Star Light

By Hal Clement

First of Four Parts

1: PIT STOP

Beetchermarlf felt the vibrations die out as his vehicle came to a halt, but instinctively looked outside before releasing the *Kwembly's* helm. It was wasted effort, of course. The sun, or rather, the body he was trying to think of as *the* sun, had set nearly twenty hours before. The sky was still too bright for stars to be seen, but not bright enough to show details on the almost featureless dusty snow field around him. Behind, which was the only direction he could not see from the center of the bridge, the *Kwembly's* trail might have provided some visual reference; but from his post at the helm there was no clue to his speed.

The captain, stretched out on his platform above and behind the helmsman, interpreted correctly the latter's raised head. If he was amused, he concealed the fact. With nearly two human lifetimes spent on Mesklin's unpredictable oceans he had never learned to like uncertainty, merely to live with it. Commanding a "vessel" he did not fully understand, travelling on land instead of sea and knowing that his home world was over three parsecs away did nothing to bolster his own self-confidence, and he sympathized fully with the youngster's lack of it.

"We're stopped, helmsman. Secure, and start your hundred-hour maintenance check. We'll stay here for ten hours."

"Yes, sir." Beetchermarlf slipped the helm into its locking notch. A glance at the clock told him that over an hour of his watch remained, so he began checking the cables which connected the steering bar with the *Kwembly's* forward trucks.

The lines were visible enough, since no effort had been made to conceal essential machinery behind walls. The builders of the huge vehicle and her eleven sister "ships" had not been concerned with appearance. It took only a few seconds to make sure that the few inches of cable above the bridge deck were still free of wear. The helmsman gestured an "all's well" to the captain, rapped on the deck for clearance, waited for acknowledgment from below, opened the starboard trap and vanished down the ramp to continue his inspection.

Dondragmer watched him go with no great concern. His worries were elsewhere, and the helmsman was a dependable sailor. He put the steering problem from his mind for the moment, and reared the front portion of his eighteen-inch body upward until his head was level with the speaking tubes. A siren-like wail which could have been heard over one of Mesklin's typhoons and was almost ridiculous in the silence of Dhrawn's snow field secured the attention of the rest of the crew.

"This is the captain. Ten hours halt for maintenance check; watch on duty get started. Research personnel follow your usual routine, being sure to check with the bridge before going outside. No flying until the scouts have been overhauled. Power distribution, acknowledge!"

"Power checking." The voice from the speaking tube was a little deeper than Dondragmer's.

"Life support, acknowledge!"

"Life support checking."

"Communication, acknowledge!"

"Checking."

"Kervenser to the bridge for standby! I'm going outside. Research, give me outside conditions!"

"One moment. Captain." The pause was brief before the voice resumed, "Temperature 77; pressure 26.1; wind from 21, steady at 200 cables per hour; oxygen fraction standard at 0.0 122."

"Thanks. That doesn't seem too bad."

"No. With your permission, I'll come out with you to get surface samples. May we set up the drill? We can get cores to a fair depth in less than ten hours."

"That will be all right. I may be outside before you get to the lock, if you take time to collect the drill gear, but you are cleared outside when ready. Tell Kervenser the number of your party, for the log."

"Thank you, Captain. We'll be there right away."

Dondragmer relaxed at his station; he would not, of course, leave the bridge until his relief appeared, even with the engines stopped. Kervenser would be some minutes in arriving, since he would have to turn his current duties over to a relief of his own. The wait was not bothersome, however, since there was plenty to think about. Dondragmer was not the worrying type (the Mesklinite nervous system does not react to uncertainty in that way) but he did like to think situations out before he lived them.

The fact that he was some ten or twelve thousand miles from help if the *Kwembly* were ever crippled was merely background, not a special problem. It did not differ essentially from the situation he had faced for most of his life on *Mesklin's* vast seas. The *principal* ripple on his normally placid self-confidence was stirred up by the machine he commanded. It resembled in no way the flexible assemblage of rafts which was his idea of a ship. He had been assured that it would float if occasion arose; it actually had floated during tests on distant Mesklin where it had been built. Since then, however, it had been disassembled, loaded into shuttle craft and lifted into orbit around its world of origin, transferred in space to an interstellar flier, shifted back to another and very different shuttle after the three-parsec jump, and brought to Dhrawn's surface before being reassembled. Dondragmer had personally supervised the disassembly and reconstruction of the *Kwembly* and her sister machines, but the intervening steps had not been carried out under his own eye. This formed the principal reason for his wanting to go outside now; high as was his opinion of Beetchermarlf and the rest of his picked crew, he liked firsthand knowledge.

He did not, of course, mention this to Kervenser when the latter reached the bridge. It was something which went without saying. Anyway, the first officer presumably felt the same himself.

"Maintenance checks are under way. The researchers are going out to sink a well, and I'm going out to look things over," was all Dondragmer said as he resigned his station. "You can signal me with outside lights if necessary. It's all yours."

Kervenser snapped two of his flippers light-heartedly. "I'll ride it, Don. Enjoy yourself." The captain left by way of the still open hatch which had admitted his relief, telling himself as he went that Kervenser

wasn't as casual as he sounded.

Four decks down and sixty feet aft of the bridge was the main air lock. Dondragmer paused several times on the way to talk to members of his crew as they worked among the cords, beams, and piping of the *Kwembly's* interior. By the time he reached the lock four scientists were already there with their drilling gear, and had started to don their air suits. The captain watched critically as they wriggled their long bodies and numerous legs into the transparent envelopes, made the tests for tightness, and checked their hydrogen and argon supplies. Satisfied, he gestured them into the lock and began suiting up himself. By the time he was outside the. others were well on with setting up their apparatus.

He glanced at them only briefly as he paused at the top of the ramp leading from lock to ground. He knew what they were doing and could take it for granted, but he could never be that casual about the weather. 1~en as he latched the outer lock portal behind him, he was looking at as much of the sky as the towering hull of his command permitted.

The darkness was deepening very, very slowly as Dhrawn's two-month rotation carried the feeble sun farther below the horizon. As at home, the horizon itself seemed to be somewhat above his level of sight all around. The gravity-squeezed atmosphere responsible for this effect would also set the stars twinkling violently when they became visible. Dondragmer glanced toward the bow, but the twin stars which guarded the south celestial pole, Fomalhaut and Sol, were still invisible.

A few cirrus clouds showed above, drifting rapidly toward the west. Evidently the winds a thousand or two feet above were opposed to the surface ones, as was usual during the daytime. This might change shortly, Dondragmer knew; only a few thousand miles to the west was country in which the setting of the sun would make a greater temperature change than it did here, and there might be weather changes in the next dozen hours. Exactly what sort of changes, was more than his Mesklinite sailor background, even fortified with alien meteorology and physics, enabled him to guess.

For the moment, though, all seemed well. He made his way down the ramp to the snow and a hundred yards to the east, partly to make sure of the rest of the sky and partly to get an overall view of his command before commencing a detailed inspection.

The western sky was no more threatening than the rest, and he favored it with only a brief glance.

The *Kwembly* looked just as usual. To a human being it would probably have suggested a cigar made of dough and allowed to settle on a flat table for a time. It was slightly over a hundred feet in length, between twenty and twenty-five in breadth, and its highest point was nearly twenty feet above the snow. Actually there were two such points; the upper curve of the hull, about a third of the way back, and the bridge itself. The latter was a twenty-foot crosspiece whose nearly square outlines somewhat spoiled the smooth curves of the main body. It was almost at the bow, permitting helmsman, commander, and conning personnel to watch the ground as they traveled almost to the point where the forward trucks covered it.

The flat bottom of the vehicle was nearly a yard off the snow, supported on an almost continuous set of tread-bearing trucks. These were individually castered and connected by a bewildering rigging of fine cables, allowing the *Kwembly* to turn in a fairly short radius with reasonably complete control of her traction. The trucks were separated from the hull proper by what amounted to a pneumatic mattress, which distributed traction and adapted to minor ground irregularities.

A caterpillar-like figure was making its way slowly along the near side of the land-cruiser, presumably Beetchermarlf continuing his inspection of the rigging. Twenty yards closer to the captain the short tower of the core drill had been erected. Above, clinging to the holdfasts which studded the hull but could

hardly be seen at the captain’s distance, other crew members were climbing about as they inspected the seams for tightness. This, to a Mesklinite, was a nerve-stretching job. Acrophobia was a normal and healthy state of mind to a being reared on a world where polar gravity was more than six hundred times that of Earth, and even "home" gravity a third of that. Dhrawn’s comparatively feeble pull, scarcely thirteen hundred feet per second squared, took some of the curse off climbing, but hull inspection was still the least popular of duties. Dondragmer crawled back across the hard-packed mixture of white crystals and brown dust, interrupted by occasional sprawling bushes, and made his way up the side to help out with the job.

The great, curved plates were of boron fiber bonded with oxygen-and fluorine-loaded polymers. They had been fabricated on a world none of the Mesklinites had ever seen, though most of the crew had had dealings with its natives. The human chemical engineers had designed those hull members to withstand every corrosive agent they could foresee. They fully realized that Dhrawn was one of the few places in the universe likely to be even worse in this respect than their own oxygen-and-water world. They were quite aware of its gravity. They had all these factors in mind when they synthesized the hull members and the adhesives which held them together: both the temporary cements used during the testing on Mesklin and the supposedly permanent ones employed in reassembling the vehicles on Dhrawn. Dondragmer had every confidence in the skill of those men, but he could not forget that they had not faced and never expected to face the conditions their products were fighting. These particular parachute packers would never be asked to jump, though that analogy would have been lost on a Mesklinite.

Much as the captain respected theory, he very well knew the gap between it and practice, so he devoted full attention to examining the joints between the great hull sections.

By the time he had satisfied himself that they were still sound and tight, the sky had become noticeably darker. Kervenser, in response to a rap on the outside of the bridge and a few gestures, had turned on some of the outside lights. By their aid the climbers finished their work and made their way back onto the snow.

Beetchermarlf appeared from under the great hull and reported his tiller lines in perfect shape. The workers at the drill had recovered several feet of core, and were taking this into the laboratory as soon as each segment was obtained, in view of the ambient temperature. Actually the local "snow" seemed to be nearly all water at the surface, and therefore safely below its melting point, but no one could be sure how true this would be deeper down.

The artificial light made the sky less noticeable. The first warning of changing weather was a sudden gust of wind. The *Kwembly* rocked slightly on her treads, the tiller lines singing as the dense air swept past them. The Mesklinites were not inconvenienced. In Dhrawn’s gravity blowing them away would have been a job for a respectable tornado. They weighed about as much as a life-sized gold statue would have on Earth. Dondragmer, digging his claws reflexively into the dusty snow, was not bothered by the wind; but he was much annoyed at his own failure to notice earlier the clouds which accompanied it. These had changed from the fleecy cirrus perhaps a thousand feet above to broken stratus-type scud at half that height. There was no precipitation yet, but none of the sailors doubted that it would come soon. They could not guess, however, what form it would take or how violent it might be. They had been a year and a half on Dhrawn, by human measure, but this was not nearly long enough to learn all the moods of a world far larger than their own. Even had that world completed one of its own revolutions, instead of less than a quarter of one, it would not have been time enough and Dondragmer’s crew knew it.

The captain’s voice rose above the song of the wind.

"Inside, everyone. Berjendee, Reffel, and Stakendee to me to help with the drilling gear. First man inside tell Kervenser to stand by on engines and be ready to swing bow to wind when the last of us is aboard."

Dondragmer knew as he gave the command that it might be impossible to obey it. It was quite likely that the maintenance check might be at a stage which would prevent engine start. Having issued the order, however, he thought about it no further. It would be carried out if possible, and his attention was needed elsewhere. The drilling equipment was top priority; it was research apparatus, which was the entire reason for the Mesklinites' presence on Dhrawn. Even Dondragmer, comparatively free of that suspicion of human intentions and motives which affected many Mesklinites, suspected that the average human scientist would value the drilling equipment more highly than the lives of one or two of the crew.

The researchers had already withdrawn the bit and started inside with it when he reached them. The crank and gear box of the muscle-powered device followed, leaving only the supporting frame and guide towers. These were less critical, since they could be replaced without human assistance, but since the wind was growing no worse, the captain and his helpers stayed to salvage them also. By the time this had been done, the others had vanished inside and Kervenser was clearly impatient on the bridge above.

Thankfully Dondragmer shepherded his group up the ramp and through the lock door, which he latched behind them. They were now standing on a yard-wide shelf running the length of the lock, facing an equally wide pool of liquid ammonia which formed the inboard half of the compartment. The most heavily burdened of the group climbed into the liquid grasping holds similar to those on the outer hull; others, like the captain, simply dived in. The inner wall of the lock extended four feet below the surface, and had a three-foot clearance between its lower edge and the bottom of the tank. Passing under this and climbing the far side, they emerged on a ledge similar to that at the entrance. Another door gave them ingress to the midsection of the *Kwembly*.

There was a slight stink of oxygen about them—a few bubbles of outside air usually accompanied anything which went through the lock— but the ubiquitous ammonia vapor and the catalyst surfaces exposed at many sites within the hull had long ago proven capable of keeping this nuisance under control. Most of the Mesklinites had learned not to mind the odor too much especially since, as far as anyone knew, really small traces of the gas were harmless.

The researchers doffed their suits and made off with their apparatus and the cases which had protected their cores from the liquid ammonia. Dondragmer dismissed the others to their regular duties, and headed for the bridge. Kervenser started to leave the command station as the captain came through the hatch, but the latter waved him back and went to the starboard end of the superstructure. Portions of its floor were transparent. The human designers had originally intended it all to be so, but they had failed to allow for Mesklinite psychology. Crawling about on the hull was bad enough, but standing on a transparent floor over fifteen feet or so of empty air was beyond all reason. The captain stopped at the edge of one of the floor panes and looked down gingerly.

The grayish surface about the huge vehicle was unchanged; the wind which shook the hull was making no apparent impression on the snow which had been packed by two-score Earth gravities for no one knew how much time. Even the eddies around the *Kwembly* showed no signs of their presence, though Dondragmer had rather expected them to be digging holes at the edges of his treads. Farther out, to the limit reached by the

lights, nothing could be seen on the expanse except holes where the cores had been dug and the whipping branches of an occasional bush. He watched these closely for several minutes, expecting the wind to make some impression there if anywhere, but finally shifted his attention to the sky.

A few bright stars were beginning to show between the patches of scud, but the Guardians of the Pole could not be seen. They were only a few degrees above the southern horizon—much of that due to refraction— and the clouds further blocked the slanting view. There was still no sign of rain or snow, and no way of telling which, if either, to expect. The temperature outside was still just below the melting point

of pure ammonia and far below that of water, but mixed precipitation was more than likely. What these would do to the nearly pure water-ice under him was more than Dondragmer cared to guess; he knew about the mutual solubility of water and ammonia, but had never attempted to memorize phase diagrams or freezing-point tables of the various possible mixtures. If the snow did dissolve, the *Kwembly* might get a chance to show her floating ability. He was not eager to make the test.

