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CHAPTER 1

Dom Perignon flowed and beluga vanished. A chamber orchestra played Bach. Crystal chandeliers sparkled and gold-rimmed china gleamed. An indoor fountain sprayed upwards around an enormous ice swan.

The ITU knew how to party in style.

From a terrace kept comparatively uncrowded by the chill evening breeze off Lake Geneva, Dean Matthews observed the gathering. Inside the hotel's Great Ballroom mingled dozens of international civil servants and hundreds of national delegates. There was an even larger number of "accredited industry observers." Matthews was one of the lobbyists, representing NetSat, a broadband satcom company.

Completion of a World Administrative Radio Conference *was* cause for celebration. New wireless technologies, and the implacable growth of older ones, kept the demand for spectrum high. For reasons of historical interest only, many radio bands had differing uses in different parts of the world: a big problem as more systems went global. Users of old systems were entitled to replacement bandwidth when new applications supplanted earlier frequency assignments.

The International Telecommunications Union took the lead in reconciling the many competing claims.

That made the ITU an essential, if underappreciated, part of the global economy. Multi-billion-dollar fortunes rose and fell with the outcome of ITU negotiations.

A waiter glided by with champagne. Matthews took a flute for himself and one for his companion. "Congratulations, Madame Secretary-General."

They clinked glasses.

"You, too." Fair enough: the WARC had just authorized a frequency range for new broadband services that was compatible with NetSat's working prototype.

Bridget Satterswaithe, the Secretary-General of the ITU, turned to the lake. Great yachts bobbed at anchor, brightly lit by marina spotlights. She sipped her champagne. "Now that the conference is over, I look forward to some sailing. Maybe see my parents in London. Even a quiet..."

Buzzing interrupted her; she retrieved the cell phone from her clutch bag. She appeared surprised at the caller ID on the display. "Please excuse me—I have to take this."

He took the stairs from the terrace down to the marina, giving Satterswaithe some privacy. Waves lapped peacefully against the shore. The wooden pier creaked under his tread. He, too, anticipated some well-deserved rest.

She rejoined him, sans champagne. She seemed shaken. "You're not going to believe why you won't be getting that bandwidth after all."

* * * *

Dean held a PhD in physics and an MBA in international trade. With ten years of telecomm experience, he was, in Internet years, a grizzled veteran. As VP of Strategy and Technology for NetSat, his job entailed much more than lobbying the ITU and its national counterparts for bandwidth.

None of that experience prepared him for Bridget's news.

She had insisted that they go first to ITU headquarters, and would not discuss it—whatever *it* was—in the limo.

She now leaned against a corner of her desk. "This all becomes public knowledge tomorrow. It's been predistributed to governments and the appropriate international scientific bodies. I'm bending rules only slightly by telling you tonight. I'm doing so because, in one very narrow sense, the biggest impact will be on NetSat.

"Of course, life as we know it will also change."

She had his full attention.

Her call had been from the Secretary-General of the United Nations, parent body to the ITU. The International Academy of Astronautics and MIT were co-hosting a press conference in the morning. Dr. Sherman Xu, the discoverer, would give the first public announcement of a confirmed radio signal indicative of extraterrestrial intelligence. The ITU would immediately initiate an Extraordinary Administrative Radio Conference to fence off the frequencies used by the extra-solar signal.

ET must be using frequencies near those sought by NetSat. Despite his months of effort to secure the

desired spectrum, the professional and personal impacts seemed inconsequential. Intelligent alien life!

Satterswaithe extracted a decanter of amber liquid and two glasses from her credenza. “The formation of a UN task force will also be announced, reporting to the Committee on the Peaceful Uses of Outer Space. Since ET uses radio, I've been asked to participate on behalf of the ITU.”

He accepted a glass. “I have a terrific job at a world-class company. As of two minutes ago, that doesn't matter to me. This news is epochal. I want to be involved.”

“My impression is that the team will consist of national government and UN personnel, plus academics. Sorry.”

He canted his head thoughtfully. He'd been an RF engineer and systems architect before moving into management. He'd been a SETI (Search for Extra-Terrestrial Intelligence) enthusiast for longer. Perhaps he had the basis for an inference that would impress her. “Let's see what I know about ET that you haven't shared.

“I don't need to tell you that the universe is full of radio noise, or that most of that noise is outside the microwave band. At one end of the microwave window, at a wavelength of 21 centimeters, is the neutral hydrogen line. Hydrogen is the most common element in the universe, so the SETI folks deduce that's the radio-dial marker to listen near.

“The OH ion radiates nearby, at 18 centimeters. H plus OH equals H2O: water. That's why the SETI crowd calls wavelengths between 18 to 21 centimeters the ‘watering hole,’ around which they theorize intelligent species will congregate.”

He tested the liquid in his glass: an unblended Scotch. Served neat: without ice or water. “Of course, that's a water-chauvinist's perspective on SETI.”

He knew that the SETI Institute had examined the nearest thousand stars at watering-hole wavelengths without success. He inferred a NetSat conflict with ET's signal, far from the watering hole. He hadn't read much about SETI work at MIT. All factors pointed away from a finding at the watering hole.

He rolled the dice. “I predict that ET's signal is about 6.7 centimeters: the hydrogen wavelength divided by pi.” Pi was the only transcendental divisor of the hydrogen wavelength that could cause a conflict for NetSat. “That would be a good indicator of a signal from intelligent beings.”

Her raised eyebrow confirmed his speculation.

“Where is the signal from?”

“Lalande 2-something. I hadn't heard of it.”

“Probably Lalande 21185.” The adult physicist had once been a boy with a four-inch telescope. A Web search agent kept him current at a hobbyist level with major astronomical news. “It's one of the stars closest to Earth, about eight light years. Near Leo Minor. It's been believed since 1996 to have at least one planet, Jupiter-sized.”

She was silent for several minutes, making up her mind. “I can't promise anything, but I'll see what I can do.”

* * * *

Bandwidth alone didn't guarantee a successful satcom company—NetSat also needed to put its birds into orbit. Some of their launches were booked on Russian and Chinese boosters. That had meant obtaining licenses to export satellites to the foreign launch sites. And *that* meant Matthews knew people in the State Department.

The connection worked.

His assistant reached him on the flight from Switzerland. No need to dash across JFK for the plane to Washington: he had an urgent appointment in Manhattan with Alex Klein, American ambassador to the UN.

The diplomat was as circumlocutory as Matthews was direct. In some manner, it would seem, with vague attribution to the auspices of the Department of State, and in public-minded and full support of a recommendation from the Office of the Secretariat of the ITU, it would appear ... that Dean was in! He should expect an invitation to join the Lalande task force.

The implication was clearer that Klein's office was available to Matthews as a resource.

Unambiguous, if deniably oblique in its delivery, was the subtext that Dean should be forthcoming with any data of a "national security nature" that might arise during the task force deliberations.

CHAPTER 2

Held at a Caribbean resort, the kickoff meeting of the Lalande task force could have been mistaken for a corporate boondoggle. The remote island was far from most of the idly curious; a smattering of UN guards turned away uninvited members of the press.

The people at the registration table disavowed all knowledge when Dean had questioned the round red sticker on his name tag. It related, he presumed, to the as-yet undefined committee structure of the task force. Five colors were in use; no one whose name he recognized had red.

The auditorium doors opened, and the crowd surged inside. The Secretary-General of the UN gave the obligatory pep talk by satellite link. He introduced Kim Chun Ku, the Undersecretary-General for Administrative Affairs, as (the day's first news) head of the task force. The SG was followed by Ambassador Juan Roderigo of Argentina, currently heading COPUOS, the Committee on the Peaceful Uses of Outer Space.

Sherman Xu reprised his big announcement of two days before. The signal appeared to come from Lalande 21185. The carrier signal was at the hydrogen wavelength divided by pi. Like naturally occurring cosmic radio sources, the faint signal faded in and out. Unlike natural radio sources, the carrier was modulated with a narrowband signal, under 300 Hertz. About every 30 hours the signal included a sequence of pulses: pulse, pause, two pulses, pause, three pulses ... up to 128 pulses. That pulse sequence was repeated once.

A complex-seeming message followed the easy-to-recognize pulse sequences for thirty hours. The cycle then apparently repeated, although that conclusion was tentative due to noise and signal fading. His team hoped to have synthesized the full message within a week—if the signal persisted that long.

It was almost noon when Kim Chun Ku claimed the podium. Kim's remarks confirmed what his title

plainly said: he was an administrator. His third viewgraph was an organization chart: five colored boxes. As one, the audience members glanced at their name badges. Whispered conversations erupted.

Kim tapped the mike until order returned, and he confirmed that colored stickers denoted committee assignments. After lunch, at committee breakout sessions, complete rosters would be made available.

The gold team, at the top of the chart, sounded like what Bridget had called the steering committee. Kim led the gold team. Membership included the leaders of the still undefined other teams, famous names from the SETI community, two assistants to ambassadors from COPUOS-participating countries, and a few UN agency heads like Bridget.

Blue team dealt with radio engineering: signal acquisition and recovery. They would work with the ITU on reducing Earth-originated interference in ET's preferred frequencies, and coordinate among radio observatories worldwide monitoring ET's signal. Blue team was mostly radio astronomers, including Sherman Xu, with some of Bridget's staff thrown in.

Green team owned what struck Matthews as the part of the project most likely to be second-guessed: analysis. They were tasked with decoding and interpreting ET's message. Membership included lots of SETI folks, a codebreaker from the National Security Agency, mathematicians, and linguists.

Gray team would ponder Earth's possible response. Opening a dialogue with another civilization was not about science: this committee was entirely staffed by diplomats assigned by the Security Council. Mathematicians and linguists from Analysis would encode Earth's message after a reply, if any, had been strategized.

And the red team? The best had *not* been saved for last.

Red denoted the media and education committee. They were to coordinate the release and positioning of everyone else's results. Red team would also field questions and unsolicited suggestions. Matthews' teammates were pool reporters, PR flacks, educators, and—oh, joy!—a multicultural behavioral response team.

