thereby avoid the objections that have been raised against the other wormhole solutions.

The first of these is the *cylindrical wormhole*. "Standard" wormholes usually have spherical symmetry, and can be thought of as two spherical surfaces in separated regions of space that have been "stitched together," so that an object passing through one surface emerges from the other. However, the sphere is not the only possible geometry for a wormhole.

Cosmic strings (see my AV column "Strings and Things," *Analog,* April 1987) are strange massive objects that may (or may not) be present in our universe. They would have formed shortly after the Big

Bang when the energy-saturated space of the early universe was being replaced by the more normal space in which we now live. If they exist at all, cosmic strings would be infinitesimally small in cross section but very long, perhaps forming loops that encircle an entire galaxy. And they would be quite massive, producing strong and very odd gravity fields. Cosmic strings can be loosely described as "seams" or "cracks" in space, long closed-loop tangles in the fabric of space itself. In cosmology they are geometrical imperfections in the topology of space, produced as the universe was unfolded out of the Big Bang.

Recently, Bronnikov and Lemos have considered the possibility of a wormhole that surrounds a cosmic string, with the geometry of a very long cylinder instead of a sphere. What they found is that wormholes are much better behaved in this geometry. They do not require negative mass-energy for stabilization and do not violate the weak or null energy conditions (see my AV column "Outlawing Wormholes and Warp Drives," *Analog,* May 2005), violations of which have been used to label solutions of general relativity as "unphysical."

The problem with Bronnikov-Lemos wormholes is that they should be infinite in length, and that is difficult in a universe that may not itself be of infinite extent. This difficulty can be avoided by "putting the snake's tail in its mouth," in other words, bending the cosmic string in a circle, so that the wormhole becomes a torus (doughnut shape). Bronnikov and Lemos have investigated this possibility, but the results are inconclusive. It is not at the moment clear whether a toroidal wormhole needs negative mass-energy for stabilization or violates the weak and/or null energy conditions. But there are indications that the desirable properties of the cylindrical geometry may be retained when the infinite string becomes a circle and the infinite cylinder becomes a torus. Therefore, perhaps we should be searching for indications of wormhole leftovers from the Big Bang in the form of doughnut shaped objects.

A second recent advance in our understanding of wormhole physics came from the work of Maeda, Harada, and Carr. Their work was motivated by their investigation of numerical relativity, in which the equations of general relativity are solved in a dynamic situation where conditions are changing (for example, the universe is expanding) using numerical approximations on a large computer. That numerical work pointed to dynamic wormhole solutions that had unusual properties, and caused the authors to look for corresponding algebraic GR solutions. The result is what the authors describe as *cosmological wormholes*. These are dynamic wormholes that cannot connect within a single universe, but instead must connect one Friedmann universe to another.

Here, a Friedmann universe is the present Standard Model of cosmology. It uses general relativity to describe a simplified version of the universe in which we live. It is a universe that is expanding at a regular rate and that contains matter that is uniformly distributed and that acts as a fluid characterized by pressure and density. The lumpy stars and galaxies of our universe are averaged out in the Friedmann model and characterized by a universal fluid, a good approximation if one takes a very large-scale view of the universe.

The cosmological wormholes of Maeda, Harada, and Carr connect two Friedmann universes (presumably ours and another one). They are dynamic, changing with time. They satisfy all of the energy conditions, and they do not require any negative mass-energy for stability. At least in isolation, they cannot lead to time-like loops and time travel paradoxes because they lead to another universe with its own time structure (and perhaps its own laws of physics). The authors suggest that such wormholes may have formed naturally in the early phases of the Big Bang and may have influenced the behavior of the universe during its initial expansion phase.

The Maeda, Harada, and Carr paper does not address the issue of whether two independent cosmological wormholes might connect the *same* pair of universes. Their calculations require certain

symmetries and probably do not tolerate the consideration of two wormhole connections in the same universes. However, the presence of two wormhole paths connecting arbitrary space-time points in a pair of universes would make possible time-like loops that threaded both wormholes and lead to time paradoxes. I suspect that there is an underlying exclusion principle implicit in the wormhole mathematics that prevents such dual connections.

* * * *

The implication of this work is that we now know of two wormhole types that *do not* require negative mass-energy for stability. These provide an "existence theorem" that negative mass-energy is not always required for stable wormholes (and perhaps also for warp drives as well). Further, the cosmological wormholes of Maeda, Harada, and Carr could have been produced during the Big Bang, perhaps in great numbers. They could still be around and could provide gateways to many other universes. Writers of inter-universe science fiction should take note.

* * * *

AV Columns Online: Electronic reprints of over 140 "The Alternate View" columns by John G. Cramer, previously published in *Analog*, are available online at: www.npl.washington.edu/av.

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Probability Zero: **GLOBAL WARMING** by Harry Turtledove

Try as we will, we can no longer deny the truth. The world *is* getting warmer. Glaciers everywhere are in full retreat. Shamans and wizards of many clans have joined together, and rightly so, in stressing the disastrous environmental impact the withdrawal of the ice will have.

Many large mammal species—the bases of our economy and our very way of life—are certain to face displacement or even extinction as the weather worsens. Clans dependant upon woolly mammoths and woolly rhinoceri for sustenance will either have to migrate into new and unfamiliar hunting grounds or begin feeding upon smaller, less satisfactory prey animals such as caribou and horses. In certain heavily impacted areas, clans may be reduced to eating beavers and marmots. There have even been reports of the regular consumption of crayfish, mussels, and other fare normally contemplated only during famines. All such movements and lifestyle shifts, of course, also entail numerous violations of tabu. The cost of propitiation is certain to be high.

Worse problems may also lie ahead for affected areas. As the tundra retreats northward, invasive foliage from the south encroaches upon it. These “trees,” as they are technically known, cannot support the biodiversity upon which we depend. Not only that, hunting becomes far more difficult: with the severely reduced horizon among trees, visibility and tracking suffer badly.

Furthermore, anecdotal reports trickling up from areas in the south already afflicted with trees indicated that predators peculiar to this degraded environment pose significant risks to hunters and even gatherers. These so-called “bears,” if such sources may be relied upon, are large, wily, and dangerous in the extreme.

It is as yet unclear to those studying issues pertaining to “forests” (as accumulations of trees are termed) whether the beasts called “boars” are predators or prey. Not to be confused with bears, boars are simultaneously alleged to be both extremely tasty and swift and savage. As trees continue to advance onto tundra, cautious experimentation seems indicated.

So far, it will be noted, I have discussed only the incontrovertible fact of global warming, its likely impact upon us in the relatively near future, and short-term coping strategies. Many will say that we should not remain in a reactive mode, but should proactively seek to reverse the deleterious effects of this warming trend. In some ways, though, such a proactive response seems more readily proposed than implemented.

Forward-thinking shamans—including some among the first to recognize the reality of our predicament—have naturally sought sorcerous countermeasures. Considerable appropriations of dried meat have enabled a large-scale research program unmatched since the one that led to the partial taming of fire (about which, in a rather different context, more soon). If only success were commensurate with effort! Even spells essayed in the dead of winter and in the anomalous cold darkness of solar eclipses have failed to halt or even slow the steady, apparently inexorably retreat of the glaciers and degradation of the tundra south of them.

Which brings me back to fire. Wizards have conclusively demonstrated that fire is a spear with a point at both ends, as likely to wound the ones who wield it as to aid them. Fire gives heat. It cooks food. So much has been known for many generations. Because of this, tundra clans, almost without dissent, reckon it highly valuable. Lately, the truth of that assumption has come under question.

You see, fire, while burning, releases invisible spirits into the atmosphere. Because they spring from fire these spirits trap heat, in much the same way hunters trap mammoths with pitfalls. Once the mammoth tumbles into the pit, it cannot hope to escape. And, once the liberated fire spirits trap the sun's heat, that

cannot hope to escape, either.

The more fires our clans burn, then, the more fire spirits commence to prowl the air. And, the more fire spirits prowl the air, the more solar heat they snare near the earth's surface. This obviously is a factor—and an increasingly significant factor as the use of fire grows—in the emerging global-warming crisis.

From this, it follows that reducing the fire spirits' footprints as they prowl the atmosphere would correspondingly reduce the amount of trapped solar heat contributing to the warming of the earth. *We must use fire less*. Those habituated to the savor and chewability of cooked meat may well object to that. So may those who have grown accustomed to sleeping soft in their tents even when snow swirls outside.

Their shortsighted, deluded self-interest must—I repeat: *must*—be rejected, and in the most emphatic way possible. The environment and its continued protection take priority over all the commonplace concerns. If fire causes the glaciers to retreat; if fire causes the tundra to follow the ice north and causes longtime clan hunting grounds to be overrun with useless, obstructive vegetation pushing up from the south in the wake of global warming; if fire causes the very seas to rise, threatening to displace or drown the clans living in low-lying regions—if fire causes these things, I say, we must suppress it. Cause them it does. Our wizards and shamans no longer leave us any room for doubt. Therefore, suppress it we must.

Let this be a warning, then, to all those so enamored of their temporary comfort that they are willing (perhaps even eager) to cling to fire despite the ever more obvious long-term environmental consequences. If they persist in releasing fire spirits into the air, we shall oppose them with all necessary measures, up to and including war.

And once we vanquish them—and vanquish them we shall, for our cause is just—we will make an example of them, so that we discourage and intimidate potential future backsliders. We will catch them and kill them and eat them.

Raw, of course.

* * * *

"Many of our most important decisions are made by someone too inexperienced to have much idea what he's doing."—Kelvin Throop

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Special Feature: **MUSINGS FROM THE FIRST GENERATION** by Michael Carroll

Anniversaries make us wonder about the nature of things, about origins and beginnings, about where we've been and where we're going. On this 40th anniversary of the *Apollo 11* Moon landing, I wonder why the Moon holds such power over us. Why do poets rhyme and romantic couples linger under its light? Perhaps we are drawn to it simply because it is so ever-present in the night sky, a force second only to the Sun. Or maybe its proximity in the cosmic scheme of things makes it the obvious next site for humanity to inhabit.

It is fitting that someone like me would be doing this wondering. I am a member of a unique generation. It's a generation with its feet planted in two worlds. The first is the world of dreams, a place inhabited by four-armed green Martians, Tiger Women of the Moon, astronauts wearing gravity belts and aviator caps. The second world is a place every bit as wondrous, a realm of real worlds, planets and moons seething with volcanoes, awash of methane oceans, blanketed by cloud depths of multi-colored poisons.

In 1960 my father took me into the backyard. It was a cool Colorado evening. The stars shimmered in a purple twilight sky, nailed in their places since the ancients gave them names like Antares and Rigel and Betelgeuse. And there, among the points of steady light, one moved. “That's Echo One,” my father pointed. It was brighter than the others, a giant Mylar balloon circling a thousand miles above our heads. “They bounce radio waves off it,” he said. I could feel him smiling in the darkness.

"Why Echo *One*?” I asked. “Why not just Echo?"

"Because,” my rocket scientist father said into the night, defying the darkness, “because there will be more."

And there were. Our human-crafted stars circled the world like buzzing bees. Some cast off Earth's gravitational chains, and sent back reports from new, far-away worlds.

And nothing would ever be the same again.

We barreled—like a hell-bent locomotive—from a dark and ignorant tunnel into the blazing light of discovery. It was a light that brightened gradually, incrementally. And what a light it is, infused with the glow of planets great and small, the drifting clouds of Eagle and Orion nebulae.

Our fuzzy telescopic maps have blossomed into real territories of mountain and desert, canyon and cloud. Mapmakers, armed with their new, clear views, put names to those canyons and mountains. There is power in a name. It lays ambiguity in concrete, sets down secure borders, brings definition to the unfocused. So the worlds out there went from “Thar Be Dragons” to places you could put your feet on. The cartographers and astronomers gave us the gift of names, some by cultural assent and others by a vote of an international committee of labelers. They bequeathed us Olympus Mons, Syrtis Major, and Valles Marineris, the heights and depths of the red planet. Their charts displayed Ganesa Macula on Saturn's mighty Titan, and Discovery Rupes, simmering beneath the swollen Sun in Mercury's sky. They endowed Saturn's moon Mimas with Arthurian names, like Camelot Chasm and Gwynevere Crater. Jupiter's volcanic satellite Io bristled with the monikers of fire gods: Pele, Prometheus, Amirani.

But before the new names came the explorers. On another night, in another place, my father pointed to the sky again, this time at a star moving from north to south. “And that one may be a spy satellite. It's probably got a hammer and sickle on it."

The evening air scattered goose bumps across my shoulders. There were people on the other side of the world, hiding behind an opaque curtain made of iron, who were sending up spacecraft, too. I was too

young to understand the ins and outs of the political world. I was blissfully ignorant of the uneasiness—even fear—that permeated daily life for my parents and their friends. Those people on the other side of Earth were as mysterious as the planets out there. Were they like us? Did they have the same fears and dreams? Did they like ice cream? Hate broccoli?

They were the ones who had sent the first person into space in 1961. Yuri Gagarin circled the world once while we, in the western hemisphere, stayed glued to the dirt, yearning for the skies. Cold War competition was strong motivation in those days. The Soviet Union had taken to the high ground, and we watched in frustration as our televised rockets blew up in shades of gray on our rabbit-eared television sets. As if sending things overhead in circles above the Earth weren't enough, those mysterious communists were first to hit the surface of the Moon with an artificial craft. Two years before the first cosmonaut looped around the world, Luna 2 slammed into the eastern edge of the Moon carrying political pennants, radiation monitors, and micrometeorite detectors. The little metal ball represented a technological and scientific triumph, and had a profound sociological effect on those of us who had not yet escaped Earth orbit.

The Moon stared at us from the cosmos, closer than the stars but still impossibly far away. And up there, on its once pristine face, was a human artifact. Half a world was celebrating. The other half was nervous.

I may have been too young to comprehend political or theological nuances, but I wasn't too young to catch the fever of excitement. A pandemic was sweeping across the world, infecting the generals, the corporate types, and my young contemporaries alike. The fever incubated deep down, stoked by newspapers and television hungry for glimpses into the great unknown. We were a generation of Magellans and Hudsons, wanting desperately to set sail on a new sea. But there were no tall ships to be had. The only vessels at dock were dinghies.

Some of us younger people didn't need Atlas boosters or Gemini spacecraft. By the time NASA was sending twin astronauts around the Earth in Gemini capsules, my sister and I had been to the Moon dozens of times. We traveled there in our family Volkswagen, parked in the garage while speeding through the starry void. When we wanted power, we pushed on a pedal and watched as brake-light rocket plumes spread across the garage door. It was a time inspired by bedtime stories, space picture books, and most of all, that sorcerer's box in our living room. Mom warned us of its two-edged nature. Sunday nights, *The Wonderful World of Disney* played, with the likes of *Mary Poppins* and *Chitty Chitty Bang Bang*. The tube offered *The Patty Duke Show*, *Hogan's Heroes*, and *Family Affair*. But there was a darker side, too. With *The Twilight Zone* and *The Outer Limits* and various thrillers and science fiction movies, a boy turned loose had no chance of self-discipline.

So I watched it. I wasn't sure what the show was. All I knew was that it had astronauts, and they were wandering around on the Moon. What could be better? But things went south fast. As creepy music swelled, several of the hapless explorers sank into the quicksand, meeting a long, agonizing demise. What was left of the party took several glowing balls, newly dug up, back to their base. Hadn't they ever seen a science fiction movie? They should have known better. I can't remember, specifically, how the glowing balls took over, but the result provided plenty of material for my Id when it was busy constructing my bad dreams.

Only later would I find a more capable tour guide in the form of Jules Verne. His *From the Earth to the Moon* captivated me. Barbicane, Nicholl, and Ardan traveled in their cushioned artillery shell—launched from Florida in a precognitive echo of later Apollo Moon missions—to coast around the far side of the Moon. As luck would have it, it was dark there, of course, so that they could not see what was on the mysterious unseen side of Earth's nearest neighbor. Fortunately for the first lunar visitors, a brief meteor shower illuminated the unlit landscape below them. Did they glimpse forests? Did oceans wash across a

verdant landscape of cloud and valley? Were their eyes playing tricks on them? We would have to wait for Neil and Buzz to take us there in person.

The Moon had become the Everest of the Cold War-era space race, a political more than scientific goal. But more distant goals beckoned, too.

For me, the summer of 1968 was for riding bikes through field of dandelions, catching dragonflies in coffee cans, and firing Estes rockets to puncture the blue heavens. Summers, it seems, are not for fathers. Along with an army of engineers and scientists scattered across the US, Dad was working on designs for a balloon probe to drift on the winds of Venus. While other dads were contemplating their next career move, or how to fix the plumbing in the second bathroom, or when to get the lawn mowed, my father—who was also doing those practical things—was busy figuring out how fast one must drive a 1965 Plymouth Fury station wagon, at the air pressure in Colorado's mile-high-city, to simulate conditions in the Venusian stratosphere. He used a slide rule, as no one had handheld calculators back then. Heady times.

The Earth's simmering sister provided great mystery. Covered in opaque, acid-laden clouds, its surface conditions mystified the scientists. Were there carbonated oceans of Perrier lurking down there? Did desiccated deserts stretch across its face? Was it a world blessed with jungles to rival Earth's Carboniferous?

To unlock Aphrodite's secrets, NASA called upon teams of engineers to design probes. A stream of wild, creative, out-of-the-box prototypes flowed from the best minds in aerospace. Some made it off the paper and onto the factory floor for preliminary experiments, tests to see if these contraptions would ever get off the ground. One concept envisioned a probe that, slowed by billowing chute, would inflate a balloon. The craft would sail aloft in the Venusian skies, far above the heat, for days or weeks.

It was a concept that hearkened back three centuries, when a great blue balloon drifted above the French countryside as the first inhabited sky vessel. The airship was the invention of brothers Jacques Etienne and Joseph Michel Montgolfier. In September of 1783, as the chill of autumn was in the French air, the *Aerostat Reveillon* ascended with the first air travelers: a sheep, a duck, and a rooster. The animals had no baggage to check, and flew majestically into the air before an audience at the royal palace in Versailles. Among the enthralled crowd were King Louis XVI of France and Queen Marie Antoinette. The eight-minute adventure took the three intrepid creatures up 1500 feet, and gently deposited them two miles away. No one knows what the animals thought of their outing, but the human audience must have been filled with awe, and perhaps envy. Here was freedom, liberty from terrestrial chains sunk deep into the molten core.

But could what the Montgolfiers did be redone on another world, a cosmic encore? Aerospace engineers had to be creative in their approaches, sometimes using unconventional tools.

Like a station wagon.

So Dad did his figuring. At the altitude under study, and the speed the probe would be descending, the flow of air pressure on Venus was equivalent to a 35-mph gale in Colorado. Dad quietly brought home a sheet of Kevlar, a bundle of expensive, high-tech material with the feel of cheap plastic. He handed me an 8-mm movie camera containing less than four minutes of film and stationed me—trembling with excitement and trepidation—in the back of the car, tailgate down. County Line Road was at the southernmost end of Denver's suburbs. Brimming with wheat fields and pheasants, the route would see little traffic. As Dad brought the car up to speed, he yelled, “Deploy!” With one end of his precious Kevlar tied to the door handle, I tossed.

We rolled down the thoroughfare with visions of white-hot clouds and sulfuric acid rains, Kevlar streaming from the rear like a Roman charioteer's victory banner. No Steven Spielberg, I filmed the best I could. We'd get no Oscars, but the test showed that the material could hold up under a Venusian gale. I was filled with exhilaration. For one precious, glorious moment that day, I was part of the space adventure, a cog in the wheel of humanity's journey into the new frontier. I was more than a kid holding a plastic sheet. I was Prometheus.

Much to Dad's disappointment, the French engineers at CNES, the French space agency, eventually decided to team with the Soviet Space Research Institute, as the Soviets were going to Venus sooner. There were delays, but political and technological. It wasn't until 1984 that a Soviet VEGA probe carried a French balloon to the hothouse world. Two “aerostats” piggybacked aboard Venera-style landers, while the carrier vehicles flew on to encounter Halley's comet. The balloons floated on westerly alien breezes, sending electronic weather reports back for nearly two Earth days. The probes finally exhausted their batteries and faded away. And through the sun-baked Venusian skies, one could almost hear the Montgolfiers applaud.

People have dedicated more than careers so that we might know the things we know today. Some have given their lives. In 1967, our family lost a friend. Along with Gus Grissom and Roger Chaffee, Ed White died in the *Apollo 1* fire on the launch pad. The brave trio was the first crew to perish in a space-related accident. My father and White had been high school buddies, and had kept in touch over the years. I had various cards and letters from the astronaut. The loss touched us deeply. Tragedy like that, or like the *Challenger* and *Columbia* disasters, makes one wonder: is it worth it? We lost good people trying to get to the Moon. But we made it. We did it for reasons of politics, which are sometimes very good reasons. Even during the deepest, darkest periods of the Cold War, scientists on both sides still talked to each other (sometimes very quietly). Lines of communication remained open during such crises as the Vietnam War, Bay of Pigs, the Cuban Missile Crisis, the shooting down of an American U2 spy plane over the Soviet Union, and many other incidents. Often, the scientists were more interested in knowledge than in politics.

We also did it for reasons that share heritage with Tensing Norgay and Edmund Hillary's conquest of Everest. We got far more out of it than cell phones and laptops, though those would not have come when they did without Apollo. Apollo didn't just give us widgets. It gave us ways of creating complex systems. It taught industry how to make quality things for a quality life. More than that, it gave us a new way of looking at ourselves. It's a positive life perspective that says, “Even if it looks impossible, we can do this."

I watched the first steps of Neil Armstrong and Buzz Aldrin in my pajamas, on the couch in our family room, curled up beside Mom, Dad, and my sister. I was nearing the end of childhood, entering adolescence. My fourteen years had seen the advent of *Sputnik*, the first people in space, and the first human visits to the Moon. In the coming years I would witness the first close views of Jupiter's moons, the discovery of rings around the outer gas giants, the first views of volcanoes on other planets and moons, and the coming and going of Comet Halley. I watched as Soviets and Americans shook hands in orbit, built space stations together, and flew joint missions to the planets. When I was a very young child, Venus was a distant point of light and the Moon was green cheese. Twenty years form now, humans may well have a permanent community on the Moon, based upon the model of Antarctica's international outposts.

And nothing will ever be the same again.

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Short Story: **THE CALCULUS PLAGUE** by Marissa K. Lingen

"Show, don't tell" is good advice for more than storytelling....

The Calculus Plague came first. Almost no one took offense at it. In fact, it took a while for anyone to find out about it at all. No one had any reason to talk about a dim memory of their high school math teacher, whose face didn't seem familiar somehow, and what was her name again? His name? Well, what did it matter?

It wasn't until Dr. Leslie Baxter, an economics professor at the U, heard her four-year-old son ask, "What's Newton's Method, Mommy?" that anyone began to notice anything wrong. At first Leslie assumed that Nicholas's most recent babysitter had been talking about his calculus assignment over the phone when sitting for Nicholas, but when she confronted the young man, he admitted that he had taken part in a viral memory experiment that was aimed at teaching calculus through transmission of memories.

Young Nicholas Baxter was living proof that it did no good to remember something if you couldn't understand it to begin with. Leslie assured Nicholas that she would explain the math when he was older. Then she went to the faculty judicial board to discuss forming a committee to establish ethical guidelines for faculty participation in viral memory transfer research.