Kervenser interrupted his thoughts.

"Captain, we will be ready to move in four or five minutes. Do you want driving power?"

"Not yet. I was afraid that the wind would cut the snow out from under us and tip us over, like backwash on a beached ship, and I wanted to be bow-on if that happened; but there seems to be no danger of it so far. Have the maintenance checks continue except for items which would interfere with a five-minute warning for drive power."

"That's what we're doing, Captain. I set it up when your order came in a few minutes ago."

"Good. Then we'll keep outside lights on and watch the ground around us until we're ready to go again, or until the blow ends."

"It's a nuisance not being able to guess when that will be."

"It is. At home a storm seldom lasts more than a day, and never more than an hour or so. This world turns so slowly that storm cells can be as big as a continent, and could take hundreds of hours to pass. We'll just have to wait this one out.

"You mean we can't travel until the wind goes down?"

"I'm not sure. Air scouting would be risky, and we couldn't go fast enough without it for scouting to be worth the trouble, as far as the human crowd is concerned."

"I don't like going so fast anyway. You can't really look over a place unless you stop for a while. We must be missing a lot that even the human funnies would find interesting."

"They seem to know what they want—something about being able to decide whether Dhrawn is a planet or a star—and they pay the bills. I admit it gets boring for people with nothing to occupy them but routine.

Kervenser let that remark pass without comment, if not without notice. He knew his commander would not have been deliberately insulting, even after the mate's slighting remark about human beings. This was a point on which Dondragmer differed rather sharply from many of his fellows, who took for granted that the aliens were out for what they could get, like any good traders. The commander had spent more time in close communication with human, Paneshk, and Drommian scientists than had almost any other Mesklinite and, having a rather tolerant and accommodating personality to start with, had become what many of the other Mesklinites regarded as soft with respect to the aliens.

Discussion of the matter was rare, and Beetchermarlf's arrival forestalled it this time. He reported completion of checkout. Dondragmer relieved him, ordered him to send the new helmsman to the bridge, and fell silent until the latter arrived. Takoorch, however, was not the sort to live with silence; and when he reached the bridge lost little time in starting what he doubtless considered a conversation. Kervenser, amused as usual by the fellow's imagination and gall, kept him going; however, Dondragmer ignored all but occasional snatches of the conversation. He was more interested in what was going on outside, little as that seemed to be at the moment.

He cut off the bridge lights and all the outside ones but the lowest floods, giving himself a better view of the sky without completely losing touch with the surface. The clouds were fewer and smaller, but they seemed to be moving past quite as rapidly as before. The sound of the wind remained about the same. More stars were slowly appearing. Once he glimpsed one of the Guardians, as the Mesklinite sailors had so quickly named them, low to the south. He could not tell which it was; Sol and Fomalhaut were about equally bright from Dhrawn, and their violent twinkling through the huge world's atmosphere made color judgment unreliable. The glimpse was brief anyway, since the clouds were not completely gone.

"—the whole starboard group of rafts peeled off, with everyone but me on the main body—"

Still no rain or snow, and the clearing skies made them seem less likely now, to the captain's relief. A check with the laboratory through one of the speaking tubes informed him that the temperature was dropping; it was now *75,* three degrees below ammonia melting point. Still close enough for trouble with mixtures, but heading in the right direction.

"—of the islands south and west of Dingbar. We'd been ridden ashore by a storm bulge, and were high and dry with half the drift boards broken. I—"

The stars overhead were almost uninterrupted now; the scud had nearly vanished. The constellations were familiar, of course. Most of the brighter stars in the neighborhood were little affected by a three-parsec change in viewpoint. Dondragmer had had plenty of time to get used to the minor changes, anyway, and no longer noticed them. He tried to find the Guardians once more, but still had no luck. Maybe there were still clouds to the south. It was too dark now to be sure. Even cutting the rest of the floods for a moment didn't help. It did, however, attract the attention of the other two, and the flow of anecdote ceased for a moment.

"Anything changing, Captain?" Kervenser's jocular attitude vanished at the possibility of action.

"Possibly. Stars are showing above, but not to the south. Not anywhere near the horizon, in fact. Try a spot."

The first officer obeyed, and a spear of light flicked upward from a point behind the bridge as he touched one of the few electrical controls. Dondragmer manipulated a pair of pull cables, and the beam swung toward the western horizon. A wail, the rough equivalent of a human grunt of surprise, came from Kervenser as the descending beam became more visible parallel to the ground.

"Fog!" exclaimed the helmsman. "Thin, but that's what's blocking the horizon." Dondragmer gave a gesture of agreement as he reared to a speaking tube.

"Research!" he hooted. "Possible precipitation. Check what it is, and what it could do to this water-ice under us."

"It will take a while to get a sample, sir," came the answer. "We'll be as quick as we can. Are we cleared outside, or will we have to work through the hull?"

The captain paused for a moment, listening to the wind and remembering how it had felt.

"You're cleared out. Be as quick as you can.

"On the way, Captain."

At Dondragmer's gesture, the first officer cut off the spot, and the three went to the starboard end of the bridge to watch the outside party.

They moved quickly but the haze was becoming more noticeable by the time the lock opened. Two caterpillar-like forms emerged carrying a cylindrical package between them. They made their way forward to a point almost under the watchers, and set up their equipment—essentially a funnel facing into the wind and feeding into a filter. It took several minutes to convince them that they had a big enough sample, but eventually they dismantled the equipment, sealed the filter into a container to preserve it from the lock fluid and made their way back to the entrance.

"I suppose it will take them a day to decide what it is, now," grumbled Kervenser.

"I doubt it," replied the captain. "They've been playing with quick tests for water-ammonia solutions. I think Borndender said something about density being enough, given a decent-sized sample."

"In that case, why are they taking so long?"

"They could hardly be out of their air suits yet," the captain pointed out patiently.

"Why should they get out of them before making delivery to the lab? Why couldn't—"

A hoot from a speaking tube interrupted him. Dondragmer acknowledged.

"Just about pure ammonia, sir. I think it was super-cooled liquid droplets; it froze into a froth in the filter, and let quite a bit of outside air loose when it melted in here. If you should smell oxygen for the next few minutes, that's it. It may start icing up the hull, and if it coats the bridge, as it did the filter, it will interfere with your seeing, but that's all I can guess at right now in the way of trouble."

It was not all Dondragmer could imagine, but he acknowledged the information without further comment.

"This sort of thing hasn't happened since we've been here," he remarked. "I wonder whether it's some sort of seasonal change coming on. We are getting closer to this body's sun. I wish the human crowd had watched this world for a longer time before they sold us on the idea of exploring it for them. It would be so nice to know what comes next. Kervenser, start engines. When ready, turn bow into wind and proceed ahead dead slow, if you can still see out. If not, circle as sharply as possible to port, to stay on surface we know. Keep an eye on the treads— figuratively, of course; we can't see them without going out—and let me know if there's evidence that anything is sticking to them. Post a man at the stern port; our trail might show something. Understand?"

"The orders, yes, sir. What you're expecting, no."

"I may be wrong, and if I'm right there's probably nothing to do anyway. I don't like the idea of going outside to clear the treads manually. Just hope."

"Yes, sir." Kervenser turned to his task, and as the fusion engines in the *Kwembly's* trucks came to life, the captain turned to a block of plastic about four inches high and wide and a foot long, which lay beside his station. He inserted one of his nippers in a small hole in the side of the block, manipulated a control, and began to talk.

2: GRANDSTAND

His voice traveled fast, but it was a long time on the way. The radio waves carrying it sped through Dhrawn's heavy but quickly thinning atmosphere and through the space beyond for second after second.

They weakened as they traveled, but half a minute after they had been radiated their energy was still concentrated enough to affect a ten-foot dish antenna. The one they encountered was projecting from a cylinder some three hundred feet in diameter and half as long: it formed one end of a structure resembling a barbell, spinning slowly about an axis perpendicular to its bar and midway between its weights.

The current induced by the waves in the antenna flicked, in a much shorter time, into a pinhead-size crystal which rectified it, enveloped it, used the envelope to modulate an electron stream provided by a finger-sized generator beside it and thus manipulated an amazingly old-fashioned dynamic cone in a thirty-foot-square room near the center of the cylinder. Just thirty-two seconds after Dondragmer uttered his words they were reproduced for the ears of three of the fifteen human beings seated in the room. He did not know who would be there at the time, and therefore spoke the human tongue he had learned rather than his own language; so all three understood him.

"This is an interim report from the *Kwembly*. We stopped two and a half hours ago for routine maintenance and investigation. Wind was about 200 cables at the time, from the west, sky partly cloudy. Shortly after we got to work the wind picked up to over 3,000 cables—"

One of the human listeners was wearing a puzzled expression, and after a moment managed to catch the eye of another.

"A Mesklinite cable is about 206 feet, Boyd," the latter said softly. "The wind jumped from about five miles an hour to over sixty."

"Thanks, Easy." Their attention returned to the speaker.

"Fog has now closed us in completely, and is getting ever thicker. I don’t dare move as I had planned; just in circles to keep the treads from icing. The fog is super-cooled ammonia according to my scientists, and the local surface is water snow. It doesn’t seem to have occurred to my research people, but with the temperature in the seventies it seems to me there’s a chance of the fog’s dissolving some of the water-ice to make a liquid. I realize this machine is supposed to float, and I don’t suppose the surface would melt very deeply anyway, but I’m wondering whether anyone has thought much about what will happen if a liquid freezes around our treads. I have to admit I never have, but the thought of chipping the ship loose by muscle power isn’t inviting. I know there’s no special equipment on board to handle such a situation, because I assembled and loaded this machine myself. I’m simply calling to report that we might possibly be here a good deal longer than planned. I’ll keep you informed, and if we do get immobilized we’ll be glad of projects to keep our scientists busy. They’ve already done most of the things you set up for an ordinary stop.

"Thanks, Don," replied Easy. "We’ll stand by. I’ll ask our observers and aerologists whether they can make a guess about the size of your fog bank, and how long it’s likely to stay around you. They may have some useful material already, since you’ve been on the night side for a day or so. For that matter, they may even have current pictures; I don’t know all the limits of their instruments. Anyway, I’ll check and let you know."

The woman opened her microphone switch and turned to the others as her words sped toward Dhrawn.

"I wish I could tell from Don’s voice whether he’s really worried or not," she remarked. "Every time those people run into something new on that horrible world, I wonder how we ever had the gall to send them there or how they had the courage to go.

‘They certainly weren’t forced or tricked into it, Easy," pointed out one of her companions. "A Mesklinite who has spent most of his life as a sailor, and covered his home planet from equator to south pole, certainly isn’t naive about any of the aspects of exploring or pioneering. We couldn’t have kidded them if

we'd wanted to."

"I know that in my head, Boyd, but my stomach doesn't always believe it. When the *Kwembly* was bogged in sand only five hundred miles from the settlement, I was grinding enamel off my teeth until they worked her loose. When Densigeref's *Smof* was trapped in a cleft by a mud flow that formed under it and let it down, I was almost the only one who backed up Barlennan's decision to send another of the big land-rovers to the rescue. When the *Esket's* crew disappeared with a couple of very good friends of mine, I fought both Alan and Barlennan on the decision *not* to send a rescue crew. And I still think they were wrong. I know there's a job to be done and that the Mesklinites agreed to do it with a clear understanding of its risks, but when one of those crews gets into trouble I just can't help imagining myself down there with them and I tend to take their side when there's an argument about rescue action. I suppose I'll be fired from this place eventually because of that, but it's the way I'm made."

Boyd Mersereau chuckled.

"Don't worry, Easy. You have that job just because you do react that way. Please remember that if we do disagree strongly with Barlennan or any of his people, we're six million miles and forty g's of potential away and he's probably going to do what he wants anyway. Whenever it gets to that point, it's very much to our advantage to have someone up here whom he can regard as being on his side. Don't change a bit, please."

"Humph." If Elise Hoffman was either pleased or relieved, she failed to show it. "That's what Ib is always saying, but I've been writing him off as prejudiced."

"I'm sure he is, but that doesn't necessarily disqualify him from forming a sound opinion. You must believe some things he says.

"Thanks, Easy," Dondragmer's answer interrupted the discussion. He was using his own language this time, which neither of the men understood very well. "I'll be glad of any word your observers can supply. You needn't report to Barlennan unless you particularly want to. We aren't actually in trouble yet and he has enough on his mind without being bothered by maybes. The research suggestions you can send down straight to the lab on set two; I'd probably mix them up if I relayed. I'll sign off now, but we'll keep all four sets manned."

The speaker fell silent, and Aucoin, the third human listener, got to his feet, looking at Easy for a translation. She obliged.

"That means work," he said. "We had a number of longer programs planned for later in the *Kwembly's* trip, but if Dondragmer may be delayed long where he is, I'd better see which of them would fit now. I got enough of that other speech to suggest that he doesn't really expect to move soon. I'll go to Computation first and have them reproduce a really precise set of position bearings for him from the shadow satellites, then I'll go to Atmospherics for their opinion and then I'll be in the planning lab."

"I may see you in Atmospherics," replied Easy. "I'm going now to get the information Dondragmer wanted, if you'll stand watch here, Boyd."

"All right, for a while. I have some other work to do myself, but I'll make sure the *Kwembly's* screens are covered. You'd better tell Don who's here, though, so he won't send up an emergency message in Stennish or whatever he calls his native language. Come to think of it, though, I suppose sixty seconds extra delay wouldn't matter much, considering what little we could do for him from here."

The woman shrugged, spoke a few words of the little sailor's language into the transmitter, waved to Mersereau, and was gone before Dondragmer received her last phrase. Alan Aucoin had already left.

The meteorology lab was on the "highest" level of the cylinder, enough closer to the spin axis of the station to make a person about ten percent lighter than in the communication room. Facilities for exercise being as limited as they were, powered elevators had been omitted from the station's design, and intercoms were regarded as strictly emergency equipment. Easy Hoffman had the choice of a spiral stairway at the axis of symmetry of the cylinder or any of several ladders. Since she wasn't carrying anything, she didn't bother with the stairs. Her destination was almost directly "above" Communications, and she reached it in less than a minute.

