THE MARS FRONTIER

Vol. 6

The Commonwealth

Contents

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Miners

14 September 2031

The Mars shuttle *Arsia* plunged into the Martian atmosphere at 4.2 kilometers per second and within seconds the metal heat shield covering its blunt, conical base was glowing red hot. A plume of ionized gas enveloped the craft, tracing a meteor-like reddish trail across the predawn sky above the Tharsis Uplift. Inside the pilot, Emily Scoville, watched the computer closely. It maintained the craft's lift at maximum, lengthening the glide and minimizing the gee forces on the eight human beings packed into the two small passenger cabins built into the cargo bay just above the engines. The rest of the cargo bay was stuffed with twenty tonnes of cargo: consumables, drills, solar power units, sunwings, new computer equipment. The passengers anxiously watched the television screen in front of them as they endured up to two terrestrial gees of deceleration.

Just as the deceleration waned—the atmosphere had done all it could do to slow their plunge to a mere 1.5 kilometers per second—Emily came on the intercom with the laconic announcement, "parachute deployment." No warning was sufficient for the jerk caused by the deployment of the drogue chutes, then the violent jerk caused by the three main chutes ten seconds later. Rather than falling ballistically in a long, graceful arc toward the surface, the parachutes caused the trajectory to steepen and the *Arsia* to head more vertically toward the ground below.

Bang! The parachutes cut loose on cue when the *Arsia* was falling at a mere 700 meters per second—1,565 miles per hour, for those unable to deal with the metric system—just 26 kilometers above and to the west of pad 7. For a terrifying split second

they were in free fall. Then the *Arsia's* main engines, formerly concealed behind now-open doors in the heat shield, blazed alive, expelling one hundred meters of orange-tinged blue flame. Weight returned, 1.3 terrestrial gees of it. The *Arsia* slowed, turned to stand vertically, then settled straight onto the bullseye in the center of pad 7, blasting dust and vaporized ice hundreds of meters across the surface. With a bump the spacecraft settled onto its legs and the engines shut off. The first eight of Columbus 6's forty personnel had arrived at Aurorae Outpost, Mars.

Two conestogas—large, pressurized, eight-wheeled vehicles—immediately circled the newly arrived vehicle, checking for heat shield damage, venting gasses, or any thing else that was out of the ordinary. Meanwhile, inside the eight safely arrived people climbed out of their seats, put on their life support backpacks, and prepared for an EVA. Scoville gave the green light for them to begin to disembark and lowered the ramp next to the airlock. Two by two they stepped out, placed their feet on the dust of Mars for the first time, and walked around excitedly, looking at the nearby hills known as Table Mesa and Boat Rock and staring at the hulking wall 1,500 meters high known as the escarpment, the northern edge of Aurorae Chaos twenty kilometers away. Little was more beautiful than the Mariner Valleys, and Aurorae Outpost was built in the easternmost end of that mighty chain of crust-cracking rifts.

The all clear was sounded; it was safe to approach the shuttle, so more vehicles arrived. Pressure-suited men jumped out to shake hands and hug their new coworkers. Soon the cargo bay doors swung open as well and twenty tonnes of cargo began to be unloaded into the waiting vehicles and the trailers they were pulling. By noon, the twenty-five personnel had managed to unload almost everything. They drove back to the

garage in the basement of Joseph Hall and went inside for more greetings and lunch. Then that afternoon another shuttle would arrive and they would repeat the entire exercise again. The next sol two more would land; the sol after, the fifth and last shuttle would descend from orbit.

Coordinating the entire operation from his office in Habitat 1 was Commander Will Elliott. On September 14, 2031—the sol of the *Arsia's* landing—he was 45 years old and had lived on Mars ten and a half years, one of three people to remain on the Red Planet from Columbus 1. Every time an eight-person crew arrived he welcomed them all personally in the garage of Joseph Hall. By 3 p.m. on the first sol there was a slight temporary letup in his work—in addition to coordinating all Mars operations, he was also Assistant Commissioner of the Mars Commission and therefore the number two person in the organization, and had to sit in electronically in many meetings in Houston in spite of the five to forty minute communications delay—and that allowed him to send emails to two new arrivals, inviting them to meet him an hour later. At four p.m. Bruce Curry arrived at his desk.

"Bruce, welcome again to Mars." Will rose from behind his desk and stepped forward to greet Curry, an experienced miner about fifty years of age, tall and thin, with balding grayish-red hair.

Curry offered Will his hand and they shook; Curry used a bone-crushing grip, as was his custom. He glanced at the Commander's melanin-hued skin and slightly curly, brown hair and considered the fact that Elliott was part African American, part European American. Curry was used to traveling around the world and meeting all types, but had never gotten completely comfortable with people of mixed racial backgrounds.

“Thank you, Commander, I’m delighted to be here. It’s an incredible opportunity.”

“For everyone; for you, for Consolidated Mining, for the Commission, for Mars. We’re really happy you’ve arrived safely. How was your journey?”

Curry shrugged. “I’m still not much of an astronaut; that part of the job takes some getting used to. Columbus 5 was rather crowded, but the food was pretty good and there were plenty of training videos to watch again and again.”

“I understood you got pretty good at zero-gee volley ball.”

Curry smiled. “Now where did you hear that? I’ll tell you, we had some pretty good matches up there. Just about everyone was on an intramural team before we reached Mars. The ‘middeck’ was a life-saver, considering how crowded the ship was otherwise, and it included a micro-gravity gymnasium twenty meters long and six meters in diameter. The trickiest part about zero-gee volley ball is returning the ball at all—it’s easy to jump from the wall to hit the ball more or less in the right direction, but hard not to crash into the opposite wall, let alone be ready for the returned volley. The second hardest part is shooting the ball through the three-meter circular hole in the midfield net! It’s great exercise, though it did lead to a few sprained fingers and wrists from crashing into people or walls.”

“I can imagine. We didn’t have either the space, or the game itself on Columbus 1.”

“I don’t think they even had it on ISS2 then! The new LEO Hilton has a nice volley ball gymnasium.”

“I heard. Now the folks at Shackleton want to invent a similar game to play in lunar gravity; they’re getting a big open enclosure in a few months. Have you been to the moon?”

“Just for two weeks, as part of our training, right before heading to Gateway Station and launching the mission.”

“Fascinating place. I suppose you’re anxious to get your crew down to Pretoria?”

Curry shrugged. “Well, we won’t get much work done here, there’s no gold at Aurorae. When will we be able to retrieve the mining equipment on the automated cargo vehicle?”

“About ten sols. All five of our shuttles are occupied right now to deorbit the Columbus 5 passengers and ninety tonnes of supplies. It takes about ten sols to refuel a shuttle, then ACV3 is our first priority.” Will leaned back in his chair. “You should have seen the aerobraking; it was spectacular. ACV3 flew right overhead Aurorae at about midnight local time and it was a mere 2 kilometers up; it had to dip quite deeply into the Martian atmosphere in order to burn off the extra speed. We’ve never had cargo arrive at 8 kilometers per second before. The flame really lit up the sky!”

“I bet. It’s a shame we had to send it from Earth so late, but Muller Mining didn’t have its act together.”

“Well, it didn’t raise the transportation cost that much, since NASA threw in the use of the solid core nuclear rocket for free.” Will paused. “I gather there was quite a rivalry between Consolidated and Muller on the flight out.”

Curry smiled slightly. “Well, let’s just say we beat them in volleyball three times straight.” Then after a pause he added, “As you undoubtedly know, we have serious

concerns about security. We have proprietary technology that is not even patented because we want to keep it secret. The four of us are in charge of watching over and moving our stuff. I wish it had been possible to fly all our stuff straight to Cassini Outpost; now it has to be broken up and hauled to Cassini a few tonnes at a time."

"It would have been quite difficult for some shuttles to land at Cassini while others landed here," replied Will. "It would have meant that different Interplanetary Transit Vehicles aerobraked into orbits with different inclinations, which would have required several aerobraking passes and would have made any emergency rescue efforts complicated. When everyone brakes into an equatorial orbit and heads for Embarcadero Station, its resources are immediately available if there's trouble, not to mention resources on Phobos and Deimos. Besides, we want everyone arriving at Mars to start here. We are part of one big team, and no one will feel that or understand that if they never come to Aurorae when everyone else is here. No, for now Aurorae is the point of entry for personnel.

"But the cargo on ACV3 will be delivered to Cassini directly. ACV3 aerobraked into an orbit with a 28 degree inclination, the latitude of Cassini Outpost. The shuttle picking up the cargo will be controlled robotically, so rescue is not an issue."

Curry listened impatiently. "I understand basic orbital mechanics, even if I am a rock miner, Commander. I suppose another way of saying what I meant is that I hope the time will come when our orbital facilities will be sufficiently robust to allow humans to travel in non-equatorial orbits around this planet. The new Sunwing model 3 won't be put together for a few months, if the work schedule holds. That means eight tonnes of cargo

for Consolidated has to be hauled overland in trailers some 6,125 kilometers over dirt tracks to their destination."

"We might fly them by shuttle. But if we do have to drive them, it probably won't be as difficult as it sounds. One conestoga can pull a nuclear reactor and a trailer with eight tonnes of cargo at fifteen kilometers per hour, twenty-four point six hours per sol, over the trail, all by itself. We haven't tried automated cargo transport yet, but it's theoretically possible. It'll deliver cargo to Cassini in two and a half weeks. We just finished widening the Circumnavigational and Cassini Trails so they can accommodate automated driving more effectively. If you'd like your team to go along, we can send a ranger as well and the four of you can sit, play cards, and watch tv while you roll to your destination."

Curry scowled and was about to respond when they saw another man approach Will's office. He was a bit shorter than average, in his early forties, with a thin mustache. Will smiled and stood. It was Gerhard Bach, the head of the four-person mining team from Muller Mining, A.G.

"Gerhard, welcome to Mars!" said Will.

Bach saw Curry and they both momentarily stared at each other. It was clear they were uncomfortable together. Then Bach entered Will's office. Will came out from behind his desk again to shake hands with the German national.

"Thank you, Commander," replied Gerhard. "And it has been quite a welcome."

"I trust you had a comfortable voyage?"

Gerhard nodded slightly. “Reasonably so. We tried to keep ourselves busy while coasting between the planets. This is quite an impressive facility; so much larger than Shackleton.”

“Oh, I don’t know. Shackleton doesn’t have thirty vertical meters of airspace, but the square meters of floor space is about the same.”

“Perhaps it’s the parkland and trees that gives this place a different feel.”

“Have either of you seen Catalina yet?”

“No,” both men said simultaneously.

“I didn’t think so. Building 1 is completely purchased by folks arriving on Columbus 6, and none of your people bought in. Building 2 still has to be completed. Let me show you.” Will pointed to the door. Curry and Bach reluctantly followed him. They crossed to Habitat 2, where the sick bay and medical science lab was located, then took a tunnel to Habitat 4, which housed some of the new arrivals. From there they crossed Clarke Dome, an experimental thirty-meter in diameter pressurized space, at first used for recreation but now serving as an agricultural area. That led them to Yalta Biome, a forty-meter dome with two buildings on the northern and southern sides, respectively; their roofs were covered by lush agricultural areas while the “yard” between them was planted in clover, flowers, and fruit and nut trees. From there it was a quick walk via another pressure tunnel to Catalina Biome.

“This outpost has evolved through various stages,” Will said as they walked. “When we first arrived here, we brought Habitats 1 and 2. Of course, they’ve now been extensively refurbished to make them more comfortable; walls of sheet rock are stronger and more sound proof than a thin plastic fabric wall with flimsy Martian plastic panels

glued on! Habitat 3 arrived with Columbus 2 and Habitat 4 arrived with Columbus 3. The latter was better designed and had a lot more usable interior space; it's now set up to house twenty people, and the dorm rooms can be used as offices and meeting rooms at other times. Clarke Dome arrived with Columbus 4 as well and was an immense relief; it gave us a big interior space, which we had never had before. During Columbus 4 we experimented with duricrete and iron construction; Renfrew and Joseph Halls resulted. They're solid, reliable, safe, but have tiny windows and feel hulky and oppressive. So then Alexandra Lescov, the director of construction here, experimented with various other approaches and eventually settled on the biome concept; rather than importing greenhouses and inflatable plastic habitats, we import a big plastic enclosure for the agriculture and build housing inside smaller bubbles within the big one, so that our housing looks out on greenery. The resulting construction is lighter, more airy, and much more appealing." Will opened the final airlock door and led them into Catalina Biome. Like Yalta, it was forty meters across and had a northern building and a southern building, with an east-west trending yard between them. "The sun floods the yard with light all sol," Will added, pointing to Catalina's yard, which was still underdeveloped, with saplings, scattered clover plants, and rather thin flower beds. "We're almost on the equator here, so when the sun is in the northern hemisphere the south building's north-facing windows get oblique sunlight at midday; half an annum later, the north building's south-facing windows get it instead. The buildings have overhangs that stick out two meters, providing shade and radiation protection to anyone staying close to the building."

"What's the radiation exposure inside the building?" asked Gerhard.

"About one rem per year; the two meters of wet soil filling the rooftop farms provide quite robust shielding. Out here in the yard you'll get seven rems per year, and in interplanetary space about twenty. The recommended max of fifty rems per lifetime will be exceeded by anyone living here, but with good medical care it can be managed fairly well. At least that's how it looks right now." He pointed to building 2. "Come look." he led them over to building 2 to a large window in the exterior vinyl siding. They looked inside and were surprised to see a huge, cavernous, empty space.

"That's right, you don't have a building bubble in this one yet," noted Gerhard.

"We used this bubble to build the dacha, our vacation spot up on the escarpment overlooking Valles Marineris. But an extra bubble arrived with the shuttle this morning. Its mass is only one tonne. We'll put it inside here and inflate it; it'll fill the cavernous space exactly. Then we'll install the airlocks and move inside to build the building within out of nickel-steel frames and sheetrock wall units. The Yalta buildings were constructed in place in a more traditional manner; we welded and riveted the nickel-steel beams together in place, then bolted on the sheetrock, installing insulation, pipes, and wires as we went. It was basically the old fashioned two-by-four and plywood system, but with materials we could make on Mars. But building 1 and this building were manufactured panel by panel in the top floor of Joseph Hall, which we've now converted into a construction area. The panels come in certain standard dimensions and every wall in here has been designed to use one of the standard panels. Because we have access to industrial-sized airlocks, we can even weld the steel frames in standard sizes up to four meters by three. And the robots that arrived with Columbus 5 are now set up and we know how to use them fairly well. So most of the manufacturing is now semi-automated;

one person can supervise three robotic welders or three robotic bolting machines at once, for example. Yalta's building 1 took three months to assemble, but Catalina's building 2 will take half as long because completed walls will be lifted in place by crane and bolted down in a few minutes."

"Very impressive," said Bruce. He stared inside. "I suppose the logical question to ask, then, is when Cassini will get a biome?"

"That's certainly an excellent question," Will began, trying to think through a simple and persuasive answer. "Columbus 6 is bringing three biomes. While Cassini theoretically could have as many as sixteen residents, we are recommending that the population be kept as small as possible; a maximum of six, with frequent crew rotations. The equipment can be run from a control room here just as easily as from a room in Cassini several hundred meters from the machines. People are needed principally for maintenance purposes. We already have extensive facilities for controlling telerobotically operated vehicles here and can easily build more. This is a much more comfortable place to live, too, with a cafeteria and a social life lacking in Cassini—"

"Commander, I'd prefer to have my entire team in one place, not two," replied Bruce strongly.

"Do you realize what it means to build a biome six thousand kilometers from here? Spacesuited workers have to lay a foundation of duricrete, with steel pilings to support the buildings. Otherwise the mass of the building could deform and puncture the airtight enclosure. That task takes months. And while each building involves only a one tonne bubble and three tonnes of life support equipment imported from Earth, the interior walls of sheetrock, nickel-steel, insulation, pipe, and wires have a mass of seventy-five

tonnes. The exterior vinyl walls and steel beams to support the rooftop farms mass another twenty-five tonnes. The interior of this biome has three thousand tonnes of regolith materials. It takes many tonnes of equipment to do the construction and tonnes more to sift the regolith, transport in the right size fractions, fertilize them, and get life started in them."

"Commander, let us start thinking about a way to do this, even if it is almost a third of the way around this world," agreed Gerhard. "I agree with my colleague. My people didn't come here to buy flats in Yalta or Catalina or vote in Aurorae Borough elections; they came here to earn maximum bonuses for themselves and maximum profits for Muller Mining. They need to be in Cassini running and maintaining equipment. I have no problem with some of my people being here or working here; especially relaxing here. When we come here, we'll probably want to stay at the Dacha. But I want them in Cassini most of the time."

"And the contracts call for you to supply four people to each of us to provide support," added Bruce. "That's sixteen people in Cassini. If you put them in Mobilhabs and conestogas, they'll tie up a lot of your transportation. Cassini's not just a little temporary stop in the desert, Commander. It's Mars's gravy train. I don't know about my competitor here, but my goal is to dig at least a billion dollars of gold in the next eighteen months. If Cassini's going to produce wealth like that, it deserves a biome, even if the people are rattling around in it."

"I believe both of you saw the proposal we sent your companies; we copied you. It called for Cassini to have six to eight people at a time; two from each of your teams and two to four people assigned by us to assist and provide support services like food and

life support. That's two Mobilhabs for now, and a building bubble without an enclosure later. Cassini will get a biome during the next columbiad, which gives us time to figure out how to get everything there and set it up. A biome requires up to a dozen construction workers at a time; where will we house them and your people?"

"Set up a bubble or two to house them temporarily. Those are details for you to work out, Commander, not us," replied Bruce.

"I suspect our companies will cooperate on this particular matter," added Gerhard, looking at Bruce. "I know I sent a memo of concern to Muller himself, and I was under the impression he wrote the Commission."

"Perhaps he did, and the memo never got to me. I'll talk to Alexandra and see what sort of acceleration to the construction schedule is possible. But I can't guarantee anything," Will replied. He turned away from building 2 and led them back into Yalta Biome, which was now teeming with people. It was getting close to suppertime and many were seated at tables, waiting for the food to be put out; the kids were in the yard, playing until their parents arrived to greet them. It was a noisy, busy scene. Will led the two men through Joseph Hall—named after an unborn child, victim of their flu epidemic four years earlier—showing them the materials production and fabrication facilities and the construction manufacturing area. They passed through Renfrew Hall—named after Paul Renfrew, the only astronaut to die on Mars—which now housed Martian biological research facilities. They passed through the Geology building, their first duricrete construction and now overcrowded with machines and samples. Finally, they walked through a few greenhouses and through the old industrial and biological facilities, now used for storage and crafts manufacture.

Will attempted conversation about other matters—the men's lives, their children—but didn't get much. "I'm committed to two columbiads," said Bruce at the end of the tour, in response to Will's question about their future plans. "If they offer a million or two as a signing bonus, I might stay another columbiad."

"My time here has a lot to do with my older son," added Gerhard. "My wife and I divorced ten years ago and my daughter got married just before I flew out. My son might want to come here in a few years after he finishes university; if he does, I'll stay."

"You might be our first father-son team," noted Will.

"I've got to finish moving our equipment to our secure location," exclaimed Bruce. "Thanks for the tour, Commander. It's an impressive facility. I hope I see Cassini get this big."

"Good to get to know you better, Bruce." Will waved slightly; Curry waved back, turned, and headed back to Joseph Hall.

Gerhard watched him go. "A difficult man to deal with," he said. "Did you know, Commander, that all four of the staff of Consolidated are Southern Baptists; fundamentalists who reject the theory of evolution?" He laughed. "They can accept the science behind flying to Mars and building gigantic gold processing machines, but not the same science when applied to the development of life!"

Will shrugged. "People are funny, aren't they? Sometimes I wonder whether Mars would have been more effectively explored and developed without them! But since we're all here, Mr. Bach, we have to cooperate closely and preferably become collegial with each other. It isn't just a question of professionalism; it's what we expect here on Mars."

“That will be difficult, Commander, but I understand your point. Well, I have to check our equipment as well; we have a lot of proprietary technology and we’re very concerned that our competitors will spy on us.”

“I understand. See you around the Outpost, Gerhard.”

“Thank you. Good sol, Commander.” Gerhard turned and headed on his way.

Will walked back to his office, wondering how the bosses of these two teams would ever cooperate in a small outpost 6,000 kilometers from “civilization.” When he got to his office, he called Alexandra.

“Hello Will,” she replied. The screen on his attaché—a flat object the dimensions of a clipboard but a bit thicker, which served as a computer, videophone, and message center—had no picture on it. “I’m outside supervising the transport of the new bubble for Catalina building 2. How can I help you?”

“I just met with Bach and Curry, and as expected, they both insist that Cassini get a biome.”

“Who do they think they are?” Alexandra sounded disgusted. “We don’t exist just to serve two small mining teams in Cassini. We have a lot of work to do here at Aurorae as well. I think you had better get the Commission involved in this. Building a biome at Cassini will be immensely difficult. We’ll have to prepare everything here and haul it six thousand klicks; twenty tonnes for the biome foundation and a hundred tonnes for each building. That would require about eleven shuttle flights, which would use up all the flights of two of our five shuttles and would consume half of our electrical output for over a year. We don’t even know we can run automated cargo caravans, but if we can, at ten tonnes per trip, one round trip every month, it’ll take twenty-one round trips and

twenty-one months, and will use up ten percent of our electricity. And a biome takes fifteen person-years of work to manufacture the parts and put them together."

"I know, Alexandra. I'll talk to Morgan. But keep in mind that three biomes have arrived on Columbus 6 and putting them here will take fifteen person-years of work as well. Each team wants to export a billion dollars of gold in the next twenty-six months; that's 200 tonnes of gold that will have to move from Cassini. If we send construction materials to Cassini by shuttle at forty tonnes per launch, then move gold to orbit at forty tonnes per launch, then land the shuttle back at Aurorae, we're talking about half as many shuttle flights as you objected to, and if we haul the gold overland that means the automated cargo caravans have something to bring back here on every round trip and we'll still have to launch the gold into orbit. We're going to have to build a biome at Cassini eventually; in fact, we'll probably have to build two so that there's redundancy. Cassini's going to grow whether we like it or not because it's where the gold is."