They were still deciding who would be on the committee—from which departments, in which proportions, and was Dr. So-and-so too junior for the responsibility? Was Prof. Such-and-such too senior to agree to take it on?—when the second wave hit.

"I know I have never taken George's seminar on Faulkner," said Leslie furiously. "Never! I hate Faulkner, and George wasn't on faculty anywhere I've studied."

"But what does it hurt to remember some kids sitting around talking about *The Sound and the Fury*, Les?" asked her friend and colleague Amy Pradhan.

"Easy for *you* to say. You didn't catch it."

Amy shrugged. "I don't think I'd be making a fuss if I had."

Leslie shook her head. "Don't take this wrong, but you don't even like it when people drop by your house without calling first. But somehow it'd be better if it was your head?"

"It's not like they can read your thoughts, Les."

"No, they can make my thoughts. And that's worse."

"They're not making you like Faulkner," said Amy. "I know someone else who caught it and loved Faulkner, and she doesn't hate it now. You can still respond as yourself."

"Mighty big of them, to let me respond as myself."

Amy grimaced. "Can we talk about something else, please?

"Okay, okay. How's Molly? Are you still seeing her?"

Amy blushed and the conversation moved on to friends and family, books and movies, campus gossip, and other things that had nothing to do with Leslie coming down with a stuffy nose and Faulkner memories.

The usual people wrote their editorials and letters to the editor, but most people could not bother themselves to get excited about a virally transmitted memory of a lecture on Faulkner. Even the Faulkner-haters in the English department shrugged and moved on. Leslie found herself alone in confronting the project head, Dr. Solada Srisai. Srisai was tidy in the way of women who have had to fight very hard and very quietly for what they have. The warm red of her suit went perfectly with the warm brown of her skin. Leslie felt tall and chilly and ridiculous.

"I don't think anyone will be hurt by knowing calculus, do you?" Solada murmured, when Leslie explained why she was there.

"You're a biologist," said Leslie. "You know how many forms you have to fill out to do human experimentation. If I want to ask a dozen freshmen whether they'd buy a cookie for a dollar, I have to fill out forms."

"Our experimental subjects filled out their forms," said Solada. "The viruses fell slightly outside our predicted parameters and got transmitted to a few people close to the original test subjects and then a few people close to them. This is a problem we will remedy in future trials, I assure you."

A grad student with wire-rimmed glasses poked her head around the door. "Solada, we've got the people from the Empty Moon here."

"Start going over their parameters," said Solada. "I'll be done with this in a minute."

"Empty Moon?" asked Leslie.

"It's a new café," said Solada. "We've come to an agreement with them about marketing. Volunteers—who have all the *forms* filled out, Dr. Baxter—will be infected with positive memories of the food at the Empty Moon Café, and we'll track their reports of how often they eat there and what they order compared to what they remember."

"Don't you have an ethical problem with this?" Leslie demanded.

Solada shrugged. "Not everybody likes the same food. If they go to the Empty Moon and have a terrible sandwich or the service is slow, they'll figure their first memory was a fluke. They'll go somewhere else. Or if they're in the mood for Mexican, they'll go for Mexican. We'll make sure that this virus is far less mutative and virulent than the others—which were really not bad considering how colds usually spread on a college campus. Well within the error range one might expect."

"Not within the error range *I'd* expect," said Leslie. "I'll be conveying this to a faculty ethics committee, Dr. Srisai."

Solada shrugged and smiled dismissively. "You must do as your conscience dictates, of course."

The business at the Empty Moon Café was booming. Leslie told herself very firmly that her memory of the awesome endive salad she'd had there was a snare and a delusion; she stayed away even when Amy wanted to meet there for coffee.

No one else seemed to care when she tried to tell them about the newest marketing ploy.

A few weeks later, Leslie was doing the dishes while her husband put Nicholas to bed. Her doorbell rang three times in quick succession, and then there was a pounding on the door. Wiping her hands on the dishtowel, she went to answer it. Amy was standing on the doorstep, an ashen undertone to her dark skin.

"There's been—" Amy swallowed hard, and managed to get a strangled, "Oh, God," past her lips.

"Come in. Sit down. I'll get you tea. What's happened?"

"Tom Barras—he's—"

"Deep breaths," said Leslie, putting the kettle on.

"You know I've been one of the faculty advisors to the GLBT group on campus," said Amy. "There's been an attack. A member of the group—Tom Barras—a nice bi boy, civil engineering major—is in the hospital."

"What happened?"

"We don't know! I thought we were—I know gay-bashing still happens, but I thought we were better than that here." Leslie bit back a comment about illusions of the ivory tower. Her friend needed a listening ear, not a lecture. Amy got herself calmed down, gradually, and Leslie went to bed feeling faintly ill. She and her husband insisted on putting Amy's bike in the back of their car and driving her home, just in case.

The story of the assault came out gradually: Tom's attacker, Anthony Dorland, said he had previously been set upon behind Hogarth Hall by a group of men. One of them had groped him repeatedly, making suggestive personal comments, while the others looked on and laughed. "I couldn't do anything about it," Anthony told campus security in strangled tones. "I was alone. But then I was out last night, and I heard his voice. It was the same voice, I know it. I would know it anywhere. He was coming out of his meeting, and so I waited until he was alone. I don't care what he does with people who like it, but I'm not that way! He shouldn't force himself on people like that! It's not right! So I thought, well, let's see how you like it when you're all alone and someone jumps on you."

When campus security asked Dorland why he had not fought back immediately or reported the incident, he looked confused. "He was so much bigger than me, and he had all his friends—I don't know—I just felt like I couldn't. Like no one would believe me." Pressed for a time of incident, he said, "I don't know. A while ago. A few weeks ago, maybe? I don't know."

The police officers looked from one young man to the other. Tom was several inches shorter than Anthony and slightly built.

Tom returned to consciousness a day later, to the great relief of his family and friends, including Amy. A few days after that, the faculty started hearing rumors of other students who had experienced the same thing but could not say when it had happened. Some of them had roommates who said they didn't remember their roommate coming in beaten up or upset; others had roommates with identical memories—and identical sniffles.

Scores on calculus midterms shot up by an average of fifteen points.

Leslie noticed a few students wearing surgical masks on campus one morning. The next day it was a few more. She took Nicholas to get one at the campus bookstore and encountered Solada Srisai coming out with a bag. Without thinking, she grabbed Nicholas close to her.

"Mommy!" Nicholas protested.

"That false memory of sexual assault," Leslie hissed. "My son caught calculus. What would you have done if he'd caught danger and fear like that? What would you have done to keep him from having nightmares that a bunch of adult men were—" She looked down at Nicholas and chose her words carefully. "Were hurting him. Personally. What would you have done about that?"

"That one wasn't mine," said Solada.

"They are *all* yours," said Leslie. "The minute you taught your grad students that it was okay to release these things without trials, without controls, without testing—the minute you taught them that it was okay to skip all that, because it was holding back progress, you earned all of this. *All of it*."

"Mommy," said Nicholas, and Leslie realized that her hands were shaking.

"Let me tell you what the alternative was," said Solada, steering Leslie and Nicholas toward a bench. "Do you want to know what my alternative was?"

"Another project completely?"

"Yes. Sure. Another project completely." Solada glared at her. "And do you know what *that* would mean? It would mean that the person who developed virally contagious memories would not have done so out in the open. You would never have heard about it. Your son wouldn't have been at risk for catching a memory of calculus—or, okay, a memory of sexual assault because an overzealous grad student decided it would be a good idea for potential rapists to know what it felt like.

"No. Your son would have been at risk for catching memories that told him that the Republican Party was the only one he could trust. Or that if he truly loved you, he would always trust exactly what the Democratic Party had to say. Or that our government would *never* fight a war without a darn good reason. Or that he should buy this cola, or drive this car, or wear those sneakers. Do you see what I mean? It was me now or a secret project two years from now."

"And that makes it okay?" said Leslie. "The fact that it could be worse?"

Solada leaned toward her on the bench; Leslie had calmed down enough not to pull Nicholas away. "If I blow the whistle on my own project, it looks like I'm trying to grab the spotlight; nobody pays any attention. But you! What are you doing? I counted on someone like you to kick up a fuss in the press. Faculty advisory committees? Official university censure? What is wrong with you? Start a blog to rant about it! Call reporters! Tell your students to tell their parents! The student paper is not enough. Rumors are not enough."

"You're saying you wanted me to—"

"You or someone like you. For God's sake, yes. Get the word out. Make sure everybody knows that this is something we can do. Make sure they ask themselves questions about how we're doing it." Solada shook her head. "I'm amazed it didn't happen before. I thought surely the Empty Moon thing would be the last straw for you. Or someone like you. And I never dreamed that one of my students would use it politically, the way I thought the big parties would.

"So be fast about it, Dr. Baxter. Be as loud as you can. I'm willing to be the wicked queen here. Better a wicked queen than an eminence grise."

And with that she was gone, leaving Leslie stunned and clinging to her son. Most of the media contacts she had were in the obscure economic press. Would it be best to call a national news magazine? The local newspaper or its big city neighbor? She'd never tried to break a story before. It had never been this important before.

"Mommy, did you take me here another time?" asked Nicholas.

Leslie's heart went into her throat.

"And Daddy was here, too, and you bought me hot chocolate?" he continued hopefully.

She relaxed. It was a real memory; they had come to the student union before Christmas. "I'll buy you hot chocolate again," she assured him, "and then we'll go over to my office and you can draw pictures. Mommy has some phone calls to make." n

* * * *

"The thinking of a genius does not proceed logically. It leaps with great ellipses. It pulls knowledge from God knows where."—Dorothy Thompson

"Proverbs are always platitudes until you have personally experienced the truth of them."—Aldous Huxley

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Series: **TURNING THE GRAIN: PART I OF II** by Barry B. Longyear

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Illustrated by Mark Evans

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The best-laid plans can go *very* ugly....

* * * *

I

The sun's rim edged above the desert horizon, brushing the tops of the plateau's night-chilled cliffs with pale gold. Gilf Kebir's day creatures began awakening, noted the light, and moved toward the promise of warmth. Night things backed deeper into shadows, away from the moisture-sucking heat of Egypt's Western Desert, away from the ever-present eyes of predators. In one such shadow Gordon Redcliff raised the front detector cover on his rifle's electronic sight and swept the wadi below. The ones down there had finished their work: seven shooters just this side of the narrows on the rocky trail climbing to the plateau where the expedition camped. Two more shooters in the shadows up on the wide slope above the narrows. From his perch, the shadowed ledge hidden from below by the reflected glare of the sun on the cliff face adjoining it, Gordon studied the faces and positions through his scope.

The shooter closest to Gordon's position had a rocket-propelled grenade in addition to his Kalashnikov. Both weapons leaned on a rock to the fellow's right. RPG was lighting a cigarette, his bearded face craggy, the eyes searching the shadows above a hawklike nose. His face indicated a lot of mileage: the Iran thing, probably. He was about the right age. RPG wore a gold chain around his neck with a crucifix on it. Probably not a Christian, though—at least, not in good standing. RPG was the back door. Gordon shifted the sight picture to the slope above the narrows. Of the two there, the younger one with the pale skin and delicate features, the tails of his gutrah folded over his head in anticipation of rising temperatures later in the day, he was the boss. He wore his ogal cool, cocked forward so that the front of the black band sat on his eyebrows. He was facing east and downhill, kneeling and touching his forehead to a cloth.

Cool's companion was older, more secular, less fashionable. He wore only the tagiyah on his head, the white cap pushed back, his falls of tangled black hair in his face. Incongruously, he was wearing a black and white Red Sox jacket over his thoub against the desert's night chill. He squatted, his elbows resting upon his knees, waiting and listening. From a less connected family perhaps than Cool's, and certainly a slob, but Red Sox was wired: the group technology geek. He was the sapper, the one with the remote. Red Sox controlled the front door.

Below them among the rocks, growing impatient in the chilly shadows, RPG and the six other gunmen, all costumed as Bedouins, were talking among themselves, smoking, wandering behind outcroppings to relieve themselves, but always avoiding that narrowest point in the trail: the bend. That's where, under Red Sox's direction, they had installed the front door in the hours before sunrise. There had only been the one truck—running electric and silent in the dark—that had brought them and their explosive device. Nothing else had been in the vehicle. No provisions for hostages. Perhaps one Christian, one Muslim, and a few secularists. At least the murderers had figured out how to get along, mused Gordon.

There was a crackle in his headset; Dr. Hussein speaking in Arabic: *"Gordon, we have all the samples, equipment, supplies, and shelters packed. We should be ready to leave for Site Safar as soon as morning prayers and breakfast are concluded. Dr. Taleghani is anxious for us to return. Is the route clear?"*

"In a moment, Doctor," replied Gordon quietly into his mouthpiece, also in Arabic. He felt a scorpion crawl across his hand but didn't look away from his scope. "I'll need Captain Mansouri at the head of the wadi in a couple of minutes. There will be something to report."

There was a slight hesitation. *"Another ambush?"*

"Yes."

A note of frustration. *"How do the devils find us?"*

"The sky is crowded with eyes, Doctor, and most of them are for rent. I'll have the wadi clean in a minute."

"Wait." Another pause. Gordon blinked his eyes and smiled slightly as he continued watching the gunmen below, knowing his academician boss needed to allow his eccentric compassion fantasy to run a bit before reality reined it in. *"Gordon, might they be open to some—I don't know—perhaps they might consider some sort of negotiation? We could pay them something for their trouble if they'd leave us alone. If Captain Mansouri's men—"*

"There are nine shooters, Doctor," interrupted Gordon. "Seven are armed with high-powered assault rifles, one in addition has an RPG. Another is controlling an explosive device planted at the bend in the first narrows. Their plan is to disable the first vehicle in the convoy, blocking the trail, then disable the last vehicle, trapping the convoy in between. Then the shooters attack the vehicles from both sides, killing everyone."

"Certainly we are worth more alive than dead."

"I don't think they're into comparative investments. These fellows are not hostage takers."

"You know this?"

"They've made no provision for hostages: no food, no bindings. Only one truck." The scorpion skittered off Gordon's hand in pursuit of game of its own. "Five minutes, Doctor, and please have someone start up one of the heavy vehicles."

A final grudging pause. *"Very well."*

Twenty seconds later the sound of a four-ton all-terrain diesel started up far behind Gordon, the whine of the eight-wheeler's starter motor and the clatter of the initial diesel exhaust reverberated loudly from the stubby hills at the edge of the crater across the plateau and into the wadi. On the slope above the narrows Cool wrapped up his prayers and spoke quickly into his handset. He gathered up the cloth he had been using, then he and Red Sox rushed behind a rocky outcropping and squatted. Suddenly everyone was in place, hidden on either side of the trail above the bend, safeties off, weapons aimed and ready, extra magazines within easy reach, and all as still as death. RPG was settled in a draw fifty meters up from the bend near where the rear vehicle should be when the convoy stopped. A very practiced crew: motionless, disciplined, professional, and therefore predictable.

The four shooters on the near side of the trail would have the longest journey to get away from Gordon's fire, the ones on the far side the shortest. Far side goes down first. Cool and Red Sox didn't appear to have anything heavier than pistols with them. They had no place to go, in addition, but toward Gordon or up the slope toward a sheer cliff once the shooting started. Red Sox and Cool go down last.

Noticing Gordon and trying to get away from his fire was only a remote possibility in any event. None of them should be able to hear any of Gordon's shots. He was over a kilometer away. For the few seconds

it would take to kill them all they would be momentarily deaf after Gordon triggered off their front door charge. Nine shots, possibly ten. Should only take five or eight seconds. Eight if he had to change clips to go for that tenth shot.

Gordon's Stryker M-3 semiautomatic sniper rifle had an eight-round magazine of 9mm magnum shattertips. He already had one round up the spout. An extra magazine was on the right of the sandbag he had filled that was cradling his left forearm as his hand held the forward grip of his M-3. Next to the mag, connected by a thin cable to the rifle, was a remote disrupter, looking very much like an early cell phone, its stub of an antenna pointed toward the wadi. He reached to the rifle's electronic sight and turned on the recoil compensator. It would maintain his sight picture and aim between shots while the weapon's gas mechanism automatically ejected a spent cartridge and chambered the next.

Of the three shooters on the far side of the trail, the most difficult to hit would be the one in the center. Of all of them, Middle Man knew best how to hide. Ex-military or ex-terror vet. None of that Christian or Jihadi action for him; his god was terrain. It chose where he went, how he stood, and what he did. All that was visible of him was an edge of the right rear quadrant of his head. He was the one who might make that tenth shot necessary: the first round to get him exposed, the tenth—after Gordon had dispatched the others and changed magazines—to put Middle Man out of his misery. Gordon centered the sight's kill dot on that spot, took a breath, let part of it out, and pressed the disruptor trigger on the rifle's front hand grip. The charge down in the narrows exploded with a roar and Middle Man surprised Gordon momentarily by standing straight up in astonishment at the early detonation, exposing the upper third of his body. Nine shots and five seconds later the last echoes of the explosion still had not completely faded from the wadi. When they had, all was still down at the narrows.

Gordon ejected the empty magazine and loaded the full one into his weapon, pulling the bolt to chamber the first round. He placed the safety on, emptied his sandbag, disconnected and pocketed the disrupter, collected and pocketed the ejected brass and the empty mag. Getting up into a squat he noted the black scorpion had crushed the beetle it had been after with its claws and was preparing to pick it apart.

"Bon apétit," he said to the insect as he duckwalked backwards from beneath the ledge, swishing the cloth of his emptied sandbag to remove the evidence of his passing. Once he was clear of the overhang, he stood, folded and pocketed the ochre-colored bag, slung his rifle, and climbed up to the head of the trail. Once there he paused and looked around.

The mesas reminded him a little of pueblo country, but without all the lights, casinos, strip developments, and golden arches. The sand sea dusting the edges of the plateau was almost lifeless. None of the wild sage, pinon pines, or junipers of New Mexico. Hunks of hazy gray-green glass littered the sands, though: part of the reason for Dr. Hussein's expedition. As the gravelly surface of the plateau crunched beneath his desert boots, Gordon keyed his headset. “It's all over, Doctor."

A lengthy pause. *"Things went well?"* Dr. Hussein asked at last.

"No trouble,” answered Gordon.

"Nine dead?"

"They aren't our dead, Doctor. That makes it a good morning's work."

Gordon knew that the geologist wanted to say what he had expressed before: that he wished Gordon would feel at least a little badly about having to kill—and having to kill so many. Gordon hadn't the need, though, and couldn't explain why to the satisfaction of those who thought he should.

"I called in my conclusions about the crater to Dr. Taleghani last night," said Dr. Hussein at last.

"I've just heard back from Site Safar. There has been an unfortunate development: one of the expedition members has been injured and needs to be replaced. Dr. Taleghani needs a special kind of bodyguard—good with languages. Tonight in fact. I suggested you."

"What about you and your staff, sir?"

"Our work for the project is concluded. As soon as we arrive at the dig, Bethany and I will be returning to Cairo on the chopper. The rest of the staff will follow on the regular truck run. Pending your agreement, I said you would be excellent for what Dr. Taleghani has in mind. You are very quick with languages."

"Thank you for the reference. If you're firing me, I'll need the work."

"Have you ever met Dr. Taleghani?"

"Just in passing at the dig." Gordon heard a Land Rover making its way from the camp to the head of the wadi trail. The vehicle came around a low hill and continued toward him. The sand-and-black-colored security car pulled to a stop on the trail in a cloud of dust at the edge of the plateau. "Here's Captain Mansouri. Signing off, Doctor."

The dust cloud moved slowly forward of the Land Rover, dissipating as it enveloped the vehicle and moved out over the wadi. The captain's angry voice came from the vehicle, bellowing at the hapless driver once again that if the fellow would brake more gradually they wouldn't have to eat so much of their own dust. The driver grinned and nodded. "Idiot!" Mansouri roared in Arabic as he climbed down from the vehicle and slammed the door.

He walked around the Land Rover and looked at Gordon. Mansouri always tried to make his comments to Gordon sound mocking, but it always came off as petulant. "Ugh, Chief Killum-Every-Damned-Body-In-Sight," greeted the captain, insultingly using his take on American Indian pidgin English. Despite being a graduate of UCLA, the Egyptian security commander took every opportunity to insult Gordon in an obviously passive-aggressive display of inadequacy, as Gordon's old college girlfriend the psych major would have put it. Mansouri was the commander of the joint Egyptian-Libyan security force that provided protection for the geological expedition to the Kebira Crater bisected by the Egyptian-Libyan border. He was a squat, powerfully built man wearing khakis, desert boots, and one of the wide-brimmed white straw hats favored by those in the expedition. His upper lip carried a thick black mustache, his brow a permanent frown. The stub of an unlit cigar was jammed in his mouth. He wouldn't ask why Gordon didn't call him before the fight. The subject had come up before. The captain had only himself and four men, none of whom were particularly proficient in marksmanship or combat. They needed to stay with the trucks and out of harm's way. Still, it bruised the captain's pride a mite.

"I take it, Crazy Horse, General Custer and the Seventh Cavalry lost again," quipped Mansouri.

Gordon frowned and slowly shook his head, his arms folded high across his chest as he stared with hooded eyes into the endless wastes of the north cliffs. "Umm, Kemosabe." He pointed toward the distant horizon with a flat hand, palm down, all fingers extended. "Scout see four white-eyes escape, Captain. All with AK-47s. Need you and long knives help Chief rootum out of rocks."

Mansouri stood there, bug eyed, until he saw Gordon's smirk. "You are as funny as cancer in an earthquake, Redcliff," said Mansouri. "Hell, you could do standup in a damned graveyard. Chief Shecky Horse. You should have been at Little Big Horn, man. You would've killed 'em."

"You seemed to be complaining about me doing all the work myself, Captain. I thought the prospect of a

little action might cheer you up."

Mansouri's face reddened. “My complaint was *not* having not enough to do, Redcliff. What bothers me is ... oh, it's the monotony of your precision."

"I'm too consistent?"

The captain raised an arm and pointed down the trail into the wadi. “I'll go down there in a minute and what am I going to find, Chief? Any wounded? No. Anyone I can question? No."

"Do you want prisoners to question, Captain? Guards, paperwork, medical facilities and personnel, provisioning, confinement? International incidents?"

Mansouri held up a hand. “You made your point. How many this time?"

"Nine."

"Nine men drilled right through their coconuts. Am I correct?"

"Only eight, Captain. One was shot in the heart."

Mansouri's eyebrows went up. “What is this? Have you added a mad splash of abandon to your terminal artistry?"

"It was just the way things worked out. Fellow stood up. Fortunate for him."

"Fortunate? I *must* hear this one, Chief. Tell me about this dead man's lucky streak."

"The original position he took didn't give me much of a shot—just the right rear quadrant of his head.” Gordon gestured with his hand tapping the right rear of his own head. “The hit would have been disabling, for sure, but knocking off a corner of his head along with a bit of brain tissue with a shattertip would have been quite painful for the fellow before I could finish off his companions, reload, and get back to him. Eight or nine seconds can be a hellishly long time when you're dribbling brains—"

"Please,” protested the captain as he winced and held out his hands, palms facing Gordon. “Please."

"Sorry, Captain. Thought you wanted to talk shop."