The most prominent features in this room were two twenty-foot-diameter hemispherical maps of Dhrawn. Each was a live-vision screen carrying displays of temperature, reference-altitude pressure, wind velocity, where it was obtainable, and such other data as could be obtained either from the low-orbiting shadow satellites or the Mesklinite exploring crews. A spot of green light marked the Settlement just north of the equator, and nine fainter yellow sparks scattered closely around it indicated the exploring land-cruisers. Against the background of the gigantic planet their spread made an embarrassingly small display, scattered over a range of some eight thousand miles east and west and twenty or twenty-five thousand north and south, on the western side of what the meteorologists called Low Alpha. The yellow lights, except for two well out in the colder regions to the west, formed a rough arc framing the Low. Eventually it was to be ringed with sensing stations, but little more than a quarter of its eighty-thousand-mile perimeter had so far been covered.

The cost had been high—not merely in money, which Easy tended to regard as merely a measure of effort expended, but in life. Her eyes sought the red-ringed yellow light just inside the Low which marked the position of the *Esket*. Seven months—three and a half of Dhrawn's days— had passed since any human being had seen a sign of her crew, though her transmitters still sent pictures of her interior. Easy thought grimly, now and again, of her friends Kabremm and Destigmet; and occasionally she bothered Dondragmer's conscience, though she had no way of knowing this, by talking about them to the *Kwembly's* commander.

"H'lo, Easy," and "Hi, Mom," cut into her gloomy thoughts.

"Hello, weather men," she responded. "I have a friend who'd like a forecast. Can you help?"

"If it's for here in the station, sure," answered Benj.

"Don't be cynical, son. You're old enough to understand the difference between knowing nothing and not knowing everything. It's for Dondragmer of the *Kwembly*. "She indicated the yellow light on the map, and outlined the situation. "Alan is bringing an exact position, if that will help."

"Probably not much," Seumas McDevitt admitted. "If you don't like cynicism I'll have to pick my words carefully; but the light on the screen there should be right within a few hundred miles, and I doubt that we can compute a precise enough forecast for that to make a significant difference."

"I wasn't sure you'd have enough material for any predictions at all," Easy countered. "I understand that weather comes from the west even on this world, and the area to the west has been out of sunlight for days now. Can you see such places well enough to get useful data?"

"Oh, sure." Benj's sarcasm had vanished and the enthusiasm which had caused him to put down atmospheric physics as his post-primary tentative was taking over. "We don't get much of our measurement from reflected sunlight anyway; nearly all is direct radiation from the planet. There's a lot more emitted than it receives from the sun anyway; you've heard the old argument as to whether Dhrawn ought to be called a star or a planet. We can tell ground temperature, a good deal about ground cover, lapse rates, and clouds. Winds are harder—" he hesitated, seeing McDevitt's eye on him and unable to

read the meteorologist's poker face. The man read the trouble in time and nodded him on before the rush of self-confidence had lost momentum. McDevitt had never been a teacher, but he had the touch.

"Winds are harder because of the slight uncertainty in cloud heights and the fact that adiabatic temperature changes often have more to say about the location of clouds than air mass identities do. In that gravity, the air density drops by half about every hundred yards of climb, and that makes for terrific PV changes in temperature—" he paused again, this time eyeing his mother. "Do you know about that sort of thing, or should I slow down?"

"I'd hate to have to solve quantitative problems on what you've just been saying," Easy replied, "but I think I have a fair qualitative picture. I get the impression that you're a little doubtful about telling Don to the nearest minute when his fog is going to clear. Would a report from him on surface pressures and winds be any help? The *Kwembly* has instruments, you know."

"It might," McDevitt admitted as Benj nodded silently. "Can I talk to the *Kwembly* directly? And will any of them understand me? My Stennish doesn't exist yet."

"I'll translate if I can keep your technical terms straight," replied Easy. "If you plan to do more than a one-month tour here, though, it would be a good idea to try to pick up the language of our little friends. Many of them know some of ours, but they appreciate it."

"I know. I plan to. I'd be glad if you'd help me."

"When I can, certainly; but you'll see a lot more of Benj."

"Benj? He came here three weeks ago with me, and hasn't had any better chance to learn languages than I have. We've both been checking out on the local observation and computer nets, and filling in on the project background." Easy grinned at her son.

"That's as may be. He's a language bug like his mother, and I think you'll find him useful, though I admit he got his Stennish from me rather than the Mesklinites. He insisted on my teaching him something that his sisters wouldn't be able to listen in on. Write as much of that off to parental pride as you like, but give him a try. Later, that is; I'd like that information for Dondragmer as soon as we can get it. He said the wind was from the west at about sixty miles an hour, if that helps at all."

The meteorologist pondered a moment.

"I'll run what we have through integration, with that bit added," he said finally. "Then we can give him something when we call, and if the numerical details he gives us then are too different we can make another run easily enough. Wait a moment.

He and the boy turned to their equipment, and for several minutes their activities meant little to the woman. She knew, of course, that they were feeding numerical data and weighting values into computing devices which were presumably already programmed to handle the data appropriately. She was pleased to see Benj apparently handling his share of the work without supervision. She and her husband had been given to understand that the boy's mathematical powers might not prove up to the need of his field of interest. Of course, what he was doing now was routine which could be handled by anyone with a little training whether he really understood it or not, but Easy chose to interpret the display as encouraging.

"Of course," McDevitt remarked as the machine was digesting its input, "there'll be room for doubt anyway. This sun doesn't do very much to the surface temperature of Dhrawn, but its effect is not completely negligible. The planet has been getting closer to the sun almost ever since we really got going here three years ago. We didn't have any surface reports except from half a dozen robots until the

Mesklinite settlement was set up a year and a half later, and even their measurements still cover only a tiny fraction of the planet. Our prediction work is almost entirely empirical, no matter how much we want to believe in the laws of physics, and we really don't have enough data for empirical rules yet."

'Easy nodded. "I realize that, and so does Dondragmer," she said. "Still, you have more information than he does, and I guess anything is welcome to him at this point. I know if I were down there thousands of miles from any sort of help, in a machine which is really in the test stage, and not even able to see what was around me—well, I can tell you from experience that it helps to be in touch with the outside. Not just in the way of conversation, though that helps, but so they could more or less see me and know what I was going through."

"We'd have an awful time seeing him," put in Benj. "Even when the air at the other end is clear, six million miles is a long way for telescope work."

"You're right, of course, but I think you know what I mean," his mother said quietly. Benj shrugged and said no more; in fact, a rather tense silence ensued for perhaps half a minute.

It was interrupted by the computer, which ejected a sheet of cryptic symbols in front of McDevitt. The other two leaned over his shoulders to see it, though this did Easy little good. The boy spent about five seconds glancing over the lines of information, and emitted a sound halfway between a snort of contempt and a laugh. The meteorologist glanced up at him.

"Go ahead, Benj. You can be as sarcastic as you like on this one. I'd advise against letting Dondragmer have these results uncensored."

"Why? What's wrong with them?" asked the woman.

"Well, most of the data, of course, was from shadow satellite readings. I did plug in your wind report, with a bit of uncertainty. I don't know what sort of instruments the caterpillars have down there, or how precisely the figures were transmitted to you; and you did say *about* sixty for the wind speed. I didn't mention the fog, since you didn't tell me any more than the fact that it was there, and I had no numbers. The first line of this computer run says that visibility in normal light—normal to human eyes, that is, and about the same to Mesklinite ones, I gather—is twenty-two miles for a one-degree blur."

Easy raised her eyebrows. "Just how do you account for something like that? I thought all the old jokes about weather men had gone pretty well out of date?"

"Actually, they just got stale. I account for it by the simple fact that we don't and can't have complete information for the machine. The most obvious lack is a detailed topographic chart of the planet, especially the couple of million square miles west of the *Kwembly*. A wind coming up or down a slope of six inches per mile at any respectable speed would change its air mass temperature rapidly just from PV change, as Benj pointed out a few minutes ago. Actually, the best maps we have of the topography were worked out from just that effect but they're pretty sketchy. I'll have to get more detailed measurements from Dondragmer's people and give them another run. Did you say Aucoin was getting a more exact position for the *Kwembly?"*

Easy had no time to answer; Aucoin himself appeared in the room. He did not bother with greetings, and took for granted that the meteorologists would have the background information from Easy.

"Eight point four five five degrees south of the equator, seven point nine two three east of the Settlement meridian. That's as close as they'll swear to. Is a thousand yards or so too much uncertainty for what you need?"

"Everybody’s being sarcastic today," muttered McDevitt. "Thanks, that’ll be fine. Easy, can we go down to Comm and have that talk with Dondragmer?"

"All right. Do you mind if Benj comes along, or is there work he should be doing here? I’d like him to meet Dondragmer, too.

"And incidentally display his linguistic powers. All right, he may come. You, too, Alan?"

"No. There’s other work to do. I’d like to know the details on any forecast you consider trustworthy, though, and anything Dondragmer reports which might conceivably affect Planning. I’ll be in PL."

The weather man nodded. Aucoin took himself off in one direction, and the other three made their way down ladders to the communication room. Mersereau had disappeared, as he had intimated he might, but one of the other watchers had shifted his position to keep an eye on the *Kwembly’s* screens. He waved and returned to his place as Easy entered. The others paid the party little attention. They had been aware of Easy’s and Mersereau’s departures simply because of the standing rule that there were never to be fewer than ten observers in the room at once. The stations were not assigned on a rigid schedule; this had been found to lead to the equivalent of road hypnosis.

The four communication sets tied to the *Kwembly* had their speakers centered in front of a group of six seats. The corresponding vision screens were set higher, so that they could also be seen from the general seats further back. Each of the six "station" seats was equipped with a microphone and a selector switch permitting contact with any one or all four of the *Kwembly’s* radios.

Easy settled herself in a comfortably central chair and switched its microphone to the set on Dondragmer’s bridge. There was little to be seen on the corresponding screen, since the transmitter’s eye was pointed forward toward the bridge windows and the Mesklinites’ report of fog was perfectly correct. The helmsman’s station and its occupant could be partly seen in the lower left-hand corner of the screen; the rest was gray blankness marked off into rectangles by the window braces. The bridge lights were subdued, but the fog beyond the windows was illuminated by the *Kwembly’s* outside floods, Easy judged.

"Don!" she called. "Easy here. Are you on the bridge?" She snapped on a timer and shifted her selector switch to the set in the laboratory. "Borndender, or whoever is there," she called, still in Stennish, "we can’t get a reliable weather prediction with the information we have. We’re talking to the bridge, but we’d be glad if you could give us as exactly as possible your present temperature, wind velocity, outside pressure, anything quantitative you have on the fog, and—" she hesitated.

"And the same information for the past few hours, with times given as closely as possible," Benj cut in in the same language.

"We’ll be ready to receive as soon as the bridge finishes talking," continued the woman.

"We could also use whatever you have on air, fog, and snow composition," added her son.

"If there is any other material you think might be of help, it will also be welcome," finished Easy. "You’re there and we aren’t, and there must be some ideas about Dhrawn’s weather you. We formed on your own." The timer sounded a bell note. "The bridge is coming in now. We’ll be waiting for your words when the captain finishes."

The speaker’s first words overlapped her closing phrase. The timer had been set for the light-speed lag of a round-trip message between Dhrawn and the station, and the bridge had answered promptly.

"Kervenser here, Mrs. Hoffman. The captain is below in the life-support room. I'll call him here if you like, or you can switch to the set down there, but if you have any advice for us we'd like it as quickly as possible. We can't see a body-length from the bridge and don't dare move, except in circles. The fliers gave us an idea of the neighborhood before we stopped and it seems solid enough, but we certainly can't take a chance on going forward. We're going dead slow, in a circle about twenty-five cables in diameter. Except when we're bow or stern to the wind, the ship feels as though it were going to capsize every few seconds. The fog has been freezing as it hits the windows, which is why we can't see out. The tracks still seem to be clear, I suppose because they're moving and ice gets cracked off before it can hurt, but I expect the tiller lines to freeze up any time, and getting the ice off them will be a glorious job. I suppose it will be possible to work outside, but I'd hate to do it myself until the wind stops. Having an air suit ice up sounds unpleasant. Any thoughts?"

Easy waited patiently for Kervenser to finish. The sixty-four-second message delay had had a general effect on everyone who did much talking between station and planet; they developed a strong tendency to say as much as possible at one time, guessing at what the other party wanted to hear. When she knew that Kervenser had finished and was waiting for an answer, she quickly summarized the message which had been given to the scientists. As with them, she omitted all mention of the computer result which had insisted that the weather must be clear. The Mesklinites knew that human science was not infallible—most of them had, in fact, a much more realistic and healthy idea of its limitations than many human beings—but there was no point in making one's self look too silly if it could be helped. She was not, of course, a meteorologist, but she was human and Kervenser would probably lump her in with the others.

The group waited almost silently for the first officer's answer when she finished. Benj's muttered translation for the benefit of McDevitt took only a few seconds longer than the message itself. When the response finally came it was merely an acknowledgment and a polite hope that the human beings could furnish useful information soon; the *Kwembly* scientists were sending up the requested material at once.

Easy and her son readied themselves for the data. She started a recorder to check any technical terms before attempting translation, but the message came through in the human language. Evidently Borndender was sending. McDevitt recovered promptly from his surprise and began taking notes, while the boy kept his eyes on the pencil point and his ears on the speaker.

It was just as well that Easy was not needed for translation. Well as she knew Stennish, there were many words strange to her in both languages; she couldn't have interpreted either way. She knew that she should not be embarrassed by the fact, but she couldn't help it. She could not help thinking of the Mesklinites as representing a culture like that of Robin Hood or Haroun al Raschid, though she knew perfectly well that several hundred of them had received very comprehensive scientific and technical education in the last half century. The fact had not been widely published, since there was a widespread notion that it was bad to release much advanced knowledge to "backward" peoples. It was likely to give them an inferiority complex and prevent further progress.

The weather men didn't care. When the final "over" came through, McDevitt and his assistant uttered a hasty "Thank You" into the nearest microphone and hurried off toward the laboratory. Easy, noting that the selector switch had been set for the bridge radio, corrected it and returned a more careful acknowledgment before signing off. Then, deciding that she would be useless in the meteorology lab, she settled back on the chair which gave her the best view of the *Kwembly's* four screens, and waited for something to happen.

Mersereau returned a few minutes after the others had left, and had to be brought up to date. Otherwise, nothing of note occurred. There was an occasional glimpse of a long, many-legged form on one of the

screens, but the Mesklinites were going about their own affairs with no particular regard for the watchers.

Easy thought of starting another conversation with Kervenser; she knew and liked this officer almost as well as she did his captain. However, the thought of the lag between remark and answer discouraged her, as it often did when there was nothing of importance to be said.

Even with no lag, conversation languished. There was little for Easy and Mersereau to say to each other which had not already been said; a year away from Earth could be counted on to exhaust most subjects of conversation except professional shop talk and matters of private, personal interest. She had little of the latter in common with Mersereau, though she liked him well enough, and their professions overlapped only in connection with talking to Mesklinites.