"And we may have to build a biome or two at Dawes too, if gold is found there. Your argument is taking us down a very complicated and difficult path, Will."

"It's not my path; I'd rather avoid it. But all we can do is postpone it, Alexandra."

"Well, do your best to postpone it! We have to build Catalina's building 2, assemble biomes 3 and 4 from scratch—by the way, I'd like to call them Riviera and Shikoku—build a biological waste recycling facility, refurbish the Geology Building, build liquid oxygen and methane tanks, and accomplish a dozen other smaller but equally vital tasks."

"I know. I'll talk to Morgan. But be prepared, Alexandra."

2

Beginnings

16-20 Sept. 2031

September 15 saw the remaining two shuttles descend from orbit with eight more people each. By mid afternoon all forty persons who had been on Columbus 6 had safely descended to Aurorae Outpost. Meanwhile, in orbit, two Lifters, full of oxygen and methane propellant manufactured from the rocks of Phobos, fired their engines and pushed two Interplanetary Transit Vehicles or ITVs each on trajectories that would take them into the asteroid belt, then back to the Earth. Ion engines on the ITVs would speed them up, getting them back to Earth in about sixteen months. Each carried two tonnes of gold that had been wrested from Cassini's gold-bearing rock and regolith.

An inaugural dinner marked the end of the arrival process. Will went through the buffet line with Marshall, his six and a half year old son; Ethel followed with Lizzie, who was almost four. In line in front of Will was Muhammad Rahmani and Emily Scoville, the British pilot who had commanded Columbus 6.

"What an incredible spread!" Emily exclaimed to Will, as they reached the end of the buffet. "Chicken, turkey, tilapia, catfish, rabbit, beef, pork; the meat alone amazes me! The pastas, breads, casseroles, vegetable dishes, desserts; it's mind blowing!"

"It's gotten a lot better since we arrived ten and a half years ago. In 2021 we could manage ten species of vegetables, wheat, corn, rice, rabbits, and chickens, and we couldn't make combinations very well. Local beef became available last fall; we imported steak until then. The biome created the quantity of plant waste necessary to support a few cows, and enough area to support a bee hive able to make honey."

“No sugar cane, though.”

“No, but last columbiad we imported sugar beets.”

“And this time we brought coffee and coca trees; rather important additions.”

“Yes, but luxuries.”

Emily eyed the payment area. There were two payment devices set up; one put one’s tray in at one end and it slowly moved through the device, emerging the other end ten seconds later, with a list of items on the tray and the price of each displayed on a screen. But they had cloths thrown over them. “Oh, we don’t have to pay? What a relief; this is so rich, it would be incredibly expensive!”

“The inaugural dinner’s on the house; it’s a public event.”

“Good. When I ran my breakfast through the machine this morning, I thought I’d die! It was $123!”

“If you think you were shocked, consider how everyone here felt! Food was free until yestersol. But now we have to charge for food, water, electricity, and communications because some of the people here are not employees of the Commission. Food averages about $400 per sol. Our salaries just increased by $150,000 per year, but that doesn’t quite cover the new charges, so everyone’s grumbling.”

“I can’t blame them; but that’s capitalism for you.”

“True.” Will turned to the drinks table and grabbed a glass of juice for Marshall and a soft drink for himself. He held it up with glee. “We ran out of Coke and Pepsi completely six months ago, so it’s nice to be restocked. So, how was the flight out?”

They began to walk toward a table. “Fairly uneventful,” replied Emily. “We had Consolidated in one ITV and Muller Mining in another, and they asked to be set on

different time schedules so that they rarely overlapped with each other in the public spaces. We had some tensions with the four Chinese and with the Arabic speaking crew; they naturally spoke their own languages in the middeck and others resented it. Muhammad proved immensely helpful to me in making the Muslims comfortable."

"Overall, it went pretty well," added Muhammad Rahmani.

"I'm impressed by the diversity of the crew; you brought people from twenty-one nations. The male to female ratio is one of the best we've seen, too."

"Yes, the crew was forty percent female. The mix has had positive results. Some relationships seem to have been started; someone dubbed the flight 'the love boat' as a result."

"Oh?"

"Yes. Cornelius Beyer and Tatiana Gavrilova have become quite close; and Sheila Burns and Arieh Feldman; and Ni Gao and Marge Bailey. The latter relationship's interesting because Marge is one of Consolidated's workers and Ni Gao is Chinese, and those groups usually don't mix. I think Bruce has given Marge a hard time about the relationship. I mention all of this to you confidentially, of course, since you're commander. In addition to these three relationships, we had nine married couples on board. It reminded me a bit of Columbus 2, where eventually everyone was married or partnered up except Shinji."

"Yes, that was remarkable." They got to the table and sat down; Muhammad sat next to Emily and Will suspected she had failed to mention a relationship of her own. "So, Emily, you're staying just one cycle?"

"Yes. My kids are grown, but I'm not ready to cut off my relationship with them yet. Besides, someone has to fly the ITVs back. I think only three or four of the forty plan to return at the end of the columbiad."

"Well, while you're here you can do just about anything you want. You've got that kind of seniority; you've been flying fifteen years."

"Thank you. I want to do some research on meteorites; as you know, I did a lot on the moon, and the supply here is enriched a bit in materials from the outer solar system. From the sound of things, there's going to be a great increase in recovery of nickel-iron meteorites for nickel steel, platinum group extraction, and copper refinement, so I'd like to work on that."

Will nodded. "We can do that. The copper refining will take place at Cassini, most likely; the Joberg epithermal deposit has some local enrichments in malachite ore, and the cheapest extraction method is to crush the malachite and put it in a carbonic acid bath with meteoritic iron. If you want to supervise that process part of the time, that will get you to Cassini. And frankly we could use someone who knows the mining teams to help coordinate our support with them."

Emily rolled her eyes, but then nodded. "They're a pain. But I can handle them."

Just then Ethel arrived with Lizzie, who had insisted on carrying her own tray. Ethel sat across from Emily; they were old friends. Within thirty seconds they were immersed in a deep conversation.

Will watched them plunge into their conversation and turned to make sure the kids were eating alright. Lizzie could not yet be ignored. So he watched her in particular.

A man with oriental features approached and Will struggled to remember his name. “Ananda Thanarat, Commander,” he said, offering his hand very gently.

“That’s right; I’m sorry I forgot your name. Welcome to Mars. You do lots of things, if I recall.”

“Mathematics is my area, with a secondary focus on artificial intelligence. I doubt I’ll use it much, though there’s quite a rush for telerobotic operations.”

“I wouldn’t exclude a.i.; we will need it soon enough. A few years ago I would have said that we can let math be done on Earth for us, but the bigger the operation here, the more we need to do things ourselves. We could already use some local expertise on further developing the artificial intelligence of our machines.”

“I agree; this is the most automated society ever to exist. The other thing I wanted to say, Commander, is Alláh-u-Abhá.”

Will smiled broadly. Oh? You’re a Bahá'í? Alláh-u-Abhá!” Will exclaimed the Bahá'í greeting quite loudly and unembarrassedly. He leaned over and gave Ananda a hug.

“Thank you, Commander. I gather there are two Bahá'ís here?”

“No, three; Enrique Delrio became a Bahá'í less than a year ago. And now we have you as well, and of course Marshall and Liz are Bahá'ís, so that’s six! It’s quite a strong group now! We’ll have to organize more events.”

“That would be great. I’ve mentioned the Faith to a few people and I think there are two or three who’d like to come to a meeting.”

“Marvelous. As you may know, we have interfaith devotional gatherings every Sunsol at 11 a.m. The Bahá'í spirit was one of the inspirers of this gathering. Maybe you can help organize them.”

“Perhaps; I would be honored to assist.”

“I’ll keep that in mind. Please sit.” Will pointed to an empty seat at the table, so Ananda, who was from Thailand, joined them. Shortly thereafter Xiaopeng Cai, a Chinese eobiologist, sat as well, followed by Fatima and Husni Hijazi, a couple who were from Palestine and Saudi Arabia respectively. “How marvelous that both an Israeli and a Palestinian could fly here on the same flight,” noted Xiaopeng.

Fatima smiled shyly. “Husni and I are delighted that we could stay together. He has always wants to go to Mars.” She spoke with a distinctive accent; very crisp and clearly enunciated, somewhere between an English, an American, and an Indian accent. “Once he was selected, the word went out that Mars needed an elementary school teacher, and I have a doctorate in that very field. But of course, Palestine doesn’t have the resources to sponsor an astronaut. Fortunately, a wealthy Saudi and two wealthy Palestinians cooperated to sponsor me as well.”

“We’re delighted you’re here,” exclaimed Will. “We can’t wait to get first grade started. Marshall’s six, and Sam turns six in January.”

“So I hear. When shall we begin school?” asked Fatima.

“How about Monsol? It’s September; the usual time for classes to start anyway. We’ve got a classroom just about ready.”

“Monsol it is, then. But that’s how many days—sols—from now; four?”

“Three. This sol’s Frisol, even though it’s Thursday on the Earth, or at least on most of Earth.”

“Getting used to a 24.6 hour day—I mean, sol—will take some time.”

“I’m sure. The Muslims here have been considering Frisol their sabbath, if I can use that term; Christians have used Sunsol. Otherwise, after 36 days of seven-day weeks, you’d go to bed on a Monday night and wake up the next morning on a Wednesday! Eventually you’ll have two Fridays that are only six days apart, or they’ll be 13 days apart because Friday was the day that got skipped!”

“It would be confusing.” agreed Husni Hijazi. He was Saudi, and a geologist. “On the other hand, clocks go to 24:39:35 before they switch to 0:00!”

“Yes, which is why we don’t have any clocks with hands; with chronometers, we can keep the same minute and second as Earth, which has scientific value. It also means that Mars has twenty-five time zones.”

“At least the times of prayer are not significantly effected,” noted Fatima. “We have sunrise, noon, mid-afternoon, sunset, and evening, after all!”

“Ruhullah doesn’t take any chances,” said Will. “Whenever we lose an entire day compared to Earth, he ‘makes up’ the day’s prayers.”

“I may want to do that, too,” said Husni. “I gather Ramadan is held at the same time as on Earth?”

Will nodded. “Ruhullah uses the Tehran times for the start and end of Ramadan, and since an entire day of time differences takes 36 days to accumulate, the fast ends up being the same number of days here as on Earth. The day is a bit longer, but twilight is

much shorter, and since Muslims fast from first to last light, it ends up being about the same, or maybe a bit less here!"

"You're quite an expert on Islam, Commander," said Husni. "What has caused your interest?"

"I am a student of all the religions, Dr. Hijazi."

"And you are a Bahá'í, right?" asked Fatima.

Will hadn't wanted to bring up his religion because Muslims persecuted Bahá'ís in many countries, and he didn't want to cause embarrassment. He nodded.

Husni smiled, but looked stiff and uncomfortable. "I had no idea, Commander. Your prophet was a Muslim."

"Indeed he was," agreed Will.

There was an awkward silence. Will raised his coffee cup. "Who wants coffee?" He took requests, then walked to the refreshment table and picked up a tray to carry everything back. He talked briefly to Alma and Johann Werner, two of the German employees of Muller Mining. As he was about to squeeze the last cups of coffee onto the tray, Andries Underwood approached.

"Are you sure you can get all of them?"

"I think so."

"Let me help, and it's a chance to complain." Andries began to transfer half the cups to another tray. "Curry's driving me crazy. He wants to excavate 100 tonnes of gold in the next twenty-six months. He wants to be on the way to Cassini early next week, at the latest, preferably by shuttle. And he wants more power; the five solar power units won't give a sustained 750 kilowatts of electricity, so he wants a sixth unit."

Will shook his head. “Just tell him I have to approve everything and he should bug me instead. But obviously we can’t give him that much. We’re importing fifteen solar power units and Cassini’s getting ten of them. We need some here at Aurorae.”

“I know, and I told him. His answer’s always the same; ‘look, we can make $500 million for you and $500 million for us, so why can’t you do this?’”

“Because gold isn’t everything. I’ll talk to him.”

“Thanks.”

Will walked back to his table and with Andries assisting, distributed the coffees. Almost everyone had finished eating, so it was time for Will to give his welcoming speech. He rose and walked to the front, where he solemnly rang the Outpost’s bell, which had been brought to the stage for the occasion.

It was not rung very often and immediately got everyone’s attention. They turned to the stage.

“Good evening, everyone,” Will began. “Tonight we celebrate the safe arrival of forty more people to Mars. Our population, previously forty-four adults and twelve children, is now ninety-six. No one could have imagined, ten and a half years ago when Columbus 1 first reached the Red Planet, that Mars would have almost one hundred residents a decade later!

“When Columbus 1 arrived it established Aurorae Outpost, and Mars had a single habitation occupied by six people. Four years later ‘the Outpost’ as it was called, had grown to twenty-three adults and one child, and the need to register a birth and sell land around it led to the declaration of a civil government for the Borough of Aurorae. Someone this morning asked me why the term ‘borough’ was chosen, since it refers to a

city or a small section of a city, such as the five boroughs of New York City. Alaska has boroughs also, and they are the equivalent of counties; they are very large, sparsely populated areas. Not all of Alaska falls within a borough, either. It seemed to be a perfect term because at the time we didn't know whether a borough would become the equivalent of a city or township, or whether it would be subdivided into towns and cities and thus become the equivalent of a state or province. We still don't know the answer to that question.

"About Columbus 3, 'personnel' here began to feel and refer to themselves as 'residents.' The idea of a brief, two or four year stay to explore was replaced by the idea of settling down here and starting families. The Outpost began to feel like a permanent place; a hamlet or village.

"For four years, the Borough of Aurorae continued to be our only civil unit, and was usually called 'the Outpost.' The population continued to grow, and the residents began more and more to feel that they were a sort of citizen of Mars. This doesn't mean we have ceased to be Chinese, Europeans, or Americans; rather, that we have added a new identity to our national identities, an identity shaped by sols instead of days, annums and columbiads as well as years, greenhouses and biomes rather than farms and housing complexes, a long time delay to watch our native television and talk to our loved ones instead of instant communication.

"Then last year a dust storm grounded the sunwings and shuttles for five months, preventing most surface exploration—because it blocked our emergency rescue ability—the public's interest dipped, our funding shrank, and we had to close the financial gap through gold prospecting. In the process of checking the remote sensing data for what

appeared to be the most important gold terrains on Mars, we found what may be the largest gold supply in the solar system. The geologists are now saying that Cassini may have as much as three billion troy ounces of gold; 90,000 tonnes, worth almost a trillion dollars. Of course, much of that may not be profitable to recover, as they are looking at gold concentrations as low as ten parts per million, which translates into ten tonnes of gold per million tonnes of rock. The ongoing exploration of Dawes suggests that it may have a mere billion troy ounces. The old highland rocks near Meridiani and several other regions on Mars are rich as well.

"Our situation here changed overnight. Shipping costs used to be so high, gold could not be recovered and shipped back to Earth profitably. Now we can make a profit on gold if the recovery costs are kept low enough, which means finding and going after only the richest deposits. Columbus 6 went from a struggling thirty-two to forty crew. Two companies sent the first non-Commission staff to Mars. Even more significantly, Mars is gaining a second outpost and a second borough, six thousand kilometers from the first. Aurorae is no longer 'the Outpost.' Finally, Mars is no longer an outpost; Mars is now a 'colony' and we are 'colonists' as well as 'residents.' More language for us to get used to.

"The governing structure will change in response. Cassini, like Aurorae, will need to elect a borough clerk and chair. Both boroughs will have to elect a treasurer for the first time. Mars Colony may soon need a clerk, chair, and treasurer as well. In another two or three columbiads, Mars will probably have over two hundred people and the time may come to elect Borough Councils, which can meet jointly to serve as a Colonial Council.

"In short, Mars is moving in directions that no one would have expected in less than two decades. The keys to our continued growth are two: a continued decline in transportation costs, and viable exports. The combination was essential for the Europeanization of the Americas and will be essential here as well. It appears we have the second key in place: gold. We can complain about the dust pollution it will cause in the Cassini area, the holes it will rip in the ground, the greed it represents, the ways it will distort our priorities here, but there will be no getting around one fact: Mars will grow. A Mars with a thousand people will do much more exploring than a Mars with one hundred. Mars with a thousand will have a more comfortable life than Mars with one hundred.

"So we will have adjustments to make. We must keep our focus on certain priorities, however: that this world will maintain peace, will strive for justice, will seek a life that is not just comfortable but happy, and that Mars will aim to become an example to old Earth of a place where human beings from many cultures and religions can live together well. These Martian values are human values, and Mars can become a vehicle for demonstrating them. If we succeed, they may be our greatest export of all."

It was a busy weekend at Aurorae. Cargo was unpacked and stored, the store was filled with new goods and therefore shoppers, new arrivals set up their flats if they had them or their rooms if they didn't, crafts and furniture privately made was displayed and sold at the Satursol flea market, the new arrivals and old residents got to know each other, the Satursol evening concert and dance was crowded, the Sunsol morning interfaith devotional program was packed, hiking trails outside the Outpost were busy, and the

Aurorae golf course, laid out carefully over the last four years by Roger Anderson and other members of the Aurorae golf club, was active.

Monsol marked the beginning of a month of training, safety drills, and team-building. It was inaugurated by another event: the opening of Mariner Institute of Technology or MarTech.

Will and Ethel had to take Marshall to school on their way to the inauguration. The three of them walked to the second floor of Renfrew Hall, which once had held their apartment but now was half filled with rooms for child care. They were surprised to see that their old living room—a space four meters deep and four wide—was now the classroom. Fatima Hijazi had a desk near the door; the two boys sat at a table between her and the window. Two attachés sat on the table. A plastic whiteboard occupied one wall with an assortment of colored markers in the tray below. The opposite wall had big maps of Earth and Mars.

“Welcome to your classroom!” said Fatima.

“I get my own attaché!” said Marshall, seeing the two computer/communicators that were standard issue for the adults on Mars. He ran to the table. “I want the red one!”

“That’s fine,” replied Fatima. She turned to Will and Ethel. “Will he be eating lunch with you?”

“Yes,” said Ethel. “You may have noticed that all four of us eat together at the same table for lunch every sol.”

“I did notice. Good, that means I have lunch free; I may need it to plan afternoon lessons! They’ll be playing in the yard starting at four every sol. Madhu told me Sammie still naps many afternoons.”

“He can take a nap too, if you can convince him,” replied Ethel. “But good luck!”

“I’m not going to sleep,” replied Marshall. “Do I get to take the attaché home?”

“Yes, you do,” replied Fatima. “It’s yours.”

“We had better say goodbye,” said Ethel. “Have fun, dear.”

I will, mom. I love you.” Marshall kissed his mom and dad, then turned back to his attaché. Ethel looked at Will, surprised; he shrugged and they walked out.

“That was easy,” said Will. “But then, he’s been in school up here for a year and a half, and he’s met Fatima several times.”

Ethel nodded. There were tears in her eyes.

“What is it?”

“My baby’s going to school.”

Will smiled. “I know. He’s growing up, my dear. He’s growing up.”

He hugged his wife, then kept his arm around her as they strode to Yalta, across the yard, and through the tunnel to Catalina.

A crowd was already filling the folding chairs in front of building two, which made a nice backdrop for an inauguration even though it was empty. MarTech had its own entrance at the eastern end of the building, big, arched, and grand. Inside the arch would be a lobby and a spiral ramp descending sharply to the basement or rising sharply to the top floor; in Martian gravity, ramps could be much steeper than on Earth. MarTech would start small, with one classroom on the top floor, six offices on the ground floor, and another classroom in the basement or “garden” level. Perhaps someday it would grow to fill the entire building, then the entire biome, then other biomes as well.

Will and Ethel had dressed in their best clothes, but some attending wore academic regalia that they had imported from Earth. The robes looked incongruous in the setting. The six-person "Outpost Orchestra" was warming up.

Once the seats were all filled, Will, Dr. Martha Vickers, and Dr. Enlai Tang stepped forward and sat in the three chairs in front of a big screen. Martha and Enlai had both managed to get their academic regalia from Earth; as the planners of the university, they were also its principal enthusiasts. Martha nodded to the orchestra and it began to play "Pomp and Circumstance." When it ended Martha stood, welcomed everyone, and gave the history of the idea and the plans. Enlai followed, speaking about the technological progress that Mars exploration represented and the great intellectual capacities already present.

Everyone turned to the screen to watch a series of videotaped welcomes from the presidents of several universities across the Earth, as well as the American Secretary of Education, the European Union's Minister of Education, and the Mars Commission's Commissioner. Then it was Will Elliott's turn. He walked to the lectern.

"I'll have to have my academic robes flown up on Columbus 7," he began. "In 1630, a thousand religious refugees from England crossed the ocean to New England and in a matter of months had set up Boston and six townships around that metropolis. Every spring several thousand more Puritans followed, and in 1636, having established their governments, towns, farms, and industry, they turned to education. Their legislature chartered Harvard College, which became the oldest and most famous institution of education in the nation that their descendants built. For the first decade of its existence, however, Harvard was a tiny institution with one or two professors and a dozen students,

housed in a single building on a large yard used by grazing cattle, on which sat a well from which they drew their water.

"MarTech grows from similarly humble beginnings. It began in year ten, rather than year six, and when the population supporting it was less than one hundred, rather than several thousand. However, it already has twenty part-time faculty, and since some of them were already supervising theses and giving courses, it already has several dozen students on two planets and a dozen courses. Because of the faculty, it already has reciprocal agreements with Stanford, Harvard, MIT, the Sorbonne, Moscow State University, Tokyo University, Louvain University, and a half dozen other prestigious institutions. It can already offer Ph.D.s in Martian geology, planetary geology, exobiology, Martian eobiology, ecology systems, and mechanical engineering. In short, even though it started later than seventeenth-century Harvard, it is already growing faster.