Why was he on the red team?

* * * *

"And so," concluded Paul Ricard, "our role is to package and control the Lalande information, while respecting various cultural sensitivities. After a short break, I propose to discuss process concepts for that mission."

The red-team leader had spoken for twenty minutes, without conveying any more than his summary. The viewpoint was what Matthews expected from a PR flack, even one with a prestigious UN title. Dean cleared his throat.

"Dr. Matthews, have you something to add?"

Unfortunately, he did. "Yes, actually. I don't think our charter, as you've spelled it out, can be accomplished."

"Why is that?" Ricard was more condescending than curious.

Matthews had sensed, when the session opened with brief introductions, that he was not alone in

wondering about his assignment. As he had suspected, Dean was the only member with a physical-sciences background.

"We don't have a monopoly on ET information." The media reps, who were being mysteriously docile, seemed to suffer from the misapprehension that task-force membership guaranteed a lock on all Lalande news. "If we withhold or spin any findings, we'll discredit the whole task force."

"I question the premise." Ricard was miffed. "We've brought into the task force the leadership of every major radio telescope. Surely we can rely upon their cooperation in the responsible release of discoveries."

Irrelevant even if true. "In days, universities worldwide will be monitoring ET directly. They can easily build an adequate receiver from arrays of commercial satellite dishes. Thanks to Dr. Xu, they know exactly where to point the antennas and the frequency to tune to. And they'll *all* be racing to post observations and interpretations on the Web."

Many surprised looks were exchanged about the room before Ricard found his voice. "How sure are you about this?"

"Very. As you know, I'm on leave of absence from a satcom company, one of many such firms. Any of a dozen people from my former staff could do this."

"Dr. Matthews?" asked Amreesh Shah, a psychologist from the behavioral-response group. "What would you propose?"

"Publish our observations rather than filter them. Clearly mark as commentary any 'adjustments' we may choose to make.

"While we won't have a monopoly on the signal, we will have resources far beyond those of other listeners. If our postings are prompt and objective, our interpretations insightful, *we* become the preferred source of ET data. If we hold back, however well-intentioned our reasons, the best we can hope for is marginalization by other news sources. At worst, who knows what motives will be ascribed to us? There's no shortage of people who see conspiracies all around them."

Shah nodded. "Distrust is the result we can least afford."

That was one point everyone in the committee agreed upon.

* * * *

From the SETI Conspiracy chat room

Suspect_Everyone: Does it strike anyone else as suspicious that the UN is orchestrating the Lalande investigation?

UFO_believer : Absolutely! And who's behind this "International Academy of Astronautics"?

42_is_true : I'd sure like to see the ET message text from a reliable source, not the US government, and *certainly* not the UN.

Suspect_Everyone : Does it strike anyone else as suspicious that it's suddenly hard to buy satellite dishes?

* * * *

Bridget idly flapped the paper umbrella from her tropical punch. Open, close, open, close. “Quite a meeting.”

Satterswaithe was an electrical engineer by training, with a PhD from Oxford. She'd gone straight from university to a British government research establishment. That had been a stepping stone to the ITU, which, after a succession of promotions, she now headed. An adult life spent in bureaucracies had not diminished her determination to make things happen. She had, however, developed a tolerance for committees that Matthews could not fathom.

Dean favored a local beer he'd discovered on the first night of the kickoff. Delightful microbrew notwithstanding, he was eager to get back to the States. He and Satterswaithe had met in the airport bar, awaiting their separate flights. “It turned out okay. Maybe I'll cancel the mob contract I took out on you.”

“For accomplishing what you pleaded for?”

“Requested in a dignified manner.” He gestured for another round. “No, for putting me with the social scientists and spin doctors. Look, I respect their sincerity and good intentions, but I've *never* met so many people who see the glass as half empty.”

“Don't blame me or the gold team. Yours was one of the few assignments Kim had made before Steering even met.” A boarding announcement from a staticky PA drowned out her next words.

“What?”

“I asked, ‘So how is it that things turned out okay?’.”

“Had it been my choice, I would've had a tough time deciding between Signals, Analysis, and Reply. It occurred to me that someone on the red team has to liaise with those other committees. A technically oriented interfacer made sense. So I've gotten myself access to all of the information that Steering has, without, no offense, enduring all of that bureaucratic ponderousness.”

“No offense taken.” She laughed. “Well, maybe a little. In any case, I'm off to my gate. I'm glad it worked out for you.”

He decided he was glad for her abrupt departure, which avoided the awkward question about whom, since it wasn't the steering committee, wanted him on the Media & Education team. It couldn't have been Kim's idea: Kim knew nothing about him.

At least the Undersecretary-General was unlikely to have heard about Matthews absent input from the US ambassador.

* * * *

From the Earth First chat room.
All_Politics_Is_Local: So what's with the Lalande task force and its closed-door ‘organizational’ meeting?

Stop_World_Government : What's the UN *always* up to? ET's message is simply another excuse for worldwide government. Whatever the task force is for ... I'm against.

All_Politics_Is_Local : It's welfare for rich-country scientists. Would a Bangladeshi textile worker

think this is the best use for the money?

Radical_Dude : There's common cause among world-government resistors, ET skeptics, and third-world advocates. Expect the UN to get a taste of what we gave the WTO in Seattle in '99.

CHAPTER 3

Alex Klein had alerted Dean to the unadvertised coordination between the Russian and American militaries and the steering committee. One thing led to another, and now Matthews was at a Manhattan deli with a Russian general and ex-cosmonaut.

Vladimir Grigorivich Antinov began his career in the Red Air Force. He'd been an advisor to Hanoi during the Viet Nam War, a time he declined to discuss. He'd graduated to, and risen rapidly in, the then-Soviet strategic rocket forces. Combining piloting and missile expertise, he'd moved into the cosmonaut corps. He'd served two tours aboard *Mir* , one as mission commander. His English, from years of joint planning with NASA, was excellent.

After an exchange of pleasantries and the ordering of lunches, Dean got to the point. "To be honest, I'm surprised that the militaries care about ET."

Antinov dumped sugar into his tea. "Our job is to worry."

"About what? ET is *far* away."

"That is an assumption it is best to validate."

Arrival of their sandwiches gave Dean a chance to consider Antinov's rebuttal. ET's signal was quickly recognized as artificial because of the pi factor. That observed wavelength, however, depended on the wavelength originally transmitted *and* Doppler shift due to relative motion between sender and receiver. Lalande 21185 and the sun moved relative to each other. ET's unseen planet must, like Earth, orbit its sun and rotate about its axis. The signal should have wobbled continuously around its "look at me" wavelength.

It didn't.

Without any decoding of content, this observation showed that the message was intended specifically for Earth. It meant that ET saw Earth well enough to measure its orbit and rotation, and then dynamically tune his signal accordingly.

"In ten years *we* could have a telescope able to resolve Earth-sized planets of nearby stars," said Dean. "NASA has requested funding for one for years. ET seeing Earth doesn't require technology much past ours."

Antinov waved over the waitress to refill his cup. "Or ET could be much closer. If he can correct a signal for planetary motions, his and ours, he can as easily compensate for blue shift to disguise transmission from an approaching vessel."

"But why announce your existence *and* hide your arrival?"

"The message may announce a visit. We can't read it yet."

Might ET be announcing his arrival? Matthews shoved away his plate, half of a corned beef on rye untouched. He'd heard nothing like this from anyone on the task force. "Since we're discussing this in a deli, you can't be too concerned."

"Did I have too much fun with you? I will explain what my people and yours are doing: probing with our most powerful radars along the signal path. These radars can detect the smallest bits of space junk in Earth orbit. We can track a dropped bolt that is hundreds of kilometers high. More than once," the cosmonaut smiled, "that has been a useful capability. We would expect to detect a starship *much* farther away. As yet, there has been no return pulse."

Matthews had never worked with military radar, but thought he could make an intelligent guess at its sensitivity from an understanding of radio telescopes. "If ET is coming, he's still well outside our solar system. Or stealthed."

Antinov winked at the mention of stealth. "I commend your newfound paranoia, though in this case such caution may be excessive. To visit us, a vessel must travel at very high speed through the scattered matter that makes interstellar space only a *near* vacuum. Could a ship maintain stealthiness against the ongoing particle bombardment? Would it not radiate, whether from collisions with such particles or some protective force field? We've seen no such evidence.

"We've even used the comet watcher trick of flipping back and forth between telescope photographs taken on successive nights of the same part of the sky. There are no unexpected moving objects, nor any unexpected occluded stars."

"You *have* been busy."

"We do only what your Space Command has done, I think."

Matthews grabbed the check. "So are you convinced that the signal is genuine, and from Lalande 21185?"

"It has been a most pleasant discussion, but duty calls." Antinov stood. "As for your question, I am *almost* convinced.

"I am entirely certain that were ET able to sneak up on us, nothing we could do in preparation would matter."

CHAPTER 4

"...And still no comment from the UN investigation. Has ET's signal been lost? If so, what does it mean? Is the UN covering up? We want to hear from you."

The radio call-in show was Dean's regular breakfast companion, entertaining when he successfully compartmentalized the sorry implications about the state of education. Today's show was annoying rather than amusing, however—even though, oddly enough, it had the facts mostly correct.

The signal from Lalande 21185 *had* vanished last night.

He retrieved today's paper from the curb. Loss of signal was front-page news, with attribution to the

SETI Institute, the Planetary Society, and Cal Tech. As he'd foreseen, universities and science-interest groups had built their own antenna arrays—and they were free to announce findings when they pleased. That usually meant only a phone call to a buddy at a peer institution to confirm an observation or analysis.

He'd phoned Ricard after getting an alert from Signals, urging the committee head to issue a statement. Ricard instead ruled that the matter needed a Media & Education consensus recommendation to the steerers. Damned committee process!

He stuffed the paper into his briefcase. There'd be time for it on the shuttle to New York for the emergency meeting.