In consequence there was little sound in the communication room. Every few minutes one or another of the exploring land-cruisers would send in a report, which would be duly relayed to the Settlement; but most of the human beings on watch had no more occasion for small talk than Easy and Boyd Mersereau. Easy found herself trying to guess when the weather men would be back with their forecast and how reliable the new one would be. Say, two minutes to the lab, or one, if they hurried; one more to feed the new material into the computer; two for the run; five minutes of arguing, since she knew her son, over whether this prediction was really any better than the last; a repeat run with modified weights on the variables; two minutes back down to the comm room, since they certainly wouldn't hurry this time. They'd still be arguing. They should be here soon.

But before they made it, things changed. Quite suddenly, the bridge screen demanded attention. It had been quiet, with gray windows masked by frozen ammonia dominating the foreshortened image of part of the helmsman. The latter had been almost motionless, his tiller bar well over to one side as the *Kwembly* pursued the circular path described by Kervenser.

Then the windows were suddenly clear, though little could be seen beyond them; the communicator's angle of view was not depressed enough to reach ground within range of the lights. Two more Mesklinites appeared and flowed over to the windows, looking out and gesturing with obvious excitement. Mersereau pointed to another screen; there was excitement in the lab, too. So far, none of the little explorers had seen fit to report what was going on. Easy judged they were too occupied with immediate problems; furthermore it was customary for them to keep their sound volume down, or off completely, unless they specifically wanted to speak to the human beings.

At this point the weather men returned. Easy saw her son out of the corner of her eye, and asked without looking around, "Do you have anything useful this time?"

McDevitt answered briefly, "Yes. Shall I have Benj translate it to them?"

"No. They're in some sort of trouble, it seems. Give them the word yourself. Dondragmer would certainly be on the bridge, or will be by the time your words get there, when anything like this is going on. Here, use this seat and mike."

The meteorologist obeyed without question. It would be the last time for many months that he would pay Easy that compliment. He began talking as he settled into the seat.

"Dondragmer, you should have about nineteen hours of reduced visibility. The freezing fog should last for less than another hour; the temperature is going down, and the fog will change to ammonia crystals which shouldn't stick to your windows. If you can get rid of the ice already there, you should at least see through them into the snow. The wind will decrease gradually for about five more hours. By that time, the temperature should be low enough so you needn't worry about eutectic melting. There will be higher clouds for another forty-five hours—" He went on, but Easy had stopped listening.

Near the end of McDevitt's second sentence, long before the beginning of his message could have reached Dhrawn, a Mesklinite had approached the bridge pickup so closely that his grotesque face nearly filled the screen. One of his nipper-equipped arms reached out of sight to one side, and Easy knew he was activating the voice transmitter. She was not surprised to hear the captain speaking in a much calmer tone than she could have managed under the circumstances.

"Easy, or whoever is on watch, please get a special report to Barlennan. The temperature has gone up six degrees, to one hundred three, in the last few minutes, the ice has melted from the windows, and we are afloat."

3: NERVE CENTER

Perhaps it was unkind for Dondragmer to have given his report in the human language. The time taken for translation might have eased the shock a trifle for McDevitt. The worst part, as the meteorologist said later, was realizing that his own prediction was on its way to Dhrawn and nothing could stop it. For a moment he had a wild notion of getting a ship and racing the radio waves to the planet so as to shadow them from the *Kwembly's* receivers. The thought was only a flicker; only so much can be done in thirty-two seconds. Besides, none of the tenders then at the station was capable of faster-than-light flight. Most of them were used in servicing the shadow satellites.

Easy, in the next seat, didn't seem to have noticed the discrepancy between the prediction and Dondragmer's report; at least, she hadn't glanced at him with the expression which nine out of ten of his friends would have used. Well, she wouldn't, he thought. That's why she's on this job.

The woman was manipulating her selector switch again, with her attention focused on a smaller screen above the *Kwembly's* four. At first an indicator beside it glowed red; as she worked her switches it turned green and the image of an office-like room with fully a dozen Mesklinites in view appeared on the screen. Easy began her report instantly.

She was brief. All she could give was a repetition of Dondragmer's few sentences. She had finished long before there was any evidence on the screen that her words were being received.

'When the response came, however, it was satisfying. Every caterpillar-like body in sight looped toward the pickup. While Easy had never learned to read expression on the Mesklinite "face," there was no misunderstanding the wildly waving arms and snapping pincers. One of the creatures raced toward a semicircular doorway at the far side of the room and disappeared through it. In spite of the creature's red and black coloration, Easy found herself reminded of the sight, a few years before, of one of her daughters inhaling a strand of spaghetti. A Mesklinite in a hurry under forty Earth gravities appears legless to human eyes.

The sound was not on yet from the Dhrawn end, but there was a rising buzz of conversation in the human communication room. It was not unusual for exploring land-cruisers to run into difficulties. In general the working Mesklinites took such difficulties more calmly than the human beings who were watching helplessly. In spite of the lack of intercom in the station, people began entering the room and filling the general seats. Screen after screen in the front monitoring areas was tuned to the "headquarters" unit in the Settlement. Meanwhile Easy and Mersereau were dividing their attention among the four sets reporting from the *Kwembly,* with only an occasional glance at the other picture.

It was not obvious on the screens that the vehicle was afloat because the transmitters shared any motion it might have, and there was little loose equipment whose motion might have betrayed a pitch or a roll. The bulk of the crew were sailors by training. Lifelong habit prevented them from leaving things unsecured. Easy kept closest watch on the bridge screen hoping to spot something outside which could

give a clue to what was occurring, but nothing recognizable could be seen through the windows.

Then the panes were blotted out once more as Dondragmer came back into the foreground and expanded his report.

"There seems to be no immediate danger. The wind is pulling us along fairly rapidly, judging by our wake. Our magnetic course is 66. We are floating level, submerged to about deck two. Our scientists are trying to compute the density of this liquid, but no one has ever bothered to work out displacement tables for this hull as far as I know. If you human beings happen to have that information, my people would be glad to get it. Unless we run into something solid, and I can't guess at the chances of that, we'll be safe. All machinery is functioning properly, except that the treads have nothing to bite on. They race if we give them power. That's all for now. If your shadow satellites can keep track of our location, we'll be glad of that information as often as you can manage. Tell Barlennan everything is all right so far."

Easy shifted microphone connections and repeated the captain's report as nearly verbatim as she could. She saw, in due course, that it was being taken down in writing at the other end. She rather hoped that the writer would have some question to ask: not that she was likely to be able to answer it, but she was beginning to get a helpless, useless feeling again. The Mesklinite, however, merely acknowledged the information and headed for the door with his notes. Easy was left wondering how far he had to go to get them to the commander. No human being had a very good idea of the layout of the Mesklinite base.

As a matter of fact, the trip was brief Most of it appeared to be outdoors because of the settlers' attitude toward massive objects overhead:

an attitude hard to overcome even on a world where gravity was only a fraction of its normal Mesklin value. The roofs of the Settlement were almost all of transparent film brought from their home world. The only departure from a common, city-wide floor level was dictated by terrain. The thought of either a basement or a second story would never have occurred to a Mesklinite. The many-decked *Kwembly* and her sister vehicles were of basically human and Paneshk design.

The messenger wove through a maze of corridors for some two hundred yards before reaching the commander's office. This was at the northern edge of the cluster of foot-high structures which formed the greater part of the Settlement. The Settlement itself was close to the edge of a six-foot cliff extending almost a mile east and west, broken by a dozen or so artificial ramps. On the ground below the cliff, but still with their bridges looming above the transparent coverings of the "city," were two of the huge land-cruisers. The wall of Barlennan's room was also transparent and looked directly out on the nearer of these vehicles; the other was parked some thousand feet to the east. A few air suited Mesklinites were also visible outside, dwarfed by the monstrous vehicles they were tending.

Barlennan was watching this group of mechanics critically when the runner entered. The latter used no formality, but burst into Easy's relayed report as he entered the compartment. By the time the commander had swerved around to receive the written version, he had heard it all orally.

It was not satisfactory, of course. Barlennan had had time to think up a number of questions since the first messenger had arrived, and this message answered none of them. The commander controlled his impatience.

"I take it there hasn't been anything useful from the human weather experts yet.

"Nothing at all, sir, to us. They may have been talking to the *Kwembly* without our hearing, of course."

"True enough. Has word gone to our own weather people?"

"Not as far as I know, sir. There's been nothing very useful to tell them, but Guzmeen may have sent a message there, too.

"All right. I want to talk to them myself anyway. I'll be at their complex for the next half hour or more. Tell Guz."

The messenger made the affirmative nipper gesture and vanished through the door he had entered by. Barlennan took another, making his way slowly westward through building after building and over the enclosed connecting ramps which made the Settlement a single unit. Most of the ramps on his course sloped upward, so that by the time he turned south away from the cliff he was some five feet higher than his office, though not yet on a level with the bridges of the land-cruisers behind him. The roof fabric bulged a little more tautly above him, since the nearly pure hydrogen in the station did not drop as rapidly in pressure with increasing altitude as did Dhrawn's much denser gas mixture. The Settlement had been built at an elevation which was quite high for Dhrawn. The total outside pressure was about the same as that at Mesklin's sea level. It was only when the land-cruisers descended to lower elevations that they carried extra argon to keep their internal pressure balanced.

Since Dhrawn's air carried about two per cent oxygen, the Mesklinites were careful about leaks. Barlennan still remembered the awkward results of an oxygen-hydrogen explosion shortly after he had first encountered human beings.

The research complex was the westernmost and highest side of the colony. It was fairly well separated from most of the other structures and differed from them in having a solid, though still transparent, roof. It also came closer than any other part of the Settlement to having a second story, since a number of instruments were mounted on the roof where they could be reached by ramps and liquid-trap air locks. By no means all the instruments had been furnished by the alien sponsors of the Settlement; the Mesklinites had been using their own imaginations and ingenuity for fifty years, although they had not really felt free about doing so until reaching Dhrawn.

Like the exploring vehicles, the laboratory complex was a mixture of crudeness and sophistication. Energy was supplied by hydrogen-fusion units; chemical glassware was home-made. Communication with the orbiting station was by solid-state electromagnetic beam transmitter; but messages were carried physically about the complex by runners. Steps were being taken to change this, unknown to the human beings. The Mesklinites understood the telegraph and were on the verge of making telephones able to transmit their own voice range. However, neither telephone nor telegraph was being installed in the Settlement because most of Barlennan's administrative effort was being concentrated on the project which had provoked Easy's sympathy for the *Esket* crew. It takes a lot of work to lay cross-country telegraph lines.

Barlennan was saying nothing about this to his sponsors. He liked human beings, though he did not go as far in that direction as Dondragmer: he was always aware of their amazingly short life span, which prevented him from getting to really know the people he worked with before they were replaced by others. He was rather concerned about the possibility of human, Drommian, and Paneshk finding out just how ephemeral they all were, for fear it might depress them. It had, in fact, become Mesklinite policy to evade discussion on the matter of age with aliens. It was also policy not to depend more heavily than could be avoided on them. You never knew whether the next ones to take over would have the same attitudes. They were intrinsically undependable, most Mesklinites felt; Dondragmer's confidence in them was a glaring exception.

All this was known to the Mesklinite scientists who saw the commander arrive. Their first concern was with the immediate situation. "Is someone in trouble, or are you just visiting?"

"Trouble, I'm afraid," replied Barlennan. He briefly outlined Dondragmer's situation. "Collect anyone you think may be useful and come to the map." He made way to the forty-foot-square chamber whose floor was the "map" of Low Alpha, and waited. Very little of the area had been "mapped," so far. He felt, as he had so often before, that there was a long, long job ahead. Still, the map was more encouraging to him than its human counterpart some millions of miles above was to its human viewers. Both showed the arc covered by the land cruisers and something of the landscape. The Mesklinites had indicated this in spidery black lines suggesting a sketch of human nerve cells, complete with cell bodies.

The specific Mesklinite data centered mostly around the spot where the *Esket* lay. This information, marked in red, had been obtained without direct human assistance. This was one place in the Settlement where there would be no vision transmitter as long as Barlennan was running things.

Now, however, he focused his attention several feet to the south of the *Esket*, where there was discouragingly little data in either red or black. The line representing the track of the *Kwembly* looked lonesome. Barlennan had raised his front end as high as was comfortable, bringing his eyes six or seven inches from the floor, and was looking at the map gloomily when the scientists began to arrive. Bendivence was either very optimistic or very pessimistic. The commander couldn't decide which was the more likely reason for his having called nearly twenty people to the conference. They gathered a few feet from him, reared up and waited politely for his information and questions. He started without preamble.

"The *Kwembly* was here at her last report," he indicated. "It had been crossing a field of snow, water snow, nearly clear of dissolved material but quite dirty according to Don's science people."

"Borndender?" queried someone. Barlennan gestured affirmatively and went on.

"The snow field started here." He crawled to a spot nearly four feet northwest of the position marker. "It lies between a couple of mountain ridges, which we have indicated only roughly. Destigmet's balloons haven't gotten this far south yet, or at least word hasn't reached us and Don's fliers haven't seen much. Just now, while the *Kwembly* was stopped for a routine maintenance check, a heavy wind came up, and then a dense fog of pure or nearly pure ammonia. Then, quite suddenly, the temperature rose several degrees and they found themselves afloat, being blown roughly eastward by the wind. We would like explanations and we badly need constructive advice. Why did the temperature go up, and why did the snow melt? Is there any connection between the two? Remember that the highest temperature they mentioned was only about a hundred and three, twenty-six or -seven degrees below the melting point of water. Why the wind? How long is it likely to last? It's carrying the *Kwembly* toward the hot regions inside Low Alpha south of the *Esket* site." He gestured toward a heavily red-marked section of the floor. "Can we tell how far they'll be carried? I didn't want Dondragmer to go out on this trip, and I certainly don't want to lose him even if we don't agree completely.

"We'll call for what help we can get from the men, but you'll have to use your brains, too. I know some of you have been trying to make sense out of Dhrawn's climatology; do you have any worthwhile ideas which might apply here?"

Several minutes of silence followed. Even those in the group most given to uttering rhetorical speeches had been working with Barlennan too long to risk them now. For some time no really constructive ideas came up. Then one of the scientists scuttled toward the door and vanished, with "Just a moment, I have to check a table" floating behind him. He was back within thirty seconds.

"I can account for the temperature and melting," he said firmly. "The ground surface was water ice, the fog ammonia. The heat of solution as they met and mixed would have caused the temperature rise. Ammonia-water solutions form eutectics which can melt as low as seventy-one.

Mild hoots of appreciation and approving gestures of nipper-equipped arms greeted this suggestion. Barlennan went with the crowd, though words had been used which were not entirely familiar to him. But he was not through with his questions.

"Does that give us any idea how far the *Kwembly* will be carried?"