"The promise of this institution lies in the future. Mars is slated to make a great contribution to human culture and civilization. We do not know what it will contribute or when, though our growth rate suggests its contributions will come sooner than we had thought. What we can be sure of is that MarTech will be central to Mars's contributions to human progress. This university will galvanize our scientific exploration, will pull together our engineering discoveries, and will serve as a focus for the development of our arts and culture. Perhaps someday MarTech will be the place people go to prepare for great feats of exploration of our solar system and beyond. It may be the legacy of Mars to become the center of the expansion of human consciousness outward into space, for where better can people appreciate the importance of exploration than on a world

founded upon it? If that comes to pass, MarTech will be the educational engine making that role possible, directing it and galvanizing it.

"So this sol we stand on the threshold of powerful dreams. Our optimism, our community spirit, our hope for the future will drive MarTech forward, and MarTech in turn will pull us forward. The importance of this sol is that the feedback loop begins. Let all of us gathered here this sol pledge some effort to make this university grow. Thank you."

Will stepped away from the lectern to sustained applause; the audience clearly liked his speech. He walked over to Martha, Martech's President, and Enlai, its Vice President for development. Enlai picked up a very large pair of scissors and the three of them moved to the red ribbon that blocked the arched doorway. Together, slowly, the three of them cut the ribbon.

Everyone applauded and the orchestra struck up "pomp and circumstance" again; it was the only relevant piece of music they knew. Everyone began to walk to the refreshment tables.

"Commander, when will I ever be able to take my people to Cassini?" Bruce Curry sounded very frustrated, on the verge of angry.

"Mr. Curry, the next month is devoted to safety and other training exercises. You've known that for at least eight months. The cargo won't be deorbited for at least three weeks anyway. So I suggest you not worry about it too much."

"Commander, do you want a half billion bucks or not? Because that's what I can dig up for the Commission if I have enough time. Otherwise, you're losing money. Time is money."

“Mr. Curry, money is not our only concern here; a higher priority is safety.”

“We don’t need a month of training. Even two weeks may be more than we need. We were training during the entire six-month voyage, after all. Please, Commander, see what you can do. We’re itching to get to Cassini and get started.”

“If we can wait, we can plan better.”

“We’ve been planning for over a year. I submit it’s now time for action.”

Will shook his head. “I can’t guarantee anything.”

“What about a biome for Cassini?”

“I’m working on that.”

Curry scowled. “Well, you fritter away your time opening imaginary universities in front of buildings that are just a shell. I want to act.” He turned and walked away.

Will watched him go, wondering how to deal with Curry. Routing messages via the Commission and Muller Mining hadn’t worked. Ignoring him was difficult.

Alexandra walked up. “What did he want? The Cassini biome?”

“That was request number two. Number one was an immediate transport to Cassini, so they could get started.”

“They’ve got to get trained in safety first. We can do training much easier here than in a tank of water on Earth. But I do have an idea for a biome, if you’re interested.”

“Sure.” There was surprise in his voice.

“The biome will be built over a two or three year time frame; maybe we should say ‘evolve.’ We could go to Cassini two mobilhabs and two conestogas, plus several rangers. We’d set up one building bubble without the biome enclosure to serve as temporary housing; it’d have to be covered by plastic sheeting, just like the dacha for

protection against ultraviolet and dust, and to anchor it. We could set up tents and portable showers inside. We wouldn't need to recycle the water; we could pour the waste water outside and extract more from Cassini's permafrost well. A crew of a dozen construction workers, camping inside the bubble, could drive nickel-steel pilings and pour a duricrete foundation for the biome in about two months. We wouldn't do much excavation; we can erect a metal frame around the biome and pile reg against it later. Once we have the foundation poured we could place the main enclosure, inflate it, and erect a building inside the enclosure in bubble one. But we'd complete and finish just the first floor; that'd be plenty of room for up to sixteen crew to live. The open second floor could be used for cooking, eating, and relaxing.

"We could get the outer enclosure in place in two months using a dozen people and about ten tonnes of materials, mostly nickel-steel. Building one would take about a dozen people, two months, and fifty tonnes of materials to get in a usable but semi-finished state. After that, we could continue the construction work with two or three workers only and a shipment of twenty tonnes of materials every few months. The biome would slowly take shape, but slowly would be plenty."

"It would be." Will thought. "I'm committed to seeing Cassini get a biome. I really don't like the idea of competition for Aurorae, but Cassini has the gold. The issue is when. Opposing a biome for Cassini looks petty. Flesh out your plan, okay, Alexandra? Let's come up with a reasonable schedule that's doable over the long distances."

3

Debates

late Sept. and early Oct. 2031

One by one, the heads of staff arrived for their first meeting since Columbus 6 reached Mars. Lisa Kok was the first to reach the conference room in Renfrew Hall; she was Director of the Department of Ecology, which was responsible for growing the food, purifying the air and water, and maintaining the interior environment. Right behind her was Alexandra Lescov, Director of the Department of Construction, Fabrication, and Repair. Accompanying Alexandra was her husband, Yevgeny Lescov, Director of the Department of Exports. Four others arrived in close succession: Érico Lopes, Director of the Spaceport, Phobos, and Deimos; Andries Underwood, Director of Natural Resource Recovery; Tina Hvitmer, Director of Public Relations; and Emily Scoville, Commander of Cassini Outpost. Finally, Will Elliott arrived, talking to Martha Vickers, the Director of the Department of Health, Education, and Culture, and with Daniel Shapiro. Shapiro immediately began to connect his attaché to the large screen dominating one wall. Roger Anderson, Director of the Department of Science and Exploration, entered immediately thereafter.

"We all know each other, but I should at least offer an official welcome to our new members," began Will. "I just received an email last night confirming the selection of Emily Scoville as Commander of Cassini Outpost. Because of the importance of Cassini in the operation, the commander of that outpost merits inclusion in our heads of staff. Daniel Shapiro is an addition based on practical needs. As all of you should know, Dan has a masters in accounting and considerable experience in banking before joining

the Mars Commission a few years back. He will serve as the comptroller of our finances here in Mars; the Commission has a comptroller in Houston who is the overall boss. Dan will also serve as President of Mariner Bank; Silvio DiPonte has turned that task over to Dan so that he can do more in legal affairs for us, and can focus on building up Mars's private sector. Dan will also serve as secretary of this group; he'll prepare the agenda beforehand and the minutes afterward. Questions?"

"Welcome on Board," said Érico to both of them.

An agenda suddenly appeared on the screen on the wall. "I thought we'd start with a round of brief reports, to update everyone and get new items on the agenda," said Will. "Let's just go around the table." And he nodded at Lisa.

"Ecology's adjusting to two events: a doubling of the population of Aurorae, with the strain on our food, oxygen, and water supplies it implies; and the expansion of our ecology into Catalina, which started several months ago when both rooftop farming areas were set up and planted. The expansion of the ecology has gone reasonably well, compared to setting up Yalta; we've managed the microorganism populations better and have avoided some of the population peaks and crashes. Columbus 6 has brought some new species and we're getting them out right away. The butterflies just started to hatch yestersol and you will see them flying around the biome; they'll be a beautiful addition."

"They're very nice," agreed Roger. "Fatima's excited; the first graders will have a more interesting nature project as a result."

"If you want to call a biome 'nature,'" commented Dan.

"As for the population increase," continued Lisa, "all the newly arrived folks are taking very long showers and our water demand has tripled. The result is the

accumulation of about two tonnes of waste water a sol in our outdoor storage tank. It'll be six months or more before we can catch up with demand, then recycle the frozen waste water completely. An item I'd like on the agenda is obtaining an additional thirty kilowatts of power a sol; it would enable us to recycle three quarters of the waste water through evaporation."

"That'll be hard to provide," replied Will. "But we'll put it on the agenda. Alexandra?"

"Construction has been very slow because everyone's still in training, but we have inflated the bubble for Catalina's building 2 and have started to move in nickel-steel wall frames. Once I can devote a construction team to it, Catalina will be completed very fast. The question for me is whether Cassini gets a biome."

Will nodded. "That's on the agenda. Roger?"

"We're pretty busy with the training, right now, but the exploration team has started to review its possible options. We plan to complete the Virgo and Pisces Trails, and I suspect we'll extend the Cassini Trail northward to the polar layered terrain and southward to Hellas, maybe farther. If we did all three of those, it would be a substantial accomplishment. No part of Mars would be more than 1,000 kilometers from a trail, except some areas in the high latitudes."

"And we've already started planning the Arctic and Antarctic Circle Trails," added Érico. "The five shuttles are all in excellent shape. Thanks to the liquid oxygen and methane storage tanks we completed six months ago, we have enough fuel to launch three shuttles any time. With the newly arrived solar power units already set up, Aurorae can temporarily make about 3,000 kilowatts of power, and we've been pouring it into

topping off the tanks. Embarcadero's in good shape, with new equipment and a bigger ion propulsion system for station keeping. Columbus 6's visits to the moons accomplished all maintenance and science goals and expanded the solar arrays to 100 kilowatts on both. Phobos and Deimos are at full production capacity; the Lifters there are refueling fast. All three will be available when the automated cargo vehicles arrive in five sols, and we'll be able to export a hundred tonnes of methane to Earth. It's looking like we won't need the scheduled maintenance and science flight to the moons eight months from now."

"So, that's the spaceport report," said Will. "Andries?"

"As you heard, we have three ACVs aerobraking into orbit in five sols with twenty tonnes each of cargo. We're holding onto two of them; Alexandra's crew will make the spray-on ablatant heat shield material and Érico's team will apply it some time between now and departure time, probably during the flight eight months from now. The third ACV will head back to Earth in two weeks with twenty-four tonnes of argon, worth about eighteen million dollars; not much, but every little bit helps. The other two ACVs might be able to fly as much as forty tonnes each, but I can't imagine we'll ever recover that much gold."

"Curry's determined to dig a hundred tonnes," reminded Yevgeny. "And Muller feels some competition from him."

"And we need the money," added Dan.

"There's no way Consolidated and Muller will hit a hundred tonnes together, let alone separately," persisted Andries.

“Even so, we should be prepared,” said Dan. “The price of gold has been going up, just like other raw materials; it’s now twelve million per tonne. A hundred tonnes is $1.2 billion, half for us and half for the mining company.”

“It’s not possible for us to send back two hundred tonnes,” said Andries.

“Sure it is,” replied Yevgeny. “We’re getting two more Lifters; we’ll have five, and each can hold seventy-six tonnes of fuel. The delta-vee to Earth from a Phobos transfer orbit is 1.4 kilometers per second and the delta-vee to achieve a very highly elliptical orbit around Earth is 0.7 kilometers per second. The Lifters could send almost four hundred tonnes to Earth, and we could use the heat shields for the gentlest, most gradual, incremental aerobraking, even with very light shields.”

“Let’s not assume the miners won’t accomplish a very ambitious goal, even if it is unlikely,” said Emily.

“It’s impossible.”

“Impossible or not, Emily’s approach is best,” exclaimed Will, intervening. “Martha?”

“My report really isn’t very interesting. The elementary school has started, day care has a new teacher, and MarTech is up and running. Aurorae clinic is now considered Aurorae Hospital; Arieh can do a wide range of surgery and once the rest of the equipment arrives, our trauma care capacity will be much stronger.”

“An important report,” replied Will. “Dan?”

“Columbus 7 is already in the planning stages and its size is dependent on our exports.” Shapiro spoke in a monotone, which immediately distracted the others from listening. “It’s scheduled to include forty people in six ITVs, three shuttles, four ACVs,

two Lifters, and one middeck. We may also include one or two inflatable ‘annexes’ to provide additional housing space if they are ready in time. But the money we make will greatly influence whether it reaches that size and whether Columbus 8 will add two more ITVs and ten more people. The contracts with Consolidated and Muller Mining gained the Commission $1.5 billion last year, which was enough to cover the cost of the new Mars shuttle and most of both ITVs. Since we paid for them in cash, we can reduce the cost of transportation on Columbus 7 to about $90 million per person, and if we export a lot of gold Columbus 8’s costs might be $60 million per person. So my job here is to hold costs down as much as possible and push exports up as much as is practical. The estimates are that if we get transportation to $50 million per person, we’ll be in a whole different ballpark where recruiting new people is concerned.”

“Consider that fifty million each is about ten times less than the cost of transporting me here on Columbus 1,” noted Will. “Tina?”

“Publicity has been rolling along fairly well; arrival is always a good time for media coverage. The trick will be holding public interest. Louisa and I have some ideas and the monthly theme schedule—have you all seen it?—features some rather unusual human interest angles.”

“So, is there any reason we need the Commission?” asked Roger, with a laugh.

“Oh, of course,” replied Andries.

“It does feel different, doesn’t it?” asked Will, with a smile. “We now have enough people to maintain parallel departments with the Commission’s offices in Houston, so we are indeed in a better position to be partners with the offices there.”

“At the cost of about six or seven full-time equivalents out of eighty-four, though,” noted Alexandra. “I have relatively little time left to do construction or even to do planning; I have to spend a lot of time maintaining coordination with several hundred people on Earth.”

“And Will, we really need more support staff in Houston,” added Lisa.

“I know, and Morgan has finally caved in,” replied Will. “The idea that we would have secretaries in Houston for each departmental director seemed impractical at first, and when it became clear we could indeed manage staff from a distance if they were trained right, the argument was that the cost would be too high—after all, these are top of the line administrative assistants that we need—and when that seemed hard to maintain because they improved efficiency, the argument really became that it gave us too much power in the administrative structure. But I’m sorry, we’re on Mars, not them! So in the next few months Morgan’s hiring six more administrative staff, which means all of you will have one full-time person to serve as your eyes and ears and argue live with others on your behalf.”

“Thank God!” exclaimed Andries.

“It will help. Emily.”

“I’m last, aren’t I, and I’ve only been appointed commander of Cassini for twelve hours. But I suppose my job is primarily to be a bridge; to argue against extravagant demands when interacting with Curry and Bach, and argue in favor of reduced requests when talking to the rest of you. I suppose my first task is to make sure Cassini has enough people to get started well, and that means twenty staff, I think.”

“Twenty!” exclaimed Alexandra. “I thought we had agreed to sixteen! Don’t take the rest from my allocation!”

“Or from exploration; we’re scheduled to investigate two more gold districts,” added Roger.

“The contracts call for four support people for each team; that’s eight, plus their eight, a total of sixteen. But ‘support’ does not include construction. The contract can be interpreted to mean that, but I would not favor that approach because it will restrict the personnel able to support gold recovery. We’ve got forty new people; is there that much harm assigning half the increase to gold recovery? It still means a big increase in every other function. Let the new people earn their keep.”

“We all earn our keep,” responded Alexandra, irritated. “And part of that ‘keep’ is making life here less rigorous; expanding our pressurized volume, diversifying our ecosystems, increasing our capacity to recycle wastes, and raising our output of goods, especially consumer goods. If we can expand our fabrication capacity as much as projected, Columbus 8 will bring the miniature compressors and other parts we will need to make small refrigerators for our flats, and parts to assemble microwave ovens as well. Think how much easier they will make things!”

“Do you want microwaves and friges, or an extra couple hundred million bucks?” replied Emily. “You can import five tonnes of stuff to make microwaves and friges for ten million dollars.”

“Are you thinking that we would send eight support people and four construction people to Cassini, then?” asked Will.

Emily nodded. “Perhaps it would be six and six; it depends on whether the support tasks will require eight. Alexandra’s ‘fifty tonne biome’ plan requires four or five person-years to achieve phase 1, which includes setting up one biome and enclosing one floor of one building, and framing out the second floor of the same building. Phase 2 involves completion of the exterior frame of the same building and filling the biome with several thousand tonnes of soil, so that agriculture can begin. Phase 3 completes building one, which expands its capacity to twenty people. The idea is to get at least the first two phases done before Columbus 7 arrives, then set up a second biome with the same two phases, then complete building one in each biome and install building two.”

“Why not finish the first biome before setting up the second? Saves money,” exclaimed Dan.

“Redundancy,” replied Alexandra. “Two biomes reduce greatly the danger of a disaster.”

“Where do twenty people stay before the biome is pressurized?” asked Dan.

“In the two building bubbles,” replied Alexandra. “We send them down in two mobilhabs and two conestogas and they inflate one or two building bubbles on a smooth surface that was quickly prepared. We can set up tents inside the bubbles and accommodate twenty or even thirty very easily, though not very privately! Sixteen would be much more comfortable. Then they prepare the foundation—just the part under the biome, not the walls around it—and inflate the main biome enclosure. Then they can move the two building bubbles inside, live in one and build a building inside the other.”

“Clever,” replied Dan. “Sorry I’m so ignorant of these matters.”

“That’s okay, we can’t all be experts in everything,” replied Will, though he didn’t point out that this was the first time Mars had a head of staffer who knew so little.

“With sixteen people, I think we could complete phase one in four or five months,” continued Alexandra. “The four miners and two support staff for each company would live in one mobilhab for each company.”

“But we need the mobilhabs for exploration,” replied Roger. “We’ll have two more mobilhabs pretty soon, but we’ll get a lot more exploration done if they’re in the field.”

“The personnel have to stay somewhere,” replied Alexandra, irritated.

“Cassini can spare them once the bubbles are set up,” said Will.

“There’s something else to consider,” exclaimed Lisa, above the rising voices. “Cassini’s biome potentially can contribute a sixth of our biological output. That translates into a more diverse ecology, diversified food sources, greater availability of cotton, and other advantages.”

“But more ecology workers means fewer for construction, fabrication, and science,” reminded Alexandra.

“But more safety,” added Érico.

“That’s important,” agreed Will. “How about this. Two mobilhabs, two conestogas, and two rangers head for Cassini with eight people and are met by a shuttle with eight more and forty tonnes of cargo. They set up the biome enclosure and the bubbles in about three months, then the mobilhabs or the conestogas leave and at least eight more people arrive. We won’t have the accommodation for twenty-four plus adequate redundancy until the bubbles and the enclosure are ready. Then we keep twenty-

four there for six to nine months, until phases 1 and 2 are completed. That gets the building set up so that the workers are comfortable, and gets the agriculture started as quickly as is practical."

There was a silence. "It's a compromise," said Érico. "Assuming, of course, you can take the extra people back when phase 2 is over. There will be pressure to complete phase 3."

"The answer is simple: no," replied Will.

"I get less construction people, and Roger gets only some of the mobilhabs he needs," noted Alexandra.

Will shrugged. "We have limited resources, and the gold is very important. I don't really want Cassini to have a biome, but it will have one; the Commission has said so after long arguments with the companies. And it's only fair that it will have a biome; Cassini's bringing in half our money!" He looked at Emily. "When can we get the crew to Cassini?"

"There are two more weeks of training scheduled, but it's not as important as the training we've completed. I'd get them there as soon as possible, especially with the dust storm season on the way. We could leave in about eight sols."

Will nodded. "Let's get the Cassini crew on the way in eight sols, then. The sooner they start recovering gold, the better for everyone."

Emily was intrigued by the group of people standing in the greenhouse, staring out. Arieh was wearing his medical scrubs, which was unusual. John Hunter stood next to him, his

black Lakota hair in a long braid down his back. Greg was wearing his priest's collar, which was also unusual.

"I really love the labyrinths," exclaimed Arieh, as she approached. "Madhu's a genius at outdoor decoration."

"You should see the sculpture garden at the base of Face Rock," noted John. "You can walk the labyrinth there, stopping to look at the wind sculptures periodically."

"It's quite large," echoed Greg. "You can spend half an hour in it at least."

"What's a 'wind sculpture'?" asked Arieh.

"A rock sculpted by the wind," replied John. "We've found some pretty interesting ones on our explorations around Mars, and we've brought them back here for Madhu to arrange in the park at the base of Face Rock. There are other natural sculptures there, too; salt weathering and other forces have produced some pretty unusual shapes."

"It's sort of like driftwood on Earth, but rarer," added Greg.

"I hadn't realized the geologists were collecting them," exclaimed Emily, joining the conversation. "I thought Madhu and maybe Roger had done it."

"Will encourages it," replied John. "Everyone got into it pretty quickly; we craved the aesthetic dimension of life."

"In some societies, labyrinths were sacred objects," noted Arieh. "That's a funny notion to me, as a Jew. Places are sacred because of the history that transpired at them, like Jerusalem, or Masada."

"And for me, everything is sacred," replied John. "Everything is alive; every rock has some sort of unknowable spirit. This world is alive with spirits."

“The spirits of the dead planetesimals that made this place, and the dead microbes that lived here,” exclaimed Greg, looking at John. He knew of the man’s vision quest and the spirits he saw, up on the escarpment.

“But what sort of spirits do they have?’ asked Arieh. He sounded slightly skeptical, yet willing to believe.

John didn’t answer right away, and the silence began to feel thick and heavy. “They feel. They can love, and therefore they can hate,” he finally said.

“What will they think of our ripping huge holes in Cassini Borough?” asked Emily, curious.

“I suspect they will feel the same toward that as the spirits on Earth feel toward mining. Some understand and some resent.”

There was silence again as everyone wondered whether to push the conversation any farther. It was not an area where they had a common cultural ground. Emily looked at the maze of red sandstone and black basalt that Madhu had laid out over the piece of “dead ground,” a chunk of Martian terrain surrounded by buildings on all four sides. With her eyes she followed a red path, avoided a dead end, and reached the image of a mesa about a third of the way through the pattern. She had looked at the same labyrinth just the sol before for a few minutes and it seemed much harder that time. “Do they change the maze?” she suddenly said.

“Yes, every month or so,” replied Arieh. “Madhu was out here yestersol moving a few short sections to change the paths drastically. She said she wanted to update them before starting her recovery.”

Emily suddenly realized why Arieh was dressed in his surgeon's scrubs. "Did you just operate? How did it go?"