Mansouri waved a disgusted hand at him. “Let's get on with the report,” he continued in Arabic as he pressed the record key on his belt recorder and punched the auto time and date marker. “Gordon Redcliff, Dr. Hussein's personal bodyguard. When did you first see those who were preparing to attack the expedition?"

"Five days ago following the convoy from Site Safar,” Gordon answered, also in Arabic.

"And you said nothing to me?"

"They hadn't done anything, Captain. It could have been tourists heading down to Wadi Hamra."

Mansouri raised a skeptical eyebrow. “When did you know they weren't tourists?"

"I knew for certain last night. I watched a truck leave them off down in the wadi then go back the way it came. They were using night vision instrumentation."

"You were here waiting for them?"

"Yes."

"So, how did you know they'd try an ambush here?"

Gordon thought a moment. “Arguably it's the best spot on the route. They needed a choke point where they could stop the convoy and attack, no one able to get away. In my opinion this is the best place on the route. They apparently agreed."

Mansouri held up a hand and pointed around. “From where were you firing?"

Gordon raised an arm and pointed down to the ledge beneath which the scorpion was now most likely feasting upon its beetle.

"The attackers. Where are they?"

Gordon pointed down into the wadi. “Down by the narrows."

"Narrows? What narrows?” Mansouri squinted and shielded his eyes from the rising sun, most of the wadi still in shadows.

"Captain, do you see the second butte coming down to the road on the left?"

"Ah ... I see it."

"There, down at the bottom."

"That far?” Captain Mansouri squinted, frowned, took a range-finding monocular from his belt, held it to his left eye, and looked through it. “There they are.” He muttered a curse and said, “According to this, that's over one and a half kilometers from here."

"That's what I made it,” Gordon agreed.

"And, for the record, you said nine of them."

"Yes."

"All dead?” The captain raised one eyebrow and looked at Gordon who didn't answer. “Silly question,” remarked the captain. “What about the truck that brought them? Should we expect it to return?"

"Probably not. They were wired. The party with the truck would have a clear-code they'd need to receive before returning. The truck is probably tucked away in another wadi. When they don't get the clear-sign by a certain time, they'll probably dump anything incriminating and take off. Perhaps you can locate them through satellite."

"Humph! By the time I could get clearance and access, that truck driver and his friends will be across the border making love to their camels.” He looked through his monocular again, his lips moving. “I count seven."

"Look just above the bend on the slope,” said Gordon, “behind that reddish outcrop."

"And two make nine.” Mansouri lowered the monocular, lifted his hat by the front of its crown, wiped nonexistent perspiration from his forehead with the back of his right forearm, and replaced the hat. Depositing the monocular in its holster, he took his handset from his belt and called in the preliminary action report to his Egyptian headquarters at Mut and to his Libyan headquarters at Al Kufrah. A chopper would be coming in from Mut to haul off the deceased. Once Mansouri was finished, he turned

off the recorder and said, “I'd best have a look.” He glanced at the sky, a single hand held out. “May Allah let them be Egyptian."

"Have something against your own countrymen, Captain?” asked Gordon.

Mansouri snorted out a laugh. “If they are Libyan, it will take weeks to sort through the red tape. If they are bloody Iranian, Palestinian, or Saudi my grandchildren will have to file the final report.” He cocked his head toward the Land Rover with its driver. “Want to ride down and have a look?"

"I already looked,” said Gordon as he began walking the trail toward camp.

"Were they bandits?” called Captain Mansouri to his back. “Or was it tribal, political, or religious?"

"Probably,” Gordon called over his shoulder.

* * * *

II

Early that afternoon, after an uneventful run from Gilf Kebir, Dr. Hussein's expedition pulled into Site Safar deep in the sand sea north of the Kebira Crater and three hundred meters lower in elevation. After packing a few things, Dr. Hussein and his wife bid good-bye to Gordon and to a few colleagues, climbed on a waiting helicopter, and flew east. Afterward, Gordon secured his weapons in the ordinance truck, his leather pack and other gear in his own tent, and headed toward site headquarters.

As he passed the red sandstone escarpment that served as the site's visual centerpiece, the unusual color of it reminded him of cliffs in the Jemez Mountains, a lifetime and another world away. He watched them digging at the base of the escarpment for a moment, thinking of the pueblo and Iron Eyes. The old man had spent his life within two hundred kilometers of Jemez Pueblo, yet he had carried the wisdom of the universe. If there had been more time. If he had opened himself to the old man sooner. If Nascha hadn't been so crazy-sick. If: a Bilagana head-game word.

Men laughing interrupted Gordon's thoughts. A few of the diggers were taking a break with tea and conversation. When Gordon had been on site and not needed he would sometimes join the midday *majlis* as the workmen gathered to eat lunch and offer their biting critiques of the archeological effort.

"Salaam ‘aleikum, he would say to them all and they would stand and wish him *'aleikum asslaam.* Once the new faces were introduced and everyone settled, conversation would turn to the wondrous things they had seen at the dig that day. Stone-faced, they would sip their tea and talk gravely of fantastically important finds. “Pieces of pottery and glassware in great abundance,” they would say, citing important period names such as Bakelite, Marmite, and Smuckers, rivaling even the great Corning find of the previous week. “Fine jelly glass, chicken bones, and Coca-Cola bottles—*the ancient glass ones!"* And they would all *ooh* and *aah* at the wonder of it all—then laugh.

Said one, “It was obviously an ancient nest of the rare hundred-winged buffalo chickens of the Kentucky period."

Added another, “They look as though they had been attacked by a tribe of the equally rare hundred-legged extra crispies.” More laughter, and they would spin archeological send-ups about the Paleo-chicken-cola Culture and the fine museum they would build one day in Cairo to house their valuable finds.

The big discovery one day was a worn-out tire from a WWII German truck. One of Rommel's Afrika Korps Fritzies had really taken a wrong turn back in WWII. The big fear had been that they would also

find Fritz, which would have shut down operations and cost the expedition more precious time and resources to repatriate the deceased veteran's remains. Fortunately the Afrika Korps driver managed to change his flat, drive off, and die elsewhere.

Hundreds of meters to go, though, before they got down to the important layer. Said one, “The sands will take this hole and refill it before the consortium finds enough money to empty all of it.” Meanwhile, it was a gig. “Smoke, drink coffee and tea, move the desert from here to there, send some money home, and no one is shooting at you,” said one fellow, who immediately grinned toothlessly at Gordon. “Forgive me,” he said, “no one is shooting at *me*.*"* More laughter.

Purposes and dreams, thought Gordon. Getting through the day alive is a noble purpose—putting bread on the table. In his own mind he had a curiosity to see what happens next. Gordon nodded once thinking again of Hosteen Ahiga. Perhaps if he had gotten more time with the old man Gordon's purpose might have been more noble.

If this. If that. As another teacher, Sergeant Grubbs at Fort Benning, had said, “If a frog had wings he wouldn't bump his ass every time he jumped."

Bilagana wisdom.

Someone at the dig recognized him and waved him to join them. Gordon paused only to wave back. He turned and looked toward the processing shelter. An aged Egyptian in western clothes was pacing back and forth nervously in front of the large reflective environmental shelter, the fabric blinding beneath the unrelenting sun. As Gordon approached, the man stopped and with only the briefest nod of his head, waved him beneath the cover of the shelter.

"Thank you for coming so promptly, Mr. Redcliff. Dr. Hussein said you are comfortable in Arabic."

"Yes,” answered Gordon. There was a hardboard floor beneath his feet, gritty with sand. It was a few degrees cooler beneath the shelter, which meant that it was almost hotter than Hell.

"Excellent. I am Dr. Taleghani.” The man walked to the desk in the tent being used for the dig's headquarters. The desk was heaped with files, loose papers, and odd bits of pottery and bone. The archeologist began sorting through the mess, obviously searching for something. Taleghani was as dried and supple as an old bowstring. As did most Egyptian academics, he favored western dress in the field, from hikers and jeans to a white cotton shirt, blue denim vest, and bleached straw hat.

Gordon slowly looked around the shelter's interior, noting the lights illuminating the worktables to his right. The sides of the shelter were rolled up to allow the furnace-hot air from Egypt's Western Desert to drift languidly beneath one side of the enclosure and out another. A dozen or more archeology students—mostly Europeans in various states of dress among a forest of water bottles—were at the tables, cleaning, sorting, and studying the detritus gleaned from the dig's upper scrapings. They appeared to notice neither heat nor anyone else's presence. Some brushed, some picked, some probed, some sketched, and some tapped furiously upon keyboards. There was a very old, very worn-out truck tire leaning up against one of the tent poles. Someone had scribbled some English on it in yellow chalk: *Eat out your heart, Heinrich Schliemann!*

"What a muddle,” said the archeologist. “My assistant pinched a nerve in his back and is in terrible pain,” he explained. “Everything is a mess."

Gordon glanced past the busy worktables to the base of the escarpment where the small legion of diggers and sorters toiled still beneath the unrelenting hammer of the sun, gathering up existence's litter a layer at a time. Over Taleghani's left shoulder, however, was something new. Just over a kilometer southwest of the

escarpment there was what appeared to be a timespanner and next to it three large generators mounted on truck beds. The generators were quiet, the site's modest power requirements being handled by a small portable generator near the cook tent.

The timespanner looked like a large turquoise blue can stuck in a cylindrical black metal spiderweb. As only a former military sniper could, Gordon admired patience. The T-span being there, though, was evidence of something other than patience. Someone didn't want to wait years for his peek at the past. He looked to the man who had asked Dr. Hussein for his services. Dr. Ibrahim Taleghani was searching a second time through the same stack of files.

Not a patient man. Curious trait for an archeologist. Gordon shifted his gaze to the timespanner. He had been a young boy when the excited announcements came of the first successful experiments at spanning time. Time travel: someone had actually done it. The excitement and wonder, though, had been immediately swallowed by the overwhelming tide of scientific, political, environmental, and especially religious hysteria against this form of transportation and investigation.

What if this? What if that? Was man really meant to? Was this really what God had in mind? What kind of pollution were we spreading by these edges into other dimensions? What might we be bringing back? Timespanning became every nation's favorite political football, every religion's evidence of the existence of faithlessness, every criminal's nightmare, and almost every scientist's harbinger of the end of life as we know it. To young Gordon, timespanning became like space travel and genetics: rich dreams, exciting possibilities, and grand promise buried beneath oppressive restrictions, narrow-minded regulations, and prohibitive costs. Timespanning was wrung dry of anything resembling adventure or even useful results.

"What Christ meant here was that to be not a Christian was to be denied Heaven."

"Oh yeah? Well, let's ask him."

"Oh, no, no, no."

"Why not?"

"Oh, no, no, NO."

But what about these issues tearing humanity to pieces? Who's right? Who's holy? Who really was chosen? What *did* God really say to Abraham? What were the Ten Commandments before they were edited, or did Moses just make them up? Did that bush really burn? As the weight of his own body pulled the spikes through his wrists, what exactly did that carpenter say to God before he died, and who was he talking to if he, indeed, was himself God? Was he even there?

"Let's go find him and ask."

"Oh, no. No, no, no."

Well, what about the uncountable versions of the Prophet's revelations collected by Zayd? What were those truly revealed by Muhammad? What did he *really* mean by them?

"Why not go and ask the guy?"

"Forget it."

Can printed texts, interpretations, temples, and rituals stand up to a real-time examination? Would our actions today be condoned by those whose names we use to justify them?

"Hey, there's one sure way to find out."

"Absolutely not. N-O-T."

Timespanning control was internationalized, priorities rearranged. Licensing was taken over by a commission controlled by the United Nations, overseen by committees of the world's religious, environmental, and scientific communities, and relegated to a highly restricted long-distance sightseeing enterprise. Countless forbidden areas, in addition to the religious ones. It was still a point of Egyptian national pride, for example, that Cleopatra should resemble an Egyptian and not a Greek, the Ptolemys notwithstanding. Until they could get a stand-in back there, *no one* was going to do any looking at Queen Cleopatra. Until the real past could be made to conform to the accepted histories and beliefs, investigation would not be allowed.

"Mr. Redcliff?"

Gordon shifted his gaze to Dr. Taleghani. “Doctor."

"You were looking at the timespanner."

"I was."

Dr. Taleghani drummed his fingers on his desktop for a moment, then removed his reading glasses and looked up from Gordon's file. “When I talked to Dr. Hussein, I wasn't aware you were an American."

Gordon returned the statement with a steady gaze.

Taleghani nodded and pursed his lips. “Dr. Hussein says you gave quite a good account of yourself when those bandits attempted to ambush his party coming back from the Kebira Crater. There have been other attacks, as well, I understand.” He fixed his gaze on Gordon. “I can't imagine what you must feel having to kill that many men."

"It's called recoil."

Taleghani's eyebrows arched. “Are you just trying to sound cold-blooded?"

"Stating a fact, Doctor."

"You feel nothing about them?"

"Doctor, empathizing or identifying with someone who is trying to kill someone I am protecting changes nothing except my reaction time."

"Still, they *are* human beings."

"Who were prepared to kill Dr. Hussein and his party, including myself.” He shrugged and held out a hand. “Doctor, I accept that everyone had a mom, once laughed at Mickey Mouse cartoons, had pimples, needs love, toyed with religion, and wants a better life. Everyone also has choices."

"And if the choice is between killing you or seeing a child go hungry?” demanded the archeologist.

Gordon lowered his hand. “It's still a choice."

After a pause, Taleghani said, “Dr. Hussein recommends you very highly."

"A live client on his way home to retirement is a bodyguard's best reference."

The archeologist glanced down at a record form, and back up at Gordon. “You fought in Iran—for the American Allies."

"Yes."

"Why?"

"Orders.” Gordon smiled. “I'm an American. I was in the United States Army. The Army was ordered in to support the Septemberist Student Movement."

"You were a sniper."

"I also peeled potatoes, cleaned grease traps, and picked up cigarette butts."

"The point is, you killed Arabs during your tour of duty."

"Persians, too, Doctor."

Taleghani frowned. “Did you kill many?"

"Not as many as the Iranians and the Arabs killed,” responded Gordon. “Forgive me for being blunt, Doctor, but does this conversation have a point?"

Despite the archeologist's dark complexion, a touch of redness came to his cheeks. “I thought you should know, Mr. Redcliff, I fought on the other side in that war. I opposed American intervention in Iran's—"

"I don't care,” Gordon interrupted. “That war is done. As I understand it, Doctor, the job you want me for is to keep you safe on an expedition. If you also want to argue past American foreign policy you'll need to take on extra help. It is not an interest of mine."

The archeologist appeared to be having a debate with himself. Gordon waited with no discernable expression of emotion until the man's internal conversation came to an end. At last Dr. Taleghani said, “Your Arabic is excellent."

"So is yours."

Taleghani's eyebrows went up. “Your manners are atrocious!"

Gordon cracked a brief smile. “I am, after all, an American."

The archeologist laughed against a desire to remain very severe, which made the laugh louder. “Very well, Mr. Redcliff,” he said as he got his laughter under control. “Very well, tell me this: How long did it take you to learn Arabic?"

"Why?"

"Indulge me, please."

Gordon shrugged and thought. “Once I got to Kuwait and among people speaking the language, one or two days to get around on my own. In two weeks I was working with Iraqi regulars without an interpreter and without getting any unintentional giggles. I eventually bought a grammar and speller and taught myself to read and write the language."

"You also worked with the Septemberists, training their snipers. You must speak Farsi."

"Yes, and Spanish, German, French, English, eleven Native American languages, and all four dialects spoken by your excavation crew at the site. I can get around in Japanese and Mandarin, but I'm not fluent."

"It is curious the American army didn't make you a translator or put you in intelligence."

"It was tried, Doctor." He thought a moment then shrugged. It had been difficult enough getting the US Army to understand that an eighteen-year-old warrior needed to do war, and that war to a mind that young and angry had nothing to do with talking, listening, or interpreting.

"Are there any religious sensitivities of which I should be aware?" asked the archeologist.

"I believe in whatever the fellow holding the gun on me believes."

Taleghani's eyebrows arched. "Rather cynical of you, isn't it?"

"Doctor, in a world where worshiping the same god by the same name but wearing the wrong hat gets people killed every hour, it's simply a matter of survival."

"And if no one has a gun on you?" pressed Taleghani.

"Then that's my business. It requires no special icons, equipment, times, foods, clothing, prohibitions, or holidays."

Taleghani pursed his lips and looked expectantly at Gordon. "Very well. What would you need from me?"

"The biggest mistake, Doctor, is keeping me in the dark. Make sure I know what's going on with as much detail and warning as possible. Don't play tricks on me. Fooling me is no great accomplishment and it can get you killed. If you want to leave your protection behind, just tell me and I'll leave you a body bag and start sending around my résumé. Don't give me any stupid orders, and don't do anything stupid yourself. If you can manage that, I might be able to keep your party alive."

"God willing," gently admonished the archeologist with a smile.

Gordon smiled back. "Doctor, if you find Allah is working for your enemies, this is something you need to warn me about in advance." He held his head back. "Isn't it time you told me about the expedition?"

"Frankly, Mr. Redcliff, I'm still making up my mind if I can trust you."

"I can help. If you're looking for a buddy, a cheering section, or a fellow believer in the sanctity or greater glory of whatever, I will be a big disappointment. If you want to walk through Hell and have a good chance of coming out the other side with nothing worse than a singed mustache, you may find me useful."

The archeologist glanced down at his papers and said, "I once took an oath to kill every American in the world."

"By yourself?"

"No." The archeologist laughed and shook his head. "No, of course not. It was as part of an imaginary pan-Islamic effort to cure the world of its sins. I was fourteen."

Gordon grinned. "Then we're even, Doctor. When his father was arrested for drunk driving in Santa Fe, Bobby Two Crows and I swore to kill every white man in the world."

"I'm hardly white."

"You're white as snow to two ten-year-olds in the pueblo who used the blame, fear, and hate they lived in every day to define the universe." For a moment Gordon remembered when they came to take Bobby away to El Rito for torching a liquor store in Bernalillo. By the time Bobby got out of El Rito, Gordon was in the Army. By the time Gordon got out of the Army, Bobby Two Crows had been dead seven years from a drug overdose.

Gordon raised his gaze and looked at Dr. Taleghani. The archeologist returned Gordon's gaze for a moment, then nodded. Gordon raised an eyebrow, cocked his head toward the T-span, and the archeologist nodded a second time and commanded those at the work tables, "Get back to work. And let this be a lesson to all of you." Dr. Taleghani weathered the confused looks as he led the way from the tent. As they left, Gordon could hear someone tuning in a Tel-Aviv station playing Shantel golden oldies.

* * * *

III

They sat alone on the sand in the shadow cast by the timespanner gantry eating box lunches provided by the cook tent. Gordon's meal appeared to be couscous flavored with raisins, nuts, and dates stuffed into pita bread along with shaved lettuce, olives, and a side of green horseradish. This was accompanied by a can of cold tea. From their places they watched the excavation workers haul baskets of dirt and debris up from the base of the escarpment to the fine sorting screens, the immediately visible artifacts having already been recorded and recovered in place. Dr. Taleghani swallowed a mouthful of his sandwich, chewed impatiently, and washed it down with tea.

"The old Landsat Thematic Mapper images gave us the original hints regarding paleorivers under the sand sea in Western Egypt. Have you heard of the Accelerated High Definition Imager satellite? AHDI?" He pronounced it "oddie."

"Yes. The Army uses it for military geology."

"Well, AHDI shows that red escarpment over there is the top of a four hundred meter cliff. At its base, far below this cursed sand, was a navigable river that flowed through grassy savannahs and forests of oak, birch, and cedar. It joined another river that went across all of North Africa and eventually drained into the Atlantic. In those times the higher elevations southwest of here had hundreds of active glaciers. There was a short growing season in the lowlands and in winter the rivers would freeze."

Although no one was near them, Dr. Taleghani lowered his voice to a confidential level. "The AHDI satellite imager showed, along the banks of *this* river, at the foot of *that* cliff, evidence of a human settlement—*an actual village!"* The archeologist's eyes seemed to light up. "Carbon dating from deep drilling samples shows they were cooking fish and yams in this village approximately *one hundred and forty thousand years ago."* He smiled and glanced down. "I'm rather excited by this."

"I guessed."

"We've never found evidence of settled community life dating this far back. A few bones and stone tools, cave paintings, nothing going back more than sixty thousand years, and those only rather wild suppositions based on dubious evidence. Nothing at all in the Western Desert save the rock art in the Gilf Kebir caves. The provable settlements we have found—barely qualifying as being Paleolithic—show small groupings of fifty or fewer persons, the settlements being little more than shelters of convenience like caves or nomadic hunting camps." He pointed toward the escarpment. "At the base of that cliff, along the river, and in the near hills we've found more than *three hundred* stone foundations for dwellings." He stared at Gordon, his eyebrows arched. *"Three hundred."*

"Yes," said Gordon.

"That doesn't even consider shelters without foundations. Nomadic tribes probably used such a place during summers as a trading center. That would easily treble the fixed population numbers. In Paleolithic terms, my boy, this is bloody London!" He sighed and shrugged, his head moving from side to side in a show of reluctant tolerance. "Of course, there are skeptics who say that the house foundations, ditches, paths and such we've detected are simply natural geological formations and flood debris that took shapes familiar enough to modern eyes to be mistakenly interpreted."

"Another ancient face on Mars," offered Gordon.

"Exactly. The rock circles I've interpreted as foundations are very regular, and I must admit one large circle with three concentric rock circles within it has me a bit puzzled. Very large. Perhaps it was a theater. Regardless, because this little corner of the past was completely wiped out in a catastrophic meteor impact and subsequent mudflow, we can now pin down with a fair degree of accuracy—"

"The second Kebira meteor impact," interrupted Gordon. "The one that ate the mountain."

The archeologist nodded. "The first impact was probably thirty million years or more ago. It must have been a devastatingly spectacular occurrence. Dr. Hussein theorizes that it was a close airburst of an asteroid large enough and hot enough to create all that desert glass that's so common south of here. It also opened a fissure through to the mantle, allowing the formation of a relatively short-lived volcano of perhaps as much as three thousand meters in elevation above the Gilf Kebir plateau and as much as thirty kilometers across at its base."

"With the second impact, Doctor, what size of a disaster are you talking about?"

"Think of perhaps two hundred Mount Saint Helenses going off at once. It may even have been responsible for ending that period of glaciation."

"It's the second impact you think you have pinned down as to when."

"Within a few hundred years. We'll be able to narrow that down to minutes."

Gordon cocked his head toward the timespanner. "With that."

"Yes. I've gotten permission to take a timespanner back for a look at the village at an as yet undetermined point before the impact takes place. On the way there we'll fix the time of the impact. Dr. Hussein's computer model shows the village and the entire river valley hit by intense radiant energy immediately after the meteor impact. The shockwave within minutes. If it's in winter, the local snow pack would already be melting by the time the mudflow and debris from the uplands arrived at the village. The streams and rivers would already be full."

"Instant devastating flood."

"Yes." Dr. Taleghani waved a hand in a gentle arc of dismissal. "The important thing for us is to get in before the impact, have enough time to observe, and then get out again with our data."

"That's how you got permission," said Gordon. "The flood."