"Not in itself We need information about the extent of the original snow field," was the answer. "Since only the *Kwembly* has been in the area, about the only hope is the photo maps made by the humans. You know how little we can get from those. Half the time you can't differentiate between ice and clouds. Besides they were all made before we landed here."

• "Give it a try, anyway," ordered Barlennan. "With luck, you can at least tell whether those mountain ranges to the east are blocking the *Kwembly's* present path. If they are, it's hard to see how the craft could be carried more than a few hundred thousand cables."

"Right," answered one of the investigators. "We'll check. Ben, Dees, come along; you're more used to the photos than I am." The three vanished through the door. The others broke up into small groups, muttering arguments to each other and waving excitedly, now at the map underfoot, now at items presumably in the nearby laboratories. Barlennan endured this for several minutes before deciding that a little more guidance was needed.

"If that plateau Don was crossing was such pure water, there couldn't have been any ammonia precipitation there for a long, long time. Why should things have changed so suddenly?"

"It almost has to be a seasonal effect," answered one of the men. "I can only guess, but I'd say it had something to do with some consistent change in the wind pattern. Air currents from different parts of the planet will be saturated with water or ammonia according to the nature of the surface they pass over, mostly its temperature, I suppose. The planet is nearly twice as far from its sun at one time as at another and its axis is much more inclined than Mesklin's. It's easy to believe that at one time of year only water is precipitated on that plateau and at another it gets supplied with ammonia. Actually, the vapor pressure of water is so low that it's hard to see what situation would get water into the atmosphere without supplying even more ammonia, but I'm sure it's possible. We'll work on it, but it's another of those times when we'd be a lot better off with world-wide, year-round information. These human beings seem to be in an awful hurry; they could have waited a few more years to land us here, I should think."

Barlennan made the gesture whose human equivalent would have been a noncommittal grunt. "The field data *would* be convenient. Just think of yourself as being here to get it instead of having it given to you.

"Of course. Are you going to send the *Kalliff* or the *Hoorsh* out to help Dondragmer? This is certainly different from the *Esket* situation."

"From our point of view, yes. It might look funny to the humans, though, if I insisted on sending out a rescue cruiser this time after letting them talk me out of it before. I'll think it over. There's more than one way of sailing upwind. You do that theoretical work you've just been talking about, but be thinking about what you'd want to take on a field trip up toward the *Kwembly."*

"Right, Commander." The scientist started to turn away, but Barlennan added a few more words.

"And Jemblakee. No doubt you'll be strolling over to Communications to talk to your human colleagues. Please don't mention this, what was it, heat of solution and eutectic business. Let them mention it first, if they're going to, and be properly impressed when and if they do. You understand?"

"Perfectly." The scientist would have shared a grin of understanding with his commander if their faces had

been capable of that sort of distortion. Jemblakee left, and after a moment's thought Barlennan did the same. The remaining researchers and technicians might possibly be the better for his presence to keep their centerboards down but he had other things to do. If they couldn't hold course without his pincers on their helms, they'd just have to drift for a while.

He should talk to the human station soon; but if there was going to be an argument, as seemed rather likely, he had better do a little course-plotting himself Some of the two-legged giants, Aucoin, for example, who seemed to have a great deal to say about their policy, were reluctant to expend or even risk any sort of reserve equipment, no matter how important the action seemed from the Mesklinite viewpoint. Since the aliens had paid for it, this was perfectly understandable, even laudable. Still there was nothing immoral about talking them around to a more convenient attitude if it could be done. If he could arrange it, the best plan would be to work through that particularly sympathetic female named Hoffman. It was too bad the human beings kept such irregular hours; if they had set up decent, regular watches in their communication section Barlennan would long since have worked out their schedule and been able to pick his party. He wondered, not for the first time, whether the irregular schedule might not be deliberately set up to block that very action, but there seemed no way to find out. He could hardly ask.

The Settlement's comm center was far enough from the laboratories to give him thinking time en route. It was also close enough to his office to encourage a pause for making a few notes before actually opening the verbal fencing match.

The central theme would have to be the question of rescue, if Dondragmer's trouble wound up crippling his cruiser. If the previous situation involving the *Esket* months before were any indication, the tightwads up above would be basically against sending the *Kalliff* Of course, there was nothing they could do if Barlennan chose to go his own way in that matter, or in any other, but the commander was hoping to keep that fact cushioned in the decencies of polite conversation. He would be happiest if that aspect of the situation never came up at all. This was one reason he hoped to work Easy Hoffman into the other end of the discussion. For some reason, she seemed prone to take the Mesklinite side when disagreements arose. She was certainly one reason that there had been no open argument during the *Esket* incident, though a more important reason was that Barlennan had never had the slightest intention of sending a rescue cruiser before and had therefore actually been siding with Aucoin.

Well, he could at least go as far as the comm room door and find out who was on duty above. With the rippling equivalent of a shrug, he lifted his sprawled eighteen inches from the office floor and made his way into the corridor. It was at that moment that the wind reached the Settlement.

There was no fog at first or for some minutes thereafter. Barlennan, promptly changing his plans as the roof began rippling, got all the way back to the laboratories; but before he had a chance to get any constructive information from his scientists the stars began to fade. Within a few minutes the lights showed a solid gray ceiling a body-length above the Mesklinites. The ceilings here were rigid and did not vibrate in the wind as those in the corridor had, but the sound outside was loud enough to make more than one of the scientists wonder how stable the buildings actually were. They didn't express the thought aloud in the commander's presence but he could interpret the occasional upward glances when the whine of the heavy outside air increased in pitch.

It occurred to him that his present location was about the most useless possible one for a commander who was not a scientist, since the people around him were about the only ones in the Settlement to whom he could not reasonably give orders. He asked just one question, was informed in reply that the wind speed was about half that Dondragmer had reported some ten thousand miles away, then headed for the communication room.

He thought briefly of going back to the office on the way, but knew that anyone wanting him would find him almost as quickly at Guzmeen's station. Meanwhile a question had crossed his mind which could probably be answered by relay from the human station faster than any other way, and that question seemed more and more important as the seconds passed. Forgetting that he wanted to make sure that Easy Hoffman was on duty above, he shot into the radio room and politely nudged aside the staff member in front of the transmitter. He began to speak almost before he was in position and the sight of Hoffman's features when the screen lit up was a pleasant surprise rather than a major relief

"The wind and fog are here, too," he began abruptly. "Some people were outdoors. There's nothing I can do about them at the moment; but some were working in the cruisers parked outside. You could check through their communicators as to whether everything is all right there. I'm not too worried, since the wind speed is now much less than Don reported. Besides, the air is much less dense at this height; but we can't see at all through this fog, so I'd be relieved to know about the men in the cruisers.

Easy's image had started to speak part way through the commander's request, obviously not in answer, since there had not been time enough for the speed-of-light round-trip. Presumably the human beings had something of their own to say. Barlennan concentrated on his own message until it was done, knowing that Guzmeen or one of his crew would be writing down whatever came in. Message crossing under these circumstances was a frequent event and was handled by established routine.

With his own words on the way, the commander turned to ask what the humans had wanted but the question was interrupted. An officer shot into the room and began reporting as soon as he saw Barlennan.

"Sir, all groups but the two who checked out at the north gates are accounted for. One of these was working in the *Hoorsh,* the other was leveling ground for the new complex twenty cables north, on the other side of the parking valley. There were eight people in the first group, twenty in the second."

Barlennan made the gesture of understanding, all four nippers clicking shut simultaneously. "We may have radio reports from the space station shortly on the *Hoorsh* group," he replied. "How many who were actually outside after the wind and fog arrived have come in? What do they report on living and traveling conditions? Was anyone hurt?"

"No one hurt, sir. The wind was only a minor inconvenience; they came in because they couldn't see to work. Some of them had trouble finding their way. My guess is that the ground-leveling crew is still groping its way back, unless they just decided to wait it out where they were. The ones on the *Hoorsh* may not even have noticed anything, inside. If the first bunch stays out of contact too long, I'll send out a messenger.

"How will you keep *him* from getting lost?"

"Compass, plus picking someone who works outside a lot and knows the ground well."

"I'm not—" Barlennan's objection was interrupted by the radio.

"Barlennan," came Easy's voice, "the communicators in the *Hoorsh* and the *Kalliff* are all working. As far as we can see, there is no one in the *Kalliff* and it's just sitting there; nothing is moving. There are at least three, and possibly five, men in the life-support section of the *Hoorsh.* The man covering those screens has seen as many as three at once in the last few minutes but isn't too confident of recognizing individual Mesklinites. The cruiser doesn't seem to be affected. The people aboard are going about their business and paying no attention to us. Certainly they weren't trying to send an emergency message up. Jack Bravermann is trying to get their attention on that set now but I don't think there's anything to worry about. As you say, slower wind and thinner air should mean that your settlement is in no danger if the

Kwembly wasn't hurt."

"I'm not worried, at least not much. If you'll wait a moment, I'll find out what your last message but one was and try to answer it," returned Barlennan. He turned to the duty officer whose place at the set he had taken. "I assume you got what she said."

"Yes, Sir. It wasn't urgent, just interesting. Another interim report has come up from Dondragmer. The *Kwembly* is still afloat, still drifting, though he thinks it has dragged bottom once or twice and the wind is still blowing there. Because of their own motion, his scientists won't commit themselves to an opinion on whether the wind velocity has changed or not.

The commander gestured acceptance, turned back to the communicator, and said, "Thanks, Mrs. Hoffman. I appreciate your sending even 'no change' reports so quickly. I will stay here for a while, so if anything really does happen I will know as soon as possible. Have your atmospheric scientists come up with predictions they trust? Or explanations of what happened?"

To the other Mesklinites in the room it was obvious that Barlennan was doing his best to keep his expression unreadable as he asked this question. His arms and legs were carefully relaxed, chelae neither too tightly closed nor gaping open, his head neither too high nor too close to the floor, his eyes fixed steadily on the screen. The watchers did not know in detail what was in his mind, but could tell that he attached more than face value to the question. Some of them wondered why he bothered to control himself so, since it was most unlikely that any human being could interpret his body expression anyway; but those who knew him best realized that he would never take a chance on a matter like that. After all, there were some human beings, of whom Elise Rich Hoffman was emphatically one, who seemed to think very easily from the Mesklinite viewpoint, besides speaking Stennish as well as human vocal equipment would permit.

All watched the screen with interest, wondering whether the human being on it would show signs of having noticed the commander's attitude when her answer came back. All communication room personnel were reasonably familiar with human facial expressions; most of them could recognize at least a dozen different human beings by face or voice alone, the commander having long ago expressed a strong desire that such abilities be cultivated. Barlennan, his glance leaving the screen for a moment and roving around the circle of intent listeners, was amused at their expressions even while he was annoyed at his own obviousness. He wondered how they would react to whatever answer Easy returned, but he never found out.

The human female had evidently received the question and was starting to form a sentence in reply, when her attention was distracted. For several seconds she was obviously listening to something and her eyes shifted away from the pickup of the Settlement communicator. Then her attention came back to Barlennan.

"Commander. Dondragmer has reported again. The *Kwembly* has stopped, or almost stopped, aground. They are still being dragged a little, however; the flow of liquid has not slowed. They have been tipped so that the trucks are out of contact with whatever surface is below them. If they aren't dragged free by the river, the/re there to stay; and Dondragmer thinks the level is going down."

4: SMALL TALK

It was a curious, helpless sensation for Beetchermarlf. The *Kwembly's* helm was connected to the trucks by simple pulley-and-cord rigging; even Mesklinite muscles could not turn the trucks when the vehicle was at rest, and, while forward motion made steering possible, it certainly did not make it easy. Now, as the vehicle floated with the driving units clear of the bottom, the helm flopped limply in response to a

casual nudge or even to a slight roll of the hull. In theory, the cruiser was maneuverable at sea, but this required installing driving paddles on the treads, something most easily done on land. Dondragmer had thought fleetingly, as he realized they were adrift, of sending out air suited men to attempt the task, then decided it wasn't worth the risk even if everyone were attached solidly to the hull by life-lines. It was likely enough, as far as anyone could tell, that they might reach the end or the edge of the river or lake or whatever they were floating on before any such job could be completed, anyway. If men were outside when that happened, life-lines would be of little use.

The same thoughts had crossed the helmsman's mind as he lay at his station, but he did not voice them. Beetchermarlf was young, but not so young as to assume that no one else could recognize the obvious. He was quite prepared to grant his captain's professional competence.

As the minutes slipped by, however, he began to worry at Dondragmer's failure to issue any orders. Something should be possible; they couldn't just drift eastward. He glanced at the compass; yes, eastward, indefinitely. There had been hills that way according to the last flight reports, the same hills which had bordered the snow field on their left, sometimes showing slightly above the distant horizon, for the last three or four thousand miles. Judging by their color they were rock, not ice. If the surface the *Kwembly* was floating on was simply melted snow field, they almost had to hit something soon. Beetchermarlf had no more idea than anyone else how fast they were going but his confidence in the strength of the hull matched that of the captain. He had no more wish to strike a reef on Dhrawn than he had ever had on Mesklin.

Anyhow, the wind should not move them too fast, given the air den-sky The top of the hull was smoothly curved except for the bridge, and the trucks on the bottom should give plenty of drag. As far as the air scouts had been able to tell, the snow field had been level, so the liquid itself shouldn't be moving. Come to think of it, the outside pressure should give a check on that. The helmsman stirred at the thought, glanced up at the captain, hesitated, and then spoke.

"Sir, how about checking hull-squeeze watch? If there is any current where we're floating, we'd have to be going downhill, and that should show—" Dondragmer interrupted.

"But the surface was level—no, you're right. We should check." He reared up to the bank of speaking tubes and called the laboratory. "Born, how is the pressure? You're keeping track, of course."

"Of course, Captain. Both bow and stern safety bladders have been expanding ever since we began to float. We've descended about six body lengths in twice that many minutes. I'm about ready to tap more argon.

Dondragmer acknowledged, and looked back at his helmsman.

"Good for you. I should have thought of that. That means we are being carried by current as well as wind and all bets on speed, distance, and where we stop are off. There couldn't be a current unless the air scouts missed a slope, and if there's a slope this plateau must drain somewhere."

"We're secure for rough travel, Sir. I don't see what else we can do."

"There's one thing," Dondragmer said grimly He reared to the tubes again, and emitted the siren-like general quarters call. Reasonably sure that all were listening, he pulled his head back so as to be equally distant from all the tubes, and spoke loudly enough to get through them all.

"All hands into air suits as quickly as possible. You are relieved from stations for that purpose, but get back as soon as you can." He lowered himself to his command bench and addressed Beetchermarlf. "Get your suit and mine, and bring them back here. Quickly!"

The helmsman was back with the garments in ninety seconds. He started to assist the captain with his, but was dismissed by an emphatic gesture and went to work on his own. In two minutes both, protected except for head covering, were back at their stations.