Arieh nodded. "Pretty well. Greg was one of the nurses assisting me. We had to make two very small incisions in order to get the laparascope into her lung, but we got the growths."

"Cancer?" Emily asked.

Arieh nodded. "Yes, I'm sure of it. I've seen it before. But we got all of it, and with the new chemotherapy drugs we brought, she should recover."

"She's lucky," added Greg. "Staying here was a big risk."

"It's a very discrete, slow-growing tumor. We'll watch her closely too."

"Radiation?" asked Emily.

Arieh shrugged. "Who knows. It could result from radiation exposure, from silicosis; we're exposed to extremely fine particles of eolian dust here."

"Mars is not without hazards."

"To babies, also," added Greg. He looked at Emily. "Radha and Lal just learned that their baby has Down's Syndrome."

Emily's eyes grew wide. "Oh Lord, that must be a terrible burden on them. How serious is it?"

"It's too soon to say," replied Greg. "We did a genetic test. She's three months pregnant, and now they have to decided whether to keep the baby."

"A mentally retarded child on Mars." Emily contemplated the matter.

"It doesn't matter, in my opinion," replied John. "The child will be able to love, and certainly he or she will be able to contribute."

“John, if the case is severe, the child will require almost constant care all its life,” said Arieh. ‘It’ll be a huge burden on Mars society.”

“Why do you define the child as a burden?” replied John. “”What are your assumptions, my friend?”

Arieh said nothing; he didn’t want to argue.

“Is radiation the cause?” asked Emily.

Arieh smiled. “We’d all like to know that. Lal’s 41 and Radha’s 34. Statistically, 34 year olds have a relatively low chance of a Downs syndrome child. We’ve had thirteen children on Mars; this is a high incidence, if it were statistically significant.”

“Which it isn’t,” added Greg.

“Another reason to pray,” said John. “No matter how good the technology gets, life will never be predictable or controllable.”

“If prayer helps,” replied Arieh. “Life here is not as easy as on Earth.”

“It beats hunting buffalo and living in skin tents when it’s twenty below.”

“But this is the twenty-first century, John,” persisted Arieh.

John looked at the Israeli. “Our children are living better than those of some of my cousins on the rez, Arieh. In fact, we may be living better than half of humanity.”

In a place as small as the Outpost, both items of news spread very fast and had a deep impact. In groups of twos and threes, the human population of Mars once again reconsidered the wisdom of their residency on the Red Planet. The issue surfaced at the first town meeting that Satursol evening.

“This issue won’t go away for a while,” noted Madhu to Will, Roger, and Ethel on Sunsol afternoon. She sat back on a chaise-long in the yard of Yalta Biome, resting from the surgery. “It cuts pretty close to the bone, especially for anyone with children.”

“I’m always amazed by the range of reactions people have to a life challenge,” said Ethel. “Some people are natural pessimists, I guess.”

“I think a lot of folks will forget,” replied Roger, sitting next to his wife. “Or maybe I should say they’ll mostly forget. Three automated cargo vehicles aerobrake into orbit in a few hours, after all. Riviera Biome is now open for walking inspections; having three biomes here is really amazing. The Cassini crew leaves in a few sols. We’ve got other things to focus on.”

“I don’t know, Roge,” replied Will. “This is pretty big because it reminds us that life here can’t be quite normal like Earth. It’ll be a few decades before having kids here is not partially hazardous, before we know whether life expectancy is close to the same as on Earth. Those are big issues.”

“And the choices are hard to deal with,” agreed Madhu. “Everyone is hugging Radha and Lal; they have to make a difficult decision. It was a risk for me to wait six years and have lung surgery on Mars.”

“Thank God it worked, too,” added Roger. He looked at Sam playing with Marshall, Lizzie, and Corazon nearby.

“Hey Will,” said Érico, who was walking by carrying a plate of barbequed chicken and vegetables. He stopped. “I hope you’re okay with the election of Alexandra as Borough Chair.”

Will shrugged. “Sure, why not? There’s nothing saying the Commander has to be chair. I wasn’t last columbiad.”

“If I can be frank, my friend, it’s better for our democracy anyway,” continued Érico. “The Borough government is a parallel body to the Commission’s command structure. I think they shouldn’t be mixed. Someday, parts of the organization here could be transferred.”

“Oh, I agree. I could see the Department of Ecology and the Department of Education, Health, and Culture being transferred to the Borough, for example. Construction, fabrication, and repair might someday be privatized.”

“Exactly. Everyone can’t continue forever to work for the Commission. If Mars is ever going to go anywhere, it has to have its own healthy private sector and its own civil society. One hundred is big enough to make a start.”

“I agree, I agree. I didn’t take it personally.” Will didn’t want to admit that he had been a bit hurt, though. Sensing that, Érico leaned over and patted his friend on the shoulder.

“You’re a great Commander, Will, which is why I didn’t vote for you.”

Will smiled, appreciating the irony of the comments. Then Érico continued on his way.

“It is amazing to think there are just about one hundred of us up here,” added Ethel, after he left. “And two outposts, for that matter.”

“It’s like getting married,” replied Will. “The terms ‘wife’ and ‘husband’ sound strange. Similarly, it’ll be strange to refer to ourselves as a ‘colony’ for some time.”

“I really don’t like the terrestrial implications of the term,” noted Madhu. “It makes us sound like a part of an imperialist operation.”

“Maybe that’s honest,” replied Roger. “Because the gold changes everything, after all. Greed, not science, will dominate this world from now on.”

“I don’t agree,” replied Will. “Roge, I’m always amazed how you are capitalist at one moment and anti-capitalist the next! Nothing here will happen without money. But that doesn’t mean money is the only motive we should have. I’d rather see us try to control and direct that greed to positive aims.”

“So would I,” agreed Roger. “Let’s just say, however, that I believe in original sin.”

“Which gets us back to the issue of optimists versus pessimists again,” commented Ethel.

“And they both need wealth for their scenarios to work; they just view it differently,” added Will. His voice trailed off as he thought about that choice of words. “Hey, Madhu! If you don’t like ‘colony,’ how about ‘commonwealth’? Doesn’t that capture our dilemma; we need wealth, but it has to be ‘common’? The wealth must be generated in community?”

“‘Commonwealth. . .’” Madhu considered the term. “Of course, it makes us sound like the British Commonwealth, which is a loose collection of nations, and that’s not what we are.”

“The so-called Commonwealth of Independent States was even looser a collection of states,” added Roger.

“Of course, there’s also the Commonwealth of Massachusetts,” noted Ethel.

“And the Commonwealth of Pennsylvania,” added Will. “The term is used lots of different ways, just like ‘borough.’ And we need a term we can redefine for ourselves.”

“Commonwealth ain’t bad, where redefining is concerned,” agreed Roger, slowly. “And it does capture an issue for us, that is, how to direct and use the flow of wealth coming our way.”

“And possibly the way of the land owners,” added Madhu. “I’m not sure I’d want them involved.”

“They already are involved, and have to be involved in any governing structure we set up,” said Will. “This is a term we’ll have to try out.”

4.

Settlement

late Oct. 2031

The arrival of three automated cargo vehicles in Mars orbit on October 1 marked the end of the training period and the start of intense work. The ACVs were large conical capsules with a heat shield on their bottoms, able to place twenty tonnes of cargo in an elliptical orbit around the Red Planet. Three Mars shuttles blasted off to meet them, pick up their cargo, and bring it to the surface; one shuttle, the *Arsia*, loaded up with mining equipment, dipped into the atmosphere several times to use atmospheric drag to change its orbit's inclination, and landed at Cassini. At Aurorae, the arrival of their last cargo for twenty-six months occupied the residents for a week, unpacking, setting up equipment, storing consumables, and learning new operations.

Before the shuttles landed at Aurorae, the largest caravan ever mounted on Mars set out overland for Cassini. During the day, one of the expedition's three rangers was as much as thirty kilometers in the lead, checking road conditions and smoothing or widening substandard spots. The first vehicles used on the moon and Mars, rangers were 2.5 meters long, 2.4 meters wide, equipped with six independently powered wheels and a bulldozer blade, and, when towing a "portahab"—a wheeled, pressurized, portable habitat—they were able to house two crew for months at a time.

Behind the lead ranger came the expedition's two conestogas, separated by about a kilometer for safety reasons. The first conestoga—named after the tough, versatile wagons that helped open the American west—arrived on Columbus 2. They were eight-wheeled vehicles, 2.4 meters wide and high and eight meters long, with heavy bulldozer

blades and powerful electric motors. They easily accommodated three or four crew and enough scientific equipment to accomplish extensive science while plowing a route across the trackless Martian desert. They were power-hungry vehicles, though, practical to use only if a portable nuclear reactor accompanied the expedition, Both conestogas were towing trailers with eight tonnes of equipment and supplies for Cassini.

Behind the conestogas were the two mobilhabs, even larger and heavier eight-wheeled vehicles 4.5 meters wide, two stories high, and eight meters long. The name was a contraction of mobile hab and captured the vehicle's purpose; with thirty-eight square meters of interior space, it was the size of a small apartment, able to house and provide work space for six to eight. Mobilhabs usually did not have bulldozer blades; they stayed on cleared roads. One of the expedition's two mobilhabs pulled their third trailer with eight tonnes of supplies.

Taking up the rear of the expedition were three nuclear reactors, each rolling down the road robotically on a trailer towed by a truck. The reactors, able to make 150 kilowatts of power with their stirling engines, had tanks for water, liquid oxygen, and liquid methane, and a conversion unit that took water, electrolyzed it into hydrogen and oxygen, then took the hydrogen and Martian carbon dioxide and combined them to make methane and more oxygen. They, too, were at least a kilometer apart.

There were plenty of tasks for the expedition's eighteen personnel to do: read, play cards, watch television, talk, and contemplate the sights. Groups were always taking rangers to points of geological interest along or close to the route, then driving relatively fast—up to fifty kilometers per hour—to catch up with the others. Unlike previous expeditions, there was no continuous geological support from Earth; Mars now had many

geologists and equipment, exploration had become routine, and there were many terrestrial professional geologists who applied for grants to support the exploration of specific areas. Some of their stops were in response to the terrestrial geologists' requests.

The caravan stopped only twice a sol: once after dawn, so that the vehicles could pull up to the reactors, refuel with liquid oxygen and methane, and drop off their waste water; and once in early afternoon for a big common meal in one of the mobilhabs and to allow crews to change vehicles. Otherwise it moved forward constantly.

The expedition set out northward along the Polar Trail at 25 kilometers per hour, barely faster than a space-suited man could run, under continuous computer control. They followed the Polar Trail through the chaoslands of the eastern mariner valleys and the boulder deposits of southern Chryse, then turned right (east) and traveled almost four thousand kilometers on the Circumnavigational Trail that circled Mars near its equator, over the battered and eroded highlands, then turned left and headed northward a thousand kilometers up the Cassini Trail until they reached the crater of the same name. The "trails" were nothing fancy; bulldozed tracks with a slight ridge of displaced reg along each sides helped define the trail edge and keep the computer-driven vehicles on the cleared portion when boulders and other landmarks in their terrain mapping software were too far apart to provide meaningful navigation, or the global positioning signal was momentarily interrupted.

Shortly before noon on sol eleven—October 16, 2031—the caravan rolled up to the future site of Cassini Outpost. Bruce Curry and Gerhard Bach headed to Emily Scoville's temporary office on the front of the second floor of mobilehab 1 right away.

"Do we really need to stop here?" asked Curry. "It seems to us there are two priorities: preparing the spaceport for the arrival of the *Arsia* and getting the mining equipment set up. The former task needs two personnel in a ranger. The latter requires everyone else. The tasks are thirty-two kilometers apart as well."

Emily was not to be intimidated. "First priority is setting up *two* building bubbles so that we have pressurized space and life support redundancy. Yes, we've managed over ten sols without them; but that doesn't mean we forsake the extra safety now. With the rangers and conestogas working on the site, we'll have them inflated tonight. Tomorrow we'll get the spaceport set up; I suspect that means the shuttle will land before sunset tomorrow night, because the spaceport requires very little maintenance to be ready. The shuttle landing will require all vehicles to be on standby in case of an emergency. Each of you will have all of tomorrow morning and half of the afternoon with your three other people and three of my people to start your setup. Then the next sol, once the shuttle arrives with six more folks, you'll have four of my people each. I'll have myself and seven folks. I may consider assigning you each one more person if the setup work gets off to a good start."

"The sooner we get started, the sooner we dig gold," said Curry.

"I know. If you want to dig gold, help my people right now on site preparation."

"Aye, aye, Commander." Curry was unhappy, but decided he wouldn't argue further. Scoville turned to the work routines she had extensively defined and emailed them to everyone. Within half an hour everyone was outside and gathered around her. She had the work assignments in hand.

“Okay folks,” she began. “The ranger 1 people head for the red stakes.” She pointed to an area that already had red stakes when they arrived. “That’s the site of bubble 1. We need all rocks and gravel removed, the plastic tarp placed and anchored. You know the drill. Team gold, you’re responsible for unloading and setting up bubble one, including its life support. The equipment goes next to its personnel airlock, which will face north. Ranger 2 and team silver, you have the same responsibilities with the green stakes and bubble 2.” She pointed to another area adjoining the first. “Keep in mind that the biome will go over there, at the base of the southern side of that low hill; we’ll be excavating its foundation in two sols. Teams blue and purple and the team with the conestoga will start preparing the ground for the solar power units over by the blue stakes down there, a kilometer west of here on the edge of the floor of Cassini.” She pointed. “As you can see, we already have three SPU pads down there; we’ll need three more. Team red will take mobilhab 1 and head for the spaceport to check the methane and oxygen tanks, blow dust off the solar panels, and check the electrical problems at pad 2. You’ve been reviewing the anomalies for the last ten sols. Team orange heads to the well by the spaceport in mobilhab 1 to thaw the frozen pipe and get water production restarted. Mobilhab 2 stays here as backup. Questions?”

“Will we get a good shower tonight?” asked Eliseo Andaluziano.

“If we can get the water from the tank next to the well, we’ll be able to take unlimited showers; we can waste the water if we have to. Anything else?”

There was nothing. “Good, let’s get started,” she said. Everyone dispersed to their areas to get started on the work, work that would have taken a week if only two or three people had been available.

Scoville herself was on team gold and was soon busy preparing the ground for bubble 1. But she did take a little time to look around. Even though she had explored the area in virtual reality several times, the actual feet-on-the-ground experience could not be captured fully by a computerized image. The site chosen for Cassini Outpost—a terrace fifty meters above the crater's floor clinging to the inner foothills of its eastern rim—was quite beautiful. Cassini's jagged, mountainous rim was a wall blocking the eastern horizon and extending its embrace to the northwestern and southwestern horizons; the opposite side of the crater was so far away that it was out of sight. The original mountain ridge was broken in many places by gaps that often led to canyons and arroyos running to the crater floor, which was covered by alluvium and dune deposits. Cassini Trail crossed the northern and southern rims of the crater and hugged the inside of the eastern rim. The Pretoria Trail ran from the spaceport—built out on the central plains of the crater six kilometers to the west—past the Outpost where it crossed Cassini Trail, up a canyon cut in Cassini's rim, through Deadwood Pass, and down the outer rim to Pretoria and Joberg, two major gold concentrations found along an ancient river valley thirty kilometers to the east. She couldn't wait to drive up to Deadwood Pass, where the view was the best and where they would eventually site a dozen wind turbines to supplement their power supply. The work that had to be done at Cassini longterm was daunting, and as she looked at the site all the possibilities rushed back at her. Everyone said an electrical relay system would be needed so that power produced at the Outpost, the spaceport, the wind turbines, and the gold recovery facilities could be redistributed. They were scheduled to build a microwave relay system involving two towers; if it didn't work for some reason, they'd have to manufacture and lay fifty kilometers of wires. Cassini Outpost needed

several kilometers of insulated pipes so that the water wells out on the crater floor could be warmed by the spare heat of the solar energy units and pumped up to the Outpost, bringing it water and needed heat. Near the wells was a small, deep crater that had filled with water several times and had a good deposit of calcium and other sulfates, essential for making gypsum wallboard for interior construction. The Outpost itself occupied a terrace four kilometers long and half a kilometer wide; theoretically it could accommodate 800 biomes and 16,000 people. There was a constant debate among the residents of Mars whether, fifty years hence, Aurorae, Cassini, or some other as yet unbuilt outpost would become Mars's largest city, capital, and cultural center. Perhaps several important cities would emerge. Or perhaps Mars would never get beyond the outpost stage.

In two hours the sites for the two bubbles had been leveled and smoothed by the rangers. A dune of wind-blown dust nearby was bulldozed over to the sites and spread widely but thinly; having the consistency of talcum powder, eolian dust made an excellent insulator and cushion. Once it was spread, heavy plastic tarps were rolled out over the site and metal stakes were driven into rings in their edges to hold them down. Meanwhile, the life support equipment—three tonnes of oxygen, methane, and nitrogen air tanks, carbon dioxide scrubbers, pressure regulators, fuel cells, power transformers, water and sewage storage tanks, water treatment units, water heaters, and related items—were unloaded from a trailer and lined up so they could be hauled inside the airlock and set up.

It was mid afternoon when the two bubbles were brought out, placed on the tarps, and unrolled. Transparent plastic sheets were laid on top of them; once the bubbles were

inflated, the sheets would be staked down to protect the bubbles from the dust and wind. Then they began to inflate the bubbles, which were shaped like croissants with their two ends cut off; they were thirty meters long and six meters wide at their ends, widening to twelve meters in the middle, with an average width of about ten meters. They were eight meters high; enough to accommodate three stories. The bubbles were made of tefzel, teflon FTP film, and other plastics in layers, each layer serving a particular need, with translucent kevlar reinforcing cables running through it for strength greater than steel. The bubbles took their final shape very quickly, but filling each with about a tonne of oxygen and nitrogen would take many hours. Fortunately, the caravan had access to plenty of gas; there was a storage tank down by the spaceport.

Once the bubbles were fully shaped, some workers began to move the three tonnes of equipment inside, along with another tonne of portable items: two portajohns, two portable showers, and housing that could be set up, known as “tents.” They started to work in their spacesuits while others, outside, drove stakes into the rings on the edges of the plastic cover sheets. The two bubbles were connected together via an inflated tunnel. Once the inflation was finished, about bed time, the eighteen residents of Cassini would have six hundred square meters of living and play space; much more comfortable than the mobilhabs, which they planned to strip of furniture and such items as stoves. In fact, they would be more comfortable than the early population of Aurorae Outpost ever had been.

About sunset they all went inside the mobilhabs for supper. There was an excitement in the air; they had reached their destination and their temporary housing was taking shape rapidly. After supper the mobilhabs undocked from each other and maneuvered into place against airlocks that connected them to the bubbles. The oxygen

pressure was 0.12 atmospheres; enough for people to walk around without a space suit, though not for long. Emily led the crowd in mobilhab 1 into building bubble 1.

Flashlights and the pale light of a half-full Phobos illuminated the bubble in a ghostly fashion. The eastern rim mountains were a dark presence against the stars, which shone brilliantly through the transparent bubble. After eleven sols of confinement in vehicles or space suits, the freedom of the bubble was exhilarating; a few started to sing and dance. Emily watched with a smile, amused.

"Don't overdo it; the air's pretty thin!" she reminded them.

"We should finish the set up," added Bruce. "We'll need our energy tomorrow."

"Oh, you worry too much!" replied Emily. "Let's enjoy the space! The gold won't go away."

"The more we dig, the more money we all get."

"A few hours is a few grams. We can afford it."

"How long will it take to complete the biome?"

"Phases one and two, six months."

"What about phase three?"

"Ask Will. The construction personnel will be needed elsewhere by then."

Bruce shook his head. "When will you all ever take this project seriously!"

Will hurried to get to his office. Usually he had no difficulty arriving by 8:30—day care opened at 8 a.m., and Marshall was supposed to be in his classroom by 8:30—but that sol had been unusual. Habitat 1 was already humming with activity when he walked in. The original wall that had bifrucated the twelve-meter circular area in two had been removed

several years ago, the former bedrooms along the southern outside wall had been converted into work stations for driving Prospectors—telerobotic rovers—and controlling equipment, and the old great room that had occupied much of the northern half had been divided, part becoming Will's office, part becoming an expanded bridge that was staffed constantly. The result was a communications and control nerve center that could run every piece of equipment in Mars space, from shuttle engines on Deimos to fans in life support systems in one of the biomes. Indeed, they had occasionally taken contract work to monitor and control robotic explorers in the asteroid belt or help control errant satellites orbiting Neptune.

Will was surprised to see Kent Bytown, looking a bit bleary-eyed, still sitting at his desk in the bridge. "Good morning! I thought you would have left for breakfast an hour ago!"

"I was waiting to give you a report."

"Oh, I didn't know. I'm sorry I'm late. I took Marshall and Lizzie to their classes and just as we arrived, Lizzie had an accident and peed all over her dress. So I sent Marshall ahead to his classroom and took Lizzie home to change her. And wouldn't you know it, the cleaning robot had just let itself into our flat and had started vacuuming Lizzie's room. So she wouldn't go in—she's scared of the thing—and then once she got used to it, she insisted on staying to watch it pick up things, put them more or less where they belonged, and vacuum. I finally had to drag her away, crying."

Kent smiled. "Miranda and I wonder how people manage to get things done and raise kids. I suppose we'll find out, soon enough. Anyway, I've been here since 10 p.m. last night. There's not much to mention. We've got a slow leak around one of the pipes

running between Yalta and Catalina; I'm not sure exactly where, but I managed to isolate it enough to turn in the repair report to Karol, and he's devoting the morning to finding and sealing the leak. The oxygen loss is pretty slow and it's into the outer envelope anyway, where we can pump it back in. As a result, I had to postpone some routine work for Muller Mining, so you may get a complaint from Bach later this morning. I was supposed to be running the centrifugal separation unit; they had loaded up the hopper with fifty tonnes of rock, enough to keep it going all night. But rather than focusing on the separator until 2 a.m., which is 7 a.m. at Cassini when someone there could take over, I felt I had to give priority to the leak."