* * * *

The early work of Media & Education had lulled Matthews into a false sense of security: the task force's original findings were uncontroversial, and so quickly released. For those first few days they'd also had a monopoly on signal reception.

Things started changing once independent observatories came on-line and the bulk of the repeating message was posted to the Web. Now the task force was in a race with every other interested party to interpret ET's message.

That message started simply enough: two pulse trains counting from one to 128. Next came hours of data without apparent pattern. The analysts soon recognized that the data immediately following the two pulse trains of 128 was a two-dimensional, 128-by-128 pixel image. The image was simple but informative: sets of tick marks, from one to sixteen, each set paired with alien symbols. ET was communicating by what amounted to facsimile transmission, he counted in octal, and he had shown Earth how he wrote his numerals—a quickly approved press release.

The bottom left corner of that first image carried ET's symbol for one: he was enumerating images. The bottom right corner bore two numbers: 128 twice. As suggested, the next part of the message could be read as another 128-by-128 image.

Subsequent images were easily recognized as math lessons, building a common mathematical vocabulary. None of the symbols matched human conventions, of course, but there were no surprises at that early stage as to message meaning. The committee had little difficulty drafting a press release citing a shared view of arithmetic.

Contention arose with the next few images, perhaps not coincidentally because an undergrad physics major at the University of Calgary was first to interpret them. She identified one drawing as a spectrogram, an energy-intensity versus frequency plot, of Lalande 21185. The next graphic was a similar spectrogram for the sun.

Beyond confirming the source and destination of ET's communication, those images introduced two new symbols: us and them. The solar spectrogram had one other novel aspect: a corner annotation indicating that a 3-D dataset followed. The 3-D dataset appeared to be a series of spectrograms, successively more crowded, but otherwise mysterious. The net effect was a crude animation, like a child's flip book. The meaning of the dataset's third dimension remained unclear. Intriguingly, each 2-D slice bore the symbol for “us.”

The committee was slow to comment on these images. The media types (and Matthews agreed) proposed simply stating that two new symbols had been decoded, but that the following dataset was not yet understood. The behavioral-response contingent thought it necessary to put these findings “into a

suitable context" to protect fragile human egos. "To those countries that were recently colonies of the West, 'us and them' distinctions are sensitive matters," was one Third World sociologist's assertion. The behavioral-response folks were further concerned that an admission "'we' had failed to understand" a dataset could make humans feel inferior to, hence threatened by, ET.

Matthews just didn't get their point: "us" and "them" were just pronouns. An undecoded dataset so early in the effort also failed to faze him ... why should ET's message be immediately clear? ET was *alien* . They waffled for two days, by which time the external media had moved on to newer news.

* * * *

Waiting for the emergency meeting to start, Matthews wondered if the committee had learned its lesson. The loss of signal was already widely known; he felt they should just acknowledge it.

Ricard had inexplicably brought a gavel, which he wielded to open the meeting. Some overseas members, unable to join the short-notice session in person, were videoconferenced in by encrypted network link; they winced as the chairman pounded too close to the mike.

"Thank you all for coming." After excessive pleasantries, Ricard came to the point. "It has been reported that the signal from ET has been lost. The matter being so important, we will discuss a suitable statement for recommendation to the steering committee." Heads nodded.

"Point of clarification," interrupted Matthews. "A more precise statement is that the signal has ceased. Every observatory, government-funded and other, reports the same thing." He'd been on-line for much of his flight; the message boards were unanimous about the time that the signal had disappeared. It hadn't faded or been randomly garbled by cosmic interference, both of which had often happened. The signal was just *gone* .

"Do we know why?" asked someone.

"The short and honest answer is: no. On the 'net, the most common guess is that ET's orbit is bringing him to the side of his sun opposite us, so he's stopped sending until he can get a clean signal through again. Perhaps, once we've decoded the entire message, he'll have told us."

In a pleasant surprise, reason won out. The not-too-tardy press release simply reported the cessation of transmission.

* * * *

"You've got incoming."

For a Brit, Bridget had a fair grasp of American slang. Matthews still reserved judgment whether he had cause to worry.

He was nonetheless suspicious. It was eight in the evening for him, making it the middle of the night in Switzerland. Moreover, she'd contacted him over the 'net, and Internet telephony had far lower voice quality than a normal call.

The task force had provided its members with PC-compatible encryption devices of unusual robustness, which he guessed she wanted to use. That turned out to be correct.

"What's up?" he asked once they'd opened a secure session.

"You know there are ITU staffers on the Signals committee. One gave me a sneak preview of their latest finding. You'll surely hear all about it in Media. Judging from the tizzy your friends got into over 'us' and 'them,' this news is sure to throw them for a circle. A head's up seemed in order."

For a *loop* , he thought to himself. "What is it?"

"Watch."

She opened two windows on his PC. In a red window she ran the animation of ET's "us"-labelled spectral flip book. The other window, colored green, showed a similar sequence of images. She slid the second window over the first, and re-ran them superimposed. The green charts were in all cases a superset of the red.

"Green is our best-guess reconstruction of Earth's aggregated RF emissions over time. The big energy spikes are from TV transmitters and ballistic missile early warning radars."

"When does your animation start?"

She grinned at him from the corner of his screen still showing real-time video. "The best fit matches ET's spectrum animation with our reconstructed data starting in mid 1950."

She had used the term "incoming" correctly: ET had lobbed a figurative bombshell at them.

* * * *

Apropos of the New York venue, it was *deja vu* all over again: another short-notice Media meeting. So far, only the task force had the explosive news. If Media moved quickly, this time they could shape the world's impressions.

ET had in 1958 captured signals emitted by Earth in 1950. He'd waited more than thirty years to respond. Why?

"It's devastating," said Dr. Shah, a psychologist, "that ET could not be bothered to answer. Are we so insignificant?"

Thanks to Bridget, Matthews had had a day to ponder the matter. "A purposefully delayed response is not the only explanation. Perhaps ET is just explaining how Earth came to his attention. His radio astronomers might routinely capture and save radio energy from neighboring stars, and not have immediately recognized our 'signal' "—he waggled his fingers as exaggerated quotation marks—"for what it was.

"ET sent us a systematically constructed message, much of which we almost instantly understood. He sent it at very high power levels. Whatever signal he's gotten from Earth was *much* weaker, unintended leakage from TV and radio and military radars. None of that was designed for him to recognize or decode. I'm guessing, but what may have eventually convinced him that we're here and aware is the rapid increase in power levels and in frequencies being used. I doubt ET extracted any meaning from the mish-mash."

Dr. Shah imitated Matthews' earlier gesture. "About those quotation marks ... what did you mean?"

"The signals ET received from us were *very* faint. 'I Love Lucy' was not meant as an interstellar communication. If ET's signal were as low-powered as what Earth emits, we'd never have detected it."

Michel Margot, a Belgian sociologist, broke the thoughtful silence that had come over the committee. “You suggest that we can't know how long ET delayed after suspecting our presence.”

Matthews nodded.

“But his radio technology is more advanced than ours.”

“Correct.”

“But not greatly more advanced, or his response would likely have come sooner.” Margot took Matthews’ silence as assent. “That's good. There could be an adverse reaction to a perceived technology gap.” To the group, the sociologist added, “This seems a responsible position to articulate.”

Heads bobbed in what Chairman Ricard mistook for unanimous agreement. He assigned a writer to draft a press release.

The phrase “not greatly more advanced” contained a significant degree of ambiguity. ET had radio receivers in 1958 exceeding any Earth owned today. His high-power transmitter was a marvel. In the interest of an announcement more devoid than usual of spin, Matthews kept to himself the thought of how much he'd like to obtain ET's radio technology.

* * * *

"In the General Assembly today, the Secretary-General of the United Nations urgently requested an emergency supplemental authorization. He stated that the UN's budget has been unusually strained by peacekeeping duties across the Balkans, sub-Saharan Africa, and the former Indonesia. He pointed to growing requests for humanitarian assistance by the UN High Commissioner on Refugees. The Lalande 21185 task force was also identified as an unanticipated expense.

"Third World delegates responded skeptically, suggesting that the UN reallocate scarce resources to its core missions. The ambassador of Congo spoke for many of his peers. ‘What is the use of an arithmetic lesson from the stars? How many AIDS vaccinations, how much famine relief, could we provide with funds we are now squandering on ET?’

"Rising polarization on the subject of funding for the Lalande investigation seems certain to conflict with the proposed international treaty on interstellar communications. The treaty, recently passed by the General Assembly and awaiting ratification by member states, requires that any response to ET come under UN auspices.”

—BBC World New Service

CHAPTER 5

“To ET.”

Matthews rarely toasted with iced tea, but Barbara White seldom drank anything stronger. Barb stood five foot zip in high heels; she said her tolerance for booze was best measured in thimblefuls.

“To NetSat.”

Barb was CEO and founder of that company. He had been employee number four before going on leave of absence. They went back a long time together.

It had been a chance encounter at the shopping mall. They'd retreated to the food court. “Is ET still being mum?”

“Yup.” He bit a taco. “Not that it could be kept secret if he began talking again. In any case, it'll be a while before we understand what he already had to say.”

“So when can I expect you back?”

“I can't tell yet.” Pause. “Not till we're done.”

She knew him too well. “What's the problem?”

“What we're learning is astounding. For example, ET's replay of what he received from Earth will teach us a *lot* about radio propagation across interstellar distances. And I work every day with brilliant people.”

“There's a big ‘but’ in there somewhere.”

“Think of the most bureaucratic dealings you've ever had with the government. This is worse. On top of a clumsy committee process, we've got all of the international politics. Amazingly, most prospective announcements get inanely entangled with nineteenth-century colonialism and worries about possible Third World misperception. Apparently our paramount mission is to build up humanity's self esteem.”

“Then come back to NetSat. I need my chief strategist.”

“Barb ... let's not go there. This work is too important.”

It wasn't the answer she wanted. She brightened as a safer topic came to mind. “Hey, I owe you a compliment. Your recommendation paid off.”