The haste, as it turned out, was unnecessary More minutes passed while Beetchermarlf toyed with the useless helm, and Dondragmer wonde$_1$cd whether the human scientists were ever going to come through with any information and what use it was likely to be if they did. He hoped that satellite fixes could give him some idea of the *Kwembly's* speed; it would, he thought rather cynically, be nice to know how hard they were likely to hit whatever finally stopped them. Such fixes were, he knew, hard to get on order; there were over thirty of the "shadow satellites" in orbit but they were less than three thousand miles above the surface. No attempt had been made to arrange their orbits so that their limited fields of visual and microwave coverage would be either uniform or complete; communication was not their primary purpose. The main human base, in synchronous orbit over six million miles above the Settlement meridian, was supposed to need no help with that task. Also, the ninety-plus mile per second orbital speed of the lower satellites, helpful though the human observers claimed it to be for moving-baseline location checking, still seemed to Dondragmer an inevitable cause of difficulty He was not at all hopeful about getting his speed from this source. That was just as well, because he never did.

Once, about half an hour after they had gone adrift, a brief shudder ran through the *Kwembly* and the captain duly reported to the station that they had probably touched bottom. Everyone else on board made the same assumption and tension began to mount.

There was a little warning just before the end. A hoot from the laboratory speaking tube was followed by a report that pressure had started to rise more rapidly, and that an additional release of argon into the ship's atmosphere had been necessary to keep the safety bladders from rupturing. There was no sensation of increasing speed, but the implication of the report was plain enough. They were descending more rapidly How fast were they going horizontally? The captain and helmsman looked at each other, not asking the question aloud but reading it in each other's expressions. More minutes passed; the tension mounted, chelae gripping stanchions and holdfasts ever more tightly

Then there was a thunderous clang, and the hull swerved abruptly; another, and it tilted sharply to starboard. For several seconds it pitched violently, and those near bow and stern could feel it yawing as well, though the fog still blocked any outside view which might have explained the sensation. Then there was another, much louder clang and the *Kwembly* rolled some sixty degrees to starboard; but this time she did not recover. Scraping, grinding sounds suggested that she was moving slightly, but no real change of attitude accompanied them. For the first time, the sound of liquid rushing past the hull became noticeable.

Dondragmer and his companion were unhurt. To beings who regarded two hundred Earth gravities as normal and six hundred as a most minor inconvenience, that sort of acceleration meant nothing. They had not even lost their grips, and were still at their posts. The captain was not worried about direct injuries to his crew. His first words showed that he was considering matters much further ahead.

"By stations, report!" he bellowed into the speaking tubes. "Check hull soundness at all points, and report all cracks, open breaks, dents, and other evidence for leaks. Lab personnel to emergency stations, and check for oxygen. Life-support, cut tank circulation until the oxygen check is done. Now!"

Apparently the speaking tubes were intact, at least. Hoots of response began to return immediately As the reports accumulated, Beetchermarlf began to relax. He had not really expected the shell which protected him from Dhrawn's poisonous air to withstand anything like such a shock and his respect for alien engineering went up several grades. He had regarded artificial structures of any sort as normally inferior in strength and durability to any living body He had, of course, excellent reason for such an

attitude. Nevertheless, it appeared when all the reports were finally in, that there were no major structural failures or even visible cracks. Whether the normal leaks, unavoidable in a structure which had to have entrances for personnel and equipment, not to mention hull openings for instruments and control lines, were any worse than they had been, would not be known for a while. Pressure monitoring and oxygen checking would of course continue as normal routine.

Power was still on, which surprised no one. The twenty-five independent hydrogen converters, identical modules which could be moved from any energy-using site in the *Kwembly* to any other, were solid-state devices with no moving parts larger than the molecules of gaseous fuel which were fed into them. They could have been placed under the hammer of a power forge without damage.

Most of the outside lights were gone, or at least inoperative, though these could be replaced. Some were still working, however, and from the submerged end of the bridge it was possible to see out. Fog still blocked the view from the upper end. Dondragmer made his way very gingerly to the low end and took a brief look at the conglomeration of rounded rocks with diameters from half his own length to twenty times that, into which his craft had managed to wedge itself. Then he climbed carefully back to his station, energized the sound system of his radio and transmitted the report which Barlennan was to hear a little over a minute later. Without waiting for an answer, he began issuing orders to the helmsman.

"Beetch, stand by here in case the men have anything to say I'm going to make a complete check myself, especially of the air locks. With all there is to be said for our design, we didn't have this much of a roll in mind when we settled on it. We may only be able to use the small emergency locks, since the main one seems to be underneath us at the moment. It may be blocked on the outside even if we can open the inner door and find the septum still submerged. Chatter with the human beings if you want. The more of us who can use their language and the more of them who can use ours, the better. You have the bridge."

Dondragmer made the habitual, but now rather futile, gesture of rapping on the hatch for clearance; then he opened it and disappeared, leaving Beetchermarlf alone.

The helmsman had no urge at the moment for idle talk with the station above. His captain had left him with too much to think about.

He was not exactly delighted at being left in charge of the bridge, under the circumstances. He was not even too concerned about the main air lock's being blocked; the smaller ones were adequate, though not for life-support equipment, he suddenly remembered. Well, at the moment the desirability of going out seemed very small but if the *Kwembly* were permanently disabled that need would have to be faced.

The real question, in that event, was just what good going outside would do. The twelve thousand miles or so, which Beetchermarlf thought of as nearly fourteen million cables, was a long, long walk, especially with a load of life-support equipment. Without that apparatus it was not to be thought of. Mesklinites were amazingly tough organisms mechanically and had a temperature tolerance range which was still disbelieved by many human biologists, but oxygen was another matter. Its partial pressure outside at the moment was presumably about fifty pounds per square inch, quite enough to kill any member of the *Kwembly's* crew in seconds.

The most desirable thing at the moment was to get the big machine back on her treads. How, and whether, this could be done' would depend largely on the stream of liquid flowing past the stranded hull. Working outside in that current might not be impossible, but it was going to be difficult and dangerous. The air suited Mesklinites would have to be heavily ballasted to stay put at any task and life-lines would complicate the details.

The stream might not, of course, be permanent. It had apparently just come into existence with the

change in weather and it might cease flowing as suddenly However, as Beetchermarlf well knew, there is a difference between weather and climate. If the river were seasonal, its "temporary" nature might still turn out to be too long for the Mesklinites; Dhrawn's year was some eight times as long as that of Earth and over one and a half times that of Mesklin.

This was an area where human information might be useful. The aliens had been observing Dhrawn carefully for nearly half of one of its years and casually for much longer. They should have *some* idea of its seasons. The helmsman wondered whether it would be ~t of order for him to put such a question to someone in the orbiting station, since the captain had not. Of course, the captain *had* said he could use the radio for chatter and had made no mention of what might or might not be said.

The idea that there was anything except the *Esket* incident which should not be discussed with the human sponsors of the Dhrawn expedition had not gone down the chain of command as far as Beetchermarlf. The young helmsman had almost made up his mind to initiate a call to the station when the radio beside him spoke. It spoke, furthermore, in his own language, though the accent was not above reproach.

"Dondragmer. I know you must be busy but if you can't talk now I'd be glad if someone else could. I am Benjamin Hoffman, an assistant in the aerology lab here at the station, and I'd like two kinds of help if anyone can find time to give it.

"For myself, I'd like practice in language; it must be obvious that I need it. For the lab, we're in a very embarrassing position. Twice in a row we've worked out weather predictions for your part of the planet which have been way, way off We just don't have enough detailed information to do the job properly The observations we can make from here don't resolve enough and there aren't anywhere near enough reporting stations down there. You and the others have planted a lot of automatics on your trips, but they still don't cover much of the planet, as you know. Since good predictions will be as useful to you as they will be to us, I thought maybe I could talk things out in real detail with some of your scientists and maybe work out the weather patterns where you know enough to supplement the background calculations and really get good forecasts, at least right in your neighborhood."

The helmsman replied eagerly

"The captain is not on the bridge, Benjaminhoffman. I am Beetchermarlf, one of the helmsmen, now on watch. Speaking for myself, I should be very glad to exchange language practice when duties permit, as now. I am afraid the scientists will be pretty busy for a while; I may be myself, most of the time. We are having some trouble, though you may not know all the details. The captain did not have time for the full story in the report I heard him send up a few minutes ago. I will give you as complete a picture as I can of the situation and some thoughts which have occurred to me since the captain left the bridge. You might record the information for your people and comment on my ideas if you wish. If you don't think they're worth mentioning to the captain, I won't. He'll be busy enough without them anyway I'll wait until you tell me you're ready to record, or that you don't want to, before I start." Beetchermarlf paused, not entirely for the reason he had just given. He suddenly wondered whether he should bother one of these alien beings with his own ideas which began to seem crude and poorly worked out to him.

Still, the factual reports had to be useful. There was much detailed information about the *Kwembly's* present situation which the men could not possibly know yet. By the time Benj's approval came from the speaker, the helmsman had recovered some of his self-confidence.

"That will be fine, Beetchermarlf. I'm ready to tape your report. I was going to anyway, for language practice. I'll pass on whatever you want. Even if your weather men are busy, maybe the two of us could try to do what I suggested with the weather information. You can probably get their measurements, and you're on the spot and can see everything and if you're one of the sailors Barlennan recruited on Mesklin

you certainly know something about weather. For all I know, you may have spent a couple of my lifetimes in that place on Mesklin learning engineering and research methods. Come ahead; I'm ready here."

This speech completed the restoration of Beetchermarlf's morale. It had been only ten of Mesklin's years since alien education had started for a selected few of its natives. This human being must be five years old or younger. Of course, there was no telling what that might mean in the way of maturity for his species, and one could not very well ask; but in spite of the aura of super-normality which tended to surround all the aliens, one just did not think of a five-year-old as a superior being.

As relaxed as anyone could well be on a floor with a sixty-degree tilt, the sailor began his description of the *Kwembly's* situation. He gave a detailed account of the trip down what now had to be recognized as a river, and of its conclusion. He described minutely what could now be seen from the bridge. He explained how they were now stranded off their tracks, and emphasized the situation which faced the crew if this could not be corrected. He even detailed the structure of the air-locks, and explained why the main one was probably unusable and the others possibly so.

"It will help a great deal in the captain's planning," he concluded, "if we can have some trustworthy estimate of what will happen to this river, and especially whether and when it will run dry If the whole snow field melts at this season and runs off the plateau through this one drain, I suppose we're here for the best part of a year and will have to plan accordingly If you can give any hope that we can work on dry land without having to wait too long, though, it would be very good to know."

Benj was rather longer than sixty-four seconds in answering this; he, too, had been given material for thought.

"I have your details on tape, and have sent it up to Planning," his words came through at last. "They'll distribute copies to the labs. Even I can see that figuring out the life story of your river is going to be a nasty job; maybe an impossible one without a lot more knowledge. As you say, the whole snow field might be starting a seasonal melt. If the waters of North America had to drain out through one river you'd be there for a long time. I don't know how much of the place your aerial scout reports cover, and I don't know how ambiguous the photos from up here may be, but I'll bet when it's all down on maps there'll still be room for argument. Even if everyone agrees on a conclusion, well, we still don't know much about that planet."

"But you've had so much experience with other planets, many of them!" returned Beetchermarlf. "I should think that would be of some help."

Again the answer was longer in coming back than light-lag alone would explain.

"Men and their friends have had experience on a lot of planets, that's true, and I've read a good deal of it. The trouble is, practically none of it helps here. There are three kinds of planet, basically. One we call Terrestrial, like my own home; it is small, dense, and practically without hydrogen. The second is the Jovian, or Type Two, which tends to be much larger and much less dense because they have kept most of their hydrogen from the time they originally formed, we think. Those two were the only kinds we knew about before we left our own star's neighborhood, because they are the only kinds in our system.

"Type Three is very large, very dense, and very hard to account for. Theories which had the Type Ones losing their hydrogen because of their initially small mass, and the Twos keeping theirs because of their greater mass, were fine as long as we'd never heard of the Threes. Our ideas were perfectly satisfactory and convincing as long as we didn't know too much, if you'll forgive my sounding like my basic science teacher.

"Type Three is the sort you're on. There are none of them around any sun with a Type One planet. I suppose there must be a reason for that, but I don't know what it is. Well, nothing was known about them among the Community races until we learned to travel between stars and began to do it on a large scale, large enough so the principal interest of wandering ships wasn't just new habitable planets. Even then we couldn't study them first hand, any more than we could the Jovian worlds. We could send down a few special, very expensive and usually very unreliable robots, but that was all. Your species is the first we've ever encountered able to stand the gravity of a Type Three or the pressure of a Type Two, for that matter.

"But isn't Mesklin a Type Three, by your description? You must know a lot about it by now; you've been in touch with our people for something like ten years, and some of you have even landed at the Rim, I mean the equator.

"More like fifty of our years. The trouble is that Mesklin isn't a Type Three. It's a peculiar Two. It would have had all the hydrogen of any Jovian world if it hadn't been for its rotation, that terrific spin which gives your world an eighteen-minute day and a shape like a fried egg. There aren't any others like it which we've found yet, and no intermediate cases that anyone's recognized, or at least that I've heard of That's why the Community races were willing to go to so much trouble and effort and spend so much time building up contact with your world and setting up this expedition to Dhrawn. We'll find out a good deal in thirty years or so about that world's makeup from the neutrino counters in the shadow satellites but the seismic equipment you people have been planting will add a lot of detail and remove a lot of ambiguity So will your chemical work. In five or six of your years we may know enough about that rock ball to make a sensible guess why it's there or at least, whether it ought to be called a star or a planet."

"You mean you only made contact with the people of Mesklin so you could learn more about Dhrawn?"

"No, I didn't mean that at all. People are people and worth getting to know for their own sake—at least, both my parents feel that way, though I've met folks who certainly don't. I don't think the idea for the Dhrawn project got started until long after your College was under way My mother or Dr. Aucoin could tell you when. It was long before I was born. Of course, when it dawned on someone that you folks *could* make first-hand investigation of a place like Dhrawn, everyone jumped at the chance."

This, of course, forced Beetchermarlf to ask a question which he would ordinarily have regarded as a strictly human affair and none of his business, like the matter of how mature a five-year-old should be. It slipped out before he caught himself; for over an hour thereafter he and Benj were arguing over the reasons for such activities as the Dhrawn project and why such a vast amount of effort should be devoted to an activity with no obvious material return in prospect. Benj did not defend his side too well. He was able to give the usual answers about the force of curiosity, which Beetchermarlf could see up to a point; he knew enough history to have heard how close man and several other species had come to extinction from energy starvation before they had developed the hydrogen fusion converter; but he was too young to be really eloquent. He lacked the experience to be able to point out convincingly, even to himself, the complete dependence of any culture on its understanding of the laws of the universe. The conversation never became heated, which would have been difficult in any argument where there is a built-in cooling-down period between any remark and its answer. The only really satisfactory progress made was in Benj's mastery of Stennish.