"Okay. I agree with your judgment call. How long was the separator down?"

"Maybe forty-five minutes. I let it run while I focused on trouble-shooting the leak, but the crusher got stuck and shut down, and I didn't want to stop the search for the leak to unstick the crusher. They didn't lose much production. Then about 4:30 a.m. a couple in bathrobes who will remain nameless appeared at the swimming pool in Yalta to go for a dip together. Before they got the covers off the pool, I switched on the intercom and reminded them that the pool was off limits at that hour. Practically scared their bathrobes off of them!"

Will chuckled. "I suppose we should enforce that rule."

Kent nodded. "It's still public space, even at that hour. It's amazing how many people are up and walking through the biomes, even at 4:30 a.m. Besides, the irrigation system was due to go off at 5:00 a.m. and that would have surprised them anyway." He picked up his coffee cup. "Well, I'm going to retire for a few hours. Miranda and I plan a long lunch together, then I'll rest this afternoon some more. I'll be back at 10 p.m., as

usual. Tonight I'll be checking the control interfaces for some of Consolidated's new equipment. That'll take much of the night."

"Good. Who's the day officer?"

"Zach; he's in cubicle number one running a Prospector until trouble comes along. We'll have three folks running Prospectors until suppertime, then two until midnight, and they're all certified to run the systems."

"Good. I'll be in my office all day, as usual. Have a good rest."

"Thanks, have a good sol." Kent rose and headed toward his flat in Catalina. Will walked into his office to get started.

He sat and activated the attaché on his desk. He was pleased to see that he had received a message from his old friend David Alaoui. He and David had been old friends on the moon, where Will had saved David's life when the latter had fallen down part of the rim of Tycho crater. Later, they had both been members of Columbus 1 and had explore Mars together. David had returned to his family on Earth while Will and Ethel had stayed on Mars and eventually started a family there. Then David had the opportunity to command the first mission to Venus orbit, run by the European Space Agency and heavily funded by France. That mission had just reached a successful conclusion.

Will clicked on the icon, activating the videomail. He was surprised to see that much of David's hair was now streaked with gray and that his friend looked older. He had to wonder whether stress or radiation was responsible.

"Good sol, my old friend," said David, and his voice and face carried the energy and enthusiasm Will remembered so well from early times together. "I suppose you watched the live broadcast of our aerobraking into Earth orbit thirty-six hours ago. It's

been a crazy day and a half since then, as I'm sure you can imagine. After docking the *Amazonis* to ISS2—she won't stay there long, she's scheduled to be lifted back to Gateway in just two months—we transferred to a Swift shuttle and headed down to Kourou. Now we're on a jet bound for Paris, where there's a big parade planned.

"I'm still not sure how I feel about being home. I missed my wife and kids, of course, and I'm really looking forward to seeing them again. I missed the Earth, too. I had missed it when we were on Mars and during the flight home, of course, but this time it was noticeably different. I suppose it's because Magellan 1 was such a cramped place. At least on Columbus 1 we could get in a spacesuit and go for a walk. But in Venus orbit, the *Guineviere* and the *Amazonis* were our entire world. Even with daily virtual reality on the Venus surface, we were going crazy in orbit the last few months. At least Magellan 2 will have three ITVs instead of two; that extra bit of space really will help a lot. I plan to push for Magellan 3 to fly to Venus with a forty-meter inflatable sphere, complete with ropes and maybe even thin plastic hiding places or a three-dimensional maze. We needed something like that; we needed the chance to get outside and wander around! What we really need is a captured asteroid, an artificial Venus moon. But that'll be decades away, if ever.

"The other thing that surprises me is that I miss Venus. When I dream every night, I still see the beautiful, swirling clouds of her atmosphere. After a while the possible fate of falling into that hellish place ceased to trouble me. And I dream of walking around; those Prospectors sent back very realistic imagery of the surface and I can still clearly see areas I drove the Prospectors around. I suppose I always will, just like I can close my eyes and see the escarpment near the Outpost, or the fossiliferous shale

outcrops at Gangis. Four worlds are now a part of my consciousness. It's an incredible privilege.

"And then there's the question of what to do next. I'll be 47 pretty soon, just like you; it feels too soon to retire, even if my family is grown up and I'm set financially for life! Sebastian invited me back to the moon to serve as an assistant commander. The Lunar Commission will need a new Commissioner pretty soon and the rumor has it he may move up and become Commissioner; I think it's fantastic that the organization coordinating lunar exploration and development is now appointing its leadership from among the people on the moon who actually do the work! I see the Mars Commission is appointing more and more departmental directors from among the folks who have returned from Mars, which makes eminent sense.

"I have no idea whether you have any advice or not. It might help, my old friend. One can be too successful, after all. Some alternatives, such as politics—either in France or Morocco—somehow don't appeal. With the possibility of Russia joining the European Union and the prospect of a 'cold peace' between the United States and Eurorussia, or even competition to see who will emerge as the world power, politics is looking pretty complicated.

"One last image for you: I held a chunk of Venus in my hand. Admittedly, I was wearing gloves; but this was a two kilogram chunk, not a little, smashed fragment recovered from the surface of the moon. It was really cool piloting the little Phoenix airplane down to the rover to recover its sample canister, then landing the Phoenix on the Samandar Sunwing and running the sample through the automated laboratory, then loading it on board the sample return rocket and seeing it launched into Venus orbit, then

finally overseeing the rendezvous of the sample return capsule with the little ion tug that pushed it up to Magellan. So many steps, and they all went flawlessly, and now we have a sample of Venus from the earliest period before the runaway greenhouse. It even shows the chemical traces of an ancient Venus ocean. I've been haunted ever since by the idea that life originated on Venus and was blasted off of it by a planetesimal, which launched the debris on a collision course with our own cold, sterile Earth. Maybe someday we'll know. The eobiologists have made a lot of progress in the last decade, thanks especially to Mars's early crust.

"Anyway, I'm rambling; maybe it's old age, radiation damage, or maybe it's jet lag! Entertain me with a story. Bye."

Will had to smile at David's last comment. It was vintage David; introspective, yet humorous. He glanced at his shelf of samples, which included many thumb-sized fragments he had found on the moon. He walked over and picked up the probable piece of Venus he had collected, one piece of hundreds the lunar explorers had found, and rolled it around in his fingers. It was grayish, dominated by wollastonite, a calcium silicate mineral that formed under the hellish temperatures of the surface. Then he went back to his desk and hit reply.

"Hey, David! Maybe I should start calling you Venus man. You're privileged, my friend. Why not consider Mercury? The rumor is now floating around that 'Eurorussia' wants to cement their space prestige by launching a mission to the innermost planet. People say the technology is now fairly mature, too; between the exploration of the lunar poles and the exploration of Mars, the surface equipment has been designed, and the American solid-core nuclear engine provides the needed propulsion. I suppose they'll

need to land robots at the Mercury north pole for at least a decade, though, before the infrastructure to support people is ready.

"If not Mercury, please come back here for even two years. It'd be good to see you again. I don't know whether Ethel and I will ever return to Earth. We keep talking about it, but we really can't go until the kids grow up, and by then we'll be pushing sixty. If Marshall and Lizie decide to stay, we might as well retire here. By then, at the current rate of growth, we'll have five hundred or more folks up here, too; we'll be getting beyond the village stage and will begin to feel like a small town. So there won't be a need to leave, and after twenty years our social and family ties with Earth will be all but broken.

"So, you want a story, huh? I'm not sure I can offer much of one. My life is much more hassle-filled than yours, right now. Hassle is a four-letter word that is spelled G-O-L-D. Rather than clearing trails to promising fossil localities, and drilling areas to search for the origins of Martian life—or evidence of contemporary life—we're examining auriferous units, flying sunwings over them for detailed reconnaissance, dropping Prospectors on them for exploration, planning trails to them, writing up the details to a commercial world eager to make a new deal with us and ultimately to haul in a big profit. If Consolidated and Muller Mining do well by the time Columbus 6 departs, tens of billion of bucks will be beating down our doors. Even now, when no one wants to make a commitment, the line of would-be suitors is amazingly long. And some of the folks in Commission headquarters seem to regard this as a big money game; the fact that it is for the purpose of developing another world sometimes seems lost on them. Maybe we need

to have more folks here go home and take up work in the H.Q., so that the reality on the ground here won't be forgotten.

"So that's a big discouragement for me. The hardest part is to try to play the role of a bridge between positions, supplying resources to the gold exploration and recovery efforts without dismantling our other efforts, conserving the exploration and science programs and making sure they grow, but not as fast as they could have this columbiad. The problem with being a moderate, or a bridge, is that both sides accuse you of weakness or compromise. So I'm under a lot of stress right now.

"But there are bright sides. Marshall's in first grade; we actually have an institution called 'Aurorae Elementary School' with a kindergarten and a first grade. Lizzie turned four last week and is developing very fast. The other sol Cornelius Beyer and Tatiana Gavrilova stood up at supper and announced they plan to get married in December; they're the first marriage from the 'love boat,' as someone called Columbus 6. We have a few more marriages being contemplated, and some sparks are appearing between some of our older, unmarried residents and some new arrivals. As the hopeless romantic that I am, these developments really warm my heart. The Deschanels have announced that they're expecting a child in May, who will be number fourteen if all goes well. This is good news because we now know for sure that child number thirteen will have Down's syndrome. That discovery and Madhu's cancer have caused quite a ripple of concern up here about the health effects of living on Mars, with some worrying about every rem of radiation and others dismissing the entire issue almost fatalistically.

"And of course, you wouldn't recognize this place if you came back. Catalina Biome's inflated and building one has people living in it; building two is slated to be

completed in early January. The excavations and foundation work has started on Riviera Biome, which will be completed before the end of 2032. Cassini's biome will be inflated in about a month. Shikoku is scheduled to be finished by mid 2033; then we'll have four biomes at Aurorae! Over the summer we built a dozen metal storage tanks, all of which can fit inside a shuttle's cargo bay in pieces; once they're welded together, they're 5.8 meters in diameter and 2.3 meters high and have an interior volume of sixty cubic meters, which can hold almost seventy tonnes of liquid oxygen or almost thirty tonnes of liquid methane. We've flown a pair to Phobos, another pair to Deimos, a pair to Embarcadero, we drove a pair to Cassini in July, and the other four are set up here at Aurorae; with ten centimeters of spray-on foam insulation and a meter of eolian dust over them, they're well insulated and hold cryogenic liquids very efficiently. As you can imagine, fuel storage has made life much easier here; we can refuel two shuttles in two sols, rather than waiting three months, and we have reserve energy for dust storms.

"I suppose these are little things, but they are material milestones for this place, and milestones are always exciting. We have 96 human beings here less than eleven years after the first landing! It boggles the mind. It's compensation for all the bullshit I have to put up with. Your calls help, too; they're encouraging even when they aren't meant to be. So I guess that's not a bad story to give you. Bye."

He sent the message off to David. Then he couldn't resist firing off a video message to Sebastian Langlais as well. When Sebastian had commanded Columbus 2 he had been a pain and something of an adversary; but they had become friends, and now they were colleagues. Will checked the time at Shackleton Station, then recorded a message.

“Good sol, Sebastian! Say, what’s your advice about handling contractors. We have two up here, and each is determined to haul a hundred tonnes of gold back to Earth in eighteen months. Never mind that we’ve already walked the ground and picked up everything that’s loose and have already blown up and picked through the really rich spots, thanks to the neutron activation instrument we were able to juryrig. They’ll be lucky to find 200 grams of gold per tonne of rock. I will say they’re working about eighty hours per week, but they’re driving my people crazy with support requests and unreasonable demands for biomes, reactors, rangers, mobilhabs, etc.

“But in spite of the stress, everything is basically working out pretty well up here. The two biomes are developing very nicely and give us much more space than we’ve had before. The canaries have escaped in Yalta and sing from the trees; a nice touch, though we would like to recapture them! The biomes now have butterflies as well, and we just got coffee and chocolate plants. Columbus 7 won’t be importing practically any food at all; we may even export Martian steak for the low earth orbit tourists!

“I hope everything is well there. I hear Shackleton can now accommodate twenty tourists. The big radio telescope construction project sounds exciting; I hope the rumor’s true. The Imbrium Drilling Project should be very promising. Let me know how you juggle everything. Bye.”

Will sent the message and turned to his other messages. Sibir Resources Company, or Sibireco, was pressing to bid on the gold deposits in Dawes Crater, in spite of the uncertainties about the success of such efforts. Sibireco had lost out in the last round of negotiations, but now they had a U.S. subsidiary that considerable expanded their capacities, not to mention their political clout. Will sent a video mail back to Mich

Dvorkin, the Mars Commission's Director of Exports in Houston, begging him not to arrange a contract that specified the establishment of a Dawes Outpost; not before Columbus 8, anyway, because the work of setting up such facilities was extremely taxing. Louisa Turner, the Director of Public Relations, was asking whether video resources on Mars could be made available; Skip Carson, a major Hollywood movie director, was considering a flight to Mars on Columbia 7 as their first tourist and wanted to have some Martian scenes filmed. Will emailed her and questioned the wisdom of such a proposal.

Then the replies came back. He dropped everything to see what David had to say.

"Hi; thanks for the advice. No, I don't think Mercury's in my future. I wouldn't be surprised that the rumor is true; a joint space project would be a good trust-builder for Eurorussia. The rumor is of a race, even, between them and the U.S. But the limit is propulsion, not life support, and I doubt the propulsion systems will be mature enough for another decade. I doubt I'll want to go to Mercury by then; I doubt anyone will want to send me, either! Once the propulsion systems are developed, though, they'll open up the Jovian system and the possibility of an Outpost on Callisto. We'll live to see human beings there, I think. But I never would have predicted it ten years ago.

"I doubt I'll be returning to Mars, either; it's a shame, I may never see you in the flesh again. But my oldest son, Zekaria, wants to go; you may see him in three or four years. He may be one of those five hundred you may see in your retirement. I bet the gold is a huge hassle; I've been following the situation as well as I could. But what can you do, money makes the world go round. Justifying Mars exploration is always the hardest part. Just hang in there; everyone says you're the key to making Mars grow and that without you it'd still have a dozen personnel in a collection of tin cans. One person can

make a difference, Will. You're the proof of it. Well, I had better catch a bit more sleep. Bye."

Will had to smile at his friend's kindness. Then he activated Sebastian's message.

"Good sol, Will. Yes, the news from the moon is good. Shackleton proper can now accommodate 110, and the Chinese station can accommodate 21, so we have quite a large capacity up here. A side note: as of next month, the Chinese clocks are changing to match ours. It's more convenient for them to be on U.S. Central time and visit us than it is to be on Beijing time and talk to mission control there.

"As for the radio telescope rumor, no, it isn't true. That contract's going to low Earth orbit; the scope will be located at the Earth-sun L2 point, and it'll be designed to be expandable. By the way, the new shuttle repair hanger is really incredible; go take a virtual reality tour on our website. We have the contract to refurbish the Mars shuttles now.

"Contractors: I guess you just have to be firm and make sure everything possible is specified in writing, otherwise they'll take advantage of you. I suppose we have a certain advantage over you. Lunar ice production is geared at $500,000 per tonne in terms of costs, with sales running $650,000 per tonne. That's a lot less than the ten to twelve million per tonne you can make. Ice production's cheaper; we only go after deposits that are more than three percent ice. Total sales outside the lunar transportation system are running about five hundred tonnes per year, or $350 million. Our big income now is tourism; they're spending 3 million bucks each to fly to the moon and back and this year we'll have 240 of them. They have to be babied, too, so that's our big test! I think I'd prefer your problem. You may be blessed by your isolation; you won't have tourists any

time soon. Our new challenge is competition from LeMonnier Station; they plan to offer a two-week stay for 2.4 million, including a visit to the Apollo 15 and 17 landing sites, where they plan to build boardwalks, so we'll have to lower prices and cut costs somehow, while being even nicer to them when they come. One third of my personnel support the tourist business directly or indirectly.

"So my advice is, be hard nosed, be thankful for your isolation, and look to the advantages of your situation. You have an atmosphere and biomes; we don't, and we miss them. Keep in touch. Bye."

Fortified by the encouragement, Will plunged back into his work. There were several emails to deal one. One was from Chester Stoughton, one of Consolidated's workers, complaining about Bruce Curry's slave-driving ways. There wasn't much Will could do about that; he had no jurisdiction. He videomailed Stoughton to that effect.

He was wrapping up work just before lunchtime when his videophone buzzed with a live call from Michiko Suzuki, their meteorologist. Will's heart sank when he saw her name on the caller identification; the dust storm season had just begun. "Is it bad news, Michiko?" he asked, answering the call.

"I hate to be the bearer of bad forecasts, but don't shoot the messenger. The long-term, ten-sol forecast shows a regional dust storm developing in this area and lasting about a month. It'll be category 2 or category 3."

"That's an important difference. Category 3 triggers a lot of restrictions that category 2 doesn't."

“I know. The new meteorology satellites give us a lot of new data; about fifty times more than we had last columbiad. The supercomputer outside of Paris does some very sophisticated crunching. The ten sol forecast is seventy percent reliable.”

Will pondered. “That means there’s a thirty percent chance the storm could be worse; or better. That’s not good.”

“In three sols, the seven-sol forecast will be eighty-five percent, and we’ll be a lot more certain about the options.”

Will nodded. “Okay. Then we had better use the three sols to educate people about the options. The miners will be the toughest. Even category 2 means no sunwing landings or takeoffs at Aurorae; that means shuttles or robotic trucks, both of which use nuclear reactors for their power sources. We can’t spare energy for them.”

“Cassini’s forecast is still good. It isn’t in an area prone to storms, unless we get to category 4 or 5 conditions. Maybe you should ship our solar power units there and bring their reactors here.”

“That’s a good idea, if I can convince them. We’ll also have to call back the scientific expeditions, since they need reactors. Aurorae ideally needs 1,000 kilowatts when it’s in fabrication and construction mode. That requires all six reactors. If we have four reactors, we’ll have to slow the construction efforts. Can you send me the detailed forecast as an email; I’ll send it out to the heads of staff, and we’ll figure out how to reallocate resources.”

“Okay, right away. Sorry to make your life that much harder, Will.”

“Thanks, Michiko. We’ll all survive, though.”

5

Crime

late Dec. 2031

Will, Alexandra, and Lisa stopped their inspection tour to watch the dust devil approach. It was fairly small—a mere hundred meters across and perhaps a kilometer high—but it seemed particularly fierce. From the rooftop garden of Catalina Biome, above the ground level, they had an unobstructed view of terrain around Aurorae Outpost, and they were alarmed to see the dust devil veer a bit and bear straight down on them. They all felt momentary apprehension—a sucking in of breath—for a moment as the swirling cloud passed right overhead. The gale force winds were visible in the rapid whirl of the dust around the funnel. Then it passed and a rain of talcum-powder dust fell on the plastic bubble.

"Wow, that was something!" said Lisa. "In all the years I've been here, I've never seen that before!"

"I did once before!" exclaimed Will. "It was about a kilometer in diameter and the entire Outpost was shrouded in dust for several minutes!"

"I thought my heart would stop for a moment!" added Alexandra. "I suppose I knew intellectually that it couldn't hurt the dome, but it still felt like we were about to be in a tornado!"

"We were, but the atmosphere's not thick enough to do any damage, fortunately," replied Will. He looked at the thickening deposit overhead. "Your crew just blew the dust off the dome, and now they have to do it again. Twice in one sol."

“I hate the dust storm season,” growled Alexandra. “Dreary, dark, cold inside, and we never have enough power.”

“Well, you got building two done,” said Will, looked around at the flourishing rooftop garden. “Lisa, the garden’s not doing badly either, in spite of the diminished sunlight.”

“The insolation’s only down twenty percent; this isn’t the worst storm season. It’s diffused sunlight that comes from the entire sky instead of from a solar disk. The solar power units are devastated, but plants don’t mind it much.”

The three of them turned and walked back into building two’s rampwell. “Even so, Will, we do need more space in the biomes in the future,” exclaimed Alexandra. “That means building smaller buildings or putting them in bigger biomes.”

“I know. I was asking about the mass and cost issues of a biome fifty meters in diameter so that I was informed, not because I was opposed.”

“The bio-50 design will mass thirteen tonnes instead of eleven, but it’ll have sixty percent more interior space. That’s possible because we can now make more of the needed parts here, and because the larger dome will incorporate some new materials. The Swift-B shuttle can lift twelve tonnes to low earth orbit and the actual dome itself is a bit less than ten tonnes, so it can be lifted by a Swift. The rest will be flown up separately. We estimate—”

Will raised his hand. “You already told me, Alexandra.” Will stopped on the ramp where it reached the top floor landing and opened a door. It led into a classroom; the electronic blackboard had been installed, but nothing else. He entered, admired the work,

then walked out the other side and went down another ramp. The women followed. "MarTech's got a great facility," he said.

"Thanks," replied Alexandra. "We should be able to start classes the first week of January; spring semester, as it were. Assuming we can make the furniture in time."

"It's in the energy budget," replied Will. "Ethel's getting started tomorrow. We have to get them ready."

"Will, if we could shake loose even five hundred kilowatt-hours per sol, we could get started on Riviera Biome," said Alexandra, pressing a point she had made several times since the dust storm season had started two months earlier. She stopped at the bottom of the ramp in the MarTech lobby. "That'd be enough to run a ranger with excavation equipment and finish the hole, with some energy left for making and pouring duricrete."

"Where will we get five hundred kilowatt hours per sol? Besides, right now you don't have the people anyway. It's either fabrication or construction; we don't have the energy for both until the storm season clears. But it's already showing signs of decrease, and the long-term forecast for Aurorae is for fewer storms."

"They think," said Alexandra. "They also think their forecasting has been seventy percent accurate!"