Dean guessed she meant the wrap-up memo he'd written on his way out the door at NetSat. He had a visceral dislike of loose ends. “The constellation reconfig?”

“The same. As you proposed, it was an easy software fix to keep our satellites and ground stations from broadcasting directly on a Lalande 21185 line of sight. We'll lose a little capacity, but we maintained our launch schedule. It *sure* beat trying to start over on a new frequency to accommodate your ET buddies. That could've put us out of business.”

“I'm glad it worked out.”

Her wristwatch beeped on the hour. “Gotta run. Listen, it was great seeing you, and I *do* want you back sometime.”

After a goodbye hug she left and he finished his late lunch. The conversation had put an unaccustomed monetary perspective on the task force's work: the cost associated with foregone use of spectrum. That was in addition to the cost of investigations, UN-sponsored and other, about which several countries were already complaining.

The epiphany came during his last taco. How about *ET's* economics? Even without knowledge of how ET allocated resources, it stood to reason that ET had made a major investment to contact Earth. His transmitter, and its power requirements, had to be enormous. For how long would his society, whatever form that took, be willing to operate it? Was *that* why ET had gone off the air?

Congress cancelled NASA's SETI program in 1993, when the agency was only spending about a nickel per taxpayer on the effort. Luckily, some private institutions had ponied up the money to keep the search alive. Many developing countries were now objecting to UN funding of the task force. Would ET's society work any differently?

There was a new urgency to decoding ET's full message, and answering while, Matthews hoped, ET was still listening.

CHAPTER 6

With intellectual discipline that many found intimidating, ET's message continued to expand a common vocabulary. Some speculated that much of ET's delay in responding had been time spent formulating the elegant reply.

Animations of motion introduced mechanics and ET's notation for the calculus. Cartoons of atoms with emission spectra identified elements and ET's symbols for them. Cartoons using the element symbols showed simple molecular representations, which were used to illustrate a simple chemical reaction. An image of a simple wet cell labelled with its chemical reaction provided a symbol for voltage, beginning a review of electrical engineering.

The purpose for all of this common vocabulary was still unknown when the task force was summoned to present its status to a philosophically divided COPUOS.

* * * *

"The Committee on the Peaceful Uses of Outer Space will come to order." Ambassador and chairman Juan Roderigo, although Harvard-educated, spoke in his native Spanish.

Only the steering committee had been invited, but Bridget had wangled Matthews a guest pass in view of his liaison duties. As a guest, he was expected to observe silently. He donned an earpiece, wondering how long it would take to adjust to English in one ear and whatever in the other. English was the worldwide language of technology, trade, and air traffic control; diplomats had no such standardization.

Undersecretary-General Kim spoke for his task force. The message summary passed quickly, boiled down to the diplomatic level of scientific literacy. Bobbing heads around the horseshoe-shaped table suggested that the summation had been understood. ET heard us; after an unexplained delay, he answered; he was now building a common vocabulary with us.

Roderigo paid the obligatory compliments to Kim for the hard work of the task force. The ambassadors from the US, Russia, Japan, Peru, and several western European countries followed suit. Then the manure collided with the ventilator.

Maurice Mbeke of Congo spoke in fluent French, but the ambassador's message, like his dashiki, was distinctly afrocentric. "I think—no, I know—that I speak for many others in asking why the aliens have expended so much effort in communicating with us. We will resist interstellar colonialism, physical or cultural."

Matthews was not entirely surprised: this was a perspective with which Matthews had become familiar, though not accepting, from innumerable discussions of the Media & Education committee. What did take Dean aback was the level of support Mbeke had. Speaker after speaker, especially from the nations who'd recently joined COPUOS, endorsed what Matthews thought was a head-in-the-sand view of the situation. To the physicist's astonishment, even some industrialized countries shared a concern about ET.

The Russian ambassador, Anatoly Shuskov, took the floor. "I ask the indulgence of the committee to have a distinguished member of my staff comment in my place." Once permission was granted, Shuskov ceded the floor to General Antinov.

"Ambassadors, thank you for hearing an old soldier. I am proud to have defended the Soviet Union for many years. I am proud to have taken part in Russia's transition to democracy. As a past member of the rocket forces and the cosmonaut corps, I believe I have credibility in defense and space matters.

"Ambassador Shuskov asked me to assure the committee that our forces have searched for evidence of coming aliens. We found no such evidence. As a cosmonaut, however, I tell you frankly: if ET did visit us, it would mean that his technology exceeds ours as an aircraft carrier exceeds a sailboat."

The simile came painfully close to accusing ET of gunboat diplomacy, a comparison not lost on the Chinese ambassador. Matthews wondered whether the association was intentional.

"I am known for being direct. If ET can come, and opts to, he will. Nothing we say or do will stop him. If ET wishes only to talk, we may choose to listen. I urge COPUOS to listen.

"It is better to know what ET can do than to not know." His eyes swept the committee. "I will state clearly what most only hint at: some nations have had cause to fear the superior technology of others. Where nations differ has been in their response to that challenge. Those who learned eventually prospered. Those who clung to their old ways soon suffered."

Pausing for a sip of water, Antinov studied his audience. Some of the former certainty was gone from their faces. "Nothing this committee can do will reduce the risks of new knowledge. You may decide not to listen to ET, but you cannot stop other countries, universities, corporations from listening. From learning. You may hope to keep ET's message from your society. You will be no more successful than you were at keeping out blue jeans or rock and roll.

"I give you a final thought. The cost of restricting knowledge is onerous. It takes a police state to even try." He smiled sadly. "We Russians learned that lesson well.

"And to bear the burden of such restrictions, only to see other countries master new technologies from ET ... that would be *truly* a tragedy."

* * * *

"...So since *we* were made in God's image, some bug-eyed thing across the galaxy can't be one of God's creatures."

"Interesting point, Rick," said the deejay. His enthusiasm sounded forced.

"The way I was taught, God sent his only begotten Son to redeem us. Jesus died for our sins, right here on Earth. That tells me that ET must be damned."

"As a good Christian, is it your duty to bring Jesus' message to ET?"

"You're not listening. They're not in God's image. They're damned. In my book, that makes them devils."

* * * *

When COPUOS reconvened for a second day of hearings, the opponents of the task force had fine-tuned their approach. No one sought to rebut Antinov's defense of listening. Perhaps it had registered that ET was no longer talking.

The skeptics today turned to exaggerated praise. The task force has done the hard work and ET's message was in the can. Anyone who was interested was welcome to finish deciphering the message.

Oh, yes ... and please leave your budget at the door.

There was a whispered consultation among the steering committee, sitting behind the long table set across the open end of the horseshoe. Bridget grabbed a mike. "We need still to talk about the Reply committee."

By prearrangement among the developing countries, today Ambassador Smythe of Belize led the attack. "ET learned we are here. He told us he is there. What's the added benefit of exchanging postcards?"

"I feel that acknowledgement is the least we can do, Madam Ambassador. ET has shown us the extraordinary fact that we are not the only intelligent beings in the universe. I also believe it is in our self interest to maintain and enhance the dialogue. We have so much to learn."

"Surely the least we can do is nothing." Several ambassadors smiled. "We can discuss proper interstellar manners on another occasion. I'd rather you expand on your second point. I'm struck not by how much we can learn but by how little. The task force has diverted some of the world's best scientists to a rediscovery of arithmetic."

Bridget squirmed in her chair. Perhaps she felt sandbagged by the lack of Commonwealth solidarity from an official of a former British colony. "Madam Ambassador, I think that summation gives insufficient credit for our work. We have made great progress in building a common vocabulary."

"What indication has ET given of having anything to say?"

"We haven't finished reading his message."

"Which is to say, none." Smythe smiled humorlessly. "And what conclusions has the Reply committee reached on an answer from Earth? I believe the answer there to be the same."

Bridget squared her shoulders. "Again, I could refer to interim progress. Surely it is not unreasonable to take some time in deciding how to respond to a whole new civilization."

"What can you tell me about this civilization? What do they look like? Do they breathe oxygen? Are they ruled by parliaments or potentates?"

"The part of the message we've decoded does not address cultural and biological matters."

The ambassador checked her notes. "Can you say what planet of their sun they live on?"

"No."

The steerers looked down at the table or around the room, everywhere but at two debaters. Matthews, seated behind Bridget in the visitors gallery, seethed.

"In fact, ET's signal intentionally hides all evidence of the planet he's from."

"I believe that to be a mischaracterization of why the signal is at a constant frequency," replied Bridget. She was also starting to get angry.

"But ET has not shown what planet he's from, even though he's shown he knows what planet *we* are from."

"Not in what has been decoded so far."

Smythe looked to her colleagues. "We staffed the Reply committee with veteran diplomats. It is no surprise to me that they have no draft response. How *could* they reply to an alien race that has offered absolutely no information about itself?"

* * * *

If Bridget had seemed angry by the end of the exchange with the ambassador from Belize, Matthews was furious. The questions had all been variations of, "Do you still beat your spouse?" Any direct answer was either an admission or an apparent evasion.

Bridget had, quite properly, pointed out that ET's message was only partially analyzed. That worked fine once or twice; after that, it came across as an excuse.

He gave her credit for maintaining her composure. Perhaps there was no politic way to tell an ambassador that she was full of crap. Antinov's performance yesterday had been one of a kind, and only his unique career allowed him to pull it off.

Roderigo called a recess. The ambassadors converged to one end of the room; the steerers huddled at their table. Matthews felt alone in a crowded room, watching COPUOS move towards declaring victory and disbanding the task force.

No COPUOS action could stop analysis of the message; ET's full text was on the Web for all who cared to see. There were also plenty of antennas beyond task force jurisdiction listening for the resumption of ET's signal. A UN withdrawal of funding, if it happened, would only slow the analysis.

No, the real problem would came later, *after* the analysis. It was not merely appropriate for Earth's answer to come from the UN level. Two days after Xu's press release, the General Assembly had passed an emergency resolution. With its hasty ratification by three fourths of UN member countries, an international treaty now required that any response come only under UN auspices. Mbeke, Smythe, and their ilk showed little interest in okaying any such transmission.