The discussion was interrupted by Beetchermarlf's suddenly becoming aware of a change in his surroundings. For the last hour his entire attention had been on Benj's words and his own replies. The canted bridge and gurgling liquid had receded to the far background of his mind. He was quite surprised to realize abruptly that the pattern of lights twinkling above him was Orion. The fog had gone.

Alert once more to his surroundings, he noticed that the water line around the bridge seemed just a trifle

lower. Ten minutes' careful watching convinced him that this was so. The river *war* falling.

Part way through the ten minutes he had, of course, been queried about his sudden silence by Benj, and had given the reason. The boy had immediately notified McDevitt, so that by the time Beetchermarlf was sure about the changing water level there were several interested human beings on hand above to hear about it. The helmsman reported briefly to them on the radio and only then did he call through the speaking tubes for Dondragmer.

The captain was far aft, behind the laboratory section and just forward of the compartment containing the pressure bladder, when the call came. There was a pause after the helmsman finished speaking, and Beetchermarlf expected the captain to come bursting through the bridge hatchway after a few seconds; but Dondragmer did not yield to the temptation. The ports in the rest of the hull, including the compartment where he was, were much too small to permit a clear estimate of the water level, so he had to accept his helmsman's judgment. Dondragmer was willing to do this, rather to the young sailor's surprise.

"Keep track as exactly as you can of the rate of fall, until you are relieved," was his order. "Let me and the human beings know the rate as soon as you can guess it reliably; tell us thereafter whenever you change your estimate.

Beetchermarlf acknowledged the order and clambered across the bridge to a point where he could mark the water line with a scratch on one of the window stanchions. Reporting the action to the captain and the human listeners, he returned to his station keeping his eyes fixed on the mark. The ripples in the liquid were several inches high, settling down only at rare intervals, hence it was some time before he could be at all sure of the change in depth. There were two or three impatient queries from above, which he answered politely in the best he could muster of his limited human language, before Benj reported that he was once more alone except for nonentities watching other cruisers. Most of the time thereafter until Takoorch arrived as bridge relief was spent by the two in describing their home worlds, correcting each other's misconceptions about Earth and Mesklin by way of language practice and, though neither was fully aware of it, developing a warm personal friendship.

Beetchermarlf returned six hours later to let Takoorch go (actually the interval was twenty-four days by Mesklinite reckoning, a standard watch length) and found that the water was down nearly a foot from his reference mark. Takoorch informed him that the human Benj had just returned from a rest period. The younger helmsman wondered privately just how soon after Tak's arrival the other had found it was time to take a rest. Naturally he could not ask such a question, but as he settled back into his station he sent a call radiating upward.

"I'm back on, Benj. I don't know how recently Tak made a report to you, but the water is down over half a body length and the current seems much slower. The wind is nearly calm. Have your scientists anything to report?"

He had time during the answer delay to realize that the last question had been rather pointless, since the principal news wanted from the human scientists was the probable duration of the river, but there was nothing to be done about it now. Besides, maybe they *did* have something of value.

"Your friend Takoorch did tell us about the water and wind, among a good many other things," Benj's voice announced. "It's good to have you back, Beetch. I haven't heard anything from the labs, but it seems to me from what you've said about the way you're tipped and the rate the water's been dropping, and from what I can judge from the cruiser model I have here, that another sixty or seventy hours should leave you dry That's if the water keeps dropping at the same rate, of course. It might do that if it's flowing away through a nice smooth channel but I wouldn't count on that. I hate to sound pessimistic but

my guess is that it will slow down before all the liquid is gone."

"You may be right," agreed Beetchermarlf. "On the other hand, with the current easing off we can probably work outside safely enough before it's all gone." This was a prophetic remark. It was still on its way to the station when a speaking tube hooted for attention.

"Beetchermarlf! Inform the human beings that you will be relieved immediately by Kervenser, and report at once to the starboard after emergency lock in your air suit. I want a check of the trucks and tiller lines. Two others will go with you for safety I am more interested in accuracy than speed. If there is any damage which would be easier to fix while we are still tilted than it would be after we are level, I want to know about it. After you make that check, take a general look around. I want a rough idea of how solidly we are wedged into this position and how much work it will take to level us and get us loose. I will be outside myself making a similar check, but I want another opinion."

"Yes, sir," the helmsman responded. He almost forgot to notify Benj, for this time the order was a distinct surprise, not the fact that he was to go outside, but that the captain had chosen him to check his own judgment.

The air suits had been removed when Dondragmer was convinced that the hull was sound, but Beetchermarlf was back into his in half a minute and at the designated lock moments later. The captain and four sailors, all suited, were waiting. The crewmen held coils of rope.

"All right, Beetch," greeted the captain. "Stakendee will go out first and attach his line to the handiest climbing grip. You will follow, then Praffen. Each of you will attach his line to a different grip. Then go about your assignments. Wait—fasten these to your suit harness; you'll float without ballast." He handed four weights equipped with quick-release clips for harness attachment to the helmsman.

Egress was made in silence through the tiny lock. It was essentially a U-shaped liquid trap, fundamentally similar in operation to the main one and deep enough so that the *Kwembly's* tilt did not quite spoil its operation. The fact that the outer end was in liquid anyway may have made the difference. Beetchermarlf, emerging directly into the current, was glad of Stak's steadying grip as he sought anchorage for his own safety line.

A minute later the third member of their group had joined them, and together they clambered the short distance that separated them from the river bottom. This was composed of the rounded rocks which had been visible from the bridge, arranged in an oddly wavelike pattern whose crests extended across the direction of the current. At first glance, Beetchermarlf got the impression that the cruiser had stranded in the trough between two of these waves. Enough of the outside lights were still working to make seeing possible, if not quite ideal.

The trio made their way around the stern to get a look at their vehicle's underside. 'While this was much less well lighted, it was obvious at once that there would be a great deal to report to Dondragmer.

The *Kwembly* had been supported by a set of sixty trucks, each some three feet wide and twice as long, arranged in five longitudinal rows of twelve. All swiveled on casters and were interconnected by a maze of tiller ropes which were Beetchermarlf's main responsibility. Each of the trucks had a place to install a power unit, and had its own motor consisting of a six-inch-thick shaft whose micro-structure gave it a direct grip on the rotating magnetic field which was one of the forms in which the fusion units could deliver their energy. If no power box was installed, the truck rolled free. At the time of the accident, ten of the *Kwembly's* twenty-five converters had been on trucks, arranged in point-forward V patterns fore and aft.

Eighteen trucks from the rear of the cruiser, including all five of the powered ones at that end, were

missing.

5: FRYER TO FREEZER

Strictly speaking, all of them weren't missing. Several could be seen lying on the boulders, evidently dislodged at the time of the final impact. Whether any had gone with the earlier bumps, presumably miles upstream, Beetchermarlf could not guess and was rather afraid to find out. That could be checked later. Inspecting what was left would have to come first. The helmsman set to it.

The front end seemed to have sustained no damage at all; the trucks were still present and their maze of tiller lines in proper condition. Amidships, many of the lines had snapped in spite of the enormous strength of the Mesklinite fiber used in them. Some of the trucks were twisted out of alignment; several, indeed, swung freely to the touch. The pattern of missing parts aft was regular and rather encouraging. Numbering from the port side, Row 1 had lost its last five trucks; Rows 2 and 3 their last four; Row 4 the last three; Row *5,* on the starboard side, its last two. This suggested that they had all yielded to the same impact, which had wiped diagonally across the bottom of the hull; and since some of the detached units were in the neighborhood, there seemed a good chance that they all would be.

The inspectors were surprised at how little damage had been done by the trucks tearing away. Beetchermarlf and his companions had had nothing to do with the design of the *Kwembly* and her sister machines. None of them had more than the roughest idea of the sort of thinking which had been involved. They had never considered the problems inherent in building a machine powered by the most sophisticated energy sources ever developed, but operated by beings from a culture still in the muscle-and-wind stage; beings who would be cut off from *any* repair and replacement facilities once they were on Dhrawn. This was, the reason the steering was done by tiller and rope rather than by powered selsyns or similar devices; why the air locks were so simple, and not completely foolproof; why the life-support system was not only manually operated (except for the lights which kept the plants alive) but had even been designed and built by Mesklinite scientists and technicians.

A few hundred of the beings had received an extensive body of alien education, though no attempt had been made to spread the new knowledge through the Mesklinite culture. Nearly all of the "college graduates" were now on Dhrawn, together with recruits like Beetchermarlf; mostly young, reasonably intelligent volunteers from among the sailors of Barlennan's maritime nation. These were the people who would have to perform any repairs and all regular maintenance on the land-cruisers, and this fact had to be kept constantly in the foreground of the designers' minds. Designing vehicles capable of covering thousands of miles of Dhrawn's environment in a reasonable length of time, and at the same time reasonably safely under Mesklinite handling, had inevitably resulted in equipment with startling qualities. Beetchermarlf should not have been surprised either that the pieces of his cruiser went back together so readily, or that the cruisers had suffered so little damage.

Of course, the intelligence of the Mesklinites had been taken into account. It was the main reason for not depending on robots: these had proved unsatisfactory in the early days of space exploration. Mesklinite intelligence was obviously comparable to that of human beings, Drommians, or Paneshks: a fact surprising in itself, since all four planets appeared to have evolved their life forms over widely different lengths of geological time. It was also fairly certain that Mesklinites were much longer-lived, on the average, than human beings, though Mesklinites were oddly reluctant to discuss this; indeed, what this would mean in terms of their general competence was as problematic as Dhrawn itself. It had been a risky project from all angles, with most of the risk being taken by the Mesklinites. The giant barge drifting in orbit near the human station, which was supposed to be able to evacuate the entire Settlement in emergency, was little more than a gesture, especially for the beings afield in the land-cruisers.

None of this was in the minds of the three sailors inspecting the *Kwembly's* damage. They were simply

surprised and delighted to find that the lost trucks had merely popped out of the sockets in which they normally swiveled and into which they could apparently be replaced with little trouble, provided they could be found. With this problem settled to his satisfaction, Beetchermarlf made a brief cast over the river bottom to the limits imposed by the safety lines and found twelve of the trucks within th~it radius. Some of these were damaged: tracks broken or with missing links; bearing wheels cracked; a few axles bent. The three gathered all the material they could reach and transport and brought it back to the *Kwembly's* stern. The helmsman considered doubling up on the safety lines and increasing their search radius but decided to report to Dondragmer and get his approval first. Indeed, the helmsman was a bit surprised that the captain had not appeared earlier, in view of his announced intention of checking outside.

He found the reason when he and his companions went back around the stern to the lock. Dondragmer, his two companions of the original sortie and six more crewmen, who had evidently been summoned in the meantime, were near the middle of the *Kwembly* laboring to remove boulders from the region of the main air lock.

The breathing suits had no special communication equipment, and the transmissive matching between their hydrogen-argon filling and the surrounding liquid was extremely poor; but the Mesklinite voice, built around a swimming siphon rather than a set of lungs (the hydrogen-using midgets lacked lungs) was another thing which had bothered human biologists. The helmsman caught his captain's attention with a deep hoot and gestured him to follow around the stern of the cruiser. Dondragmer assumed that the matter was important and came along after directing the others to continue their work. One look and a few sentences from Beetchermarlf brought him abreast of the situation.

After a few seconds' thought he rejected the idea of looking immediately for the missing trucks. The water was still going down; it would be safer and easier to conduct the search when it was gone, if this did not take too long. In the meantime repairs could be started on the ones which had already been found. Beetchermarlf acknowledged the order and began to sort the damaged equipment in order to plan the work.

Care was necessary; some parts were light enough to be borne away by the current when detached from the rest of the assemblies. Some such items were already missing, and had presumably gone in just that fashion. The helmsman had a portable light brought to the scene and stationed one of his helpers a few yards downstream to catch anything which got away from him. He thought how helpful a net would be but there was no such item aboard the *Kwembly*. It would be possible to make one from the miles of cordage she carried, but it hardly seemed worth the time.

Eight hours of labor, interrupted by occasional rests spent chatting with Benj, saw three of the damaged trucks again serviceable. Some of their parts were not of the original quality, Beetchermarlf and the others having improvised freely. They had used Mesklinite fabric and cord as well as alien polymers and alloys which were on hand. Their tools were their own; their culture had high standards of craftsmanship and such things as saws, hammers, and the usual spectrum of edged tools were familiar to the sailors. The fact that they were made of the Mesklinite equivalents of bone, horn, and shell was no disparagement to them, considering the general nature of Mesklinite tissue.

Replacing the repaired units in their swivels took muscle even by Mesklinite standards. It also took more tool work, as metal in the mountings had been bent out of shape when the trucks were torn free. The first three had to be placed in Row 4, since Row *5* was pressed against the boulders of the river bottom and the other three were too high to be reached conveniently. Beetchermarlf bowed to necessity, attached the trucks where he could, and went back to fixing more.

The river continued to fall and the current continued to decrease. Dondragmer ordered the helmsman and

his helpers to move their work area from beneath the hull, anticipating what would happen as the buoyant force on the *Kwembly* decreased. His caution was justified when, with a grinding of boulders, the vehicle slipped from its sixty-degree tilt to about thirty, bringing two more rows of trucks within reach of the bottom and forcing two workmen to duck between stones to avoid being crushed.

At this point it became obvious that even if the water fell further, the cruiser would not. A point on its port underside about a third of the way back from the bow and between Rows 1 and 2 was now resting on a single rock some eighteen feet in diameter and half buried in the river bottom:

a hopeless object to dislodge even without the *Kwembly's* weight on it. Beetchermarlf kept on with his assigned job but couldn't help wondering how the captain proposed to lift his craft off that eminence. He was also curious about what would happen when and if he succeeded. The rocky surface which formed the river bed was the last sort of thing the cruiser's designers had had in mind as a substrate and the helmsman doubted seriously that she could run on such a base. High-gravity planets tend to be fairly level, judging by Mesklin (the only available example), and even if an area were encountered where traction seemed unpromising, the designers must have supposed that the crew need merely refrain from venturing onto it. This was another good example of the reason manned exploration was generally better than the automated kind.

Beetchermarlf, in a temporarily philosophical mood, concluded that foresight was likely to depend heavily on the amount of hindsight available.

Dondragmer, pondering the same problem, getting his vehicle free, was no nearer a solution than his helmsman some fifty hours after going aground. The first officer and the scientists were equally baffled. They were not worried, except for the captain, and even his feeling did not exactly parallel human "worry". He had kept to himself and Beetchermarlf (who had been on the bridge at the time) a conversation he had had with the human watchers a few hours before.