"I'll concede that one to you," agreed Will. "Thank God we took the conservative approach, got a nuke from Cassini, and sent them the solar power units."

"But did you have to send out the two geology expeditions? The nuke they're splitting would make all the difference here."

"Not to mention safety issues," added Lisa.

"Safety seems fine. Cassini can offer better emergency services than Aurorae could on its first two columbiads, and its weather has consistently allowed sunwing and shuttle flights. Mission Control's satisfied. The explorations have been concentrated in the northern hemisphere where the atmosphere is dusty, but not stormy. Even the solar power units have worked fairly well at Cassini. The exploration teams have been essential for keeping up our media presence, and they've done that very, very well. Elysium-Utopia has been geologically fruitful and interesting."

"And where will we put Viking 2?" asked Lisa.

Will smiled. "How about the park below Face Rock? No, I'm joking. I think we need to put it in our first museum, after we've taken it apart and studied it thoroughly." He turned to Alexandra. "But back to your concerns. Alexandra, why not go to Cassini yourself for a few months and oversee the construction there? Nature has conspired to concentrate our resources there; Cassini's got plenty of solar power, while we're struggling on limited nuclear and wind power. We can send people there to get everything finished while the folks here turn to fabrication, then when the storm clears the extra personnel can return here and turn to construction with a vengeance."

"I know." Alexandra sighed. "I just hate to think of Cassini as getting as big and sophisticated as Aurorae."

"Oh, Alexandra, don't worry about that! We have to think about Mars, not about our borough!" Will had raised his voice. He lowered it. "Come on. Let's look at this rationally. Catalina's done, and if we start Riviera in April or May, we can still finish it and Shikoku before Columbus 7. Let's get phase two finished so agriculture can begin at

Cassini and generate more food for us. Then let's turn to a few other essentials; phase 3 and the completion of building one; and installment of the microwave power relay."

"We've got to get the relay system running," she conceded. "We need the experience of beaming power from Cassini to the gold fields so that we can beam it to here from the top of the escarpment, where the atmosphere is much less dusty."

"Hell, we may be able to beam the power from here to Phobos, and Phobos to Cassini!" replied Will. "And vice versa. And from either one to a mobile expedition almost anywhere on the planet. Or for that matter, if this works well, power can be beamed from Magellan station to TROVs on the Venus surface. They've already successfully beamed power from the various peaks around Shackleton to the facilities in the permanent shadow, and last month they test beamed power to ion engines pushing cargo from earth orbit to Gateway. Doesn't that capacity excite you?"

Alexandra hesitated. "Yes, it really does. I agree, we need to test that equipment. I was hoping to test it here, though."

"Why, when it was meant to be tested at Cassini?"

She shrugged. "As I said, I had hoped. Okay, Will, I concede your logic. I don't like it, but I agree it is logical. I really think you've been giving away too much to our greedy miners. But I will go to Cassini next month, for two months, and I can take another six people along. They'll be enough to get all of building one finished and haul in regolith to get agriculture started."

"Good." Will smiled; he was pleased he had convinced her, even if it was grudging. "A Mobilhab and a ranger are scheduled here the sol before Christmas with

four crew. Two Mobilhabs can go back, carrying as many as ten or twelve. They're departing January 3."

"How long will that take? Why not fly?"

"There are still no shuttle flights. Besides, you can use the ten sols pretty efficiently reading or whatever. You can relax, too; it's allowed on Mars."

"I might even drive Prospectors; I haven't done that for a while."

"The Mobilhab has the capacity to control four Prospectors at once," replied Will. "The guys coming back will be pretty busy; some will be running mining equipment all the way home."

Alexandra nodded. "Okay, I'll go."

Will smiled. "Excellent. I think you'll enjoy the trip."

Less than a week later a Mobilhab and a ranger rolled into Aurorae bearing four workers from Cassini and two explorers who had flown to Cassini from Elysium. The power cart bearing the reactor carried five tonnes of gold, the total production by both companies for the previous month.

"The work is hell," Eliseo Andaluziano said to Will over coffee that afternoon. "Curry is a real slave driver and Bach, to compete, has felt he had to be the same. So we're all working about seventy-five hours a week, sometimes more. And something is always breaking; the mining equipment was never designed properly to operate in Martian cold. They're lucky to keep the equipment going seventy percent of the time."

"We don't have the energy to run it all the time, anyway," added Louis Tremblay, who had also just returned from Cassini. "Even with extra solar power units, the

combination of mining and construction is very power hungry. I had a lot of trouble figuring out how we'd keep fuel in the shuttles."

"You did a good job, Louise," said Will. "How's morale?"

"It ain't great, but it ain't horrible either. Emily got the biome bubble set up in record time and by next week the bottom floor of building 1 will be enclosed, which means everyone will have a real room to live in. Of course, it'll be another month or two before the rooms are painted and comfortable."

"Less," replied Will. "We're send down Alexandra and six workers to replace the four of you who left, and they're taking more construction materials. They should have all three levels of building one enclosed in two months. They'll set up the bubble for building two, also, to provide redundancy, though the structure inside it will be minimal."

"That'll help a lot," said Louise. "I understand Ray Munson has bought a flat here in building 2, and that Curry tried to order him not to."

Will was surprised. "He has bought a unit, but I don't know anything about the circumstances. The Werners have as well, and I don't think they're mad at Bach." He pointed to Chester Stoughton, one of Consolidated's staffers, who was strolling through DiPonte's store. "So, why did he get permission to accompany all of you here?"

Eliseo shrugged. "He hasn't told us, but my impression is that he has come to hate Curry and the work. But I gather he's still working hard, just remotely. He was running mining equipment twelve hours a sol on the ride here."

"Interesting. I guess I should ask him."

"I'd go now, before he disappears into a Prospector operations cubicle!" said Louise.

Will nodded and rose from the table. He walked over to DiPonte's store; the door was wide open and Stoughton was the only one inside. There was no need for DiPonte to staff it; anyone with questions could call him, and if anyone walked out with an item, they'd be billed for it anyway. A computer chip in each item, video cameras, and a paid monitor in India did the rest.

Chester was examining the Cuban cigars and the Russian vodka, though the latter was inside a locked cabinet. He looked up. "Oh, Commander. Good sol."

"Good sol to you, too. Welcome back to Aurorae."

"Thank you. Two and a half months away; this place is a sight for sore eyes."

"Cassini's still pretty limited. We'll be sending the Mobilhab back to Cassini in a bit over a week, so the visit won't be that long, I'm afraid, especially when you add ten sols of travel each way."

"It's sort of like being on an old-fashioned cruise ship, except there's no swimming pool and no open bar. Commander, is there any possibility we can arrange for me to stay here? I could continue to provide support services telerobotically. The isolation, especially the lack of women, was driving me crazy."

"Well, have you talked to Bruce about it? He's your boss, after all. He's made it very clear that he wants his people in Cassini for maximum flexibility."

"I know, but here, five time zones behind Cassini, I can provide support services to Cassini in the middle of the night that are much harder to provide there."

"And what did Curry say to that?" asked Will, point blank.

Stoughton looked down. “I think he’d be as happy to be rid of me as I am to be rid of him. I want to stay on Mars, but not work for Consolidated. Maybe we can arrange a swap with someone else?”

Will shook his head. “I think the chance of anyone else wanting to work for Consolidated is pretty remote. I hear working conditions are difficult.”

“Difficult! Impossible! Morale’s in the toilet! He’s a slave driver! Bach’s just as bad, too! Scoville’s driving her people too, in response. There’s constant repair work and a lot of work is being done by hand or in a spacesuit that was supposed to be done remotely because one thing or another is broken.”

“What do you recommend?”

“Set a limit on work hours, for personal safety! It really isn’t safe. Send down more people, and figure out how to replace the parts that are breaking with other parts that are more robust. It’s an experimental operation, not a working operation.”

“Either way, it’s an operation recovering five tonnes of gold per month.”

“At the cost of a lot of sweat, and maybe blood.”

That got Will’s attention. “We will have to look into the matter, then. We’re sending down a bigger support team; that’ll help. Some of the people going down are experts at safety and others are experts at design; maybe they can solve some of the frequent breakdowns.”

“I hope so.” Stoughton looked at the vodka bottle, a liter, with a price tag of $3,000. “When will someone be here, so I can buy this?”

“The vodka? It isn’t a question of who. The cabinet will be unlocked automatically Frisols and Satursols 6 p.m. to 1 a.m. Those are the only times alcohol can

be purchased or consumed here. The cafeteria sells cheaper stuff, though; we're now brewing beer locally, and it's supposedly pretty good. We even have a contract to export five hundred liters to the Hilton Orbital."

"I'll try some, but I really want the vodka."

"Come back tomorrow evening, then. Meanwhile, can I offer you chocolate? It's the best quality money can buy." Will reached down and picked up a 25-gram, $75 bar that had a famous logo cheaply printed on locally made paper.

Stoughton smiled like Will had made a bad joke. "No thanks, Commander. I really want something stronger."

Frisol was busy and Satursol was pleasant. After half a sol of working Satursol morning, Will came back to Yalta Biome for lunch, then remained for the quarterly flea market. About forty people had things for sale. Some had used clothes and toys they no longer needed, at prices half as outrageous as those inside DiPonte's Store. Even used paperback books sold for $50, roughly the cost of flying them to Mars. But more interesting were Lal Shankaraman's remarkable photographs of natural objects on Mars, Enrique Delrio's metal furnishings, Madhu Gupta's ceramics with geometric designs, Friday Nguru's wicker chairs, Radha Bhatt's hand-woven rugs, Ernesto Alves's carved plastic and wooden sculptures, and Ryoko Furukawa's beautiful water color paintings of flowers. They were not cheap; generally they were priced five to ten times more than they would be on earth. But the buyers knew that raw materials cost vastly more and labor was worth eight times as much as on Earth. Many objects were snatched up in a few minutes in spite of the price tag. Everyone walked around with a wad of thousands and hundreds; few

items required anything smaller. The average consumer spent $5,000 to $10,000 that sol and thought nothing of it.

Then Will and Marshall went for a swim while Lizie napped and Ethel rested. Supper was always special on Satursol, with more meat and desserts than usual, even during the dust storm season when agricultural productivity declined. When the dishes were cleared away and the sun set, the stage was illuminated for the performance of a locally written one-act play by the "Aurorae Players." Marshall sat spellbound and a bit baffled by the play, but he had seen enough theatre to love it.

After the play ended about 8:30, the families began to drift out, the kids went to bed, the lights dimmed a bit, the music became more contemporary, and the cafeteria changed its character as Mars's singles gathered to socialize. Will and Ethel put the kids to bed, then sat in the living room to watch television; Earth's favorite Saturday evening shows had been downloaded onto the Outpost's computers. They watched their usual lineup, then went to bed.

At 2:30 a.m., Will's attaché suddenly began to beep wildly. In response, the house computer brightened the bedroom lights. Will jumped out of bed and grabbed the device. He deactivated the video, noted the name of the sender with trepidation, and opened the circuit. "What is it, Kent?"

"Will, sorry to awaken you, but about five minutes ago Sheila Burns came into the bridge crying and saying she had been raped by Chester Stoughton. I called Eve Gilmartin and Martha Vickers right away, waking them up, and they asked Sheila to meet them at the hospital. Martha stopped by to bring her. I figured I had better call you."

“Thank you. I’ll be right there. Call Silvio as well and tell him I want him to come to the bridge immediately as well.”’

“Got it. Bye.”

“Bye.” Will closed the circuit, apologized to Ethel, pulled on his clothes, and jogged to the bridge. He felt numb and in shock, which the freezing air in the tunnels didn’t cure. Mars had never had a problem like this before. It wasn’t prepared.

When he arrived in the bridge, Kent was reviewing videotapes. “I found where she left Chester’s apartment, and the computer’s looking for the moment when she went in. They were in the patio all evening, so there will be a lot to review. Shall I call up the tapes of inside Chester’s room?”

“No; not yet. We need legal advice. The hallways and the dining area are public spaces. What happened?”

“Sheila was gradually going from shocked and angry to hysterical, so I can’t guarantee we know all the facts yet. Basically, she said she had a few drinks with Chester, he invited her to his room to take a look at something—I was never quite sure what—and he forced himself on her.”

There were footsteps behind them. They turned and Silvio DiPonte, hastily dressed, tired, and grumpy, entered the bridge.

“Has the price of gold collapsed?” he asked.

“No. Sheila’s in the hospital right now; she says she was raped by Chester Stoughton.”

“Who?” Silvio didn’t know the name.

“He’s one of the workers for Consolidated; he arrived here yestersol. Kent, you summarize.”

“Sure.” Kent repeated the account he had told to Will.

“Perhaps we should go talk to Sheila?” suggested Will.

Silvio shook his head. “Not yet, and I had better not go at all. I don’t need to know all the details of the alleged incident; I need to know enough to render an unbiased opinion.”

“You’re the borough judge, but Silvio, who will be the lawyers? What law do we follow?”

“We have to follow the laws of the state of Texas, since the Commission headquarters is in Houston. Of course, we can’t follow either the laws exactly or the legal procedures, because this is Mars, not Houston. I don’t know the details of the rape statute, but we can assume that rape is a serious crime punishable by imprisonment. We’ll need to get the details.”

“But how can we hold a trial here?” Will exclaimed, worried.

Silvio shrugged. “I’ve thought about this problem, but only at a theoretical level. Trial by jury would fit our circumstances best, with the judge and jury empowered to ask questions. We may need to hold a town meeting to establish the legislation needed for a trial. I’ll reread the Aurorae Declaration.”

“But we have no prison, and an angry resident can sabotage this place pretty easily,” said Kent.

Silvio nodded. “If this person were found guilty, most likely he would have to be sent back to Earth for punishment. But we would have to set up a system that maximizes

his cooperation here; time off for good behavior if he cooperates, for example. And we don't need a prison because we can enforce house arrest and all sorts of other restrictions. We'll have to be creative."

"Do we have the jurisdiction to be creative?" asked Will.

"Of necessity, we do. As chief judge I can make constitutional rulings."

"Okay." Will looked at Kent. "Let's go talk to Sheila."

Silvio shook his head. "Let the physicians do their job first. I'll go to the sick bay and remind them of the legal need for evidence. Sheila came here and told to Kent; you have cause to arrest the accused. I'd bring him here, ask him if he wants a third party present to advise him, remind him of his rights under United States law, and ask some questions."

"Who? The Commander?" asked Kent.

"No, the Duty Officer, who is charged with maintaining the health and safety of the residents. That includes law enforcement."

"But I have no training!"

"Never mind about that, Sheriff Bytown," replied Will, putting on a western drawl.

"Watch out, I'm swearing you in as deputy!"

"This is not the wild west," replied Silvio. "Security is listed among your duties, Kent. Read the—"

"I know, I just never thought I'd need to do it! I'm a systems analyst!"

"Well, you are the borough constable as well; that's a better term than sheriff, I think," replied Silvio. "You are authorized to arrest, hold, and question the suspect for a

reasonable time. So go get him. I'll talk to the physicians. The Commander will go along as your deputy."

The men headed their separate ways. Silvio had a very short walk from the Bridge in Habitat 1 to Aurorae Hospital in Habitat 2. Getting the attention of any of the women was more complicated, however. Finally, Eve came out. When she saw it was Silvio, she immediately knew what was going on. "She can't talk to a lawyer now. She's been traumatized."

"Fine, Eve. I'm here to remind everyone of their professional duty. If a crime has been committed, it has to be decided in a court. The court will need evidence. The court will also need testimony; yours, Martha's maybe Sheila's."

"Court? We're on Mars!"

"Indeed we are. That means we can't ship Sheila and Chester to Houston tomorrow for a trial. No one can get to Earth for about a year and a half. And we can't just push Chester out an airlock without a spacesuit. If we intend to be a civilized society we have to hold a trial and determine a punishment."

"I see what you mean." Eve looked horrified. "This is terrible."

"Be thankful our first serious crime wasn't murder. We'll have one of those some sol, too."

"I suppose. The Garden of Eden has just found its serpent."

"No, the serpent has always been here; he just hadn't bitten anyone. Now he has. As a physician, you have to play your professional part. Martha can counsel Sheila and the counsel will be confidential because of the physician-patient relationship, but she

should be careful not to distort Sheila's memories. You and Martha need to consider what evidence of rape should be submitted to the court."

"I understand." Eve nodded. "I'll tell Martha."

"Thank you." Silvio turned and walked back to the bridge, partly to think, partly to watch the systems.

Kent had his attaché with him so if an emergency developed, he'd be able to handle it, but he wasn't thinking about that. He and Will were somewhere between frightened and high on adrenaline as they crossed Yalta Biome, entered Catalina Biome, and headed to the main entrance of building two. They went down the steep ramp to the garden level and knocked on the door to Chester Stoughton's room.

No answer. They knocked again, then again. Then they knocked loudly.

"Maybe he isn't there," said Will.

"He should be." Kent knocked loudly again several more times. Then he raised his attaché and pushed a series of icons to see where Chester's identifier was. It was a chip in the communications earpiece most people wore during the sol. "His identifier is in there."

"He's probably there. How many times have we knocked?"

"Six or eight."

"We'll knock some more, and then we'll ask the computer to open the door." Will knocked loudly on the door. "Chester, please open the door!" He exclaimed loudly.

Another door opened nearby and Eliseo appeared. "What's going on?"

"You'll hear about it tomorrow," replied Will. He knocked two more times. "Okay, constable."

Kent nodded. “Computer, this is Kent Bytown invoking safety condition orange. Please unlock the door.” There was a pause, then every door on the hallway emitted a faint clicking sound.

“You should have been more specific. Let’s go,” said Will.

Kent opened the door. Chester had a flat eight meters by five. The front two meters was a hallway with a bathroom on the left and a closet on the right; the rest was a bedroom with a high window in the far wall. The lights came on automatically when the door opened. Chester was lying on top of his bed, naked, sound asleep.

The two of them had to shake him several times before Chester stirred, and then he wasn’t coherent. “He must have passed out from alcohol consumption,” said Kent.

“Then let’s get a bathrobe on him and carry him to the hospital,” said Will. “We’ll call in some more doctors and keep him in another room.”

6.

Trial

late Dec. 2031

Will, Kent, Silvio, Martha, and Eve got no sleep that night. The men—supplemented by Alexandra Lescov, the Borough chair, and Érico Lopes, the Borough secretary—discussed procedures with Douglas Morgan and a task force on Earth until an hour after dawn. When Aurorae Outpost awakened the next morning, the residents encountered a short, simple announcement that, because someone had been accused of the serious crime of rape, there would be a town meeting at 1:30 p.m. that afternoon to discuss legal procedures.

No one could talk about anything else at breakfast and brunch. The interfaith service at 10:30 quickly changed its theme to “the life of society” and Father Greg was engaged to deliver a sermon on the subject. Over half the adults attended; an excellent turnout. Even more watched parts of it on the web. It shaped the tone of lunchtime discussion.

By 1:30, the food had been cleared from the tables and everyone was seated and ready for the town meeting, which was held on the patio where everyone dined. Alexandra called the meeting to order and asked for the “meditation,” a quotation approved by the three Borough Officers that was meant to set the tone of the gathering. Then before she could say anything more, a sea of hands shot up.

“My goodness, people have something to say! Okay, we can entertain a few questions. Roger, you’re waving your hand too forcefully.”

He took that as recognition and stood. “Shouldn’t we know who is accused of raping whom?”

Alexandra paused to select her words carefully. “The purpose of this meeting is to discuss the legal proceedings that should be followed when a crime such as rape is reported. This is not the place to discuss guilt or innocence, nor should the question of who is accused of what influence our planning.”

“But I’ve already heard who the accused is!” exclaimed Zach.

Silvio rose and looked at Alexandra, who nodded. “Look, we know there’s gossiping and rumors, and I won’t deny the accuracy of some of them. While gossiping and rumors are not against the law, we don’t think they should be encouraged. If you want to know what the gossip says, no one will punish you for asking. But we don’t see any reason the town meeting should be a forum for them. There has to be a trial of some sort and the question of guilt or innocence will be discussed and decided then. Our purpose here is to decide on the procedure. The procedure is unaffected by the details or who is accused of what.”

“A trial,” said Irina, shaking her head.

“Yes, a trial,” replied Alexandra. “Look, friends, most of us are still a bit in shock this would happen here. Mars has less than 100 adults and they are all highly trained professionals who have been screened for the ability to work in a team. But that doesn’t mean we’re perfect. All of us make mistakes, and occasionally the social behavior of professionals will cross the line. When that happens, there have to be consequences. We have a chair because we have to agree on rules together and that requires a facilitator of discussion. We have a secretary to record our decisions and implement tasks we agree we

all need. We have a treasurer because as a population we want things done and they have to be paid for. And we have elected a judge because we need someone to keep us in line sometimes."

"Is this an issue being handled by the borough government or by the Commander?"

"Raise your hand please, Lal. The answer to your question is 'yes.' It is being handled by one or the other. We're still not completely sure which."

"No, no," replied Will, raising his hand. Alexandra nodded, so he stood. "Look, Mars no longer consists just of employees of the Mars Commission. It has employees of two companies and the Borough now officially employs an elementary school teacher. Plans are underway to incorporate Aurorae Hospital and MarTech. The store and the bank have part time employees and many of us have small weekend businesses. I am not Commander of all these enterprises. The Borough has to be the institution to determine what to do here. I am the servant of the Borough in this case and I have participated in the planning heretofore at the pleasure of our elected officers."

Alexandra raised an eyebrow at that comment; Will had called them together, after all, rather than the Borough officers inviting him. "Our understanding of this crisis has developed quite a lot in the last twelve hours," she added. "One lesson is that until we decide which tasks here are done by the Commission and which by the Borough—because in a sense, a transition has started—the town meeting probably should appoint Dr. Will Elliott as the Borough Manager. Other questions?" She looked around. "Thierry."

Thierry Colmar rose. “I want to know what the Commission’s position about this town meeting is. Do we really have the freedom to make decisions?”