"Yes. The theory is that any possible influence such an intrusion might risk will be canceled out by the devastation before it can introduce any effective changes that would be projected to the present. That is, if we can find insertion windows within the desirable time frame. In other words, we don't have to worry if the wrong grain of sand gets turned if we know it's going to get buried beneath hundreds of meters of

muck until the present.” He glanced at Gordon. “So I am authorized to go back and have a look."

"Have a look,” Gordon repeated, a slight mocking tone to his voice. He studied the archeologist's face until the man looked down at his lunch box. Glancing from Taleghani to the escarpment, from the escarpment to the gantry, and from the gantry back to the archeologist, Gordon nodded, picked up a handful of sand, and let it trickle out between his fingers. “I believe I warned you about keeping me in the dark, Doctor. But perhaps you haven't done that. A bodyguard who is good with languages. Perhaps I am to use your crossword puzzle book to swat camel ticks that manage to sneak into the capsule—"

"Yes, yes, of course I want to leave the capsule, Mr. Redcliff,” the archeologist interrupted with an angry whisper. “If there is an inhabited village on that river bank, I must visit it. I *must* see the individuals who live there, record them, speak with them, hear what they can tell me."

"And *that* is what you don't have permission for,” pressed Gordon.

The archeologist looked down. “Yes."

"Does Dr. Hussein know about this?"

Taleghani nodded once. “I've been talking about this ever since we got the AHDI images and realized how close this site is to the Kebir Crater. Numair attempted to discourage me, but he is also my friend."

"He did seem awfully young to retire,” said Gordon. “Getting out of the desert fast to protect his pension?"

"He has a family to support."

"And you?"

Taleghani shook his head. “No. I have no family."

"What about the T-span operator?” asked Gordon.

"His name is Mehmet Abdel Hashim—a former student of mine. He's been in it with me from the beginning. Mehmet wants to touch the past and fortunately he does have family. His father is on the board of the International Temporal Span Authority."

"Does Mehmet's father know about the trip you're planning?"

"Not *all* the details.” Dr. Taleghani studied Gordon's face for a moment and asked, “Do you have family?"

Gordon paused, wrestling with an answer that revealed more about himself than he wanted. “No one,” he said at last, his gaze on the tip of the escarpment. There had been an insane mother, a father who stuck around only long enough to make a joke, the wise man who taught him as much as Gordon had been willing to learn, and the spotter during the war who he learned to love as a brother. All dead now. There had been the Dinéback in the pueblo, but he and his mother had never really been welcomed as a part of that.

The archeologist dismissed the subject with a quick wave of his hand. “The departure window all our planning depends on opens here late this evening,” he said. “It was cutting it very close waiting for Dr. Hussein's findings, and now Harith and his back ... We cannot keep the timespanner waiting for Harith's back to mend. We must leave tonight."

"Weapons?"

"Harith has arranged for protection, including some weapons. The matter of defending us is ultimately up to you, though."

"How big is the expedition?"

"You, me, and the T-span operator, although Mehmet goes back with the unit."

"Goes back?" Gordon inquired with an arched eyebrow.

"Yes. He drops us off on top of a hill outside the village—right beneath where we are sitting, in fact. Then he returns here to the present and returns for us at the next window."

"This tale gets better with each telling, Doctor." Gordon fixed his gaze on the archeologist's eyes. "How long?"

"That depends on exactly when the meteor hits and what local departure windows are connectable to present time arrival windows. There are several sets of theoretical windows we've tentatively incorporated into our planning ranging in time from twenty-one to twenty-five days. We won't be able to set our times and locations exactly until we get there. No one before has ever timespanned this far back." He examined Gordon's face. "Three weeks in prehistory, Mr. Redcliff. Aren't you excited?"

"Positively giddy." Gordon frowned as he turned a few considerations over in his mind. "In Iran, Doctor, what did you do in the war?"

Taleghani held out his hands at the seemingly irrelevant question. "Why?"

Gordon smiled. "Indulge me, sir. I'm lashing up a small but carefree band of brothers in preparation for a possible upcoming fracas. If you'll pardon the expression, I need to pick chiefs and Indians."

"I was an intelligence officer attached to Egypt's Third Field Army Headquarters. My principle duties involved interpretation of satellite surveillance imagery."

"In officer's training, did they teach you any hand-to-hand combat? Basic infantry skills?"

"No. I didn't go to officer's school. I received my commission directly when I was called."

Gordon's eyebrows went up.

"Unless they had already gone to officers' school, few of us called up for staff support positions had time to train. Bloody shock and awe. It was pretty much get my uniform issue, one boot on, one arm in a sleeve, and report for duty. There wasn't time for any niceties such as combat training. There was a pistol range qualification," said Dr. Taleghani. He looked away from Gordon's face. "Are you thinking this expedition itself is one of those stupid things you warned me against doing?"

Gordon held up a finger. "Risky, perhaps. Going without any weapons and with flowers in our hair, that would be stupid. Your pistol qualification, Doctor: how did you do?"

"I was afraid you were going to ask." Taleghani looked down at his lap. "My pistol instructor told me to keep an electric shaver in my holster and not to charge the batteries except under expert supervision."

"You're not joking."

The archeologist looked up at Gordon. "I was an officer—a major. No matter how abominable I was

with a pistol, that was quite disrespectful for a sergeant, I thought." He shook his head apologetically. "He was quite justified in his assessment, however. I am afraid I'm a scientist, not a warrior, Mr. Redcliff. Do you still want to be my bodyguard?"

"I've already taken on the job, Doctor, although you do seem to stack the challenges rather precariously. Can you run?"

"Run?"

"Are your legs in good shape? You look healthy. Running may be our best defense."

"Well, sir, I run two miles every morning," the archeologist said proudly. "Even in the sand. When I was nineteen I earned a position on my country's team in the Orlando Olympics."

"When you were nineteen."

Dr. Taleghani frowned. "I received a bronze in the eight-hundred-meter event. How did you do?"

"When the Olympics were held in Orlando, I got suspended from summer school for punching Tommy Wilson in the nose." Gordon smiled wryly. "I was nine years old. Tell me, what changed from when you were fourteen and swearing to kill Americans and when you were nineteen and running in Orlando?"

"I discovered Egyptology." Dr. Taleghani grinned. "Egyptian universities have the best field trips and museums in the world, but no one goes after Egyptology like American academics—and I will never admit I ever said this," he added. "While I was studying in the US, I also tried out for Egypt's track-and-field team. Wonderful years."

"Doctor, have you given any thought to what you're going to face once we return to Site Safar?"

"When we return?"

Gordon nodded. "I don't care what kind of song and dance your operator Mehmet has memorized to lay on the media and the powers that be, and I don't care who his father is. As soon as Mehmet comes back with that T-span can empty, everybody from the T-span czar and the secretary general of the UN to those antiquities caliphs in Cairo, not to mention a few governments around the world, and every priest, monk, rabbi, mullah, shaman, and witch doctor are going into vapor lock. I expect us to be met by something resembling a firing squad."

"Do you want out?" asked the archeologist.

"I can always plead I was following orders, Doctor. But if they come at you with the police or the army, I can't do anything about that. Can you have the arrival take place somewhere else? Somewhere unannounced?"

"A slight problem with that." The archeologist gave Gordon a wan smile. "The nearest alternate window is just outside Tripoli nine days ago."

Gordon smiled. "I doubt you could move that quickly even when you were nineteen, Doctor. When's the next window here?"

"Four hours after we leave there's a return window within meters of where we are right now. That's one of the advantages to doing this on site. Mehmet will bring the vehicle back through that window while we're investigating the village. The next window here is thirty-one days later, local time."

"After that?” asked Gordon.

"Here at the site a window will open approximately eight months from now, but I'm fairly certain the departure window for it won't open until after it's probably a hundred meters beneath that debris flood. Other locations are inaccessible for one reason or another."

"For instance."

"Well, countless windows are available in space. Unfortunately we do not have that kind of recovery system, not to mention transportation. Eighteen minutes before the window is available here at the site there is one available quite near the bottom of the Marianas Trench southwest of Guam."

"And we don't have earplugs,” Gordon commented.

"Among other things,” confirmed Taleghani. “A day after that a surface window opens in Gaza near the remains of the football stadium, and it's likely neither one of us would survive that."

"You were on the same side in the war. You are Muslim, aren't you?"

"As you phrased it, Mr. Redcliff, I am but I wear the wrong hat.” The archeologist raised a hand and patted Gordon's shoulder. “We will be fine once we return here to the site. I hope to extinguish everyone's indignation with a bit of wonder—call it showmanship. Tell me—may I call you Gordon?"

"You're writing the checks."

"Gordon, are you familiar with a historical figure named Squanto? He was an American aborigine who was kidnapped in 1605 by one George Weymouth, brought to England, and shown to—"

"I know who Squanto was."

"Good. I plan to return to our time with one of those villagers, Gordon. We're going to bring back our own Squanto. I'd like your thoughts on that."

In English Gordon answered, “Holy crap."

* * * *

IIII

Gordon found the supplies had been well thought out. The archeologist's youthful anthropology, language, and martial arts assistant, Harith Fayadh, had included Ka-Bar fighting knives, a Detz .44 magnum bolt-action hunting rifle with optical telescopic sight, an old-fashioned but very reliable S&W .38 Special revolver, and a very modern Fedders M2 shockcomb. Gordon decided to keep the Detz rather than use his own rifle. The Detz was a simple, rugged, reliable weapon. Gordon's Stryker was quicker and deadlier but relied upon sophisticated electronics. If something went wrong, the Stryker would be so much dead weight. The Detz could be repaired with just about anything from a penknife to a coin. The optical sights were rugged and removable.

Harith had thrown out his back at the dig, the pinched nerve in his spine causing terribly painful spasms. A blessing in disguise, as Dr. Taleghani informed his cot-ridden assistant when they visited him in the tent he shared with three archeology students who were at the sorting tables. “You have all the information regarding the expedition, my boy. If something should happen to us while we're back there, we will be depending upon you to get us safely home."

Harith nodded once brusquely, glared at Gordon, then fixed his gaze on a tent pole holding his corner of

the shelter above the sand. “Please stop this juvenile sulking, Harith,” requested Dr. Taleghani as he sat on the edge of the young man's cot. “It's quite tiresome.” He patted Harith's shoulder. “Now, tell me what is troubling you so, my boy."

"An American sniper,” he hissed, glancing at Gordon. “His only skill is murder."

Dr. Taleghani burst out with a laugh. “What nonsense is this? Gordon is a bodyguard, and he is very good at what he does. He is also quite gifted in learning languages, which is my principal reason for finding him valuable."

"I have black belts in karate and tae kwon do. What belt do you have?” Harith asked.

Gordon pointed to the hand-tooled leather belt with silver buckle depicting a winking Coyote in his belt loops. “A black Hosteen Ahiga."

Harith rolled his eyes. “Really. Eight ninety-five at your Wal-mart?"

Gordon glanced at Dr. Taleghani. “I see I have been misinformed about Egyptian manners."

"There is no need to have manners with a murderer,” retorted the young man. “Doctor, this man is evil. I saw his record. He murdered for the Septemberist gangsters and spawned more murderers like himself."

With an ill-concealed expression of astonishment, Taleghani leaned back and looked at Gordon. “I apologize. I'm afraid I've not been aware of my assistant's depth of feeling about the war."

"He's a little young to have been in it,” observed Gordon.

"My father wasn't,” countered Harith. “Perhaps you are the one who killed him."

"Perhaps,” acknowledged Gordon. He studied the young man for a moment then walked until he was standing on the opposite side of Harith's cot. “Where was your father killed? And when? Were you told?"

"Tabriz. The last year of the war."

Gordon shook his head. “That's one death I'm not responsible for, Mr. Fayadh. My unit never made it north of Malayer and I spent the last year of the war in a hospital."

"And I am to believe you, of course,” Harith said sarcastically.

Gordon shrugged. “I would lie if there was a point. There is no point."

Harith closed his eyes, the muscles in his jaws flexing. “Do not tell me the war is over."

Gordon grinned as the memory of an Iranian captain he once met touched his mind's eye. “No war is ever over, Mr. Fayadh,” he answered. After a pause he squatted, looked into the pale young man's dark eyes, and said, “When I was a boy, much younger than you, every morning in the dark before sunrise my mother would take me to the top of Bear Rock. There she would stand, cursing the gods she imagined, beating a medicine stick against the rock, demanding the sun to appear. She called the sun Glittering Man. Some believed her to be a witch, but her only goal was to bring light to the world and end evil."

Gordon thought back to the schoolhouse and the boys and girls taunting him about his mother, the witch. He had fought back, eventually. First it was with fists. Eventually he told them he was studying to become a witch himself, and that his studies would require him to kill someone, preferably a child. In middle school he once cut off a bit of his own hair and taped it to a filing card with the name, address, relations,

and habits of Lee Waters, an eighth-grader and the ringleader of the school's bullies. He allowed the card to be “lost” in the hallway between classes, and it eventually found its way to Lee Waters.

"What is this?" demanded Lee during the next class break, his hate-filled eyes dark and small in the boy's angry face.

Gordon turned from putting his books in his locker and glanced at the card. *"That's for making medicine—you know, spells and curses. I have cards like that for everyone in school."* He had gone on to describe evil-wishing magic and how he needed hair, fingernails, blood, or such from a person to bury with corpse flesh to pray them down into the dirt. Lee took the card and put it deep within his own pocket. Gordon smiled. *"That's all right. I have more."* The bullying ended, but the terrible isolation continued.

"My mother called her gods Glittering Man and Blood Woman,” he said to Harith Fayadh. “I would help my mother raise Glittering Man from the night with my own curses. As the edge of the disk cut the horizon, my mother Nascha would sing her chant demanding the gods to bring down pain, death, horrible sickness, confusion, and all the punishments on the evil ones in the world. Just in case the spirits were forgetful, she would recite for them all of those evils. Mrs. Potts, the lady we bought eggs from, was evil."

"An egg lady? Why was she evil?” asked Harith.

Gordon pointed with his forefinger at the side of his head. “Mrs. Potts was wall-eyed. She never had it corrected and always favored looking at the world through her left eye. My mother believed that was the egg lady's evil eye."

"What nonsense,” said the youth with unconcealed contempt.

Gordon pointed at Harith. “You are also one of the evil ones my mother begged the gods to kill."

"Barbarian rubbish,” protested Harith. “I am not evil. And how would she know me?"

"You are Arab Bilagana, the child of Arabs. To my mother, that made you evil."

"She believed Arabs to be evil because they're Arabs? Deluded woman."

"Look at it through her eyes. Arabs caught Africans and sold them to British and American slavers. The freed descendents of those slaves joined the US Army and became cavalry soldiers on the western frontier. The Anglo Bilagana and the Zhini buffalo soldiers fought against my mother's relatives’ ancestors.” Gordon grinned. “So those Arabs and all of their sons, daughters, and countrymen until the end of time, according to my mother, are evil and should be exterminated."

"And this is how you believe?” asked Harith, his expression testimony to the ridiculousness of the proposition.

"No,” Gordon answered. He took a deep breath and let it escape from his lungs slowly, as he looked out from beneath the rolled-up edge of the small tent to the endless dunes of the sand sea. “I do not believe in evil."

"What an astonishing thing to say. You don't believe in evil? In this world? Have you spent your life with your head beneath a rock?"

Dr. Taleghani began to rebuke his assistant, but Gordon stopped him with a look and a slow shake of his head. He faced Harith. “I used to hate evil when I was a child living with my mother, Mr. Fayadh. I now consider such a belief a childish superstition."

"Why should you not fly in the teeth of thousands of years of God's words?" said the young anthropologist. "Hear me, Allah. Gordon Redcliff doesn't believe in evil. Your work is done." Harith laughed at his own joke until his spine bit a little more deeply into an inflamed nerve. When he was finished wincing he said, "So, if you don't believe in evil, Mr. Redcliff, in what do you believe?"

Gordon closed his eyes then reopened them a moment later. "I believe in ignorance, stupidity, laziness, fear, greed, cruelty, insanity, cowardice, corruption, indifference, and disease. I don't believe you and your descendents should be exterminated unless and until they raise a hand against me or those I want to protect." He looked back at the boy and there was a smirk on Harith's face.

"If I might borrow a good old Yankee American expression," Harith said in English, "so what?"

Gordon nodded and continued in English. "I'll tell you what, kid. It is advice I got from a very wise man many years ago. He said it doesn't matter what kind of family, racial, tribal, national, political, or religious bullshit your head is filled with or how long it's been there, you can still pick your own path."

"And now my faith is insane? What I believe is bullshit?" Harith spat back, wincing as his passion plucked the strings of his abused spine.

"I didn't say that. I've read the *Quran,* however, and nowhere in it does it say that Americans are evil."

"When it was written, there were no Americans."

Gordon grinned widely, held up a finger, and wagged it back and forth. "Not according to my mother."

A tiny smile fought its way through Harith's self-imposed outrage, then he nodded. "Very well. I will give your mother that one."

Dr. Taleghani said to his assistant, "Harith, enemies are not enemies forever unless you choose to make them so."

Harith glanced at Gordon. "Tell me, Mr. Redcliff, do you really want to go on this expedition?"

"Very much." Gordon faced Dr. Taleghani. "It sounds much more interesting than sifting sand or drilling holes in rocks with Dr. Hussein." He looked back at Harith. "Your boss is quite an adventurer."

"Possibly I'm a bit jealous of you."

"Possibly," agreed Gordon with a grin. "I imagine we'll bring back a wealth of images and information for you, though." He glanced at Taleghani and the archeologist nodded back. "And something else, as well."

Harith glanced around to make certain no one had overheard the American. Satisfied they were the only ones within earshot, he lowered his head back to his pillow and said, "Take care of our adventurer, then, Mr. Redcliff. I truly envy you what you will find." Harith frowned as he stared at nothing for a moment then focused on Gordon's face. "You do not believe in evil. Do you not, then, believe in good?"

"Opposing moral forces stalking me, urging me on and off some other-imposed path of righteousness like the old Goofy cartoon?" asked Gordon.

"Goofy? I do not understand."

"A Disney character, a cartoon dog. In this old cartoon I saw as a child, Goofy constantly has a good little Goofy on one shoulder and a bad little Goofy on the other. One Goofy is dressed like an angel, the other dressed like Satan, each little Goofy counseling big Goofy to do things good or bad according to

their respective agendas. No, I don't believe in that."

"You reduce human morality to a Goofy cartoon?"

"No. The animators did that. I just happened to find the rendering insightful."

"Then why are you here? I mean, in the world—in life? What is *your* mission?"

"Aside from protecting your boss?" Gordon thought for a moment. "Making my way between the bombs, doing what I can do."

"Toward what end?"

"To find out what happens next." As soon as he said it, Gordon knew his answer to be facile. There were a few details for Harith and Dr. Taleghani to sort out. While they sorted them, Gordon rested his gaze upon the escarpment, turned the conversation in his thoughts, prodding at the young man's question.

Mission. Reason for being. What was the mission of Gordon Redcliff's life?

He had taken on many missions during his life. His longest mission had been to help his mother raise the sun, kill evil, and carry her overwhelmingly insane burden of historical hatred. When she died, although he thought her insanity died with her, he'd lifted the burden to his own shoulders. That lasted, twisting his own life and outlook, until the middle of his first tour in the most recent war and the aftermath of the bloody fall of Esfahan.

In the mountains south of the former Persian capital, Gordon and his new spotter, a twenty-three-year-old kid from Long Island named Phil Andreakos, had been temporarily detailed to keep an eye on a captured IRI army captain. Andreakos and Gordon had a solid business relationship that had racked up an impressive record of kills, but they had never become close. Watching the Iranian captain, however, was a way to structure a bit of time before being sent out on their next mission. A soldier was a soldier to Andreakos, hence he felt obligated to make the IRI captain's time with them as pleasant as possible. The three of them sat outside the intelligence officer's headquarters in the shade of a hill. Andreakos and Gordon were both sitting on empty ammo boxes. The captain was in his early thirties, his hair prematurely touched with gray at the temples, his uniform touched with the dust and wear of an infantry officer. He sat on the ground leaning against a weary-looking juniper. After a few minutes Andreakos asked the captain in Farsi if he could get him some water or something to eat.

"Never from the hand of a Greek," spat back the captain, turning away his head. Andreakos stared back, his mouth slowly opening.

From a Greek? he mouthed to Gordon, a big grin starting on his face. He turned to the Iranian officer. *"I can get you tea, some falafel, a bagel, maybe one of the guys has a birthday cake."*

"Are you deaf as well as ignorant? Never! Never from the hand of a Greek!" The captain held out a shaking hand at the surrounding mountains. *"Don't you know where you are? Have you no clue?"*

Andreakos couldn't let it be. He could understand why the Iranian captain might hate Americans, Brits, Iraqis, Israelis, Indians, Turkmen, Pakistanis, Lebanese, or Kurds. But what did he have against Greeks? Greece had even sat out the past four Middle East wars.

"Why, pray tell?" prodded Phil.

"Alexander!" retorted the captain, as though Phil was the most ignorant of peasants, then he spat in the dirt.

Andreakos sat back on his ammo box. *"Alexander?"* he repeated. *"Like, in The Great?"*

It was the funniest thing Phil had ever heard. This guy was still pissed off about a war that had happened twenty-four hundred years before either of them or their governments had been born. The captain apparently blamed Phil and all the other Long Island Macedonians for at least part of it: The murder of Darius, the destruction of the Persian Empire's golden age, the sanctity of Persian purity defiled, defiled, oh merciful Heaven, defiled by the Greeks! *The horror! The horror!*

Phil couldn't get over it. He prodded the captain into reciting lists of atrocities committed by Greeks against Persians. The Iranian captain couldn't see through his hatred and shame long enough to notice that Phil was putting him on and having the time of his life.

Oh, that's so horrible, Captain. I'm mortified. So ashamed. Please. Tell me more.

It was better than television. The antics of the pair finally crumbled Gordon's unremitting poker face driving him to laughter. It was either laugh or explode. Before he could allow himself to laugh, though, Gordon had to choose that different path the way Hosteen Ahiga had said. He had to release his mother's hatred, as well as his own, and let it fall from its own weight. He had to let go of Wounded Knee, The Long Walk, Mrs. Potts's evil eye, the infected blankets, the murder of Narbona, the governor of New Mexico's Hawaiian shirts, Fort Defiance, Jay Silverheels, the disappearance of the buffalo, the Bureau of Indian Affairs, Squanto, the twenty-four dollars in junk jewelry, the buffalo soldiers, Injun Orange Funny Face Drinks, the sheep killers, the Washington Redskins—crimes and evils real and imagined committed against people he never knew by people who had never existed or were long dead and gone. Then he laughed. He'd never laughed so hard in his life. He laughed so hard he was crying, which angered the IRI captain even more, which made him seem even more ridiculous. The Iranian didn't know, however, that Gordon was mostly laughing at himself—himself and at the human race. After that Gordon allowed himself to become friends with the Long Island Greek. Brothers.

Wars end only when memory ends. Missions, though, are mercurial, assigned, and ultimately chosen. So what was the mission? What was Gordon Redcliff's purpose on the planet? Was it even necessary to have a mission beyond getting through the day without compromising oneself or falling for one of the Trickster's jokes? That seemed to be Hosteen Ahiga's purpose. Gordon was moving from one desert to the next, one conflict to the next, and for what purpose?