Protocol be damned. He started pushing through the crowd to the American ambassador.

* * * *

Alexander Klein had an imposing resume. He had earned PhDs in history and international studies from Yale at 22. He was tenured at Stanford at 27. At thirty, he was a senior staffer on the National Security Council. The UN ambassadorship was his second cabinet-level position.

Klein overruled the aide attempting to shoo Matthews away. They stepped into a small chamber off the COPUOS hearing room. The ambassador heard Matthews out, asking occasional questions and jotting notes. Glancing often at his watch, Klein kept the conversation ruthlessly focused: absent a compelling new argument, the hearing was moving towards shut-down of the task force. Matthews hoped he was making that case.

Roderigo's gavel fell. Ambassadors, witnesses, staff and observers all took their seats. The chairman recognized Klein.

After a flowery introduction, Klein took some notes from his jacket. He rubbed his chin thoughtfully. "Dr. Satterswaithe, might I impose on you for a bit longer?"

Bridget nodded.

"I'd like us to step back from the text of ET's message, or rather from the part of that message so far decoded. I've been led to believe that it might be instructive to consider the broader context."

Klein glanced again at the notes of his consultation with Matthews. "Would I be correct in understanding the following? In just the last few weeks we've been given proof that humans are not alone in the universe. In fact, we have neighbors who can see our little world here."

"That's right, Mr. Ambassador."

"And these neighbors not only have better telescopes than we do, they have better radios as well."

"Again, that's correct."

"That's a lot of knowledge from a supposedly secretive source." Klein studied his notes again. "And the signal that conveyed all of that knowledge to us, was sent by a transmitter far more powerful than anything we've ever built?"

As Bridget agreed once more, Matthews worried that Klein was overdoing it. The Third World delegations had already shown more discomfort with possible culture clashes and perceived inferiority than the physicist had thought possible.

"Thanks for keeping me clear on these points, Doctor." Klein took off and polished his glasses, the image of a harmless college don. "Some of my esteemed colleagues have raised a concern, and I am not unsympathetic, about the cost of the task force.

"I have reason to believe that these are not the only costs. If I could refer you for a moment to your 'day job,' would I be correct in my understanding that radio spectrum is a valuable resource? An economically precious resource?"

Bridget leaned forward with a renewed confidence. She (and the ambassador) had gotten it. "Very much so. For example, we had to disrupt the plans of a global satcom company to avoid interference on ET's channel." She had in mind NetSat.

"I see. Presumably our Lalande friends have to sacrifice the same frequency to communicate with us?"

"Yes."

Klein turned his attention to his fellow ambassadors. “I find that my perception of ET differs from some of my colleagues. For example, I feel that I know a lot about him. He's curious: he wants to know more about us. He's smart: he knows a few tricks we might like to learn. He's serious: whatever effort we've made to hear and understand his signal, it must be *far* smaller than the investment ET made to formulate such an elegant message, to reserve valuable radio spectrum just in case we answer, and to devote a transmitter the likes of which we have yet to build. We would know none of that if our neighbor had simply chosen not to tell us.”

He tucked his notes—perfectly delivered, so far, thought Dean—back into his jacket. “It's said that money talks. ET has dedicated quite a lot of whatever he uses for money to this endeavor. I think he's entitled to have us hear him out.

“I predict,” and here Klein paused dramatically, “that by the time we've finished the processing of ET's message, we'll have discovered a request for information from us.” Matthews silently mouthed *his* prediction along with the ambassador.

“I think we all should keep an open mind about how, what, and when to answer ET. For surely, if we do not reply, it will be *his* committees deciding not to throw good money after bad.”

He smiled once more at Bridget. “And then who can say what amazing knowledge we will have forfeited?”

CHAPTER 7

The steerers were disinvited from day three of the hearing, where COPUOS would decide the task force's fate. Bridget and Dean sought distraction at the Statue of Liberty. She had never seen it; he'd visited it at the age of eight.

“That is one handy connection you have with Alex Klein,” she offered on the return ferry. It was the first violation of a tacit no-business policy.

“Oh?”

“I've been holding back, too. It appears you were right about ET requesting information.” She paused as the ferry's horn blasted. “Although it's generally impractical to decode out of sequence, the analysts have scanned ahead in the message. They figured that a sneak preview might suggest in advance technical specialties we should add to staff.”

“So what lies ahead?”

“The message gets more and more complex. Most of what's left looks like physics and electronics. Amid that technical detail, oddly, is a return to arithmetic. That's followed by a brief return to chemistry. The arithmetic and the chemical reactions both use a symbol we don't understand. Everyone assumes we'll know what it means once we read things in order. The puzzling thing is, that symbol doesn't appear earlier.”

“Give me an example?”

“Sure. Call the undecoded symbol ‘X.’ The math is stuff like 2+3=X and 7-1=X. The chemistry starts

as similarly basic chemical reactions, with a reactant missing, replaced by X. Then X shows up in a lot of hairy chemistry material."

A cloud blew over the sun, turning the harbor air instantly chilly. He was too deep in thought to notice. "You didn't pick 'X' at random. You're thinking of everyone's favorite algebra variable: X the unknown."

"My mind's been heading that way since the speech you put your ambassador up to."

"Okay, let's assume 'X' *is* something to be solved for. ET used trivial arithmetic problems to introduce the symbol. He used simple chemistry problems to generalize the concept beyond math. And then..." He stopped, staring into space.

"And the remaining occurrences of X might just turn out to be ET's shopping list."

* * * *

Matthews' cell phone chimed as the ferry docked. Chattering, jostling tourists almost drowned out Alex's news. COPUOS had narrowly approved task-force continuation: a 43-40 vote. Dean gave a thumb's up to Bridget, now on her own phone.

The gesture was arguably too soon. Alex's next words were less upbeat. "Winning this round meant cashing in several favors owed the US. I expect Mbeke and his allies will try packing the committee with new Third World members before the next review. If that happens, I don't see where the votes would come from to authorize a reply."

* * * *

Bridget's call was a summons for them both from Kim; they took a cab from the dock to the UN. One short hour after the vote, hundreds of Earth Firsters were already demonstrating in front of the UN building.

To Dean's surprise, Bridget excused herself when they got to the Undersecretary-General's office. "Today's vote was unpleasantly close," said Kim, as the door closed behind Bridget. "We must do better next time."

Dean shrugged inwardly. Where was this going?

"Perhaps we need fresh thinking. The kind of insight that your Ambassador showed yesterday ... with your input. Bridget also speaks highly of you." Kim smiled, "Joining the steering committee would be much more efficient than maneuvering us."

Matthews didn't protest the insinuation: there was adequate truth to it. Coming from a career politician and diplomat, the remark was probably meant as a compliment.

"Now assuming that you *will* join us, I suggest that you join a post-vote strategy session."

CHAPTER 8

It turned out that Matthews' prediction on the ferry had been only half right.

At his suggestion, the next steering committee meeting included a synopsis of the whole message. The head of the Analysis committee, Koji Matsumoto, gave the summary. Koji was an intense astrophysicist

on loan from NASDA, the Japanese space agency. He looked surprisingly awake for someone teleconferencing from Tokyo, where it was 3:00 a.m.

Matsumoto uploaded a graphic. “This chart overviews the entire message and our progress in reading it. Message blocks flow from left to right and top to bottom. The ‘look at me’ pulses and earliest images are at the top left. As you know, ET marks each image with the dimensionality and size of the next image. This lets us separate the message into its parts, although many of the later blocks don't make sense yet.”

Dean studied the graphic. In rough terms, he visualized the image in three segments. The first quarter was red, fading to orange. The middle half was yellow. The last fourth spanned the rest of the rainbow, in thin slices.

“The blocks we think are fully decoded appear in red. We have covered that material at earlier meetings. Orange shows blocks that are partially interpreted. We believe the yellow area that follows is, like the orange, progressively more advanced mathematics, physics, and chemistry.”

Matsumoto sent a new image. “Here we see more detail about the end of the message. The thin green slice is only a few frames long: it is where ET introduces what we think is a question-mark symbol. The blue that follows is what Dean called the shopping list; we'll return to that. The indigo area seems to be electronic schematics. Violet, the final section, appears to derive units of measure, such as time intervals, from fundamental physical constants.”

Another graphic appeared, its blue border suggesting that it came from the shopping-list portion of the message. Dean saw a chemical reaction in which the presumed question-mark character represented a catalyst. Beneath the reaction was a line of three other symbols.

Matsumoto went on. “Here is a typical frame from the shopping list. It certainly seems plausible that ET is asking if we can identify a catalyst for this chemical reaction. On the next line are the ‘us’ and ‘them’ symbols, Earth and ET, separated by something we didn't recognize at first: a vector symbol from the early physics tutorial. We think it is used here to show direction.”

In short, the line read: “Earth to ET.”

Flick. Another blue-bordered graphic appeared. It, too, showed a chemical reaction, seemingly for a fuel cell. A question mark again stood where a catalyst would be indicated. Beneath that were the us, to, and them symbols—but with one key difference: the direction of the vector was reversed.

“In addition to what Dean called ET's shopping list,” said Matsumoto, “we think ET has sent us a catalogue.”

* * * *

From the Earth First chat room.
All_Politics_Is_Local: The $%^#!! UN is still moving toward a reply to ET. How can they be stopped?

Stop_World_Government : See your verbs, dude? Passive voice! UR the problem. What can *you* do?

All_Politics_Is_Local : I'll bite. What can I do?

Radical_Dude : Be in New York when COPUOS meets next. Earth First is organizing mass

demonstrations, with support from around the world. If the UN doesn't change course, we'll show them that the Battle of Seattle was only a tea party. Earth's precious resources are for Earth!

All_Politics_Is_Local : I have been properly rebuked and reeducated. Earth First!

Radical_Dude : Amen to that!

* * * *

Call it barter, which sounded primitive, or trading intellectual property, or *very* long-distance e-business. By any name, the task force had finally answered the question, "What does ET want?"