Alexandra looked at Will, who stood to reply. “Yes, we do. The Commission participated in the discussion to hold this town meeting, and we made it clear to Morgan and the others present by videophone that we live a hundred million kilometers from them and have to decide our own fate in matters such as this. Otherwise, morale and our collective will would suffer. The Mars effort, after all, is not just our jobs; it is our lives.”

Will sat and Alexandra pointed to Tina Hvitmer. Tina rose. “I’m concerned that discussion of legal procedures is premature because they hinge on the concept of the society we want to create. A trial assumes a certain adversarial relationship in determining guilt or innocence. Even the terms guilt and innocence imply concepts of right and wrong. I’m wondering whether we need to start at a more basic level.”

Hands immediately shot up, including Silvio’s. Alexandra nodded to him. He rose. “I’m afraid we do not have the luxury of starting from scratch, in terms of social organization. After thousand of years of living together, human beings have discovered that they have to have laws, government, and a legal system. No society has every abolished them. If we were to try, we have to remember that a breakdown of society endangers our lives profoundly; we can’t scatter all over this world to get away from each other. The Outpost has a population density of about 15,000 persons per square kilometer, higher than many cities on Earth. Finally, the treaties on which this settlement is based specify that the laws of the state of Texas apply here.”

“But how can we possibly behave as if we were in Texas!” exclaimed Jacques Deschanel mockingly.

“Look, that’s what the treaties say,” replied Silvio, ignoring Alexandra. “Some Texas laws would be silly here. Others would be absurd. But this town meeting has not yet passed an entire body of laws and it has yet to define a legal procedure. We have to make a start in order to replace the Texas laws with our own.”

“That’s the purpose of this meeting,” added Alexandra. “I said we’d have a few questions. We have done that. I propose we turn to Judge Diponte’s report. I don’t see a point to debating utopian matters now.”

No one disagreed with that, much to her surprise. Many residents did not possess utopian dreams; their political philosophies represented the full spectrum one found on Earth, with no position able to dominate. Under those circumstances, a variant of the terrestrial status quo had to prevail and could be changed only slowly.

Silvio Diponte walked to the stage. He tapped some keys on his attaché and a slide—the first of seven—appeared on the screen behind him. “One: the proposal is fairly simple. The town meeting can only determine the procedure in Aurorae Borough, so that’s all we are discussing this sol. We have a legal vacuum if someone commits a crime on an expedition, so we will have to develop a mechanism for handling Mars-wide crimes eventually, but not this sol.

“Two: We have an elected judge. Theoretically he can preside over a trial and render the verdict, if we want. But we have an educated population here and we already have the institution of the town meeting, so I’d favor trial by a randomly chosen jury of twelve persons, which will be randomly reduced to nine jurors after the defense and prosecution have rested.

"Three: Since we have no lawyers here besides myself, I recommend that the role of the presiding judge be to insure that the jury gets full and impartial information. The Borough can appoint someone to prosecute the case and the defendant can appoint someone to defend him or her, lawyer or not, subject to the approval of the presiding judge. Whether the system is adversarial or not, it will have to be used if the crime cannot be resolved in any other way.

"Four: For felonies—which are crimes such as theft, rape, and murder that potentially carry prison terms—the punishment should in the foreseeable future assume transfer of the individual to Earth for imprisonment; however, the length of the sentence there will be dependent on the individual's cooperation with us up here, and the possibility of a substantial reduction in the sentence should be an available option to the presiding judge in order to give the individual an incentive to function as a member of society here until he or she can be returned to Earth. Such individuals will live under house arrest or equivalent until they return to Earth; they will be expected to perform as model employees, then return straight home to eat their meals until the next sol. Their freedom of movement will be sharply restricted inside the Outpost and they would not be allowed to leave it at all.

"Five: If the individual is judged unable or unwilling to function as a member of society, we have two alternatives. One would be to set up a pair of connected shelters a short distance from here and place the individual there without a space suit or vehicle so they could not escape. We could provide the individual with consumables and periodically order him or her to move from one shelter to the other, so the first could be

depressurized, then entered for repairs. The individual would be expected to perform useful work in his or her prison cell, and thus would be contributing to society.

"Six: The other alternative is much more gruesome, but could be necessary under some circumstances: execution. I am not suggesting we discuss and debate this matter this sol because I am sure it will take a lot of thought and debate. But I mention it because we have unusual circumstances up here: we must protect ourselves from an individual who could seek to endanger all of us. As a society we must make every effort to prevent felonies in the first place; even more of an effort than societies on Earth make, because our population density is so high and our life support systems so fragile. But we also must be prepared to protect ourselves as a society.

"Seven: This entire matter will no doubt provoke a discussion of the rights of the individual versus the rights of society. Perhaps I should say up front that my position about this eternal debate is a bit different than many, and it has influenced my proposal. I think our small population and the vastness of the world demands that individual initiative be tapped to the fullest. On the other hand, our high population density and fragile life support systems demand that social cohesion be maintained under all circumstances. We cannot afford a breakdown of law and order. Furthermore—and here is where my view is different from many on Earth, at least—I feel that maximal individual initiative and maximal social cohesion somehow have to be held together in a creative tension. They are not mutually contradictory; just mutually difficult to balance. Government *has to be* an instrument to maximize both, and if it fails in either case it will fail all of us and the society we are building. My hunch is that our technological and

environmental circumstances can allow us to build a society that will hold both together, even though no one has done this on Earth before."

"Here, here," exclaimed Will, nodding.

Alexandra glared at him for speaking without permission. Hands shot into the air; nearly everyone wanted to speak. "I can see this is going to be a long afternoon, and I suspect Silvio's last remarks are going to cost us an extra hour. Okay, folks, we're going to start with questions about the proposal, to clarify its contents, then we'll debate aspects of it. Philosophy comes last! So who has questions? Érico, I need you up here to keep track of who gets the floor."

The town meeting ended only when supper came out and children—who had run underfoot during much of the meeting—had to be fed. Will invited Érico, Silvio, and Alexandra to abandon their families and sit with him to discuss while they ate. "I think this sol went very well," Will said. "It was long and exhausting, and not everyone is satisfied, but the vote in favor of Silvio's procedure was solid."

Silvio nodded. "It means we can proceed to the trial next week."

"What about the matter of the admissibility of the emergency audio and video?" asked Érico. "That's a huge privacy issue."

"Waiting for those arguments are the biggest delay we could face because we'll have to engage legal minds on Earth. We could proceed to trial without the tapes. I think the evidence will be strong enough without them. After all, we will soon know what the medical evidence of sexual relations was, the medical evidence of their degree of

inebriation, and both parties will have a chance to say what happened. Kent can testify as to Sheila's mental state as well."

"We'll have to resolve the issue of the tapes sooner or later, so we probably should wait," said Érico. "We all know there are audio and video recorders in our private quarters, but they are there to determine whether someone is trapped in an emergency. I don't think they should be expected to provide evidence of a crime. If they are used that way, people will have an incentive to deactivate them and that will thwart their purpose."

"Then we may be waiting a few months, which raises the issue of what to do with Chester and how to keep him away from Sheila. Besides, this is a small community and it needs closure," said Érico.

"Someone will have to decide whether to push the prosecution now or later," said Alexandra. "The role of Borough Chair is to facilitate meetings, not manage. The Aurorae Declaration does not envisage what to do in this situation."

"We need more law," agreed Will.

"For Mars, not just for Aurorae," replied Silvio. "The creation of Cassini forces us to separate the two. We need to plan a constitutional convention to draw up bylaws for Martian government, including a legal framework. Relying on Texas law, we've already seen, is problematic."

"But we still have less than a hundred adults," said Alexandra.

"So?" replied Will. "This isn't a remote Australian village; we're a hundred million kilometers from Earth. We're not talking about independence, just civil authority. The Commission is essential to us as a conduit for development, but it doesn't have to provide us with government."

"Then we need another town meeting to appoint a Borough Manager," replied Alexandra.

"We're never going to get any work done," replied Will.

"How's all this going to play out with the public?" asked Silvio.

"We'll see," replied Will. "Louisa says that the criminal act of one individual cannot damage us very much, but our reaction to that act can either raise our prestige or lower it. The wiser we are, the better we will look."

By skipping the issue of whether the audio and video taping of Chester's room would be used, the trial was able to proceed two sols later in the new MarTech classroom, which was set up as a courtroom for the occasion. Twelve jurors were chosen randomly from the eligible population and sworn in; Silvio drafted the oath. Then with Greg Harris serving as defense counsel and Daniel Shapiro serving as prosecutor, they proceeded through the evidence. Eve and Arieh, the physicians who had examined the two parties, testified that sexual intercourse had occurred; Kent testified about Sheila's tearful arrival and played the audio and videotape of the two of them on the patio and in the hall outside Chester's room, as well as the tape of Sheila leaving, clearly upset. Both were given the chance to testify; Sheila did; Chester declined. The jury found him guilty three hours later. He was sentenced to house arrest until he could return to earth, when he faced two to ten years in prison, depending on his behavior.

"I was hoping this verdict would resolve the matter, but now I'm not so sure," Will said to Silvio and Alexandra after the trial ended. They had retreated to Silvio's office behind the store after everyone had left the courtroom.

“Oh, I wasn’t expecting that,” replied Silvio. “The Chinese, the Arabs, and some of the Latins seem baffled by the idea that Chester could be thrown in prison, while the Americans and Europeans largely are outraged by his behavior.”

“And the prospect that he might spend only two years in prison outrages some women,” added Alexandra.

“The cultural divisions are a bit more complicated than that,” said Will. “Some of the Chinese say he got what he deserved, and I’ve heard one American man say Sheila should have known better.”

Alexandra was startled. “I hope you straightened him out.”

“I tried. Those attitudes are hard to change. We have racism up here, too. Ask Friday Nguru.”

“And all sorts of tensions,” agreed Silvio. “Arieh has complained to me that the Arabs won’t associate with him because he’s Israeli.”

Will sighed. “I suppose we shouldn’t dwell on the negative side of life here. We need to plan some dialogues on these issues, and give everyone time off to attend. The Commission needs to schedule more cultural sensitivity into its terrestrial training program for Columbus 7.”

“How’s all this playing in the media?” asked Silvio.

“We’ll see how the trial is received. Louise is calling me with a report about midnight. But she told me yestersol that in several countries there has been extensive media coverage of the issue of rape as a result, and national discourse has begun. So that’s good.”

“Very good,” agreed Alexandra.

“Tomorrow’s Christmas,” reflected Silvio. “We have a good healing period coming up. Many people are taking vacation between now and New Year’s, and there’s Cornelius and Tatiana’s wedding on Satursol. There will be a lot of time to relax together, talk together, and think about what happened.”

“We should start planning another town meeting for later in the week,” added Alexandra. “We need to have the town meeting appoint the Commander as the official Borough manager, so that there is no question that he has authority to initiate law enforcement efforts in a situation like this.”

“That’s fine with me, but I’ll leave the planning to you.”

“I wish this meant I didn’t have to go to Cassini.”

Will chuckled. “Sounds like you’re looking for any available excuse to avoid he trip! I doubt the Borough Chair will have to handle a crisis like this again any time soon. No, I need you in Cassini, Alexandra. I’ve planned to videoconference with both Bach and Curry tomorrow and lay down the law. No more eighty-hour work weeks. Low morale was a contributing factor to this incident. You and your engineers have to look over their mining equipment closely with an eye to making permanent improvements. Chester told me, before all this trouble started, that the cold was causing a lot of unanticipated maintenance. Either the companies have to heat the rock before processing it or the equipment has to be redesigned. Take along your best engineers. They’ll have to spend some time doing construction as well, but they’ll have a new and interesting challenge to tackle.”

“Will, that could take a lot of time. We don’t have experience fabricating mining equipment to work well at forty below.”

“Alexandra, we need the money. Besides, your people love engineering challenges.”

“We already have a few challenges scheduled, you know.”

“Yes, but this one is higher priority than you anticipated. We’ve got to recover more gold, or we have to recover the same amount in fewer hours.”

“Or maybe we should spend less money and enjoy more time with our families.”

“Maybe,” replied Will. “We’re still only four months into Columbus 6; this is the time to work. The relaxation comes later. Tell you what, Alexandra. Get all these tasks done and you and your team will be able to fly back to Aurorae. That’ll save you ten sols.”

Alexandra smiled at the thought, then frowned. “Wait a minute. If the dust storm isn’t over, we won’t be able to fly; and if it is over, you’ll be flying the shuttles back here anyway.”

Will smiled and shrugged. “Then pray the storm will be over!”

7.

Proposals

early March, 2032

Will's stomach growled again. It was March 2d and the first sol of the Bahá'í fast. He had been up before dawn to eat a big breakfast with Ethel, Enrique, and Ananda and it was beginning to wear off. But a videomail from the United States Secretary of the Interior, Barbara Lindsley, was anticipated, and if the rumors were right, it would be intriguing. He activated it.

"Good day, Commander Elliott. Or perhaps I should say 'Good sol'; I gather that's the Martian equivalent. I apologize if I come off as ignorant of your customs up there. Perhaps you've already heard rumors about the proposed project I'm calling you about, the so-called 'Bio-Archive' project. This is a proposal to ship ten biomes to Mars over the next ten years—two every other year, for some reason, though I suppose we could send one per year if that were better—each containing at least five hundred different species of macroscopic organisms adapted to a particular climate. The ten biomes would represent the full range of biomes found in the United States, from Alaska's North Slope to the rainforests of Kauai. Each would be accompanied by a team of at least two trained ecologists. The cost is estimated to be a max of $1.5 billion over the entire decade and a steady $150 million in annual maintenance after that.

"The proposal was made originally by Senator Forest, one of your biggest supporters in Congress, and he thinks we can raise some of the money from agricultural research companies. I understand the concept is controversial; a few critics have suggested it would be cheaper to set up a Kauai rainforest inside a bubble in Antarctica.

I'm told it really wouldn't be cheaper there, though. We forwarded the proposal to Commissioner Morgan this sol and he requested that I copy you directly, and that you would forward it to your Ecology Department. We in the Department of the Interior are excited by the prospect of archiving an entire American biome or environment on Mars, not only for your benefit, but to ensure the environment's survival and to promote research on it. We hope this project proves to be possible at your end. Please let me know you've received this message—preferably by noon—since I am really not sure how to send a videomail to Mars. Bye."

Will smiled as he watched Barbara Lindsley's face fade. She was the wife of the Vice President and had a Ph.D. in the chemistry of water pollution. She was known to be daffy, eccentric at times, brilliant in some areas and utterly ignorant in others. He could see that her reputation matched his experience. He glanced at his computer's chronometer, then when the message was sent: 11:50 a.m. Washington time. She had expected an acknowledgement in ten minutes, which would have required communication at four times the speed of light. Since he just arrived in his office, it was already mid afternoon in Washington. He hit reply.

"Dr. Lindsley, I've just arrived in my office here in Aurorae Vallis—it's almost 9 in the morning here—and immediately listened to your message. We'll review the proposal right away and provide comments on it. We are delighted that so much interest is being shown in our facilities and their expansion and welcome ideas such as this one. I look forward to further communications with you. For your information, this sol Aurorae's clocks are 5 hours and 25 minutes behind yours; in other words, our clocks roughly agree with Hawaii's. Tomorrow, our clocks will be about 6 hours and 5 minutes

behind yours. Because of the slowness of the speed of light, communications take about twenty minutes to reach Mars from Earth right now, and a reply takes twenty minutes to return to Earth. I'm afraid those are limitations on our communication that we cannot overcome. Bye."

He sent the message, then forwarded it to Lisa Kok for her comments. Then he opened the email with the written proposal and read it. It wasn't quite as weird as he thought. Each biome would be set up as a park, but human foot traffic would be allowed in small parts of it and buildings could be built inside it as long as ramps connected the roofs to the lower level to allow the movement of animals up what, to them, would be hills. Up to twenty percent of the interior could be devoted to agriculture and other human uses appropriate to the biome. The proposed ecology was not all "mosses and bugs," as someone had complained; caribou, elk, fox, antelope, key deer, wild turkeys, quail, prairie chickens, mallard ducks, Canadian geese, humming birds, and various other larger species were proposed, even though it was hard to imagine how the larger species would be transported to Mars or would survive in the small space. Guaranteeing the species's survival in spaces that required high population densities was a research priority, as it had implications for preserving endangered species in small national parks. Even burrowers like prairie dogs and mice were under consideration, in spite of the possibility that their sharp teeth could cut a hole in the biome's air-tight enclosure. The ecological research that could result was a major consideration; eleven years of ecological research on Mars had bountifully yielded insights into the nature of complex ecological interactions. Numerous sensors and cameras would allow terrestrial researchers to supplement the two Mars personnel assigned to each biome. A permanent

increase in the construction crew by three would allow the biomes to be set up and maintained, though it was not enough to allow any interior construction.

Will skimmed the proposal and thought about its implications. Then Lisa Kok called. “Will, this is a bit better than I thought,” she said. “Obviously, it’s something we want to support. They’re proposing biomes even bigger than the Bio-50 slated for Columbus 7; probably at least 75 meters across, which would enclose almost half a hectare. It would give us lots of interior space and a wide variety of climates and ecologies to experience. It would bring us considerable ecological expertise that could be used in many other ways. It would result in mass produced biomes that would reduce our costs.”

Will frowned. “We don’t have the capacity to haul domes of that size and mass here, yet. And Lisa, do you really think the science in this plan is rigorous and useful enough?”

“That’s a good question. We do a lot of highly respected, peer-reviewed ecological research up here while figuring out how to raise watermelons on less space and increasing the yield without decreasing the quality of the fruit. I suspect our reputation is one reason the Bio-archive project has a chance. You could set up enclosures on Earth more cheaply, but maintaining the long-term financial commitment to them may be problematic; consider the difficulties faced by Biosphere 2 in Arizona. Everyone knows we’ll maintain them; we have a stake in doing so, the biodiversity enhances our quality of life while improving our chances of survival. You could say the same about the moon, except for several problems; they can and do import a lot of their food from Earth; micrometeorites that the Martian atmosphere stops are a serious

problem for enclosures on the moon, and micrometeoroid protection adds a lot of expense; and the month-long rotation causes lots of ecological problems or requires a lot of artificial light. We have none of those difficulties. Finally, everyone has to be looking outward at Jupiter and Saturn and wondering how human settlements there will be provisioned, and our biomes are the obvious precursor. So ecological research on Mars should have a bright future."

"Even without the issue of terraforming," agreed Will. "You're right about the long term. I still think it'll be hard to justify this kind of expense in the next decade, though."

"Well, let's support the idea and see," she replied. "With transportation costs coming down and the basic technological infrastructure developed, this is the sort of project we can hope for."

"That's true. I'll see what I can do. Thanks, Lisa. Bye."

"Bye." Will closed the circuit. Over forty minutes had passed and Lindsley had replied during his conversation with Lisa. He hit the play icon.

"Thank you for your acknowledgement, Commander. I had no idea Mars was so far away; I thought light was pretty fast to reach planets near the sun. I guess you aren't as close to the sun as I thought. I'd very much appreciate the considered opinion of your ecologists, especially on matters like ground water remediation inside the biome; the high animal densities will general a lot of fecal material. These will be very complex, sophisticated ecologies. They will give us insights how to support the mammalian diversity of, say, the early nineteenth-century Great Plains, on the five percent of the land still available as national park and grassland. If we can convince the environmental lobby

to allow an experiment in a few parks here, intense ecological management could become an important alternative philosophy. The research has profound implications, especially as genetic engineering is expanded in more and more species. I just bought a GEN-401 Cornucopia tree the other sol for my back yard; have you seen them? One branch yields peaches *and* pecans, while another has apples, the third gives pears and the fourth nectarines. The four major branches grafted onto the trunk all have slightly different leaf colors and the flowers are all different, so the tree is extraordinary to look at! Yet genetically, the tree is an apple, more or less. I'd like to see a cornucopia biome up there eventually, with species using photosynthesis five times more efficiently than wild plants to produce ten or twenty times as much usable biomass. An extraordinary possibility. Bye."

Will stared at the screen, then chuckled. He hit forward to send the message to Kok. "Lisa, this is F.Y.I. in case you want to know where the opposition to the Bio-Archive will come from! Lindsley is not as green as she sounds, at least not to ecological purists, especially if they find out what's growing in her back yard. So be careful. Bye."

The next sol the *Pavonis* blasted off from Cassini and flew ballistically to Aurorae, landing on a tail of flame a half hour later. It brought Alexandra Lescov and part of her construction and engineering team back home, as well as some geologists exploring the northern hemisphere and a few company people taking some vacation time. The dinner on the patio that night was big, as it usually was when a shuttle or an exploration team returned safely. As the meal was winding down, Alexandra stopped by Will's table and offered her hand to him. "So, did I do good, or what?"

“You did great, Alexandra; it deserves more than a handshake.” Will rose from his chair and gave her a hug. “Cassini building one is completely finished, Cassini Biome is filled with soil and plants are growing, the microwave power link is up and working, and some of the worst design flaws in the mining machinery are patched.”

“Of course, it took all of nine weeks, and I had hoped to be back in four or five. But once I was there, we all had a pretty interesting time.”

“You seemed to be enjoying the challenges, according to Emily at least.”

“Oh, we were. The biome work was routine; we had just finished Catalina, so it was easy. The mining equipment was the most difficult problem, but we have a lot of experience with breakdowns in excavation equipment, and that was the key problem for both companies. The new, heavier parts should reduce the maintenance quite a bit, though an entire redesign and new parts manufactured on Earth to the revised specifications would be best. And the power transmission system was plain fun! We knew it would work and the locations of the transmitting and receiving towers had already been finalized. It was a matter of setting everything up and calibrating.”

“You’re using pretty high power densities too, aren’t you?” asked Ethel, who was listening.

Alexandra nodded. “Three kilowatts per square meter; almost three times the power density of sunlight on Earth. A 500 kilowatt transmission array needs to be a bit over twelve meters across. No one would dare use power densities that high on Earth because of the danger to living things, but we have plenty of land to declare off limits here.”