When Dr. Taleghani was ready to leave, Gordon stayed behind and looked down at Harith. “I apologize for my earlier answer to your question about why I am here. I answered as I did because I didn't have the words. A stupid thing to do. Now I know the answer: to find a mission. That is my mission on this planet, Mr. Fayadh: to find a mission."

The young man studied Gordon's face a long time and then nodded at what he read there. “A noble and lonely quest, Mr. Redcliff. May Allah in his wisdom help you find it. I am Harith. May I call you Gordon?"

"Yes."

"This is an English name, correct? Gordon?"

"Yes,” he answered. “It is English."

"I'm curious about something. If your mother thought the Arabs evil, whatever must she have thought of the English?"

"Please do not be offended, Harith, but you are still too young to hear what my mother thought of the

English," he answered. Harith laughed.

"Then how came you by the name?"

"My father. That was before he left us and went to live in Los Angeles to become a Hollywood Indian. It was the night I was born. Never met the man until I was eighteen. Before I reported for the Army I went to Los Angeles, looked him up, and asked him why he named me Gordon. He said he got it from an old movie, *Flash Gordon*."

"What?" Harith said disbelievingly.

"He said my mother told him that when I was born she would charge me with defeating all evil that exists. Flash Gordon, he said, defeated evil and saved the universe. Then my father laughed at me and went to work. He was playing the role of an Oglala Lakota chief named Red Cloud. That was the only time I ever saw him, except in the movies." Gordon smiled. "My father was from Bear Enemies People in Santa Clara. Chief Red Cloud spoke his Lakota with a Tewa accent."

Harith smiled. "Take care of my boss, Gordon Redcliff. He is a very good man of great vision."

"I will do my best. Take care of your back. In case we don't make it back according to plan, we are going to need some big help."

Harith winced as he held out his right hand. Gordon took it. "Good luck, Gordon Redcliff. Allah willing, may you find what you seek."

* * * *

Inside the capsule, Dr. Taleghani introduced Gordon to the T-span operator. Mehmet Abdel Hashim had a jutting chin, brilliant white teeth, a flowing black pompadour, and the immature beginnings of a beard and mustache. The young pilot eagerly adjusted instruments mounted into the metal hull and checked calculations while Gordon and Dr. Taleghani, unobserved by others at the camp, loaded and stowed the supplies they'd need for their stay. Once the supplies were loaded, there was little to do but wait. Gordon decided to try qualifying the archeologist on a few weapons. He took his leather knapsack containing the .38, shockcomb, and ammo, slung the Detz, and brought the archeologist out into the dunes to practice on a makeshift target made from pasteboard.

At a range of three hundred meters, Gordon put the eye out of a mouse in a pest control advert he fixed onto the cardboard with a bit of tape. He put two more shots through the same hole and proclaimed Harith's zeroing of the weapon adequate. Dr. Taleghani wouldn't even consider touching the rifle. They moved up to ten meters and Gordon reached into the bag for the .38 and a box of ammunition.

They only used up four rounds before Gordon called a halt to the exercise for health reasons. Dr. Taleghani was becoming a nervous wreck as Gordon tried to get him not to shake, not to close his eyes, to look at the target through the iron sights, and slowly squeeze the trigger all at the same time. On the last two shots Taleghani was still shaking but now more violently and also had his face turned away from the target besides having his eyes tightly closed. In addition, the safest place on the desert that day appeared to be right in front of that piece of cardboard. Other than the original zeroing shots, it had suffered not a single perforation. Looking down at the cardboard, Dr. Taleghani said ashamedly, "I will hear no comments about electric shavers!"

"I wasn't going to say a thing," said Gordon. "But I think I understand why Harith included a particular weapon in our inventory. It's called a shockcomb."

"It sounds a terror."

"No sound to it, Doctor. Nothing jumps, nothing explodes, no recoil."

"It sounds promising," acknowledged the archeologist.

Gordon went to his knapsack, replaced the .38 and the box of shells, and removed what looked like a silver comb with a greenish pistol grip. He held it up toward the archeologist. "This is a shockcomb. A hearing-sensitive, brain-damaged, spastic neurotic with advanced glaucoma and a migraine could fire expertly using this thing."

"Despite the unfortunate characterization, I've never seen anything like it," said the doctor, taking it from Gordon's hand. "It's incredibly light."

"The same technology that produced the T-span makes the shockcomb possible. There's no real metal to it. Last I heard, it's classified. If I really was in US Intelligence, I'd be real curious where Harith obtained this."

"The boy is quite resourceful. What does it do?"

"I only did a familiarization course with one of these. Technically it shuffles or compresses selected time-space, briefly allowing whoever operates it to move, change things, or escape unobserved. In brief: aim, pull the trigger, and run like hell. To the observer, you look like you vanished when what you've actually done is slow the observer down. In another mode you actually do vanish. We only have one of these."

"What will you use?"

"I'll take the .38 and the rifle. Back to your weapon, Doctor. Besides minor space-time puckers, at extreme settings a shockcomb can kill. See that switch? The weapon has a focused range of twenty meters and a spherical range of almost three meters."

Dr. Taleghani held up a hand. "Focused? Spherical?"

"Yes. If you want to move someone else in limited space-time, use focused mode." He touched the switch illuminating a tiny white light. "To move yourself through limited space-time, use spherical. It literally places you on the edge of an alternate dimension for a nanosecond, which will seem to you like anywhere from five seconds to half an hour, depending on the intensity. It picks you up and puts you down up to six hundred meters away."

"So, is this is a matter transmitter? I thought science had taken a vote and decided this was impossible."

"Next you'll be telling me the Earth orbits the Sun, Doctor. Actually, it is more of an interdimensional matter hitchhiker rather than a transmitter. Regardless, in spherical mode make certain you don't have part of someone else within range when you pull that trigger. Whatever's in range goes; whatever isn't stays. Messy." Pointing to another switch below the first, he said, "This is the intensity switch." Indicating the color-coded settings, he showed the positions for safety, space-time movement, and killing. "Remember to check your switches before pulling that trigger." He set the selector switch to spherical and the intensity switch to red.

"What's that?"

"Suicide," answered Gordon. He turned the intensity switch down to the 10 on the indicator. "Here. Stand close."

Frowning, the archeologist stood next to Gordon, who aimed the comb at the piece of cardboard. "See

our old target?"

"Yes.” Gordon pulled the trigger and the cardboard, apparently, vanished. “Where is it?"

"Look down."

Dr. Taleghani looked down and they were standing on the cardboard. “Amazing!” He looked up at Gordon.

"That was spherical mode. Let's try focused.” He adjusted the switches, handed the weapon to the archeologist, and began walking away. When he was fifteen meters from the archeologist, Gordon turned and faced him. He held out his arms. “Very well, Doctor. Aim, fire, and move."

Dr. Taleghani aimed at Gordon, pulled the trigger, and seemed to vanish. From behind him, Gordon heard the archeologist say, “I *like* it!"

They tried it out a few more times, then Gordon turned off the weapon and placed it back in his pack. “One thing more: each assembled shockcomb has a standby function that, unless it is reset every so often, makes it fire on its own: high energy in extreme tight spherical mode."

"It puckers itself out of existence?” said Taleghani, holding out his hands. “For what possible reason?"

"If an absent-minded professor, for instance, left one of these things out in the timestream, what might happen?"

The doctor's eyebrows arched. “Well, with no effort at all, whoever found it could become a wizard, always supposing he didn't kill himself first.” His expression changed to one of confusion. He said in a very quiet voice, “What's the point of the thing if they never allow anyone out of a capsule?"

"The weapon design preceded the regulations, Doctor. However once they saw what it could do, the powers that be decided to keep it and use it. I have it set for seventy-two hours."

"How does it recharge?” asked Dr. Taleghani.

"Just turn it off and leave it out in the sun,” said Gordon. “Next to a hot fire will do even better."

"I'm feeling much better about my contribution to our chances of survival, Gordon. Much better."

"Want to make another try at that .38? Never hurts to have a backup."

"Don't be absurd,” answered the archeologist.

* * * *

Just before departure early that evening, representatives of the International Temporal Span Authority, the consortium, the media, and the staff of Site Safar were in attendance, along with the head of Egyptian antiquities, representatives of the Egyptian and Libyan governments, and Mehmet's father. Captain Mansouri was even there, a frown hanging above the cigar stub stuffed in his face. Security this time, however, was courtesy of the Egyptian army. A company of regulars ringed the gantry and stood posts among the crowd while two more companies surrounded the entire site making certain there were no unwelcome publicity seekers, bomb-tossing or otherwise. Anything planning to cross above the site closer than fifty kilometers in altitude would be fried from the sky, according to the air force general who was attending.

There were television cameras and politicians, hence there had to be speeches. Both governments were

in trouble with their peoples, and the Safar Project's time span would be the farthest reach into the past that had ever been authorized. Perhaps the romance of this possible brush with another era might take peoples' minds off the violence, sickness, and want stalking the streets of both countries' cities.

In the blinding light cast by the TV and excavation floods, Dr. Taleghani waved and said a few cryptic words of farewell into the PA system—words that would be much less cryptic when the archeologist presented his living fossil Neo-Squanto to the world. Gordon wondered what their visitor would make of this sight, these people, these times, and what they would have to do to get the fellow to come along with them. They hadn't talked about kidnapping, although the original Squanto had to be taken by force.

Harith Fayadh was at the edge of the small crowd, being helped by one of the European archeology students, a blond fellow wearing white shorts, a faded yellow tee shirt, and a bleached straw cowboy hat. Harith wore only the white ankle-length dishdashah. Gordon nodded at Harith and the young fellow nodded back, revealing nothing by his expression save disappointment, a bit of anxiety, and a lot of pain. Wishes and prayers for a safe journey came from this one and that one, and finally Mehmet Abdel Hashim leaned toward the sound pickup and called time. "Dimensional windows and tide wait for no man," he quipped, causing a ripple of nervous laughter in the crowd. Mehmet's father, a tall man with his son's good looks, applauded and beamed proudly at his momentarily famous son.

As a number of reporters shouted questions at the same time, making all of their voices unintelligible, the three climbed the black gantry stairs, entered the capsule, and Mehmet pulled shut the hatch and sealed it. The tiny crowd did not dissipate. After all, the travelers should be back in under four hours local time, as far as they knew. Just going for a peek.

"You, Mr. Redcliff," said Mehmet, tinting the view plates against the glare of the floodlights, "have you been out before?"

"As a boy in Philadelphia. I got to see the signers of the Declaration of Independence."

"What did you think?" He flipped three switches that started the large generators.

"My friends and I thought it was a rip-off—a gyp. We wanted to see Custer's Last Stand."

Mehmet's handsome features frowned as he looked from his gauges at Dr. Taleghani. "And you, Doctor?"

"I too have been in a timespanner, Mehmet, much larger than this one. It was in Cairo at the university when I was a student. My friends and I also believed ourselves gypped. We were shown a lot of dust and desert with an occasional horse and rider vanishing into it. We had supposedly witnessed Muhammad's army of ten thousand on its way to persuade Mecca to submit to Islam. It could have been a cheap Hollywood production, from what little we could see."

"What did you want to see?" asked Gordon.

Dr. Taleghani grinned like a mischievous schoolboy. "Allah forgive us, we were Egyptian boys. We wanted to see Cleopatra."

Mehmet grinned widely and nodded. "I personally wanted to see Nefertiti. I did, however, get to see T.E. Lawrence and his Bedouins blow up a Turkish train."

"Was it as good as the motion picture?" asked Gordon.

"No," answered Mehmet. "The lighting and audio were terrible and no close-ups. Reality has much to live up to."

Gordon nodded. “That's been my experience."

"Very well,” Mehmet continued, “then both you barnacle-encrusted time mariners know there will be no perceptive spatial movement until we get to when we are going. Do not touch the hull once we start punching dimensions. I'll warn you when we start. Hull materials will become intensely cold. It won't be cold long enough to affect the capsule's air temperature significantly, but it will be cold enough to burn you rather severely should you be touching the wrong thing at the wrong time.” He held up a pair of thin white cotton gloves.

"I wear these just to be safe.” He nodded toward the formed plastic couches behind which they had stowed much of their supplies. There was a pair of white cotton gloves on the center couch and the couch to their left. “You may as well be seated. In a little over thirty-eight minutes—God willing—we should have you when you want to be. Then after we unload I go back for three weeks of unmitigated grilling and endless browbeating and guilt from my father for leaving the two of you behind."

"What if they ground you and the operation?” asked Gordon. “What happens to us?"

"We have rather good leverage should something like grounding the T-span happen,” said Mehmet, smiling at Dr. Taleghani. “Leaving you there for three weeks or so won't affect anything in the present. Anyone you might come into contact with will most certainly be eliminated by the combination of the shockwave and the floods resulting from the Kebira impact."

"Leaving us back there for years, however,” said Taleghani, his hands held up in innocent helplessness, “who can say what effects we might have? If we don't get picked up on time, perhaps we might just get it into our minds to strike out on our own, make a run for it, get outside the flood area, perhaps bring some of the locals with us. I fancy I'd get tired cutting meat with a stone knife and might let slip how to find iron and make things out of it. Might even have central air conditioning before long."

"That would put a spin on that old grain of sand,” said Gordon.

"We couldn't really do such a thing, of course,” said Dr. Taleghani. “Place all of human history and accomplishment at risk? The dynasties of Egypt? The pyramids? Unthinkable, although,” he smiled, “not unthinkable to the authorities, I trust. They'll let Mehmet return for us."

Taleghani sat in the center couch and Gordon sat to his right. After an uneventful thirty seconds during which Mehmet stood at the wall and studied his small panel of instruments, the view plates seemed to mist. White and fuchsia vaporous streams appeared in cones extending above the cabin's overhead view plate to an infinitely distant vanishing point. “As far as those on the ground are concerned, we're gone,” Mehmet announced. He finished checking his instruments and faced them. “In a few more minutes the stage will be finished with orientation. We're not just going back a few hundred years, so there is much to calculate concerning the movement of the African plate, the movement of Earth within the movements of the solar system, galaxy, and universe."

"What is next?” prompted Taleghani.

Mehmet took his place in the remaining couch, raising a small instrument panel from his left armrest. “Once we're oriented, we'll fold into the general location of the escarpment, run our time, fix our windows, then I'll steer through the arrival window neat as you please and put down where you want us to land.” Suddenly the cones of vapor vanished, revealing that the travelers were suspended high above the silica glass dunes under a full moon at night. Gordon and the archeologist got out of their couches, both of them looking down at the sands through the view plates.

"Mehmet,” said Dr. Taleghani, momentarily backing away from the hull, “what happens if I get sick?"

"Please don't, Doctor. Whatever isn't splattered all over you, me, and Mr. Redcliff gathers on the inside walls of the protective field. When the field collapses, the film collapses with it—all over the three of us. You must have brought some sandwich bags. If not, use a pocket."

"It might make sense to stop looking down," suggested Gordon.

"I agree," said Mehmet. "Please, Doctor. We're ranging the dimension edge. Get back in your couch and close your eyes." As Gordon and the archaeologist returned to their couches, Mehmet's hands became busy upon the controls as flashes streaked across the sky, everything taking on a turquoise hue. "Moving back," he said. "Very well ... Punching dimensions now. Touch no metal."

The turquoise hue abruptly went to orange, then midnight blue. Mehmet looked at his passengers and Gordon held up his gloved hands, as did Dr. Taleghani. "Excellent. A few days per minute accelerating by levels until we're close to ten millennia per minute. That's about as fast as I can take it with this portable. As we guide in to the proper time, I'll fine tune the locater, get the exact time on that meteor impact, then we'll sort and pick the window sets we'll use."

The view plates showed the dunes beneath began creeping, then walking, then flowing backwards across the desert as the passage of the sun and moon became a blinding river across the sky. Soon the dunes themselves became a blur, then vanished, leaving behind what appeared to be a gently hilly landscape stained ochre moving to pale green.

"Intermittent glaciation period," said Dr. Taleghani, all thoughts of being sick forgotten. "Before the complete advance of the desert. Oh, this is *magical!"*

"We're going through the seasonal cycles so rapidly," said Mehmet, "nothing can register except aggregate color. Look closely at one spot, you may be able to catch a glimpse of a tree trunk."

For the space of an eye blink the valleys between the hills were covered with water, then with faint green, replaced by more water, then green. Floods and ice fields that lasted for years passed in instants, each successive flood revealing more and more of the brick-red rocky cliff.

"The escarpment," said Gordon.

"This is the way to excavate," said Taleghani, nodding enthusiastically. "None of the evidence is disturbed and we get right down to what we want to see."

Gordon looked at the floodwaters below, the storms and ice averaged with calms into a smeared pale gray blanket from which the red cliff reached toward the flashing skies. As Mehmet slowed the movement back in time, the scene below was one of absolute devastation—almost a moonscape. Suddenly there was a flash that momentarily blinded them. When Gordon's vision cleared, he saw they were above a forested valley cut by a meandering river, a bend of which swung by the base of a tall red cliff. The cliff was much higher and shaped differently than before.

"There's your meteor strike, Doctor," said Mehmet, tapping with his finger upon a data screen. "Impact fix is automatically logged into your locators. Look toward the south."

Gordon turned. In the distance was a huge mountain—the cone of an inactive volcano, its craggy flanks white and heavy with snow and active glaciers, the exposed rock cliffs appearing hazy blue. It was a massive peak, dominating the landscape.

"Kebira Mountain," whispered Dr. Taleghani. "Oh, I wish Numair—Dr. Hussein—could see this!"

The flashes in the sky slowed, revealing the vegetable life along the banks of the river. As Gordon looked

at the distant mountain, he felt a strange sadness in his chest. The mountain towered above everything, its icy summit glittering in the sunlight. It was the kind of mountain that would be sacred to a people who needed to see their gods. Gordon had seen Mount Taylor, the southernmost of the Four Sacred Mountains called *Tsoodzil* in Navajo religion. It too was an ancient volcano, its sacred stone the turquoise. Mount Kebira was about the same height above sea level but seemed so much more impressive because the lands surrounding Mount Kebira were only hundreds of feet in elevation instead of thousands. This mountain would be a god to anyone living in its shadow.

Mehmet looked up from his instruments. “I show 194 days from our arrival window until impact. Your original window arrival and departure set appears good, Doctor. A very good guess."

"Excellent, but that's rather more time until impact than I'd thought."

"You'll get in your full three weeks on the ground,” said Mehmet, “and with a good safety margin in case of mishaps.” He pointed at a readout. “There are two additional useable return windows from near here, Doctor. The next opens forty-six days after the first. The return there is a place close to the west coast of Mexico called Ahome. Ninety-two days after that a window opens that returns in Tokmak, Ukraine. Not ideal, but useable."

Gordon looked to his right, toward the base of the cliff along the riverbank. Dr. Taleghani had been right in his interpretation of the AHDI survey images. It was a village, most of the dwellings round. Some appeared to be made of sod, others of wattle and daub, a few large tents made of painted leather. The houses had single entrances facing east and thatched conical roofs with smoke holes in their centers, making the homes resemble traditional Navajo hogans. Some of the round shelters had larger round shelters attached to them. Two of the round structures, located toward the center of the village, were much larger than the others. Gordon could easily count more than two hundred houses, with more hidden by folds in the forested hills. More square wooden and mud structures, skin shelters, and lean-tos. Away from the village, tucked away in draws and along the river shore, he could see the glint of an occasional fire. It was bloody London, as Dr. Taleghani had said. Several thousand persons living in close proximity spoke of agriculture, trade, numbers, writing, community social organization, clans, law, common defense, perhaps even a larger organization—a nation. And all this before any of it was supposed to exist. Of course, all this was wiped out, hidden beneath an ocean of mud before anything these villagers were, did, or imagined could contribute to the future.

"What are you thinking right now, I wonder,” said Dr. Taleghani. Gordon turned and the archeologist was feasting his eyes upon the village he had theorized and had now proven to exist. “When you see that, Gordon, how advanced they are, what does it make you wonder?"

"I was wondering how many times over the millennia have humans used intellect, effort, and industry to reach up from barbarism and want, only to be knocked back down by chance circumstance."

"Fascinating evolutionary question. If we could ease the regulations on timespanning, we could find out. Theoretically, we could trace your family tree on back to the bacteria in the primordial sea."

"Or to Adam and Eve, or First Man and First Woman from the Black World, or Unkulunkulu's creations, or Ymir's children, or visitors from another solar system stranded on Earth,” said Gordon.

"Which is it, I wonder."

"Not enough persons wonder,” Mehmet chimed in.

Taleghani looked at Gordon. “Give us your take on the future, Mr. Redcliff."

Gordon smiled and shook his head. “Doctor, I don't believe a desire for truth will ever overcome the investment so many have in what they hope is true."

"Perhaps our little expedition will aid in lessening that investment.” Dr. Taleghani rubbed his hands together. “Look at all this. I'm jumping with excitement. Is this what it's like for a Christian child Christmas morning?"

"I wouldn't know,” answered Gordon as he looked at the instruments on Mehmet's hull panel. Using the common calendar, it was one hundred and thirty-nine thousand years and change BCE. The image of the red cliff fuzzed into a mix of meaningless colors.

"Approaching the window,” warned Mehmet. “Buckle in.” As they secured themselves in the couches, fuchsia and white ribbons of vapor reappeared above them. The vehicle suddenly yawed as though the craft had been shoved by an ancient wind, which made Mehmet's head snap up to look at the instruments on the hull panel. Then the hull was slammed by a force that made it scream as it cracked. Before anyone could utter even a cry, sudden coldness flowed over them. As he lost consciousness, the film of tears on his eyes freezing, Gordon thought that this must be what it feels like to be dipped in liquid nitrogen.

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Pain like inflatable devils trapped inside Gordon's eyes attempting to eat their way to freedom, then deeper pain as something gnawed at his guts. He was the giant, Coyote deep inside him, cutting off pieces of his guts to feed the starving people trapped there. Coyote asked where the giant's heart was and someone pointed at the volcano rumbling and smoking in the distance. Coyote took his knife and cut a great hole in the giant's heart, the lava flowing from the wound.

As the giant died, Coyote led the people to freedom....

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There was the smell of wood smoke, herbs, and cedar. Sounds of movement came to him, a soft musical voice whispering something between a song and a prayer. There was a gentle hand on the back of his neck, a taste of warming broth, a glimpse of tear-filled eyes, then he returned to the universe of soft whirling darkness, yellow eyes watching him from the deep shadows, two silver figures shimmering then vanishing in the light of the fire, his life force wasting away as the witch people sang the Hard Flint Song.

He was facing north, the direction of evil, and all was coming to an end. Something had gone wrong, he was dying, and the witches had come to pull him into the maze. He reached out his hands to the old man and the young man—Hosteen Ahiga and Phil Andreakos. But they were both as dust caught by a witch's wind. Two others, though, were waiting there for him. One had eyes, the other a mouth. The mouth called his name.

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He felt himself edging from darkness into twilight—the smell again of wood smoke. The air moved and an icy breath touched Gordon's right cheek. The pain in his head soared almost beyond feeling. He allowed the pain to push the dream images from his mind's eye. Gordon tried to move, but he was too weak. More smoke as the gentle wind shifted. Oakwood and cedar burning. He closed his eyes and inhaled. Pleasant odor. The smell of the pueblo away from the village, back in the hills. And Hosteen Ahiga. A scent of winter. Iron Eyes always smelled of wood smoke in the winter.