It had begun as a regular progress report, on an optimistic tone. Dondragmer was willing to admit that he hadn't thought of a workable plan yet but not that he was unlikely to think of one. Unfortunately, he had included in the remark the phrase "we have plenty of time to work it out.

Easy, at the other end, had been forced to disagree.

"You may not have as much as you think. Some of the people here have been considering those boulders. They are round, or nearly so, according to your report and what we can see on the bridge set. The most likely cause of that shape, according to our experience, is washing around in a stream bed or on a beach. Moving rocks that big would require a tremendous current. We're afraid that the stream which carried you there is just a preliminary trickle, the first thaw of the season, and if you don't get away soon you'll face a lot more water coming down."

Dondragmer had considered briefly.

"All right, but we're already doing all we can. Either we get away in time, or we don't; we can't do better than our best. If your scientists can give any sort of specific forecast of this super-flood we'll be glad of it, of course; otherwise we'll have to go on as we are. I'll leave a man on the radio here, of course, unless I have too much for them to do; in that case, try the lab. Thanks for the information, I guess.

The captain had gone back to work and to thought. He was not one to panic; in emergencies he seemed calmer than in a personal argument. Basically, his philosophy was the one he had just expressed: to do all one could in the time available, with the full knowledge that time would run out some day. At the moment, he only wished he knew what all he could do was.

The big rock was the main problem. It was keeping the drivers from traction, and until they not only touched bottom but bore heavily on it there was no moving the *Kwembly* with her own power. She might conceivably have been shifted by muscle power at Mesklin's Rim, or on Earth, but not under Dhrawn's gravity. Even a two-foot boulder was hard to move in that field.

There was rigging inside which could be set up as lifting tackle but none of it could begin to support the vehicle's weight as a static load even if its mechanical advantage were adequate.

Some trucks, four, to be exact, were in contact with the troublesome rock itself. Several more in Row *5* were touching bottom. None of these was powered at the moment but converters could be transferred to them.

If the four on the rock, and the ones forward from them, and some of the Row *5* trucks, were all to be powered why couldn't the cruiser simply be backed off?

She could. No reason at all to doubt it. On level ground with reasonable traction any four well-spaced power units could drive her. With her weight concentrated on only a few trucks, traction should be better than normal and a backward move would be mainly downhill.

It was not lack of self-confidence which caused Dondragmer to outline this plan to the human being on communication watch; he was announcing his intentions, not asking for advice. The man who heard him was not an engineer and gave casual approval to the move. As a matter of routine he reported the situation to Planning so that the information could be distributed. Consequently it reached an engineer within an hour or so, long before Dondragmer was ready to execute his plan.

It caused a raising of eyebrows, a quick examination of a scale model of the *Kwembly,* and two minutes of rapid slide-rule work.

The engineer was a poor linguist, but this was not the only reason he went looking for Easy Hoffman. He did not know Dondragmer very well, had no idea how the Mesklinite would react to criticism; he had worked with Drommians, since there were some connected with the Dhrawn project and he felt it safest to have his point presented by the official oil-spreader. Easy, when found, promptly assured him that she had never known Dondragmer to resent reasonable advice, but agreed that her better knowledge of Stennish would probably help even though the captain was fluent in the human tongue. They went together to the communication room.

Benj was there, as was usual when he was not on duty. He had by now made friends with several more of the Mesklinites, though he still liked Beetchermarlf best. The latter's long work hours resulting from the accident had not entirely prevented them from conversing and Benj's Stennish had improved greatly; he was now almost as good as his mother believed.

When Easy and the engineer arrived, he was listening to Takoorch and was not too sorry to interrupt the exchange with the news that there was an important message for the captain.

It took several minutes to get Dondragmer to the bridge; like the rest of the crew he had been working almost constantly, though by luck he happened to be inside when the call came.

"I'm here, Easy," his voice finally came through. "Tak said you had a business call. Go ahead."

"It's about this way you plan to back off the rock, Don," she began. ""~ don't have the whole picture here, of course, but there are two things bothering our engineers. One is the fact that your forward truck will run off the stone while you still have ten feet or more of hull, including some of your bridge, over it. Have you measured to see whether there's any risk of bare hull slamming down on the stone as the truck

rolls off? Also, toward the end of the maneuver, you'll have your hull supported almost entirely at the ends. The pneumatic undercarriage may distribute the load but my friend here isn't sure it will; further, if you get the bare hull instead of the mattress taking half the *Kwembly's* weight, Dhrawn's gravity is going to make a very respectable effort to break your land-ship in half. Have you checked those points?"

Dondragmer had to admit to himself that he had not and that he had better do so before the project went much farther. He conceded this on the radio, thanked Easy and her friend, and headed for the main lock, long since cleared for use.

Outside, the current had dropped to the point where life-lines were no longer necessary. Water depth was down to about seven feet, measured from the average level of the smallest boulders. The water line was, indeed, at about the most inconvenient possible level for seeing the whole picture. He had to climb part way up the rock, a difficult task in itself, though helped by the fact that he had some buoyancy; from there he had to follow the forward trucks to a point where he could compare the curvature of the big boulder and that of the *Kwembly's* lower bow. He could not be completely sure, since moving the hull backward would change its pitch, but he did not like what he saw. The human engineer was probably right. Not only was there risk of hull damage, but the steering bar came through the hull just ahead of the mattress by means of a nearly air-tight mechanical seal backed by a liquid trap and made its key connections with the maze of tiller-ropes. Serious damage to the bar would not actually cripple the vehicle, since there was a duplicate aft, but it was not a risk to be taken casually.

The answer to the whole situation was staring him in the face by that time but he was another hour or more in seeing it. A human psychologist, when he heard about this later, was very annoyed. He had been looking for significant differences between human and Mesklinite minds, and was finding what he considered an undue number of points of similarity.

The solution involved work, of course. Even the smallest boulders were heavy. Still, they were numerous, and it was not necessary to go far for a plentiful supply. With the entire crew of the *Kwembly* at the job except for Beetchermarlf and those still helping him with the trucks, a ramp of piled stones grew with fair speed from the stern of the trapped vehicle toward the key rock.

It was a help to Beetchermarlf. As fast as he readied a damaged bearing unit for service, he found himself able to get at new installation sites which had been out of reach before. He and the stone-carriers finished almost together, allowing for four trucks which he had been unable to repair because of missing parts. He had made thrifty use of these, cannibalizing them for the needs of some of the others, and had spotted the unavoidable gaps in traction widely enough to keep the cruiser's weight reasonably well distributed. To work on Row *5.* practically buried in the river bottom, he had had to deflate that part of the mattress. Pumping it up again when the two trucks were replaced caused the hull to shift slightly, to the alarm of Dondragmer and several workers underneath; fortunately the motion was insignificant.

The captain had spent most of the time shuttling between the radio, where he kept hoping for a reliable prediction of the next flood, and the work site, where he divided his attention between the progress of the ramp and the view upstream. By the time the ramp was complete the water was less than a yard deep, and the current had ceased entirely; they were in a pool rather than a stream.

It was now full night; the sun had been gone for nearly a hundred hours. The weather had cleared completely, and workers outside could see the violently twinkling stars. Their own sun was not visible; it was barely so at the best of times this deep in Dhrawn's heavy atmosphere, and at the moment was too close to the horizon. Not even Dondragmer knew offhand whether it was slightly above or slightly below. Sol and Fomalhaut, which even the least informed of the crew knew to be indicators of south, glowed and wavered over a low eminence a few miles in that direction. The imaginary line connecting the two had tilted less than twenty degrees, human scale, since dark; the Mesklinite navigators would have said

less than four.

Outside the range of the *Kwembly's* own lights it was almost totally black. Dhrawn is moonless; the stars provide no more illumination than they do on Earth or Mesklin.

Temperature was nearly the same. Dondragmer's scientists had been measuring the environment as completely as their knowledge and equipment allowed, then sending the results to the station above. The captain had been quietly hoping for some useful information in return, though he realized that the human beings didn't owe him any. The reports, after all, were simply part of the job the Mesklinites had engaged to do in the first place.

He had also suggested to his own men that they try some independent thinking. Borndender's answer to what he regarded as sarcasm had been to the effect that if the human beings would supply him with reports for other parts of Dhrawn and with computer time with which to correlate them, he would be glad to try. The captain had not intended sarcasm; he knew perfectly well the vast difference between explaining why a ship floats on water or ammonia and explaining why 2.3 millicables of 60-20 rain fell at the Settlement between Hour 40 and Hour 100 of Day 2. He suspected that his researcher's misinterpretation had been deliberate; Mesklinites were often quite human when in search of excuses and Borndender was currently feeling annoyed with his own lack of usefulness. Without bringing this aspect of the matter into the open, the captain merely repeated that useful ideas would be welcome, and left the lab.

Even the scientists were ordered outside when the time finally came to use the ramp. Borndender was irritated at this and muttered something as he went about the academic nature of the difference between being inside the *Kwembly* and outside her if anything drastic happened. Dondragmer, however, had not made a suggestion; he had issued an order, and not even the scientists denied either his right or his competence to do so. Only the captain himself, Beetchermarlf and a technician named Kensnee in the life-support compartment were to be aboard when the start was made. Dondragmer had considered acting as his own helmsman and taking a chance on the life equipment but reflected that Beetchermarlf knew the tiller cable layout better and was more likely to sense anything going wrong in that department. Inside power was not directly concerned with motion, but if any slip or collapse of the ramp caused trouble with the life-support system it was better to have someone on hand. This support system was even more important than the cruiser: in an emergency the crew could conceivably walk back to the Settlement carrying their air equipment even if the cruiser were ruined.

The reasoning behind the evacuation order should have left Beetchermarlf and Kensnee as the only ones aboard, with even the captain watching from outside. Dondragmer was not prepared to be so reasonable. He had stayed aboard.

Tension in the crowd of caterpillar like beings gathered outside the monster hull mounted as the drivers took up the slack in their treads. Because Dondragmer could not see the tense crowd from the bridge, he was calm; Beetchermarlf could feel their mood and was perturbed. The human watchers, observing by way of a set which had been taken from the life-support room and secured on a rock projecting from the water a hundred yards from the land-cruiser, could see nothing until the cruiser actually started to move. They were all calm except Easy and Benj.

The boy was paying little attention to the outside view, instead he was watching the bridge screen on which part of Beetchermarlf was visible. He had one set of chelae on the tiller, holding it fast; the other three sets were darting with almost invisible speed among the grips of the engine control lines, trying to equalize the pull of the different trucks. He had made no attempt to power more than the usual ten; the cords which normally cross-connected them, so that a single line would work them all, had been realigned for individual control. Beetchermarlf was very, very busy.

As the *Kwembly* began to inch backward, one of the human beings commented explosively.

"Why in blazes didn't they put remote controls, or at least torque and thrust indicators, on that bridge? That poor bug is going crazy. I don't see how he can tell when a particular set of tracks is even gripping, let alone how it responds to his handling."

"If he had fancy indicators he probably couldn't," replied Mersereau. "Barlennan wanted no more sophisticated gear on those vehicles than his people could repair on the spot, except where there was really no choice. I agreed with him, and so did the rest of the planning board. Look—she's sliding off, smooth as ice."

A chorus of expressive hoots came from the speaker, muffled by the fact that most of the beings emitting them were under water. For a long moment, a score or so of the 'midship trucks were hanging free as the stern of the *Kwembly* came off the ramp and moved back over the river bed. The engineer who had been afraid of the bridge effect crossed his fingers and rolled his eyes upward. Then the bow dipped as the forward trucks came down onto the ramp in their turn, and weight was once more decently distributed. The twisting stress, which no one had considered seriously, lessened as the cruiser eased onto the relatively level cobbling of the river bed and came to a halt. The crew divided and poured around bow and stern to get to the main lock, no one thinking to pick up the communicator. Easy thought of reminding the captain, but decided that it would be more tactful to wait.

Dondragmer had not forgotten the instrument. As the first members of the crew emerged from the inner surface of the lock pool, his voice echoed through the speaking tubes.

"Kervenser! Reffel! Take the scout fliers out at once. Reffel, pick up the communicator outside; make sure the shutter is in the flier before you start; then make a ten-minute sweep north to east and back. Kervenser, sweep west and around to south for the same time. Borndender, report when all your measuring equipment is aboard. Beetchermarlf and Takoorch, outside and realign the engine control cords to normal."

His communicator at the bridge had the sound on, so Easy heard and translated these orders, though the reference to a shutter meant nothing to any of them. She and her colleagues watched the screen of the outside set with interest as the two tiny helicopters rose from the upper lock, one of them sweeping toward the pickup and presumably settling outside its field of view. The other was still climbing as it left the screen, heading west. The picture rocked as the set was picked up by Reffel and wrestled into its space aboard the flier. Easy flicked a switch absent-mindedly to record the scenes for future map work as the viewpoint lifted from the ground.

Dondragmer would have appreciated being able to watch the same screen but could only wait for a relayed verbal report from Reffel or a delayed but direct one from Kervenser. Actually, Reffel did not bother to relay. The ten-minute flights produced no information demanding speedy delivery. What it amounted to, as Dondragmer reported to the human audience, was that the *Kwembly* was in a valley some fifteen miles wide, with walls of bare rock quite steep by Dhrawn's standards. The pilots estimated the slope at twenty to thirty degrees. They were also remarkably high, fully forty feet. To the west there had been no sign of a new flood as far as Kervenser had flown. He noted that the boulders strewing the valley floor gave way to bare rock within a mile or two and there were numerous pools like the one in which the *Kwembly* was now standing. To the east, the stones and pools continued as far as Reffel had gone. Dondragmer pondered these data for a while after relaying this information to the satellite, then ordered one of the fliers back to work.

"Kerv, get back aloft. The helmsmen won't be done for hours yet. Go as far west along the valley as you can in an hour and check as closely as your lights will allow for any sign of more water starting down.

Make that three hours, unless you have a positive finding, of course, or have to turn back because of bad visibility. I’m going off watch. Tell Stakendee to take the bridge before you leave."

Even Mesklinites get tired but Dondragmer’s thought that this was the right time to get some rest was unfortunate, as Barlennan pointed out to him later. When the captain insisted that there would have been nothing for him to do even if he had been fully alert, his superior gave the Mesklinite equivalent of a snort of contempt.

"You’d have managed to find something. You did later."

Dondragmer refrained from pointing out that this proved that his omission was not a serious error; but he had to admit to himself that it had appeared so at the time.

It was almost eight hours after Kervenser’s departure that a crewman hooted outside the door of the captain’s quarters. When Dondragmer responded, the other squeezed the situation into a single sentence.

"Sir, Kervenser and the helmsmen are still outside, and the pool of water we’re in has frozen."