He wants, it would seem, to learn useful things from us.

Though something like this had been suspected for days, since Dean and Bridget's ferry ride, it was more persuasive in Matsumoto's concise briefing. Consensus quickly jelled on the interstellar trading scenario. Speculation swirled about how the system could work. More heat than light was being generated.

Matthews coughed for attention. "Koji, could you bring back your first chart?" The image Matthews had requested popped up. "I'm going to climb out on another limb."

"As we keep re-learning, ET is very systematic. So why do electronics reappear after the shopping list and catalogue? Koji, might the indigo area be a new tutorial or trade goods?"

"We see no new symbols in the indigo region, so I would not think it is tutorial. We also found none of the 'us to them' or 'them to us' phrases, so I do not think indigo relates to trading."

"As I expected." Matthews pushed back his chair, feeling the need to pace. "One of the few things ET already knows about us is that the signals we send, or more accurately leak, are so weak he can barely hear us. That's pretty clear from the time-lapsed replay of what he's heard. Surely if ET had extracted any information from Earth's radio leakage, instead of just our dial tone, he'd have sent a bit of it back to let us know.

"ET's transmitter is far more powerful than anything on Earth, or it's capable of incredibly focused beamcasting, or both. So, another speculation. I bet that the indigo material, the electronics, is a transmitter design. There's no reason for ET to ask to trade until we learn to speak intelligibly."

"Perhaps I can complete the decoding," added Matsumoto. "If we grant Dean's speculation, a meaning might also be placed on the last portion. At a high level, as I said, the part of the message coded in violet derives units of measure. This appears to include time intervals and a radio frequency.

"If Dean is correct, the last part of the message may be telling us when and where ET will be listening for our reply."

CHAPTER 9

A side effect of Matthew's new assignment was more time spent in New York. The steering committee met often, with only the furthest-away members telecommuting. His house plants took it hard, but otherwise it worked well. In particular, it gave him the chance to better bond with the other steerers. His new routine of a morning jog with Vladimir Antinov was pure bonus.

Pounding along a Central Park track, Dean saved his breath for keeping up with the fanatically fit general, while Antinov did the speaking. Each run brought a revelation and the always useful reminder one learned more by listening than by talking.

Today Vladimir was pondering a new press release from Dean's former committee fellows. His perspective was always an eye opener, as different from Dean's industrial viewpoint as Dean's was from the academics and bureaucrats who dominated the task force.

"Good technique, my friend, divide and conquer." The Russian didn't appear to be sweating. "Analyzing as much of the message at once as possible makes sense."

"In my world, we call it parallel processing."

"The labs back home say it is an interesting approach." He referred to what had indeed proven to be a transmitter design.

Dean considered, reminded of his favorite evasion. As in: this casserole is interesting. "More surprising than interesting." Pant, pant. "Curiously complex."

"You should think like a Russian." When the physicist made no reply, Antinov continued. "Consider *Mir* . I loved seeing the faces on your astronauts when they first came aboard. They were in shock about *Mir* . So primitive. So klugged."

"Kludged?"

"Yes, thanks. Kludged. Despite our kludging, or maybe because of it, USSR had a space station twelve years before one piece was launched for a NASA space station." He jogged in place at the crest of a hill while the huffing American caught up. "The best is the enemy of the good enough."

"My brain is not at its best when bouncing."

"You Americans believe advanced capability requires advanced technology. You think ET's solution must be simple and elegant." They zigged off the path to pass some mere power walkers, then zagged back on. "You never think of *Mir* ."

"So." Matthews was out of breath. "You're ... saying ... brute force."

"Perhaps. Of course, I would not know an elegant radio design if it shot at me. I only suggest that you consider it."

"Food ... for thought."

"Only five kilometers. You would not survive a real run." Antinov pointed to a coffee shop. "Come, we'll get some real food."

* * * *

"The University of California at Berkeley announced the discovery at the end of the ET message of a deadline for Earth's response. Dr. Enrique Ramirez, of the Department of Computer Science, stated that ET has requested that Earth begin its reply 97 days from today.

"A UN spokesman confirmed that its task force had been seeking an independent validation of a similar translation. The spokesman would not speculate what answer the task force might recommend, or even whether a response was under consideration."

—GlobalNet Evening News

* * * *

With time running out before a pre-reply COPUOS review, and the authorization vote Alex Klein predicted the task force would lose, Matthews widened his search for ideas.

After hours of chat-room exploration and web surfing, Matthews encountered "A note on amplifiers in the Lalande 21185 transmitter design" by a Joachim Frisch. Dean clicked on the URL and started scanning. As an aura of professionalism emerged, his reading slowed down. Searching on the author, Dean found nine papers in refereed engineering journals, although the most recent was ten years old.

His second review was very slow and deliberate. He was reminded of, and thought deeply about, Vladimir Antinov's comments about *Mir* .

It was early evening in Frankfurt. Hoping that Herr Frisch was not out enjoying the Oktoberfest, Dean started to dial.

* * * *

From the SETI Conspiracy chat room.
Suspect_Everyone: So now there's a pressing deadline to answer ET ... Who else smells a six-legged, bug-eyed rat?

42_is_true : How convenient! ET spies on us for 30+ years and we get a few months to reply. What's the rush?

Suspect_Everyone : The rush, my naive friend, is to stampede us. Remember that the UN already pushed through a treaty allowing only *them* to answer ET. The vote to reply will be one more pretense why we "need" world government.

Remember_Seattle : They've made a losing gamble. Once we delay them past the deadline, the whole pretense lapses. Join Earth First at the barricades in NYC.

CHAPTER 10

The stretch limo of the American UN mission was twenty minutes late in retrieving Matthews. Traffic crawled, snarled by picketing Earth Firsters. Despite the unruly crowds, Dean could have made faster progress on foot.

"Thanks for seeing me on such short notice. I appreciate your flexibility, since my calendar doesn't offer much."

"You're welcome, Mr. Ambassador. What can I do for you?"

"Please, we're alone. It's just Alex. I wanted to advise you of an issue in regard to your recent inquiry."

Matthews didn't speak diplomatese, but in his experience an issue was never a good thing.

ET's shopping list and catalogue, when decoded, had been much alike. All sixteen entries on the shopping list were related to chemical reactions and materials science. The catalogue hinted at fifteen catalysts and materials; the sixteenth entry promised a superior optical telescope design.

It was commonly interpreted that ET would swap any item from his catalogue for any item we supplied from his shopping list. The problem was with comparative skill levels: ET's wares and the new solutions he sought were both mostly unfamiliar to the task force's chemists and chemical engineers. Lots to ask for; nothing to trade.

ET's shopping list included catalysts for fuel cells. There had been a long-shot chance that the US national labs had related unpublished work. Alex's office had agreed to expedite a DoE query for Dean.

"First off, no luck with the national labs. I'm told, in fact, that the example ET used to define 'fuel cell' is potentially better than anything we have.

"On the other hand ... my good friend, the Secretary of Commerce, was contacted discretely by two key constituents, if you know what I mean. The corporations they represent may each have one of the catalysts sought by ET. The research is not yet ready for patent application."

Key constituents, presumably, were campaign contributors. "Will they share information with ET? Do they understand the impracticality of obtaining payment from him?"

They grabbed armrests as the limo braked suddenly. Three protesters in bug-eyed-monster masks with Devil's horns had darted in front of the vehicle. Their waving placards asked, "Do I look trustworthy?"

Klein grimaced at the street theater. "Barter is awkward, as is the delay. Sixteen years round-trip? That's not the real issue, however.

"Sending technology to ET means a turnover to the task force for encoding and transmission. Neither company trusts the UN to keep proprietary technology secret here on Earth.

"Federal purchase of the technology has been mentioned, but we're talking billions. A purchase probably couldn't happen in time, even if it were the right thing to do."

Matthews looked glumly out blackened, one-way limo glass. More and more demonstrators streamed past the trapped limo towards the UN. "Look at this crowd. Can they spell Luddite?"

The ambassador snapped shut his briefcase. "The major economic powers all *want* the ET technologies. We've been trying hard to freeze COPUOS membership until after the natural milestone of an authorization to reply. I expect to lose the procedural vote on that membership freeze today.

"We have nothing to trade, long odds of getting a reply authorized are about to get worse, and the clock is running out. Your Luddites are the least of our problems."

* * * *

"I became interested in a report from the Analysis group. As they had determined, there are obvious subassemblies for signal modulation and amplification. There is an impressive design for focusing and steering a beam using a phased-array antenna, like we use for radars. It is elegant work."

Joachim Frisch tapped the printout spread across his dining room table. The schematic was roughly two

meters by three. It had been printed on letter-sized stationery and taped together. “And then we have *this* complicated mess.”

Frisch was a frail, grey-haired gentleman of seventy-three years. He'd never fully recovered from a car crash two years earlier, and was wheelchair-bound. Until his retirement, he had been a customer-support engineer at the big German electronics firm, Siemens. He still did free-lance consulting, troubleshooting others’ designs and suggesting improvements.

“Forty years moving from customer to customer, application to application, builds a skill set. I thought that mastering yet one more design, even an alien one, would be easy. I've seen *many* radio circuits in my time.”

Matthews nibbled on one of the biscuits set out by Frau Frisch. *Honigkuchen?* “Your web posting suggests that you had more success than the task force.”

“Ah, but I cheated. I have a hobby to help.” He rolled into the adjoining living room and opened a cabinet to reveal a rack-mounted set of ancient stereo components.

To a crisp, metronome-like performance of the Fifth Brandenburg Concerto, Matthews reconsidered his mental dating of the equipment. The sound quality was exquisite, at least as good as that of his own recently purchased stereo. The orange glow of vacuum tubes had clouded his judgement. “I admit it, I'm a transistor chauvinist. These tubes produce a better, truer sound. How long did this take to build?”

Frisch laughed. “I began in college and I'm not done. In these modern times I must make many of my own tubes. Later, if you wish, I will show you my workshop.”