"God'n? God'n?"

A voice.

He thought about opening his eyes. The thought itself hurt, so he stopped doing that. The right side of

Gordon's head felt as though it had stopped a freight train. The air was cold on his face, though, snowflakes touching his brow, cooling it. He felt a flake on his nose and tasted one on his tongue. He opened his eyes to tiny slits, a blur of images spinning to his right. He forced his eyes to focus on one thing—a vertical stick—until the remainder of visible reality settled down.

Vertical stick. Its upper end forked. End of a cross pole in it. Support for the lean-to in which he found himself. Firelight reflected from the pole's surface. Dark beyond the pole: Snow, trees, and shadows. It was night. Snowing lightly, the flakes small and dry.

He turned his head gently to his left, the pain in his head making him lightheaded. When he could risk opening his eyes once more, Gordon saw in the swim of images that he was in a lean-to thatched with cedar boughs. Looking to his right he saw that the open side of the shelter faced a fire in a ring of stones. The biggest of the stones, a gray plate the size of a car wheel, was on the far side, reflecting the heat into the lean-to, a pair of ghostly images beyond the rock plate dissolving in the light. The ground outside was white with a thin coating of snow. He could feel he was on a warm pelt-covered bed of more cedar boughs, their fragrance mixing pleasantly with the smell of wood smoke. Gordon was covered with a blanket of fur and also by a very warm human body. He risked glancing down.

"God'n? Mina ah tu?"

He forced his eyes to focus. There was the face of a young woman among the fur covers looking up at him. Middle twenties, maybe. Her complexion was a tannish-sandy caramel, quite fair, her hair straight, pinkish brown in the firelight, and braided with little white dried flowers. Her face was roundish, her dark, almost Asian eyes separated by a very Roman-looking nose. “Squanto?” he asked in a rough whisper.

She looked surprised, grinned, placed her hand against the fur of her coat, and said, “Nom. Nom*at*. Pela. *Peh*-la.” She placed her hand on Gordon's breast and said, “God'n.” Returning the hand to her own breast she repeated, “Pela."

"Pela,” he repeated. Gordon studied her face and it seemed like it was in the wrong time. Pela was no stooped-over, heavy-browed, shaggy-haired Neanderthal. But, then again, her people had all been wiped out without leaving a discoverable petroglyph or tooth by which to remember them. A good question for the archeologist.

He gingerly raised his head and tried to look around. The woman took his chin in a firm but gentle hand and drew his gaze back to her face. She was shaking her head, sadness in her eyes. “Tallygan, Mimmit,” she said as she held up two fingers, shook her head, then placed the palm of her left hand against her left cheek, closed her eyes, and tilted her head over on her left side. With two fingers of her other hand she pinched her nose shut. It didn't look to Gordon as though the two Egyptians had made it.

With a great effort he propped himself up on his elbows and gestured with his head in one and then another direction, regretting both movements.

"Eta?” she said.

Where. Gordon nodded. “Eta."

Pela pointed toward the foot of the shelter. Limb by limb, Gordon struggled from beneath the furs, stood, and steadied himself by holding onto the trunk of a sapling as a wave of faintness and nausea hit and passed. Opening his eyes once again, he looked into the darkness. Pela was standing beside him wearing a suit of furs. He had only a moment to admire the furs when the cold suddenly cut through his light desert clothing like a thousand razors and began running his headache into the red zone. He sagged, wrapped his arms around his shoulders, and peered into the dark. From where he stood he could see two crude

graves that had been scraped into the soil, the dirt and stones heaped upon the bodies, a dusting of new snow on the fresh dirt. “Hell,” he whispered to himself as sadness filled his heart. The archeologist and his former student had paid a steep price for Coyote's lesson.

He squatted and pressed his thumb and index finger against his eyes. By the time he took his hand away, a small part of the pain and dizziness had subsided. He looked at the graves once again, then noticed beyond them a strange shape reflected dully in the firelight. A few meters past the graves, jammed at a crazy angle between the shredded trunks of three cedars, was the hull of the timespan capsule, the side facing him crumbled like a sand sculpture too long past the sculpting. The hole in the hull made an opening larger than the hatch door that was now so much dust lost in the falling snow. As he watched, another piece of the hull dropped from its place to the dust beneath.

He had only begun to wonder what they must be thinking at the empty gantry at Site Safar when the world starting spinning again. The invisible electric ice pick slammed into his right eye and he clutched at his head. There was a tug at his arm. “God'n?"

"Pela.” He waited until the pain in his eye eased, stood, then turned and looked down at the woman. The top of her head came up to the middle of his chest, and she had a white fur cap on her head that would've been the envy of any fashion model in Paris or New York. She handed him a white fur robe that had a hole cut in it for his head. Pela held it up for him to put on, which he did. His shoulders and upper torso immediately began to warm. She indicated with her hands and the hat on her own head that she was making a hat for Gordon from the circle she had cut from the fur he was wearing and from some other pieces. Very special hat.

He nodded toward the graves. “Taleghani, Mehmet,” he said. Squatting down he drew a disk in the snow and a crown of flames around it and pointed up in the sky.

"Ekav,” she named the sun. With his finger Gordon traced a path across the sky from one horizon to another, perpendicular to the lay of the bodies in the graves.

"Nom,” she answered, tracing the path of the sun from one end of the graves to the opposite horizon. It took very little time after that to determine in which direction the doctor and his student's heads were pointed. They both pointed east. Suddenly he felt very tired and remarkably silly. What did it matter in what direction a corpse was buried in this time? Mecca wasn't even a settlement yet, Abraham's deal with his god still a hundred and thirty-five millennia in the future. The ancient Babylonian gods Abraham rejected to follow his god weren't even theories. Neither was Babylon. Still, the east was sacred. The rising sun does that to those who want to move in tune with the universe.

Pela tugged on his arm to coax him back to the lean-to. He showed her with his hands he would remain for a time and she should leave him be. She nodded and returned to the fire. Gordon saw a log on its side, went over, brushed the thin layer of snow from its top, and sat on it heavily, facing the graves. When he was certain he wouldn't pass out, he pulled the fur up around his neck and ears.

He had known the archeologist and the Timespan pilot only a few hours. “Didn't take me long to get caught up in the doctor's vision, though,” muttered Gordon. He lifted his right hand and touched his right temple. There was a large scabbed-over cut there that extended up into his hairline. After touching the wound, he sniffed at his fingers. They smelled like pine sap. Pela had treated it with something. Gordon lowered his hand to his knee.

"So, Doc,” he whispered to Taleghani's grave, “what's Plan B? Hang in here and hope Harith and Mehmet's old man can organize a rescue?"

How long to arrange for another timespanner, he wondered. How long to get permission for a rescue?

There was a return window in twenty-six days, but when would be the next arrival window? Before the end of the twenty-some days. And the next? It could be in fifty days or five months. Meanwhile what?

Strange sounds in the night answered his questions—something between a moan and a whisper. He wasn't sure he hadn't made the sounds himself. And meanwhile? He smiled as he imagined the archeologist standing before him. “Meanwhile,” he whispered, “don't do anything permanent.” Do nothing that might be projected into the future. Watch out for those grains of sand.

He studied Taleghani's grave, attempting to focus on it through a brief pass of ripples like heat waves above a blistering hot road. “So, Doc, Plan B is to sit around waiting for a ride or until Mount Kebira blows up all over me."

Gordon slowly stood, fighting waves of dizziness, then turned and looked through the trees across the river to the village. He could see only the white cones of thatched roofs dusted with snow. Deep in the trees to his right were the whispers of moving paws. He glanced in that direction, his heart quickening. He smiled at the reflection of yellow eyes looking back at him. “You've taken me down a path this time, Coyote,” he said. “The lesson, though, is still a little unclear."

Reality began to pitch and yaw with his weakness and he turned and stumbled back to the lean-to. Once there he gingerly climbed beneath the covers next to Pela, fully dressed in her furs. After a moment he began exploring his own body with his fingers, looking for injuries. Legs, neck, head, and back sore. Nothing broken. Nothing cut but his head, which seemed to have borne the brunt of his trauma.

His watch and silver belt buckle were missing. No, there was a bit of the buckle left in the hand-tooled leather where it had been attached to the belt. Half of the prong had been left dangling in a hole in the belt's tongue. He picked it out and looked at it. The silver surface was dull, resembling a cold solder joint. Holding it between two fingers, he squeezed gently. The piece of silver instantly transformed into powder. That was what must have happened to his watch, he realized, and to the capsule. He called to mind the sensation of the capsule moving that had alarmed Mehmet so. One of the dimensions they'd nudged into on the way to Pela's village must have nudged back.

Titanium into flour, silver into talc—what must physics be like in that other place, he wondered. Gordon decided that when he was able he'd inventory what he had left in the way of weapons and supplies. Anything that used metal was probably going to be useless. Tonight, however, he would rest and try to learn a few words of another language: body parts, camp items, terrain and weather features, animals, plants, foods, a few verbs, an adjective or three. After that, maybe tribes, organization, defenses, weapons, what's going on in Pela's world, who calls the shots, and what gods justify insanity in this time and place.

Sooner or later he would have to address the big one for himself: stay in the village where Harith and the timespan bigwigs knew when and where to find him, or get the hell out of London before the meteor hit and turned the village into a bloody mud bath. And did he even want to survive almost a hundred and forty thousand years out of his own time?

He gestured toward his mouth, then pointed at his head.

"Chola,” answered Pela, touching her own head. “Amu,” she continued as she touched her mouth. Later, as she pointed at body parts, snow, things in the camp, and said the words, Gordon tired and the pain filled his head until it took him deep into the shadows and left him there.

* * * *

**II*

The new sun came up soft and peach-colored, the beams of the new day caressing the freshly fallen snow through the cedars, the sound of a distant rooster greeting the light followed soon by the momentary barking of a dog down in the village. Gordon listened to the sounds, allowed his gaze to note and record every aspect of his surroundings before it settled on the wisps of smoke from the fire's coals climbing into the icy air. Wood smoke. The smell of it brought Hosteen Ahiga before his mind's eye, the old man in the reservation hat always outside the New Meeting House on the Jemez Mountain Trail near Buffalo Hill Road, sitting on a bench next to the Coke machine, smoking cigarettes. Adults driving by would wave, call out greetings. Those walking by would nod their heads in acknowledgement, present a new wife, husband, baby, or a child who had accomplished something special. The only response they'd ever get from the old man was a nod. Once in a rare moment he would repeat the name of a presented child. His gaze, however, was always fixed out there on some vista invisible to other eyes. Young boys making fun of him would call him Iron Eyes Ahiga and say the old man waits for the return of Goyaaté, the leader the Bilagana called Geronimo.

That February afternoon when Gordon was eleven, after another day fighting in school, he ran away from the place and hitched a ride to the trail, hoping to get a ride down to Route 44 and from there to anywhere. Life as a Pueblo Indian sucked, and life as the son of a Navajo witch sucked even more. Walking south toward Buffalo Hill Road, Gordon passed by the meeting house and saw Hosteen Ahiga next to his Coke machine, sitting, smoking, staring with unblinking eyes at whatever it was he was seeing. The old man had on a heavy olive-colored wool coat with dull rust-colored horizontal stripes in homage to the winter.

Unfocused anger was Gordon's constant childhood companion, its occasional focusing landing him in most of his difficulties with authority. At that moment the apparent unremitting serenity of another angered him more than anything else. He climbed the meeting house steps and stood in front of Hosteen Ahiga. The old man smelled like wood smoke. Gordon stared with his own unblinking gaze into the old man's eyes. After a minute of this futile attempt at staring down Iron Eyes, Gordon began to suspect the old man was blind. He was not, however. At last Hosteen Ahiga said, “Grandson, my mother was Joan Blackdeer of the Coyote Pass People. My father was George Ahiga of the Folded Arms People. You are Gordon Redcliff. Your mother, Nascha, was born to the Coyote Pass People, which makes you Coyote Pass. Your father—"

"My father is gone,” Gordon rudely interrupted the old man.

Hosteen Ahiga's face cracked the tiniest of smiles, the wrinkles at the corners of his eyes deepening. “Fathers and mothers never go completely, Grandson.” His eyebrows went up as his shoulders gave an apologetic shrug. “That's DNA for you,” he added.

Gordon, fighting to keep his angry expression and attitude, said, “What about my father, old man?"

"Niyol Redcliff was born to the Bear Enemies People in Santa Clara. Eleven years ago he stood where you are standing and told me he was going to Hollywood to get into movies."

"Did he tell you, Grandpa, why he ran? Why he left us?"

The old man nodded, his unrelenting gaze fixed on Gordon's eyes. “He said your mother was crazy as a corset full of frogs, and he couldn't stand it anymore."

Gordon blinked and looked down. “Why didn't he take me?” he asked.

Hosteen Ahiga allowed the question to answer itself as he shifted his gaze down the Jemez Mountain Trail, windrows of dirty snow beneath darkening clouds that promised yet another winter storm. He looked back at the boy. “Your mother is sick, Gordon. There is nothing anyone can do for her except be

there."

"The Christians over on Mission Road say they pray for her," said Gordon. "Prayer is talk, and talk is cheap."

The front rim of the old man's hat dipped slightly. "As I said, there is nothing anyone can do for her except be there. Being there was too much for your father." Hosteen Ahiga leveled his gaze at Gordon. "Perhaps you are stronger."

Gordon looked down the road that promised to leave all his nightmares behind. He heard the old man say, "Coyote teaches much, Grandson, but his lessons are expensive. The Trickster's wisdom is to lead us down paths right into trouble just to show us why those aren't the paths we should have traveled."

"Useful knowledge delivered too late, you mean," cracked Gordon.

"Better late than never," countered the old man. "But when a path seems attractive, take a moment to ask yourself why it seems that way. It might be that it is the path you should follow. Maybe, though, what makes it attractive is something that needs fixing here. Every path has a lesson for those sharp enough to see it."

Gordon sat next to the old man in the cold for two more hours, the new storm fast upon the pueblo, listening to the old man, watching the snowfall, hearing from Hosteen Ahiga many of the things he should have heard from parents, grandparents, uncles, teachers, and friends. Then Gordon turned up his collar against the storm and walked across the river up into the foothills to Nascha Redcliff's hogan. The next morning before sunrise, standing with his mother in the new snow upon Bear Rock, Gordon helped Nascha bring up the sun and defeat evil.

Seven years later, near the end of Gordon's senior year in high school, Nascha Redcliff died in her sleep. Hosteen Ahiga, one of his sons—Jim Ahiga—and council member Michael Sweet came and did what no one could do when Gordon's mother was alive: bring her into the Diné. Naked except for moccasins and ashes, Hosteen Ahiga and Michael Sweet washed and dressed Nascha's body. By the time they were done Gordon and Jim Ahiga had finished chopping through the logs on the hogan's north side. Iron Eyes and Mike passed Nascha's body through the corpse hole where it was received by two Bilagana funeral home men who took care of the burial. Hosteen Ahiga plugged up the smoke hole and Mike Sweet boarded up the east-facing entrance, abandoning the hogan forever to Nascha's ghost. Before the sun was down, Nascha Redcliff's body was buried and Gordon was sitting next to Hosteen Ahiga on the meeting house bench waiting on the bus to his future.

"Now she is Diné," said Gordon.

"Better late than never," said the old man, a twinkle in his eyes. "Mike said the school would send you your diploma."

"Thank you for your help. I didn't thank your son or Mike Sweet. Could you tell them how much I appreciate their help?"

Hosteen Ahiga nodded. "I will tell them."

The exaggerated hiss of the bus stopping across the road signaled the need to end goodbyes. Before Gordon could say anything to the old man, Hosteen Ahiga handed the boy a small package wrapped in blue cloth and tied with a thin strip of leather. "Take this, Grandson. In the times to come, wear it when you can."

Gordon opened the package and in it was a black hand-tooled leather belt with silver tip and buckle. The leather in the belt's center was worked and stained into an image of Coyote. The rest of the belt was dotted with stars against a night sky. The buckle also carried an image of Coyote, one eye closed in a wink. On the inside of the belt was the maker's name: U. Ahiga. “You made this? Are you U. Ahiga?"

Hosteen Ahiga nodded.

"This is beautiful. Thank you.” Gordon put on the belt. After admiring his present, Gordon frowned and looked at the old man. “What does the *U* stand for? What's your first name?"

"Ulysses. My father named me after Ulysses S. Grant."

"Why? He was a terrible president."

"True. But Ulysses S. Grant was a great warrior, Grandson, who wrote a great book that my father read from cover to cover and finished the last page just before I was born.” He grinned widely and laughed. “I much prefer Iron Eyes."

Laughing, Gordon got on the bus that would take him to the Army recruiting station in Albuquerque. He took a seat, waved at the old man through the window, and saw the old man wave back as the bus pulled away. In basic training five weeks later he was notified that Ulysses Ahiga had died in his sleep two days before. He had been just short of his ninety-sixth birthday. Wood smoke: Hosteen Ahiga always smelled like wood smoke in the winter.

"God'n head,” said Pela, interrupting his reverie. Gordon turned and looked at this woman from another time lying next to him. She tapped the side of her own head with the heel of her left hand, “God'n head full *ashili*.” With her hand she made like a multi-legged creature crawling across the ground. Bugs. Pela drew a picture in snow. Ants. His head was full of ants. He smiled. His head was overfilled with thoughts, worries.

"Pela sees much,” he said. He looked at her crestfallen expression. “That is good,” he quickly added. Her smile returned.

"God'n head hurt better?"

"Some better.” He held the thumb and index finger of his right hand closely together.

"Tahi,” she said.

"Some better a little,” he answered her.

She pulled down the furs covering her, climbed over Gordon, and began coaxing the fire to life by placing scraped birch bark, dried grass, and tiny cedar slivers on a few coals and blowing upon them. When she had a flame, she began adding sticks. “God'n ants what?” she asked, without looking back at him. What was he thinking about?

"Old man."

"Father?"

"Tribe elder; gifted in years.” Gordon tried to represent what Hosteen Ahiga had meant to him with the words he knew in Pela's language. Still much to learn. “Good man,” he said. “Like father."

"How many summers?” she asked.

He thought for a moment, then flashed nine sets of ten fingers at her followed by five fingers of one hand and one from the other. She appeared stunned at the age Gordon claimed for the elder. “Much gifted in years,” she said.

Gordon pulled down his cover, rolled painfully to his side, struggled to his feet, and stood holding onto the lean-to's cross pole for support until a wave of dizziness passed. As he reached down to get his white fur poncho, every muscle in his back and legs protested.

He slipped on the poncho, a pain in his right shoulder making him grunt. With his fur poncho on, he grabbed again at the cross pole as another wave of dizziness washed over him. When he could again risk opening his eyes, he saw on the bed of cedar boughs his new hat. He bent over a second time and picked it up. The circle Pela had cut from the white fur poncho to make a hole for his head served as the top of the head covering. Its sides, however, were made of a deep black fur that felt like mink. He touched its softness with his fingers, stroked it against his cheek, and smelled the herbs with which Pela had treated the pelts. It smelled of balsam fir. He placed the hat on his head, and it fit comfortably over the tops of his ears to keep them warm. Out of the corner of his eye he caught Pela looking up at him.

"God'n like hat? Want change? I fix."

"I like hat.” He didn't have the word for perfect. “I like hat very much."

A river of pain flowed behind his eyes, he held the cross pole tightly as his knees sagged. As the pain lessened, he felt her standing next to him. “Head hurt not so better,” he said with a smile. Time. He didn't have the word for time. “Better a little soon.” He squeezed her arm.

She nodded, feigned business as usual as she turned and added another stick to the fire. He frowned against the pain, thinking that Pela was waiting for something. The thinking was hurting his head right then, and he turned and began pulling himself toward the graves, one halting step after another. Once past the shelter, he stood looking across the valley with its still unfrozen waters.

Gordon looked down at the river, reviewing his lessons from Pela. The river's name was Avina. She was the goddess who gave them water, fish, reeds, sewing thread, medicinal and beauty herbs, shellfish, skin mud, and building mud. Avina cleaned their clothes and bodies and rose once or twice a year to replenish the intervale lands for planting. The gentle river gave no hint that soon she would become an endless towering column of mud, rocks, and shattered trees that would seal this entire valley with death.

He looked up at the sky: Davimo, god of the day sky. Smoke climbed up to the god's face from dozens of smoke holes. He heard a voice. As Pela worked at the fire, preparing to cook, she was singing to something up in the sky, but not Davimo. She would be singing to Tana, the winged wolf-woman goddess of maidens and widows. In this age, no woman considered herself complete without a man. Conversely, no man considered himself complete without at least one woman. In his entire life, Gordon had never felt complete. Perhaps, he mused, it was the lack of a woman. Allowing the thoughts to fall from his mind, he turned and looked at the graves, momentarily seeing again those heat ripples rising from a cold and lonely place.

As near as he could understand from Pela's description, Mehmet had been missing part of his head. He'd probably caught a piece of the imploding hull as the metal weakened, Gordon speculated. Pela said Taleghani hadn't had a mark on him. Old guy, though. Probably had a chest full of modern medical miracles—replacement valves, pacemaker, wire leads. Suddenly everything metal powders and stops working, stops conducting electricity. The former Egyptian major who couldn't be trusted with a loaded sidearm and who wanted to bring Squanto from the past to speak to the future was now alongside his devoted student, groceries for prehistoric worms.

"My religious sensitivities," muttered Gordon to himself in Towa, recalling Taleghani's question from another age. He pulled the remains of his belt from its loops, held it out, and looked at the leather image of Coyote. Gordon draped the belt around his neck, looked up, held out his arms, faced his palms toward the sky, and searched below the tree branches for shadows. After a moment, one of the shadows seemed to move.

"I see you, Coyote. You reach back even to here," he said. "No such thing as a joke too old for the Trickster, eh?"

The shadow didn't move.

"So, here I am, Gordon Redcliff, your tool and plaything. I'm still on this side of the dirt and once again have no explanation for that. Since I am still alive, however, I have two small requests to make of you, Yellow Eyes: one new, one old. The new request is this: Give up just a little bit of your joke. Let the ghosts of the two Bilagana, Ibrahim Taleghani and Mehmet Abdel Hashim, let them walk among Pela's people so they can see and learn what they can before the meteor hits, the mountain shatters, and Pela's people vanish. Ibrahim and Mehmet paid a big price to touch this part of the past. Is it so much to ask to let them steal a look at what they paid so much to see?"

He lowered his hands and looked up from the shadows to the few clouds hanging motionless before the rising sun. "The old request, Trickster? It is what it has always been: Before you close my eyes for good, Coyote, let me understand the joke."

Gordon pulled the fur wrap more tightly around his shoulders and stood for a moment in silence. The shadow in the deep woods moved again and then was gone. After a pause, Gordon walked beyond the graves to where the timespanner vehicle had been. All evidence remaining of the vehicle consisted of three crazily tilted cedars, their facing trunks stripped of bark and branches, and a lumpy pile of greenish powder at their bases lightly covered with snow, strips of gray plastic molding and gasket material sticking up from the mound here and there. Some of the lumps were chunks of hull that hadn't powdered completely. A touch was all it took. He dug into the powder with a stick and his hands. It was like playing in hellishly cold, coarse, dry wheat flour. He felt something hard and pulled up something large and plastic. The couches were still whole. They'd make great patio furniture for some leisure-burdened ancient, once leisure and patios were invented. He pulled the other two couches from the dust and placed them aside.

He found the plastic containers of food bars and water as well as his pack and the doctor's. The thin plastic was cracked and shattered. The food supplies that were not encased in metal appeared all right as well as a few of the medical supplies. His personal knapsack was made entirely of leather and was in excellent shape. Taleghani's knapsack relied upon metal rivets, buckles, and rings and had fallen apart. Something red and sticky had burst inside, as well, and had eaten the fabric. Inside the pack were the remains of Taleghani's changes of clothes, camera, and recording devices—all useless.

The rifle's plastic stock, the lenses from the scope, the smokeless powder from the ammunition now contaminated, and the shockcomb were all that remained of the weapons. He regretted the loss of the fighting knives. He had noted Pela doing her cutting with a flint knife. Gordon saved the lenses from the scope and placed them in his bag.

From the bottom of his pack he picked up the small olive-colored locater and adjusted down the readout screen's light intensity level. It still worked. It was based on the same technology as the timespanner and shockcomb. The assortment of readouts, it had been explained to him by Dr. Taleghani, would let them know when the window is about to open, where it is exactly, and would let Mehmet know where they were when he came back to find them and good old Squanto. All automatic.

"Except that the fellow who can read the instrument is dead, the pilot who is to come looking for us is dead, the ship that is to pick us up is so much powder, and Squanto apparently has other plans." There was one part he could read, however: 191 days until impact. He glanced at the shadows. Yellow Eyes was back, looking at him, whispers of paws in snow, the Coyote People maintaining their watch. Gordon poked through Taleghani's pack until he found the doctor's locater. Its case had been eaten through by the red goo, and the screen was dead.

If a rescue ever were attempted, Gordon could still be found. Once found and returned to Site Safar, however, the authorities would be looking for someone to blame for the deaths, for the unauthorized intrusion into the past, and for the destroyed vehicle. "I wonder who that will be," Gordon muttered facetiously to Coyote. He replaced the working locator in his bag and opened one of the energy bars. As soon as he tore the wrapper a foul odor assaulted his nostrils. He opened another. All of the food was either spoiled or contaminated. Something in the food or in the wrappers had reacted badly when the vehicle's metals altered properties. He'd have to rely upon local fare.

One leather bag, one shockcomb, a set of lenses for a low-power telescope, a time locater, a change of clothes, the Widow Pela, and one hell of a disaster coming in a matter of just a few months. There was a moment of dizziness, the images of his two fellow travelers flashed before him, then all pain left him as he watched the snow-covered ground rush up to smack his face.

* * * *

"God'n? God'n all good?" came Pela's voice through the fog. As the pain filled his head he opened his eyes. It was dark again and he was in the lean-to, Pela's seated form silhouetted by the fire behind her. She must have dragged him there. He guessed he must outweigh her by twenty or twenty-five kilos.

"A little good," he said. He thought on it, the pain beginning to diminish, becoming a dull presence rather than a stabbing insistent maniac. "Better good," he said gingerly sitting up. "Food?" he asked her.

Pela grinned widely. "Food good." She turned toward the fire, reached, and brought back some kind of toasted bits of meat stuck on a cedar stick. The pieces of meat were bigger than if they'd been from a mouse. Rabbit, maybe. He pulled a piece from the end of the sharpened stick, and it was rabbit spiced with something resembling chili and honey. With it came a wooden cup filled with a hot tea brewed in a fired ceramic pot. Before he knew it Gordon had cleaned the stick, which was all the compliment Pela needed. She presented him with another. While he ate, she gave him his numbers and showed him how to write them. The system resembled Roman numerals without the subtraction. A four was four vertical slashes. A five was a big dot resembling a fist. A ten was two fists crossed at the wrists—an X. Fifty was a hollow box and a hundred, a solid box. "Old man, like God'n father," she said, and marked ninety-six in the snow:

* * * *

[] XXXX*I

After praising her cooking and thanking her for the food, he closed his eyes, images of ghosts merging with Pela's songs to Tana and fading memories of school numbers. Before he drifted off, he opened his eyes barely to slits, his gaze drifting to the fire. Shimmering beyond the reflective stone plate were two transparent figures standing there, watching him. Then they seemed to dissolve into the night. Gordon closed his eyes.

The old ones in the Diné believed in ghosts. Even the Christians in the pueblo carried the fear. Gordon remembered telling Phil Andreakos that snipers cannot afford to believe in ghosts. With the body count his unit was racking up, they'd have to issue spectral hotels to house all the ghosts generated. Simpler not to believe in them. *"But,"* Gordon's spotter had observed, *"not believing in ghosts won't get rid of*

the ones that are real."

It was a put-on. Phil used to kid the other troops in the unit about him and Gordon taking scalps on the battlefield, hanging them on their lodge pole, absorbing their mystical powers. They didn't even have a lodge, much less a lodge pole, but Andreakos loved putting on the replacements. Phil once found a dead horse outside Ahvaz and cut off its black tail and mane. He'd dangle little clumps of hair bound with rawhide from the tree outside their tent, wear them from his battle dress, and give them as little gifts with a deadpan stare saying, “The Great Spirit grant you this warrior's strength.” Then Phil would hold his hands out, embrace the skies with his dark-eyed gaze, and chant gibberish. *Ha te, makka me te hey, ya ya* and so on. The recipients of these gifts would sometimes ask Gordon about it and he would always give them the same response: an Iron Eyes stare from an expressionless face. He'd nod once and say, “Andreakos really know how to sharpen knife."

A French reporter got wind of it somehow and the international news media went into multiple orgasms about US troops scalping dead Arab and Iranian soldiers, selling the scalps as souvenirs. Then a lone sensible reporter had a belated DNA done on one of the “scalps” and it turned out to be one hundred percent Arab all right—Arabian horse. The company CO called Gordon and Andreakos in, but as soon as the captain clapped eyes on the pair he burst out laughing. They gifted the captain with a prime scalp for his lodge pole.

Ha te, makka me te hey, ya ya.

Gordon felt the smile on his face. The memory of the Long Island Macedonian was alive in Gordon's memory. Ghost enough. He opened his eyes again and glanced at the fire. The shimmering images had seemed to emerge from some other plane of existence. He wondered if they were hallucinations from being whacked in the head. Perhaps they were leftovers from his brush with that other dimension. Maybe they were indeed the wandering spirits of the dead—

The images emerged from behind a rippling curtain of existence, the light waves passing through them distorted. The two figures seemed to turn toward each other for a moment, then face him again. Gordon closed his eyes. Real or not, he needed to rest. As he allowed the sleep to take him, he smiled and whispered the Chant of Fulla Bull he had once learned from that great warrior and U.S. Army shaman, Scalper of Dead Horse:

Ha te, makka me te hey, ya ya...

* * * *

**III*

The next morning all his hallucinations and mental wanderings had left him, along with his headache. He gingerly poked at his head wound, tried to make the headache come, but it was gone. For the first time, Gordon felt he was mending. He told Pela he wanted to walk, to see, to talk, to eat. She rolled a few food items in a skin, placed it in Gordon's pack, slung the pack over her shoulder, then took his hand and slowly led him through their camp to a trail through a dense growth of cedars. He found walking the trail difficult, his headache returning and spiking in intensity after a few stumbles. After awhile the crisp clean air in his lungs, the stretch of his muscles, and the change of scenery diminished his headache to tolerable levels. As he had been trained to do, he cleared the cobwebs of his past and the speculations concerning the future from his mind and concentrated on his surroundings. Hosteen Ahiga and the instructors at sniper school agreed on at least one thing: *Now* is when everything happens. Twice he saw Coyote watching him from the shadows. Once he saw a beam of sunlight distorted by something invisible passing before it.

On the other side of the wood was a clearing that opened onto a bluff overlooking the southern range of hills, most of them more than fifty percent cleared for agriculture, the fields connected by narrow paths—no wheel tracks; no houses or huts. The farmers and their families lived in the village, Gordon presumed. On the horizon, towering majestically above the misty white plateaus, rose the mountain—Black Mountain to Pela's people, none of whom had ever seen the mountain black. “Old-old ones, tell old-old stories,” Pela said to him. “Long before snows, Ekav make mountain from fire. Mountain cool black. Black Mountain. Then snows come.” She grinned widely as she showed Gordon a log upon which he could sit and rest. “Now mountain white,” she said, pointing at the vertical faces. “Cliffs black.” Gordon looked back at the peak and seated himself on the log.

The morning sun sparkled from several of the glaciers busily carving cirques in the old volcano's flanks. Pela sat next to Gordon and unwrapped their food. Dried fruit, nuts, a bit of jerked venison. She held her hand out toward the sun. “Ekav kiss high flat lands,” said Pela, lowering her hand. “Ekav's kiss bring Yomi Black Mountain Mother up from flat land in fire. Mountain Mother touch sky waters and birth Avina, spirit of river; Ekav touch ground and birth Kaag, spirit of land and growing. Davimo, god of day sky, touch Mountain Mother and birth Walking Man and Walking Woman. Walking Man and Walking Woman come down from mountain and begin Black Mountain Clan. All clans come from Black Mountain. Pela Black Mountain.” She looked up into Gordon's eyes, a question on her face. Credentials time.

"Gordon born to *Coyote* Pass People,” he said, noticing as he did so a slight mist of confusion cross Pela's eyes. He hadn't their word for coyote. Maybe there weren't any coyotes here and in her time. “Dog with shadow tail."

Pela took on the English word, *Coyote*.

"Born to *Coyote* Pass People; born for Bear Enemies Clan,” he said.

"From where?” she asked with a confused frown.

He raised his right arm and pointed toward the west. “Very far away."

"How long?” she asked.

Her people had horses. Land distances were measured in days riding a horse. How many days would it take to get to the New Meeting House steps in Jemez Pueblo a hundred and thirty-nine thousand years in the future riding a horse? “Too long to go back,” he said.

Too long to go back, he repeated to himself as weakness seemed to fill his body. “Tired,” he said to Pela. She wrapped their remaining food and they returned to camp.

* * * *

After a sleep in which dreams brought him back to Bear Rock and his mother angrily dressed down Glittering Man for the sun's repeated failure to scour evil from the world, Gordon awakened to Pela's quiet singing. It was a story song about a young girl who wanted to become a flower and a flower who wanted to become a girl. It was a Trickster tale Iron Eyes had told him back in the pueblo. Instead of a young girl, Iron Eyes's tale was a young boy and instead of a flower it was a jaybird. The Trickster's lesson was the same: Walk in beauty, the path of beauty to be found not in feathers or petals but within. Gordon was wondering what Hosteen Ahiga would make of this land, this woman, and this situation when the light beyond the fire shimmered and distorted. Two figures, he was certain.

Do you hear me? He said to them in thought. The images faded, seemed to meld for a moment, then separate. “You understand me?” he asked in Pela's tongue. She turned, looked at him, and realized that

he was not talking to her. *"Hal tafhamunii?"* he asked the images in Arabic.

Pela looked to where Gordon was speaking. “Do you see them?” he asked her.

"No,” she whispered. “What God'n see?"

Right then it was nothing. The images had faded away. He shook his head in answer to her question. “My eyes play tricks,” he said as he gently tapped the right side of his head. “Head hurt make me see things."

"See Pela work, God'n,” she said.

Pela was working on a white bear skin she had taken from a substantial pack of pelts she kept at one end of the lean-to. With a sharpened bone punch, a bone needle, some kind of vegetable fabric for thread, braided leather cords, a bone hair pick, and her flint knife, she was creating a beautiful white fur coat. “Killing coat,” she said. “White for winter hunter.” She glanced knowingly at him. “Look like bear, look like snow, stay still, bear no see you.” She cocked her head slightly in the direction of the fire's far side.

He nodded at the woman's wisdom and set his gaze to searching among the shadows beyond the fire. Winter camo training. If you and your weapon are white, and if you lie flat and motionless, you look like snow. If you stand and move, you look like Frosty the snowman. If you are made of light waves and can only be seen when you move, don't move if you don't want to be seen. Gordon removed his covers, stood, and asked Pela to tell him about the coat she was making. While she talked he walked around the fire and searched among the trees and shrubs.

The coat had been commissioned by a hunter of the eastern Many Horses Clan named Afeht, three days ride, Pela told him. Afeht paid Pela in advance for the coat with a healthy packhorse four winters old. “Too cold for horse sitting toahmecu,” she said, waving a hand at the night. “Horse with Bonsha. Bonsha sister of dead husband. Bonsha feed horse while Pela sit toahmecu."

Gordon continued searching and asked. “What is toahmecu? Why Pela on hill?"

She was silent for a long moment, then Pela explained as she worked. She had been married before to Iveleh the pointmaker. Iveleh had been collecting flint nodules three summers before at Tall Bird Cliffs deep in Yellow Claw Country to the south and had been killed in a landslide. Pela had given Iveleh no children and she was now an old woman as her people reckoned such things: twenty and eight summers. She made winter outerwear, had a thriving trade, owned a bit of property, and could cook and keep house. However she wasn't a terrific prospect for marriage, she insisted Gordon understand. No possibility of sons. “Too old, so they say."

She nodded her head toward the shadows and Gordon shook his head and returned to the lean-to.

"Pela,” she continued, “trap animals, stretch and cure pelts, make caps and coats and snowsuits, and die alone. Pela not like alone and go to village *naticha*, Tonton Annajaka."

A naticha appeared to be something like a shaman or witch doctor. Very wise woman. The naticha prescribed god-waiting, or toahmecu. Pela did just like Tonton said. She needed to pray to Tana to bring her a man and go to a place where her prayers could be fulfilled, if the god so chose. Such prayers and waiting required a tall hill. Her cousin, Shayvi Woodman, owned this hill, and it was the tallest hill south of the Avina. It also faced the red cliff on the opposite side of the river. On the other side of the south cedars the hill had a view of Black Mountain. Powerful spiritual place. “Crops on Shayvi's Hill almost as good as water bank crops,” she claimed.

"What is power of the red cliff?" Gordon asked, putting aside the light distortion entities for the moment.

"Up high on red cliff ledge, God'n, where men go, meet, perform rites, talk with Wuja, white bear god of men, fatherhood, and hunting. Higher on cliff, next ledge, girls welcomed as women, perform rites, talk with Tana." Pela pointed toward the north. "High, high on top of cliff Tonton Annajaka speak with Itahnika—" She pointed at her own eyes, "—seeing spirit. Naticha see from Itahnika there what Pela must do."

So, on Shayvi's Hill Pela set her fire, built a lean-to, spread her spices, and prayed for Tana to pull down from the night skies what Pela could not seem to obtain for herself from the land. Pela then god-waited. She had been camped there for thirty-one days and nights filling in the idle times between praying and caring for herself by filling a few garment orders.

Then from a blinding blue flash of lightning entered Gordon Redcliff and his mortally wounded brothers in their crumbling turquoise flying boat. Pela was distressed that Tana's gift had come at such a terrible price, the deaths of Mehmet and Taleghani. In her singing that first night with Gordon she had asked Tana for Gordon to forgive her the deaths of Gordon's brothers. Mimmit was all dead when she pulled him from the falling-apart boat. Tallygan was still some left alive a little.

"Taleghani, Pela, before dying, he see you?" Gordon asked her, pointing at his own eyes.

She nodded. "Tallygan see Pela." She thought for a while. "Tallygan say Pela," and she continued in heavily accented Arabic, *"very—very beautiful."*

Gordon told her then what the words meant. He assured her that Ibrahim Taleghani had died a happy man just to have seen and heard her, to have felt her touch. He also told her that the death of his two companions had not been of her doing.

She frowned and after a long silence she looked at Gordon. "You man thinking for Pela, God'n? Gift from Tana? You no say."

Hard to argue with a goddess, thought Gordon, particularly one who delivers the goods with such spectacular production values. He wasn't sure though what she meant by "man thinking for Pela."

"Pela, was Iveleh man thinking for you?"

She nodded and held up her left hand with all fingers spread. "Five moons Iveleh wander between choices, then he think for Pela."

"Gordon no understand thinking for Pela."

Pela screwed her face up in an expression of attempting to solve a difficult problem. At last she smiled and nodded. "God'n hunt?" she asked.

He nodded, his gaze fixed on the fire. "I hunt."

"Before God'n throw spear, he need to close with prey. Get close, no?"

He nodded. She could have instructed snipers at Benning.

"Before stalk, God'n look at all animals, then choose one for kill. After God'n choose, he think for prey before throwing spear."

Stalking. Thinking for was getting inside the prey's head, knowing enough about the quarry to tell what it

was thinking. Was this one worth the hunt? Was Pela talking about engagement? Or was it a stage in which a prospective mate thinks about it, considers it, gets inside the quarry's head. An engagement to be engaged? “Pela thinking for Gordon?” he asked.

"Yes.” She placed a hand on her breast. “God'n thinking for Pela?"

He glanced down at the fire and said, “I know not."

"Ask Wuja,” she urged. “Ask shadow-tail dog."

"Coyote,” he reminded her.

She leveled her gaze at him. “Ask *Coyote*. Pela must know. When God'n know he thinking for Pela, Pela must know.” She went back to her sewing, her look of concentration designed to conceal her feelings.

"If I don't, Pela, will you sit toahmecu after now?"

She shook her head and sighed. “When God'n strong we go to village. Pela go home.” A great sadness crept into her voice. “Toahmecu done. Pela go home.” She cocked her head toward the shadows beyond the fire, her expression querying him regarding his creature search.

He shook his head.

* * * *

That night Gordon watched Pela sleep. His gaze traced her eyelashes, the line of her lips, the turn of her nose. Dr. Taleghani had been correct. She was very beautiful. Pela: daughter of Cualu and Tahm of the Black Mountain Clan. *Pela Sleih*: Pela of the Furs. He caught himself thinking what it would be like awakening in this existence without that face as his first sight, her voice removed from his day.

He settled back and stared at the night sky above the dying fire. Gordon had been with women before. There was that psych major in Arizona when he had gone to college for a brief period after the Army. Before her was the high school English teacher in Columbus when he had been in sniper school at Benning. In between was that watercolor artist in Port Elizabeth in the Namibian Containment that crisped a third of southern Africa. They were all emotional parking places, though. The romantic love thing—commitment, attachment—had always eluded him. He'd never felt a sense of belonging anywhere with anyone—except through a sniper scope.

Over his life he had seen men who said they were in love. Some acted very silly about it. Some had been very dangerous. The sanest ones had been married. So too had been the most miserable.

Hosteen Ahiga had outlived three wives. He had loved, he said, the first and the last. The second he had married out of obligation. “She was a Christian woman,” he had said. “She talked with scorn about spirits I walk with. I must go to church and believe as she believes if I want to be saved and have her love.” He shook his head. “I don't listen to her when she talked like that. I walk in beauty, my heart is calm. So then she wants a divorce. That's best and I agree. Before she goes to the lawyer, though, she come down with sickness. All over in a few days. Her heart, says the Bilagana doctor down in Albuquerque. She had a Christian ceremony. I went to her church one time for that.” He turned his unwavering gaze toward Gordon. “They tell me, ‘Take off your hat.’ I went home."

Gordon looked at Pela's face again, uncomfortably reflecting that the most intimate relationships in his life had been with those images in the crosshairs just before squeezing a trigger. Pela had saved Gordon's life, she cared for him, she had buried his comrades, she'd dressed his wounds; she was, as Dr. Taleghani

said, very beautiful. Pela wanted him, she was a woman of substance who knew her way around in this world, and Gordon wouldn't hurt her even for a ticket back to his own time. And there might still exist just such a ticket. In the future her God'n might just pick up and vanish. There would be no way he could bring her back with him. The Timespan chiefs would eat off their own faces first.

The future—Gordon reached to his pack, found the locater, and looked at the readout. Pela's future was going to end in one hundred and ninety suns. Certainly simplified things. What if the marriage doesn't work out? Six months. You can do anything for six months. Besides, he thought, what might it be to have an actual home? Aside from the insanity of Nascha's hogan and the rough comradeship of Army barracks, he'd never had a home. Romantic love. Perhaps he could learn how to do that before the mountain vaporized. “That would be a gift,” he whispered to himself.

Pela wasn't looking for a proposal. The custom, as he understood it, was to think about it. The Black Mountain Clan's way of having a prospective suitor “think about it,” though, involved a number of things from qualifications, relationships, and ceremonies that had both man and woman think “for” each other, which was something more than thinking about someone. In thinking for, one considers the step one is contemplating—turning over the possible future relationship like a gemologist examining a rough stone from all angles, noting the flaws, attempting to see what could be made of it.

Gordon looked into the shadows past the fire, knowing that Yellow Eyes was keeping watch. There is the path, Coyote was saying with a wink of his eye. It's beautiful, fur-lined, and chock full of healing promises. Gordon Redcliff could live happily ever after, maybe—or at least until those fellows from the future come looking for him or the floods come for him—

The reset alarm on the shockcomb invaded his thoughts, beginning as a low whine and increasing in pitch and volume until it achieved an ear-splitting magnitude. Gordon quickly reached in and hit the reset. He looked at the indicator. Another four seconds and it would have puckered itself, the locater, and Gordon's change of underwear out of existence, not to mention a good bit of his right thigh.

"Pela hear scream, God'n."

He looked at her. Pela's eyes were open and they were very clear, very deep. “A thing of mine. I need to fix it sooner. Feel bad to wake Pela,” he apologized. Gordon studied Pela's eyes seeing in them a strange mix of fear and longing. Something more, as well. Belonging. He felt as though he belonged with this woman.

This moment had been coming at him for a lifetime, it seemed. His surroundings couldn't be more strange, yet he had a sense of belonging he had never before felt. He knew that when—or if—they came in a Timespan can to get him, they could either bring Pela back with him or leave him there with her.

"Perhaps I am your gift, Pela,” he said at last as he placed a hand on her cheek, surprised to be comfortable in meaning what his words said. “Perhaps, Pela, you are my gift. Gordon is thinking for Pela. Does Pela still think for Gordon?"

As her eyes welled with tears, Gordon wondered if Coyote was revealing yet another turn in his elaborate trick. Pela suddenly turned her head and buried her mouth in Gordon's open palm, holding it to her lips, kissing it as she nodded. “Pela thinking for God'n,” she said, then whispered it again, “Pela thinking for God'n."

There was a tender feeling in his heart, affection, a tiny crystal of joy and love that was instantly shattered as Pela turned her lips from his palm and let out an eardrum-shattering combination of screams and hollers in the direction of the village, the echoes bouncing off the cliff and facing hills.

A moment of silence, then more screaming calls came from the village below. Pela screamed back. The phrasing and pronunciation were different than Gordon had learned up to that point. It was a kind of yodeling. Gordon pieced some of it together: Pela was announcing to her clan sisters in the village that Tana had granted Pela's wish. Pela had been gifted with a fine, strong, big, dark man from a strange place. Really big. Really dark. *Reallystrange*. He was thinking for her now and she was thinking for him.

Her sisters yodeled back their congratulations, their thanks to Tana for their sister, and their prayers and good wishes. Then they yodeled the news on to the ends of the village and beyond. The calls went on and were relayed for almost an hour. Long after Pela slept, Gordon remained sitting before the fire, catching occasional glimpses of the shimmering images, waiting for the secret visit from the village he was sure was coming.

TO BE CONCLUDED.