“So what do you find most interesting about ET's radio?”

“Our symbols for electronic components of course differ from ET's. We learned ET's symbols early in the message, in the physics tutorial. Do you agree?”

“I think so,” said Matthews. “I am not an expert in that part of the message.”

“ET drew a wet-cell battery and showed it with a new icon. This is how we know his symbol for a voltage source. He made an animation of electrons moving, and another symbol, and we know how he shows current.

“Then ET drew the simplest possible circuit: the voltage symbol in series with one new symbol. The drawing is above the most familiar of electrical equations.”

Ohm's law, recalled Matthews: junior-high physics.

“Obviously, the new symbol is for a resistor,” continued Frisch. “There is also a graph. It is not drawn as we would, but from context, it is recognizable: current versus voltage in the new device. The graph describes a resistor, so the plot is a straight line.”

Matthews nodded. “We don't know how ET builds a resistor, but the circuit is so simple we were sure to recognize the new element. The real purpose of the chart was to introduce voltage/current plots, transfer functions.”

“Indeed.”

"And does ET use transfer-function graphs to describe all of his other circuit elements?"

Frisch smiled. "Exactly! Later in the message such graphs define many new electrical devices. They behave like diodes, capacitors, inductors, and other familiar parts."

"Leaving to us to decide how the component is actually constructed." Fascinating. "Almost any EE today, seeing a three-terminal amplifying device would assume it was a transistor. He would consider the associated transfer function drawing as a cartoon and dismiss any subtle differences from what is expected of a transistor."

"And only a stubborn tube-loving fossil would consider that it could be a tube, a triode." Frisch once more tapped the tablecloth-sized printout. Despite his obvious excitement, the old EE seemed weary. "But the way ET built his very high powered amplifier section ... it is not like a transistor design. Not like a solid-state design."

"We should take a break. Would you mind one more question first?"

"Please."

"For a large radio transmitter, are there reasons to prefer tube technology over solid state?"

"None." Frisch rubbed his temple pensively. "ET has many parallel antennas in his phased array, so this task could easily be done with transistors. I have given the matter serious thought."

That fit. There was plenty of stress among the engineers assigned to boosting the power of some Earth transmitters, just in case a reply was authorized, but Matthews had heard not one word of worry about integrated circuit inadequacies.

Mir, thought Matthews. Antinov's advice never to underestimate what could be accomplished using only basics and brute force. "Unless ET doesn't have solid state technology."

Transistors and integrated circuits had revolutionized Earth, had made such sweeping changes that no one had considered that the seemingly advanced ET might not have them.

How valuable to ET would transistors be?

* * * *

"The streets of Manhattan were brought to a standstill today, in a limited demonstration of Earth First's resolve.

"Earth First has united the many communities committed to protecting our world's interests. Our voices include people of faith, supporters of national sovereignty, defenders of our planetary resources, and guardians against extraterrestrial duplicity. We come from every class, country, and continent.

"Members of COPUOS, disband the Lalande task force, or face our wrath."

—Earth First communique

* * * *

Within minutes of leaving the Frischs' apartment, Matthews had phoned Bridget. Within the hour, she

was booked on the next flight from Geneva. She brought with Sven Olssen, the ITU analyst who had first recognized ET's radio-frequency replay.

They began the next day with a whirlwind tour of the old city's medieval cathedral, since Frau Frisch had asked Matthews to delay his return until late morning. Her husband had been exhausted by the excitement.

"So," said Herr Frisch, "you return with friends today. These ideas of mine may have some merit."

Bridget laid a hand on the German's forearm. "Very much so. Your insights are most helpful. We appreciate your help."

"I wish I had insights to offer for the entire design." Frisch pointed at the alien schematic, still draped across the dining room table. "This whole section continues to elude me."

Matthews laughed ruefully. "And an entire UN task force."

"Well, as I'm sure everyone has seen, this section provides input to the focusing and aiming circuits that drive the phased array. If so, some of this strange area generates direction information. Parts seem to do signal modulation and frequency shifting. Mostly we see what appear to be control loops. What and how they control I do not understand. It is so complex, loop within loop within loop."

They sat staring at the schematic. After a while, Sven said, "If this were software, I'd call it spaghetti code. Everything is intertwined."

"While we're admitting to odd associations, I can top that." Bridget traced a circuit loop. "I'm reminded of something far more venerable. Maybe it was seeing the old cathedral this morning, but loops within loops bring to mind wheels within wheels. Pre-Copernican astronomy: deferents, epicycles, and equants."

Matthews' mind turned neither to software nor Ptolemaic astronomy. Something in the schematic, or in the comments about the design, reminded him in some way of challenges he'd faced *before* the task force.

That was when the metaphorical light bulb of enlightenment switched on.

CHAPTER 11

With only twenty days remaining until ET's reply window opened, COPUOS scheduled a task-force review to decide whether and how to respond. Rampaging Earth First protesters delayed the session's start by a day.

The USG summarized the task force's progress since the last COPUOS review. Completion of reading ET's message. An overview of the catalogue and shopping list. Specific reply windows proposed by ET, the first only nineteen days away—the opportunity after that, two years away. The immense benefits of obtaining ET's offered technologies. Earth's unfortunate lack of answers to ET's questions. The race to enhance Earth's largest transmitters so that ET could detect a signal and not just the carrier wave.

Then it was Matthews' turn.

"Many have expressed surprise, and some disappointment, that ET's message is commercial in nature. That approach has come to make sense to me. Our task force has not been an inexpensive undertaking. Radio telescopes are not inexpensive instruments. Adapting transmitters for interstellar use, sacrificing the use of spectrum ... these are all very real costs. Governments have historically found SETI a hard investment to justify. Dialogue with another star, however intellectually stimulating, can quickly come to seem less worthy of financial support than today's natural disaster or international incident."

Emotionless faces looked back at Matthews, diplomats all skilled at internalizing their reactions.

"Can humanity maintain a purely intellectual conversation in which answers to our questions will come, at best, after a sixteen-year delay? Will we maintain financial support for such a dialogue? I don't presume to speak for Earth; that is the responsibility first of this committee, and, based on your recommendation, for the entire United Nations. ET, however, has reached a conclusion for *his* society: communications with Earth are to be self-supporting.

"So ET constrained our decision: there must be value to him in our reply. Perhaps we can also learn about each other's cultures, but only if our relationship works economically.

"Here is the crux of our problem. ET has more sensitive radio receivers than we, more powerful transmitters, better telescopes. His knowledge exceeds ours in the areas, chemistry and materials science, in which he solicits our contributions. While there may be exceptions, potentially trade-worthy technologies in our most advanced laboratories, we are entangled in ownership issues here on Earth.

"The question becomes, simply: what do we have to trade?"

Ambassador Smythe of Belize cleared her throat. "It is a rather delicious irony that the developed world's knowledge is not commercial."

Matthews ignored the barb. "We've all felt hampered throughout this investigation by how little we know about ET. Well, ET knew less about us when he sent his message than we now know about him. Recognizing how ET jumped to conclusions about Earth may help us be more realistic about him.

"Effectively, ET could hear us whispering, but not make out anything we said. We presume ET sent us a transmitter design because he inferred from our weak transmissions that Earth couldn't talk any louder. That's incorrect. He offers us his sophisticated chemistry, and apparently feels, with *no* basis that we can see, that our chemistry must be comparably advanced. That is also wrong.

"The transmitter design is the single largest part of the message. Analysis of the design has been enlightening. It is a more powerful transmitter than humans have cared to build, but we *could* build a transmitter that powerful if we so chose. The Undersecretary-General has explained how we are working to do just that. The interesting fact about ET's radio design is not its power, but rather something it took a while to recognize.

"It appears that Earth's electronics technology is *far* superior to ET's."

* * * *

"Rioting Earth First demonstrators, unsuccessful at preventing the COPUOS hearing for a second day, have shut down areas of Manhattan up to two miles from the UN. Arrests now exceed two hundred. Sympathy protests are causing lesser disruptions in London, Canberra, Tokyo, Berlin, and Paris.

"Undeterred by but surely not unaware of the violence, the Lalande task force and the committee that

oversees it continue to debate whether Earth will reply to ET."

—AP World News

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The USG called a ten-minute break after Dean's revelation. Coordinating diplomats was like herding cats: thirty minutes later, the head count had only crept back to a quorum.

"I worked at a satcom company before joining the task force, and that background provided a useful insight.

"To be pocket-sized, satellite-capable phones must avoid big batteries and antennas. We put the satellites in low Earth orbit to minimize power requirements for the phones. In these orbits, satellites constantly move in and out of sight. It takes a lot of software to sort out which satellite should handle a particular call, and when to hand off a call to another satellite. Meanwhile, the Earth rotates under the satellites, bringing different ground stations into play."

"Yes, yes, Dr. Matthews." Ambassador Smythe stood in the doorway, back from her extended break. "I'm sure your former employer appreciates the advertisement. It isn't clear that ET would be impressed."

Dean decided to overlook both gibes. "Because satellites move along their orbits and ground stations rotate with the Earth, there are continuously varying Doppler shifts over various links. The software must adjust.

"You'll recall that ET's signal maintained a constant wavelength. Achieving that constancy took correction in real time for the relative motion of ET's star and our sun, for the orbital motion of our planets, and for the rotation of our planets. The calculations resemble those with which I am familiar from the design of satellite constellations.

"Our analysts have closely studied ET's transmitter design. Two observations surprised them. First, ET's electronics are based not on transistors and integrated circuits, but on vacuum tubes. That was astonishing enough. The second conclusion was more amazing. ET does not employ digital computing."

Scattered whispering had erupted in the gallery at the mention of vacuum tubes; the comment about computing elicited even less seemly murmuring. The chairman glared at the small audience. "If necessary, I will clear the room of all staff and invited guests." He motioned at Matthews to continue.