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Reader's Department: **THE REFERENCE LIBRARY** by Don Sakers

When I was a mere slip of a lad in my first year of college, I naturally signed up for the one and only class in science fiction and fantasy. I liked the professor so much that I took the next class she offered, and the next, and so on ... which is how I wound up with a minor in English literature to go with my major in math (thank you, Sue Abromaitis).

In one of the early classes, probably Eighteenth Century Novels, our first assignment was Swift's *Gulliver's Travels*. I plunged into it expecting a dull, turgid classic; instead, I found tiny people, giants, alien races and societies, and an aerial city populated by advanced scientists and held aloft by antigravity.

I raced off to the professor's office, determined that she was alone, and said, "I just finished *Gulliver's Travels*. Does the rest of the class know that we're reading science fiction?"

She smiled and held a finger to her lips. "Don't tell them, otherwise they'll decide they have to hate it."

The point of this whole dreary story is to illustrate the uneasy tension that exists between the universe of Science Fiction and the world of Literature.

When the Earth was young and there was no such thing as genre, what passed for SF was just another part of Literature. The *Epic of Gilgamesh* was the first post-apocalyptic story on record, and Daedalus the first scientist-hero. Lucian of Samosata wrote space opera in the second century, Dante meticulously built worlds according to the best medieval science, Shakespeare penned the preliminary screenplay for *Forbidden Planet*, and Cyrano de Bergerac talked about sending rockets into space in the 1600s ... all well before Dean Swift sent Gulliver off on *his* adventures. Mary Shelley's speculations about the uses of electricity paved the way for the careers of Great-Grandpappys Verne and Wells. And every one of those authors is undeniably a part of Literature, published in respectable Penguin Classics editions available at the nearest college bookstore.

Then Grandaddy Hugo came along and gave Science Fiction its own separate playground, and Father-of-Us-All John Campbell refined it into a thriving genre. And so it happened that Science Fiction waved goodbye to Literature, and the two went their separate ways.

Ever since then, stuffy old Literature has turned up its nose at its younger sibling ... while upstart Science Fiction, for its part, has often delighted in tweaking the nose of its big brother. But underneath, each has always envied the other, if only a little bit.

Every once in a while, Literature takes a hold of the conventions of Science Fiction, and produces a minor masterpiece. Huxley's *Brave New World* and Orwell's *1984* are well-known examples. In later years, ultra-Literary authors such as Margaret Atwood, Caleb Carr, P. D. James, Doris Lessing, and even John Updike tried their hands at SF-type books, with varied degrees of success. Recently, even Philip Roth ventured into SF territory, with an alternate history novel called *The Plot Against America*. (Although poor Mr. Roth, in a poignant author's note, begs his reader's indulgence for this queer notion of a story in which history went off in a different direction—a notion that he seems to think he invented himself. As Professor Abromaitis might say, don't tell him that Murray Leinster was there seventy years before.)

To be sure, when Literature plays with Science Fiction's toys, it doesn't dig too deeply into the toy box. You're not likely to see Barbara Kingsolver exploring post-Singularity AIs, Ann Tyler writing the definitive First Contact novel, or Iain Pears writing of murder on a generation ship.

No, what's popular in Literature these days is a touch of environmentalism (like T. C. Boyle's *A Friend*

of the Earth) or good old dystopian futures. In fact, since Cormac McCarthy's *The Road* was published in 2006, Literary dystopias (also known as “post-apocalyptics") have been all the rage.

If you want to get a sense of what Literature has been up to lately, here are two recent dystopian novels that even hardcore SF readers can find worthwhile.

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The Pesthouse

Jim Crace

Vintage, 272 pages, $13.95 (paperback)

ISBN: 978-0-307-27895-1

Genre: Dystopian Futures

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The medieval post-apocalyptic America of *The Pesthouse* will be familiar to anyone familiar with SF of the 1960s and 1970s. Technology has regressed to the level of subsistence farming, transportation is by foot or horseback, and the sword and bow-and-arrow are the height of weaponry. No one remembers the exact nature of the long-ago catastrophe that left the world so changed.

When disaster destroys his village, farmboy Franklin heads off for the East, where rumor tells of ships bound for Europe, the land of milk and honey. Along the way, Franklin hooks up with Margaret, who is recovering from “the flux,” a feared disease that has left her shunned and outcast.

On their journey, Franklin and Margaret fall in love and acquire a child. There are adventures: slave-traders kidnap Franklin, and Margaret spends some time with the obligatory anti-technology religious sect. Eventually they come to the East Coast to find disappointment ... but also hope.

Crace does a good job of portraying various aspects of this future, and the characters are compelling. Margaret and Franklin are worth spending time with. And in the end, if the whole thing is just a little over-familiar to SF readers, it's still a rewarding journey.

* * * *

Jamestown

Matthew Sharpe

Mariner, 416 pages, $14.00 (paperback)

ISBN: 978-1-933368-60-3

Genre: Dystopian Futures

* * * *

More Thomas M. Disch than Walter M. Miller, Jr., *Jamestown* is a delightfully quirky and anachronistic dystopia.

In this post-apocalytpic near future, Captain John Smith leads a band of settlers out of a poison-choked Manhattan in an armored bus. They head down ruined Interstate 95 in search of the promised land, Virginia. Once they arrive, there's this woman named Pocahontas ... but if you think you know where the story is going, guess again.

The best part of this fun novel is Sharpe's invented language, which is easily fit to stand beside those in *A Clockwork Orange* and *The Moon is a Harsh Mistress*. A mixture of Elizabethan and modern slang, with a good bit of Sharpe's own weirdness thrown in, it's refreshingly SF-like.

Fair warning: Sharpe's future world is a violent and vulgar place, definitely not for the easily offended. If that's not to your taste, give this one a miss.

* * * *

So there are some examples of what Literature has been up to lately. But let's not forget that for every bit as long as Literature's been messing around in Science Fiction's playground, SF has been sneaking into the house and putting its feet up on Literature's furniture.

There have always been the Brits. In England, the split between Literature and SF was never as serious as in the States. John Wyndham, Brian Aldiss, John Brunner, J. G. Ballard ... all were more-or-less accepted as at least literary-with-a-small-l. Even among the Campbell stable there was Arthur C. Clarke—I am far from the only one to have noticed that some passages in Sir Arthur's work are sheer poetry.

The whole New Wave Movement of the 1960s, a British import to begin with, was largely an attempt to move SF closer to the Literature side of the yard (and further away from the disreputable neighbors like Westerns and other pulp fiction).

But still, even pulpy American SF had its Literary lights ... and still has them today. True, some of the usual names have lately been having out-of-genre experiences: Ursula K. LeGuin in ancient Italy (*Lavinia*); Norman Spinrad exploring the halls of Montezuma (*Mexica*); and Samuel R. Delany experimenting in alternative autobiography (*Dark Reflections*). But that still leaves a few SF writers to proudly carry the banner into Literary territory.

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We'll Always Have Paris

Ray Bradbury

William Morrow, 224 pages, $24.95

(hardcover)

ISBN: 978-0-06-171977-6

Genres: Short Story Collections, Literary SF

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Ray Bradbury can hold his head up high in any Literary circles ... indeed, in *any* circles. *We'll Always Have Paris* is a collection of previously unpublished Bradbury stories. That alone should be enough to convince you to rush out and snag a copy. But perhaps you're unconvinced.

Let me make a confession here: I didn't always like Bradbury. In my salad days, even before Professor Abromaitis and Jonathan Swift, I didn't consider Bradbury to be a *real* science fiction writer. He wasn't rigorous about his science. Just look at *The Martian Chronicles* (especially when compared to *Red Planet* or *The Sands of Mars*): you just know that Bradbury never calculated the intensity of solar radiation on Mars, or the heat of fusion of ice in the thin Martian atmosphere—heck, he had people walking around on Mars *without breathing gear*. Fantasy, yes; horror, even—but not science fiction.

It wasn't until much later, when I'd been exposed to a lot more different types of fiction and a lot more

experience of life, that I came to realize that Bradbury was his own thing, independent of narrow genre definitions. And I came to understand that if Bradbury were willing to allow Science Fiction to claim him as part of the family, then Science Fiction would be smart to accept the honor. Especially in an era in which Certain Writers made it a rite of passage to loudly and conspicuously reject Science Fiction.

So I'm not going to tell you that some of the stories in *We'll Always Have Paris* are mainstream, others are fantasy, still others science fiction, and one is a poem. I'm not even going to tell you that one story, "Fly Away Home," is a Martian Chronicle. No, I'm just going to tell you that they are all Bradbury, and that should be enough. There are 22 tales in this volume, so if you read one a day and take weekends off, you can stretch it out for a whole month. Except you won't, nobody *could*. So it will be over all that much sooner, and you'll be out of brand-new Bradbury, and you'll have only yourself to blame.

Needless to say, this book would also be a nice present for anyone who likes good stories, SF or not.

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The Best of Gene Wolfe

Gene Wolfe

Tor, 544 pages, $29.95 (hardcover)

ISBN: 978-0-7653-2135-0

Genres: Short Story Collections, Literary SF

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Gene Wolfe is another one of those writers who stretches the boundaries of SF. Fantasy? Satire? Horror? Absurdity? A single Gene Wolfe story can be all of these, and SF as well, and at the same time it can be something else entirely.

There is no denying that Wolfe is an Important writer: all you have to do is look at the awards, the reviews, the literary analyses, the esteem in which he is held around the world. Less known, perhaps, than Bradbury (but who *isn't*?), he nonetheless commands as much respect from the world of Literature as he does in the SF field.

The Best of Gene Wolfe is subtitled "A Definitive Retrospective of His Finest Short Fiction," and that just about sums it up. Now, one could quibble that this isn't "the best" of Gene Wolfe, for "the best" certainly includes some of his longer works as well—but it's certainly the best of Gene Wolfe that will fit in 544 pages.

If you're a Gene Wolfe fan, then you don't need to hear any more from me. But what if you're not?

If you've never read Gene Wolfe, I understand. There are 31 stories in this volume, and not one of them was published in *Analog*. Wolfe grew out of the Damon Knight/Milford tradition, and it's entirely possible that you've never been exposed to his work.

If you think you don't like Gene Wolfe's work ... again, I understand. Anyone can pick up a Bradbury story and instantly be drawn into it. LeGuin and Delany take a little bit more work, but not much. And some readers jump right into Wolfe as easy as stepping on an escalator. But a lot of others find that his work requires some effort. (A lot, of course, depends on the particular story.) Now, most everyone finds that his work rewards the effort ... but sometimes you have to be in the right mood to tackle a Gene Wolfe tale. And if you've run into his stuff while you weren't in the mood, you could easily get turned off.

If you've never read Wolfe before, or if you're doubtful, go to the library and try some of the stories in

this book. “Petting Zoo” and “Has Anybody Seen Junie Moon?” are fairly accessible, and “The Island of Doctor Death and Other Stories” is a classic. “The Fifth Head of Cerberus” is longer, but quite rewarding. By the time you've finished those, you'll know whether you are a Gene Wolfe fan or not.

And if you *are*, you'll have the whole rest of the book to look forward to. You can return that library copy and buy one of your own.

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Let's see ... by this time I've scandalized some of my purebred SF friends by recommending some Real Literature; I've left some of my hardcore Literary friends feeling faint by recommending some honest-to-Ghu Science Fiction; and I've annoyed both groups by suggesting that they are sometimes two sides of the same coin. Now let's see if I can go ahead and alienate *everyone* by recommending, as a fine example of both Science Fiction and Literature, a (gasp!) *comic book*. And not only that, but a comic book that's been made into a *movie*.

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Watchmen

Alan Moore and Dave Gibbons

DC Comics, 416 pages, $19.99

ISBN: 978-0-930289-23-2

Genres: Superhero, Graphic Novels

Science Fiction? Really?

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All right, not in the modern *Analog* sense, not any more than Bradbury. But in the wider, *Astounding Stories* sense, yes. There's technology, both mechanical and biological. There's physics. There's a trip to Mars. There's psi. There's a consistent alternate history, and an underlying logic to all the events in the story. And there's sense of wonder to spare.

Literature? Really?

Yes. Alan Moore is a literary writer. The story involves grand themes of human existence, and small personal themes of individual human characters. There is symbolism, both subtle and overt. Not only is there poetry to the words, but there is poetry in the art as well.

As with most great books, a summary of the plot is inadequate. *Watchmen* is set in an alternate version of the 1980s, a world in which superheroes exist and play their part among the forces that shape the world. In the 1960s the premier superhero group in the world came under the influence of the United States government. Some heroes were sent to Vietnam to win the war and enforce American hegemony; others retired at government insistence ... and some became outlaws. Now two decades have passed, and someone is killing the heroes. From here, the story goes into the nature of power and control, the meaning of heroism and hero-worship, and (of course) various plots to control and/or destroy the world.

Watchmen is not easy to read. The story is dense, and it's very violent. Some of the characters are unpleasant, others are delightful. There's a lot of psychological depth, and in the end there is no easy answer to the many questions the book poses. If you still think comics are for children, this one will convince you otherwise ... I wouldn't let even the most well-adjusted child near this book.

Still, *Watchmen* is a classic, and it deserves your attention. n

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Don Sakers is the author of *A Rose From Old Terra* and *Dance for the Ivory Madonna*. For more information, visit *www.scatteredworlds.com*.

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Reader's Department: **BRASS TACKS**

Dear Dr. Schmidt,

I liked your thoughts in your March 2009 column about large changes to society that are may not be possible to accomplish with merely incremental, evolutionary change. As an example that might call for non-evolutionary change, you discussed a transition to a culture where we discard wasteful over-consumption and enjoy added leisure. I agree with your goal, but I disagree with your description of the problem. As I read your problem statement, it is that society, out of a false assumption of the necessity of full employment has invented vast amounts of easily-identified, useless make-work, and that an obvious improvement would eliminate that make-work and divide the remaining work between workers each working fewer hours.

I think that any cultural assumption of the need for full employment has no bearing on why we have this alleged make-work. The main incentives in private enterprise are to cut payrolls to the bone, eliminating any job that does not somehow contribute perceived value that some customer is willing to buy. All the cases you describe as make-work, I would describe as natural, profit-driven strategies to meet existing customer demand: You cite as make-work doormen, fashion, and the advertising that sustains its demand, and things built not to last, including outright disposables. While I agree that these are all inefficient uses of labor and physical resources, I strongly disagree that "making work," against all profit-motivated reason, has anything to do with the motivation behind this waste. Instead, I think most economically wasteful activity comes from a combination of two main sources of inefficient economic choices, choices that make these inefficient uses of labor and resources profitable for corporations:

*Humans crave status—we are instinctively driven to seek rank as "alpha" mates. In Western society, status is largely a function of economic rank, as displayed through visible consumption, so this drives a perceived "need" to consume in fashion-driven ways that can match any level of productivity we might reach. There is a profitable market for boundless fashion-driven consumption (of all sorts—fancy cars, houses, ballet tickets, hotels with doormen, etc.) and advertising (to manipulate our perceptions of what will bring us status points most efficiently).

*Humans evaluate long-term costs poorly. There are really two sub-problems here. First, most environmental costs are hidden from the consumer. A two-cent plastic bag that (hypothetically) does fifty cents worth of damage to the environment, in production and disposal, still costs just two cents, and the consumer is blissfully unaware of the external cost to the environment. Second, humans place too much weight on short-term costs versus long-term costs, badly undervaluing the long-term savings of a more-durable but more-expensive product. If people were willing to pay four times more for a product that lasts ten years than for a product that lasts two years, profit-driven corporations would not hesitate to build more durable products, however many people that might put out of work in the long run!

How do we avoid these inefficiencies? As you point out, any solution involving central planning of the economy is likely to be disastrous— free enterprise is still the most efficient way to run an economy. However, even the most ardent free-enterprise advocates agree that it makes sense to internalize external costs, and that smart consumers will make better choices than ignorant ones. Consumption that is damaging to the environment or that permanently depletes non-renewable resources (causing hidden external costs to future generations deprived of those resources) should be taxed proportionally to the harm done—this is no harder to justify than the old "you break it, you pay for it" common sense rule that we all learn as children.

Education, in the broadest sense (which includes media such as this magazine), and evolutionary cultural change is, I think, the best solution to the problem of foolish consumers. We will probably never learn to

devalue status—status-seeking seems to be built into our genomes, but we can learn to value more highly status metrics that are not based on high consumption, and can even learn to hold conspicuous consumption in contempt. The current fashion for living green is an interesting step in the right direction—actually turning people's status-driven desire to be in fashion into a reason to avoid obviously environmentally damaging forms of wasteful consumption! Culture could evolve to place higher status on products built to last longest, and schools could teach the merits of considering lifetime costs, when choosing our purchases. Study of history and of other cultures can teach that we can live well with far less than we imagine and that moderate consumption with abundant leisure is a happier lifestyle than abundant consumption with little leisure to enjoy it.

Dan Tow

Palo Alto, CA

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Dear Mr. Schmidt:

I would like to comment on your recent editorial “How Do We Get There From Here?” wherein you postulated that our society could have more happiness and leisure, with less work and fewer resources consumed, if we simply stopped buying stuff we really don't need (and paying to store it just in case we ever want to use it).

So, “How do we get there from here?” Actually, it should be quite simple. A society of modest desires, a sense of community cooperation for the big stuff, and a decent work ethic should be more efficient than our current society. In addition, it should be more economically sound and therefore secure. The extra efficiencies combined with a less materialistic mindset should also allow for greater happiness and leisure with less work. Those are strong selling points.

There are already examples of communities, such as the Amish, that live a different existence in our midst for extended periods of time. If groups of people who wish to voluntarily engage in “cooperative capitalism of modest desires” form their own communities, then the positive example that they set should rapidly draw new members. Thus, they would eventually grow to encompass all sufficiently evolved individuals while the rest of society struggles on and learns the hard way.

This method requires no grand plan, no government involvement, and no coercion. It can be started in any size and place amongst any group that wants to, according to the basic principles that they feel are most important. And the successful groups would naturally grow using only the time-tested method of leading by example. Another benefit is that it allows many different forms that can adapt to many different circumstances and personality types.

I have personally evolved from a “can I afford that” attitude to a “do I need that” attitude recently. One of the motivating factors was a dramatic reduction in disposable income and another was a challenging time that forced me to reassess my priorities. As such, we may all soon experience a once in a lifetime opportunity to change the way Americans in general think about labor, resources, and consumption. So, let's get started...

Now here's a challenge from me to you (or your readers). How does one have a healthy economy in a declining population base? This is the ultimate question that *must* be answered for long-term stability.

Keith H Bowen

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Dear Stan,

First, I must say that I absorb every word of every *Analog*—what a great resource for new thinking and pure entertainment! Your March 2009 editorial really hit onto something I have been mulling over for a few years now. Obviously we all must pull together to do something different in our societal arrangement.

I believe a great first step would be to manufacture goods with much longer service lives. I think we have already done this in the automotive industry although there have been serious lag times between new technology and the consumer. I think of my own case (luckily retired with a good pension); I more and more have to replace items that in the past gave me many times the service lives of most products. Sure, it gives workers more paid hours to keep pumping out necessary items. But for instance, if I could buy a refrigerator, washer, or dryer for more original outlay of money, but it would last four times as long (like times past), I would have less money going out, and I would not need as much income to keep a reasonable standard of living. Manufacturing workers also would need less to keep their households running. Therefore the fewer hours being spent on the job along with commensurate pay cuts would soon be balanced out by needing to spend less. I suggest that a perfect first step to your ideal society could simply be a return to the manufacture of higher quality goods. This one step could require more time worked per item, which then could be split into more workers.

I am old enough to remember stoves, refrigerators, washers, and dryers that seemed to never need replacing. Now a new top-end product such as that has a useful lifetime of a few years without major outlays for repairs or replacements. Better major items like these would of course mean a lot less spending per household, so the household would need fewer paid hours of work to maintain their living standards, and far less energy and resources would be consumed also.

Just one step in the right direction—quality, quality, quality! This, I believe, shows that changes to a new societal order can be done incrementally.

Sincerely with gratitude to you and the *Analog* staff for producing one of these very high quality products.

Garrin Fullington

Hilo, Hawai'i

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Stan,

Regarding the March 2009 issue of *Analog*: I *loved* David Bartell's “Cavernauts"!

Boyd Waters

Socorro, NM

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Stan,

I thought you might like hearing about something I experienced recently. The current commander of the International Space Station (Colonel “Mike” Finke) is a fan of mine, and this week NASA set up an AV link so we could talk live. It was quite cool to be talking in real-time with an astronaut in orbit. One of the things he mentioned was looking for my stories in *Analog* when NASA transmitted the e-book versions up to the station. Which means that *Analog* has a subscriber in orbit.

John G. Hemry

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Reader's Department: **UPCOMING EVENTS** by Anthony Lewis

6-10 August 2009

ANTICIPATION (67th World Science Fiction Convention) at Palais des congres de Montréal, Montréal, Québec, Canada. Guests of Honor: Neil Gaiman, Elisabeth Vonarburg; Fan Guest of Honor: Taral Wayne; Editor Guest of Honor: David G. Hartwell; Publisher Guest of Honor: Tom Doherty; MC: Julie Czerneda. Membership: until 15 July 2009 (see website for latest details): CAD/AUD 240, USD 200; GBP 135; EUR 145; JPY 18000; supporting membership CAD/AUD 55; USD 50; GBP 30; EUR 35; JPY 6000. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Nominate and vote for the Hugos. Info: www.anticipationsf.ca/English/ Home. C.P. 105, Succursale NDG, Montréal, Québec, Canada H4A 3P4

4-7 September 2009

North America Discworld Convention (conference dedicated to Terry Pratchett's Discworld books) at The Tempe Mission Palms Hotel, Tempe, AZ. Guest of Honor: Terry Pratchett; other guests: Esther Friesner, Diane Duane, Peter Morwood. Info: www.nadwcon.org, info@nadwcon.org, +1.480.945.6890, North American Discworld Convention 2009, c/o Leprecon, Inc., P.O. Box 26665, Tempe, AZ 85285.

18-20 September 2009

FENCON VI (Dallas/Ft Worth area SF conference) at Crowne Plaza North Dallas, Addison, TX. Guest of Honor: Lois McMaster Bujold; Music Guest of Honor: Carla Ulbrich; Fen Guest of Honor: Warren Buff; Artist Guest of Honor: Kurt Miller; Toastmaster: Paul Cornell; Special Guest: Keith R.A. DeCandido. Membership: $35 until 1 September, $40 at the door. Info: www/fencon.org/, FenCon, PO Box 701448, Dallas, TX 75370-1448.

2-6 September 2010

AUSSIECON FOUR (68th World Science Fiction Convention) at Melbourne Convention and Exhibition Centre, Melbourne, Victoria, Australia. Guest of Honor: Kim Stanley Robinson; Artist Guest of Honor: Shaun Tan; Fan Guest of Honor: Robin Johnson. Membership from 1 January 2009 until some later date (see website for latest details): AUD 210, USD 175, CAD 185, GBP 100, EUR 120, JPY 16000; supporting membership AUD 70, USD 50, CAD 50, GBP 25, EUR 35, JPY 4900. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition—the works. Nominate and vote for the Hugos. Info: www.aussiecon4.org.au/, info@ aussiecon4.org.au, GPO Box 1212, Melbourne, Victoria, AUSTRALIA 3001