"I reviewed my background only to make a point: Doppler correction is familiar to me. The geometry can be messy, but the correction is easily programmed into a standard digital computer. ET has a distinct analog control loop for each component of motion: his planet's orbit, his planet's rotation, Earth's rotation, and so on." More precisely, and of doubtful interest to the diplomats, ET's transmitter employed coupled feedforward servo controls.

"ET's system works, or we would never have heard him. Still, by our standards his approach is *extremely* cumbersome. Each correction factor is provided by a physically separate circuit, involving many vacuum tubes. Tubes are inherently unreliable devices, compared to transistors. That makes his circuits prone to component failures."

Crowd noise and the sound of gunfire—from rubber bullets, Dean silently hoped—repeatedly punctuated the briefing. Scowls began exceeding sympathetic expressions as the din rose repeatedly. Had Earth First overplayed its hand?

He pushed on. “ET's most advanced technologies appear to be chemistry and materials science. In these areas ET clearly exceeds our knowledge. But ET does not know what he does not know: solid state physics. He probably never seriously investigated digital computing: our pre-transistor computers were unreliable novelties, room-sized monstrosities with less computing capability than my wrist watch. Digital computing simply isn't practical without solid-state devices.”

Once more the roar of angry protesters made speaking difficult. The supposedly multicultural demonstration seemed to have found one voice: obstructionism. Resistance to change. An inarticulate remembrance of his time on the Media committee nagged at his subconscious.

Dean took a deep breath. “At this time, I'd like to introduce the task force's recommendation. We *should* respond to the Lalande message, starting transmission in seventeen days as per ET's request. We should order from ET's catalogue.

“For prepayment, we propose to ignore ET's shopping list. We would instead send introductory instruction in computing and the design of some simple solid-state devices. It need not include anything proprietary. Our accompanying catalogue will be for more advanced device designs and digital algorithms.

“We would be surprised indeed if ET failed to find these new technologies far more attractive than anything he has requested.”

* * * *

In a logical world, the presentation was complete. In this world, the fun had only begun. As Roberto Ramos, the Chilean ambassador, was being recognized, Dean spotted Alex Klein's prearranged gesture identifying a planted question.

“Dr. Matthews. A point of clarification, please. Is the task force proposing that Earth's trade goods be elementary computing and electronics techniques?”

“That's correct, Ambassador.”

“Technology we all,” and here the ambassador's arm sweep encompassed the many nations comprising COPUOS, “have mastered and moved on from.”

“Yes. ET's science appears not to have gone in those directions.”

“And in return for our decades-old technology we can expect to receive advanced chemical knowledge. In effect we get something for nothing.” Ramos thumped the table. Around him, many ambassadorial heads were nodding. “How can we lose?”

“Who are ‘we’ that cannot lose?” The question came from the task force's nemesis, Ambassador Smythe of Belize. “Who obtains this advanced chemistry?”

“If I may?” It was Khaldun ibn-Saud, ambassador and crown prince of Saudi Arabia (and, Matthews suspected, another Klein ally). “All of our universities have listened to ET. When he responds, all will do so again. We shall *all* get the new technology.”

Another outburst from the street interrupted the discussion. Li Zhou Huang, the Chinese ambassador, narrowed his eyes. Despite its extreme understatement, the facial expression left no doubt how Li felt

about the disorder. Of course, Dean remembered, his government still rationalized the Tienanmen Square massacre. Talk about cultural differences.

The physicist's mental alarm triggered again. Putting his trust in his subconscious, he gave less than his full attention to the debate. The ambassadors were talking to each other now, rather than questioning him, anyway. Cultural differences. Cultural sensitivities.

As controversy raged, the message decoding remained unchallenged. The potential benefit of the proposed swap was uncontested. The subliminal text of Matthews' briefing, that ET would get technology inferior to what the less prosperous countries had already mastered, seemed to have converted a few ambassadors. That was one cultural sensitivity addressed...

What *was* his subconscious poking at?

A steady stream of objections, orchestrated by Ambassador Smythe, pressed what seemed to be the last counterargument to a reply. Who is this ET? Why is he so secretive? What are his motives? Stripped of all pretense, the obstructionist case was simple xenophobia.

French-accented English in Dean's earpiece presented the objections of Chad. Some combination of the female translator's accent and the booming bass voice of Chad's ambassador recalled the leader of the Media & Education committee. "Our role is to package and control the Lalande information," Paul Ricard had said at the kickoff, "while respecting various cultural sensitivities."

Dean had focused that day on the impracticality of *controlling* ET's information. What about the *packaging* of that information? He'd sat through dispute after droning committee dispute about the optimal multicultural spinning of prospective announcements. What had he learned?

Swelling chants of, "Hey, Hey. Ho, Ho. COP-U-OS has got to go!" began again to drown out the debate. Sirens erupted. Li Zhou Huang's eyes narrowed once more, his hostility towards the crowd's coercion evident. Earth First had been wise to omit China from its planned disturbances.

What did ET know about Earth's cultures? Almost certainly, nothing. Ditto for any sensitivities that knowledge of ET's culture might arouse on Earth.

"ET hang up! ET hang up!"

Few things are as satisfying as the realization of a previously unrecognized assumption. When the outside chaos momentarily ebbed, Dean seized the floor. "The concerns now being expressed may rest on a misapprehension."

"And what is that?" asked Ambassador Smythe icily.

"That ET is being secretive." He spread his arms wide. "Many cultural perspectives are evident in this room. Despite that, our talk of 'ET' suggests we may have fallen into the error of positing a single alien culture.

"Imagine an ET conference preceding their transmission. Perhaps they too have many cultures, developed over millennia. Their national representatives argue over how to introduce themselves to their newfound neighbors: us.

"Will they present all of their cultures, or the supposed important ones, or only their cross-cultural

commonalities? Will each society describe itself, or must all groups agree to every description? Will their entire history be an open book, or should embarrassing episodes be withheld? What is sent when two nations, one perhaps an ex-colony of the other, or former military adversaries, disagree about events? Will explanations be made about contradictory religions or systems of economics? How might our society, or societies, react to theirs?

"ET took more than thirty years to contact Earth after detecting humanity's presence. We have all wondered why." Dean slowly and deliberately made eye contact with each ambassador. "Perhaps the ETs needed that long to agree upon the one mutually acceptable description of their cultures...

"Silence."

When Li Zhou Huang and Alex Klein simultaneously smiled, Dean knew that he, the task force, and humanity had won.

EPILOGUE

The auditorium was packed in flagrant disregard for the fire code. More people filled the hallway. Matthews recognized task force members, COPUOS ambassadors, talking heads from the networks. People kept glancing at their watches. Twenty-one minutes to start of transmission, and counting.

Dean wriggled through the crowd to join Bridget, who looked as exhausted as he felt. Fair enough: refining and encoding Earth's reply, then checking and double-checking it, had taken 'round-the-clock efforts for two weeks. The Reply committee had borne the brunt of it—the final tweaks to the message had been made just that morning, but almost everyone on the task force had felt the crunch.

"I find myself envying ET. Discovering unexpected courses in quantum mechanics and computing. Following our recipes to build their first transistors and solar cells." She gestured with a meatball on a toothpick. "And *then* he'll read our catalogue."

"So you think he may be interested in processes for making integrated circuits? Or schematics for the old PC in my den closet?"

"Could be," she grinned. "Really, it's a brilliant solution. Trade our common knowledge, that no one can object to parting with, for their expertise."

"And since we'll post our message to the Web, everyone who cares gets a sneak preview of our order. That's at least sixteen years to figure out ET's technology or to decide to exit a business that could be made obsolete."

"Your attention, everyone," called the amplified voice of Kim Chun Ku. A wave of shushes broke out. "Please be seated."

On stage, large-screen TVs showed the great parabolic antenna at the Jodrell Bank radio observatory (now also an interstellar transmission station), the nearby control room, and a slaved copy of the main console display bearing only a decrementing counter.

The antenna was prepositioned, its motion as it tracked Lalande 21185 too slow to be visible. The control room had been vacated by all but a few technicians, the USG, and Sherman Xu. As the counter reached sixty seconds, Kim whispered something to the man who had started it all. The crowd cheered

as Xu took his seat at the console.

At zero, Xu tapped the enter key. To thunderous applause, the text of Earth's response began scrolling down a monitor in the auditorium. Dean and Bridget embraced, and were far from the only people exchanging hugs, kisses, and backslaps.

The more important version of the message took the first step of its journey: an uplink to a geosat over the Atlantic for relay to Jodrell Bank in the UK. Jodrell Bank would start Earth's beamcast: responsibility would be handed off from transmitter to transmitter as the world turned. The eighteen-hour message would repeat continuously for the thirty days ET had said he'd be listening.

The USG entered the auditorium to thank everyone for their contributions. He kept his remarks brief, knowing them to be anticlimactic. The room emptied slowly, everyone too wound up to leave but for the first time in months lacking a clear purpose. Party noises from down the hall were subdued.

* * * *

Dean and Bridget found themselves alone in an otherwise empty auditorium. "Yes, I envy ET," repeated Bridget. "He has only eight years to wait. We've got to endure twice that."

"We actually have plenty to keep us busy."

Perhaps eyes actually could twinkle—he was emitting some good vibe.

"Okay, Dean. What *haven't* you told me?"

"Remember ET going off-line a while back?"

"Sure. Didn't we decide his planet was going behind his sun? Too much interference?"

"That 'explanation' was purely speculative, since we can't see his planet."

She tipped her head in puzzlement. "What *are* you saying?"

"There's a small matter I've kept to myself since we cracked ET's transmitter design. Remember the beam-steering and Doppler-correction logic? That circuitry is implicitly a model of his planet's movement and ours. I took the liberty of programming the model onto my laptop."

"So *is* our speculation plausible? Might ET have stopped sending because his orbit meant his sun would be in the way?"

"Not even close. ET had another reason for stopping his transmission. My guess is that he had another use for his big transmitter." The smile Dean had been hiding burst forth, an ear-to-ear grin.

"Now that we've built ourselves a phone, it appears we *might* have other neighbors to introduce ourselves to."