“And the efficiency is about seventy percent?”

“Yes, that’s how much power comes out at the other end, with one relay in between. We set up a relay tower on top of one of the highest peaks on Cassini’s eastern rim, where the horizon is about 100 kilometers away. Just about all the major gold fields are within range.”

“Now we have to set up a relay on Phobos,” exclaimed Rosa Stroger, who was sitting at the next table over, breast feeding her two-month old daughter and listening to the conversation. “The pointing technology has to be a lot more precise and is more expensive, but it’s cheaper than wiring the planet.”

“Right on,” agreed Alexandra. “Say, how did that repair to the reactor go?”

Rosa nodded. “Pretty well.” Just two sols earlier she had taken one of their six reactors apart using remote manipulator arms and welded a patch in place over some cracks in the vessel.

“Do you think we can build our own natural uranium reactor, Rosa?” asked Alexandra. “Because we are now entering an era of potential energy shortage. Six reactors were enough to power everything during a dust storm in Columbus 5, but they weren’t enough this time and will be even less adequate when Columbus 7 arrives with another 40 people. We were lucky Cassini was spared by the storms; if it had been souped in as well, the folks there would have been huddling in their Mobilhabs with the lights turned down low, conserving power and doing no gold recovery.”

“We need to build a lot more methane storage tanks,” replied Will. “We can store the power to ride out a major storm.”

“We can, Will, but we need more nukes,” replied Alexandra. “This trip has made me realize it more than ever. And as Ruhullah can tell you, some pretty good uranium deposits were discovered north of Cassini.”

“How could we possibly build a reactor?” asked Will, skeptically.

Alexandra looked at Rosa, who was in charge of their reactors. “Well, we’ve been accumulating heavy water for export, and we now have about a tonne. And we can make graphite moderators from the accumulating plant matter in the biomes.”

“I’d go with the heavy water, like the CANDU design,” said Rosa. “It’s tried and proven. We’ll need a lot more deuterium, though. It’d be best if we imported the vessel, steam generator, and turbine from Earth; the efficiency and safety would be better.”

“Flying them here would be controversial,” noted Ethel.

“Yes, but much less so than flying a fully fueled nuke,” replied Rosa. “The equipment is not dangerous to Earth because it would not include anything radioactive.”

“You know, this would have been a crazy idea two years ago,” said Will. “First, we wouldn’t have needed such a reactor; second, there was no money to build it. But now we’re bigger, and the gold potentially changes everything. We might be able to persuade the Mars Commission to support the project. How big would this nuke be?”

“Ten to fifty megawatts,” replied Rosa.

“Now, what about the argument that we can import a solar cell manufacturing facility for a similar mass and probably for less cost?” asked Will.

Alexandra hesitated. “My concern would still be dust storms, and I don’t know whether we could get a facility that can make solar panels fast enough for that mass.”

“Not to mention the personnel we’d have to devote to the manufacturing process,” added Rosa.

Will considered a moment. “Okay, put together a proposal that I can take to the Commission.”

“I’ll work with Rosa,” said Alexandra. “The other implication of this idea is that we could build a breeder reactor using heavy water and convert uranium 238 into plutonium 239. A plutonium-uranium mix could be manufactured into fuel rods for reactors on the moon, nuclear engines, etc. The current American administration is opposed to lifting radioactives to Earth orbit. Maybe we could become the chief supplier instead.”

Yevgeny Lescov, their Director of Exports, smiled. “That’s a big potential income.”

“But oooh, controversial,” replied Will. “Because it would include the capacity to manufacture nuclear weapons. I don’t think the international community is ready to deal with that issue.”

“You’re probably right,” said Alexandra. “But it’d be pretty easy to monitor us; the fuel reprocessing facility could be filled with cameras.”

“Yes, but the fear would be that if we turned off the cameras, we could build a bomb before anyone could stop us, because of the distance,” replied Will. “It would be a big act of trust to permit fuel reprocessing here. It isn’t impossible, but I can’t see it happening any time soon.”

Alexandra nodded. “I suppose we should focus on our own technological milestones, like beamed power.” She looked at the setting sun, which was crossing the

entire length of the yard to them. “It’s nice to see the sun here again. I assume, after a short vacation, my people can resume work on Riviera?”

Will nodded. “A lot of the materials are ready, too. We did a lot of fabrication while you were away. The textile weaving machines were set up, too.”

“Oh, good. By the way, how’s the prisoner holding up?” asked Alexandra.

“You can ask Greg; he talks to Chester every morning. You can also ask Chester himself, if you want. He’s permitted to come to the patio every morning between 9:30 and 10 a.m. and can visit the store at the time. It’s the only trip outside his flat that’s allowed except a trip to Martha’s office if she can’t get to his flat. Apparently his morale is improving and Greg says he’s beginning to accept why he is being punished. Silvio’s beginning to ask whether ten years of this sort of arrangement isn’t sufficient punishment, if his behavior improves as a result of counseling.”

“Mars might not need prisons after all,” noted Alexandra.

It was the next afternoon when Will tried on the first pair of pants manufactured on Mars. He walked across the textile manufacturing area in them, then stopped to admire the pants in the mirror; then walked back across the room. “They feel a little stiff,” he commented. “Or even thick, like wearing cardboard.”

“Oh, don’t say that!” exclaimed Susan Jung, their fabrics specialist, who had supervised the manufacture of the pants. She scribbled some notes on her attaché. “I think the thread is a bit too thick. Next time, we can weave it with a thinner thread. The cloth does have a bulky feel to it.”

“Yes; maybe that’s better phrased. How much cotton’s in it?”

“Forty percent, and sixty percent polyester. We’d use more cotton, but we don’t have enough right now.”

“Wash and wear?”

“Yes, it’s treated to hold a crease, but as you can see, I may not have done the process correctly.”

“They do seem a little wrinkled.” Will looked again. “It’s exciting to wear clothes we made here.”

“And we’ll save a lot of imports,” added Susan. “We’ll have about 150 people here by the end of Columbus 7; more if we have more children. If each one imports 10 kilograms of clothes per columbiad, that’s a tonne and a half.”

“And how many did you make?”

“Oh, just these! We made enough cloth for one pair of jeans, and cut them according to your specifications. You should see the automated, computer-controlled equipment at work.” She pointed to a unit about the size of two refrigerators side by side, nearby. “That thing can take loose cotton and/or raw polyester fiber, spin them together to make a very strong thread, spool the thread, then feed it into a power loom for weaving. It can make everything from sheets and handkerchiefs to rugs and canvas.” She pointed to a device about the size of a piano. “And the tailoring flatbed can take a length of cloth, spread it out, pin it in place, fold it and pin the fold, cut either the top or bottom piece or both, remove the scrap pieces, sew seams automatically, and a lot more! It can embroider fancy patterns in a matter of hours. And it has several thousand different designs.”

“So we can make everything from blue jeans to wedding gowns?”

“Oh, yes! It’s quite versatile. Of course, we don’t have the right fabric for wedding gowns!”

“Not yet.” He looked at his pants again. “They feel a bit tight.”

“Commander, the computer doesn’t lie! You must have put on some weight since the measurements were taken.”

“Come to think of it, I have. The increase in the availability of sugar here lately has caused all of us to eat more sweets, and I’ve gained a kilo or two.”

“There, you see! Why don’t you wear them a while; maybe to dinner, and show them off.”

He smiled. “You’re trying to drum up business with Diponte! But sure, I can do that. Why don’t you make another pair with thinner thread; let’s see what that feels like. I’d make a dozen sets of pants for different people and give them a chance to try them on and test them for a while. We need to see how the seams hold up—”

“Oh, they’ll hold up fine, they’re double sewn!”

“Good. But we still need to test for shrinkage and other possible factors. Let’s make sure the design is right before ordering new uniforms for everyone. That’d be a big order and would take a lot of work to fulfill, so let’s not take the chance that it’ll be wasted because of some error. Meanwhile, you can make towels, sheets, window curtains, etc., for a month or two. Have you planned what you can make for sale at the store?”

“We may not sell clothes on the rack through the store. It makes more sense, with our small population, to let people order what they want and make it for them. The patterns we have are standard ones from reputable manufacturers, and the manufacturers

will get a royalty plus they will be able to advertise that their clothes are made on Mars. So they will post a catalog to the Aurorae website containing the designs we can make. People can select the color, weave, etc., and we'll make in a week or two, depending on demand."

"What will be the price?"

"About five times the price on Earth, but that'd still be about half the import price."

Will nodded. "Good, that sort of ratio should work if the quality is adequate."

"That's what Silvio said, too. He thinks we'll capture a major part of the gift market up here. People want to give each other birthday presents, but unless they plan far ahead, the pickings are slim."

"He's right." Will glanced at his watch. "Well, I have to pick up the kids, then walk to supper. Let me know when you have more to show me."

"Okay. Next time, let's show Ethel, too."

Will nodded and headed toward the rampwell. He hurried down to the ground level and through the tunnel to Yalta. He crossed the patio, already filling with people eating supper, looking for his kids. Marshall, now seven, was throwing a baseball to his friend Sam Anderson in the clover patch in the middle of the yard.

"Why are you carrying pants?' asked Marshall, when he saw his dad approaching. Then he made a face. "*What* are you *wearing*?"

"Pants!" replied Will, a bit defensively. "What's wrong with them?"

"They're ugly!"

"No they aren't. They're just a style you're not used to."

“You see them in the movies and on t.v.,” said Sammie.

“Correct,” said Will. “They’re called blue jeans.”

“But they aren’t blue!”

“These are a dark blue, but in this reddish light they look more black. Never mind. How was school?”

“Ms. Hijazi took us on a field trip to Catalina Biome to catch butterflies!” exclaimed Marshall. “And we actually caught one! A swallowtail!”

“What kind of swallowtail?”

“Oh, I don’t remember. And she told us that pretty soon there would be a lot more biomes, each representative of a different climate in the United States; maybe ten of them!”

“She’s right.”

“But then she laughed at you,” added Sammie.

Marshall looked hurt that his friend brought it up. “She explained to us that the purpose of the biomes was to bring all the plants and animals of a certain place here, so the entire group of living things could continue to live in harmony with each other. She explained that Mars would be kind of like Noah’s ark. But then I asked whether they were bringing elephants and giraffes and lions here, and she laughed.”

Will laughed. “She laughed, Marshall, because you were so smart! You see, the plan is supposed to be what you said; a complete sample of all plants and animals. But no one is willing to haul the really big animals here.”

“Why not?”

“It would be very difficult. It would be hard to handle an elephant during a launch, in weightlessness, and in landing. How would you feed it for six months? What if it pooped in zero-g? And when it’s here, pretty soon it would eat more food than the biome could make for it; what then?”

Marshall frowned. “But then, what sort of plan is this, to make a Noah’s ark here?”

Will laughed. “A silly plan, that’s what. Sometimes adults are silly. But it might happen anyway. Come on, let’s get some supper.”

Will led the boys over to Lizzie, who was so busy playing with Corazon she didn’t want to eat supper, especially since she knew it meant she’d have to go to bed afterward. They all went through the food line; Will focused on supervising the children because the sun wouldn’t set for another two hours, and during the Bahá'í Fast he couldn’t eat until the sun was gone. By the time they were finished Madhu and Érico had showed up, so Sammie and Corazon went to eat with their parents. As Will, Marshall, and Lizzie sat, Ethel arrived at the patio. She soon joined them at the table as well with a full plate; even though it was the Fast she was eating, thanks to the exemption for menstruation. The family always ate supper together at the same table; at lunch, however, the kids could eat with their friends and teachers if they preferred. It was a uniform rule among all families, with few exceptions.

They talked about their adventures of the sol. Will’s was his new pants, which Ethel liked. Marshall told everyone about the butterflies. Lizzie had had dancing lessons that she had enjoyed. Ethel had finished programming a lathe to cut a complex metal

shape needed to strengthen one of the mining machines and she had tested it on a sheet of plastic. She looked forward to making the part the next sol.

As the kids were finishing, Ruhullah Islami walked over, a cup of coffee in his hand. “Good evening,” he said to Will and Ethel nodding. “And happy Fast to you.”

“Thank you, Ruhullah,” replied Will. He was pleased that the Muslim had acknowledged the Bahá'í Fast; Ruhullah had been extremely uncomfortable with Will and Ethel when he had arrived, because there was a long history of Islamic persecution of Bahá'ís in Iran. “It’s a beautiful evening, isn’t it?”

“Yes. Thank God the dust storm season is now over; the weather is now pleasant in here.”

“I really hope we can get more nukes; it would prevent the disruptions in our schedule.”

“We’ll see; the matter is under consideration in Houston. We sent the preliminary proposal to them a few hours ago. There are other solutions to our energy crisis that work as well or even better. We’re already building more methane and oxygen storage tanks so that we can store energy for the storm season. We can make wind turbines pretty easily, and they’re effective most of the time the solar power units aren’t; we got a lot of power from them here. And the Commission could manufacture and send to us a plant to make solar panels for less money than a nuclear reactor and a similar mass.”

“How many people will it tie up, though?”

“Several, but it’s a safer renewable energy supply than a nuke.”

“But it’s less exciting.”

“And less controversial.”

“That’s true.” Ruhullah smiled. “As you know, we found some pretty big uranium deposits down in Deuteronilus. In a few decades we might be supplying a major portion of Earth’s uranium. I’d love to lead an expedition down to excavate yellow cake and truck it back here. Keep that in mind.”

“Sure, I will. I wouldn’t be surprised if we don’t send down an expedition before Columbus 7 arrives. But it may be after Columbus 6 leaves.”

“That’s alright, Commander, because I’ve been thinking about my commitment to stay two columbiads. I’m doing very rewarding work and having a good time doing it, and I’m helping build a new kind of community. So, perhaps, I’ll settle here.”

Will smiled a very big grim. “Excellent! That’s what I like to hear. You’ve made my sol!”

Ruhullah was embarrassed. “Thank you. I hope I can do more here, also. Maybe we could talk some time about other tasks I could try. I’d like to develop some new talents.”

“I’m glad to hear it; we need everyone to be able to do at least two jobs well, preferably three or four! What would you like to try?”

“I don’t know. If you had any need for administrative help, I’d try my hand there.”

Will shook his head. “I wish administration didn’t take so much time already. It’s all my time, half of Daniel’s, and a quarter to a half of all the heads of staff. We’re hiring a few more high-powered administrative assistants on Earth to simplify the work we have to do.”

“With all the coordination problems that result.”

"Exactly; the time delay requires novel communications strategies. If there's an opening, I'll let you know."

"Thank you, Commander." Ruhullah smiled and walked away. Will thought about Ruhullah's request for a while; it was intriguing.

Will and Ethel walked home with a plate of food Will would eat in another hour when the sun set, while Marshall and Lizzie played for another hour in the yard. It gave the parents an hour of relative peace and quiet. After sunset and the descent of darkness on the yard, the kids came in and the Will ate supper, then the kids went to bed. About 9 p.m. Will turned back to his attaché to see what communications had arrived. His sister had videomailed from her new house in Santa Cruz, Bolivia, where the family had settled. He sent her a quick message in return and copied his mom; he tried to be in touch with them twice a week, which allowed some level of family life to continue in spite of the distance. Then he spotted a message from Doug Morgan, which he immediately played.

"Will, thanks for the proposal for a reactor fueled with indigenous uranium. Your people did very thorough research in very little time; the capacities you are developing up there are to be commended. The proposal, of course, will be controversial, not only because of the opposition to nuclear power down here, but because solar power will get much cheaper up there once you can make your own panels. I still think that's the better way to go, especially with a pilot plant operating on the moon that could be copied, but I'm willing to entertain alternatives.

"Now, let me tell you about my conversation with Daffy Duck earlier this morning; er, I mean with the Secretary of the Interior, Dr. Barbara Lindsley. Sorry, I

can't resist; it's not just that she's a Democrat, but that she's so goofy sounding. Please apologize for my partisanship, I know it offends you. Here I go, sounding like her! Anyway, she and Senator Forest plan to push the legislation forward for the next fiscal year. I argued that Bio-Archive is not only a biological backup for Earth, but a biological self sufficiency for Mars, and should be coupled with an effort to develop Mars's self sufficiency in other areas as well, such as dome manufacture and power generation. Those two areas would greatly reduce the overall cost of Bio-Archive because the domes being proposed are really massive—very expensive to transport—and they require power. An 80-meter dome that encloses a half hectare of land, four times the area of your 40-meter domes currently in use, would mass eight times as much, or sixty tonnes. That's far more than we can launch into low earth orbit, aerobrake into Mars orbit, or land on Mars. She seemed to appreciate the idea that sixty tonnes of equipment to manufacture tefzel, teflon, PCTFE, and kevlar, would be a better investment, and she was keen on the idea that the plastics manufacturing companies might want a grant to develop such an automated manufacturing facility, because they could use the technology to make their own plants more efficient as well. Finally, I argued that the only way to do a project like this was to put as much of the approved costs up front as possible, because there's no guarantee Congress will be in as generous a mood ten years from now. Bio-archive could get funded for its first few years and then abolished otherwise. With the economy booming right now, this is the time to make a request for big bucks. She agreed, so I'm hiring a few consultants to develop the project and we'll award some contracts. We'll pursue Bio-Archive vigorously, and related projects like plastics and solar cell manufacturing. There's still time to get something on Columbus 7; the Hohmann cargo

launch is scheduled for a bit more than a year from now. The reactor project is for Columbus 8 or even Columbus 9, so we still have some time to develop it. Bye."

8

Vacation

early June, 2032

"In short, Senator Stutz, this proposal is good for the United States in several significant ways, as well as promoting the biodiversity of New Mexico and producing jobs in the Albuquerque. We'll put much of the country's significant biodiversity on Mars, which means American species will play a bigger role in developing this other world, and other countries will be encouraged to archive their various biomes in response. We'll assist Consolidated Mining in significant ways because domes and power will be cheaper and more plentiful; and as you know, Consolidated has several significant operations in New Mexico.

"Finally, let me add a note about the potential bipartisanship this project represents. As you know, in some ways Mars has been out of favor in Washington for the last two years. I think with this project we have a chance to set the relationship on a positive footing again. It's a project good for America and Mars; its good for Martian exports and American mining interests; it's about as green a project as you can imagine, so it's good for everyone's environment. I hope we can count on your support. Let me know if I can answer any questions. Bye."

Will stopped the recording, then hit send. He had followed the script on his screen perfectly and had sounded natural; he was getting better at the lobbying business. Stutz was a prominent figure in Congress and had been mildly against the project, though Louisa Turner thought he could be brought around.

He turned the page to the message he was to send to Senator Talcott. Will was most of the way through the Senate membership; customized two to three-minute messages for all the senators were taking almost two full sols of his time, especially since every office was acknowledging and some were asking additional questions that he had to answer. It was becoming a problem; he had a lot to get done before starting on his four-sol vacation. And Talcott would be a tough nut to crack. He had a long voting record of opposition to Mars exploration. Will skimmed the message Turner had tailored for him. She was a genius at making persuasive arguments and he had to admire her persistence and hard work. But the message would require a lot of care and earnestness and he was tired. He couldn't handle it, yet, so he turned to his message box. Sebastian Langlais had written from Shackleton Station, a collection of regolith-covered habitats and other structures strung out along a crater rim near the lunar south pole, catching near-eternal sunshine. It would be a much more interesting and relaxing message to listen to.

"Good sol, Will," he began. "I'm giving you a call to let you know that our director of ecology, Jaime Grondahl, will be contacting Lisa Kok about the larger biomes proposed for Bio-Archive. I'm glad to see the bill is moving through Congress. I've even called some of our supporters and told them to refrain from criticism. Because of geographical limitations, we really can't host a project like this. In the entire south polar region there are only twenty peaks that get sunlight 75% or more of the time, and we can't be tying up the peaks with biological archiving facilities. We've already got solar power or other facilities on twelve of them, and all twelve are the peaks within fifteen kilometers of the station. Where would we put a bio archive?

“But we do need biomes. Jacaranda Biome opens next week; it’s the first in the new fifty-meter line that you’re getting next year. I wish it had been as easy to build as yours! It wasn’t easy transforming Palmer Pinnacle. You probably remember it, I think you and David explored it pretty thoroughly back in ’16. We basically had to reverse the peak, digging out the middle and pouring the regolith and rock into a circular wall as high as the dome crest. It gives good micrometeorite protection, but we have only a few small windows so we can see outside. The circular walls and the track for the mirror above the dome were exhausting to build in spacesuits; the joke is that we now have the experience to build a lunar railroad. The mirror is pretty heavy, also, because it’s mounted on two big uprights forty meters high and is covered with micrometeorite-proof kevlar blankets. But it tracks the sun well. Overall, it was by far our most complex construction project. The results will be reasonably good; Jacaranda has sunlight continuously except for four periods of six, fifteen, twenty, and thirty-nine hours each. The last period of darkness needs low level artificial light, but the others don’t. Insolation varies from as high as terrestrial normal—which is really too much, twenty-four hours a day—to one percent, and it’s over fifty percent for about 75% of the month. It’s quite good for plants, though it’ll be strange for anyone to live in.

“But we really need bigger biomes. There are two peaks within 600 meters of here where we want to replace the solar power systems with biomes, and the peaks can accommodate biomes up to one hundred meters across. It’d be a waste putting something smaller up there. A cluster of four fifty-meter domes would be possible, but it would be complicated to build their mirror systems. So we want to coordinate biome plans with Mars. I assume you’re planning to manufacture biomes there, rather than hauling the

plastics from Earth. We'll have to buy more nitrogen from you, but our carbon supply isn't bad now, between the dry ice we're recovering and the sewage we're hauling in. Let's work together on this.

"Anyway, I hope you and your family are well. My son's application for Columbus 7 has been accepted, so you'll be shaking his hand in about 17 months. I just hope he comes back! Bye."

Will paused to think about the message; he was intrigued. He hit reply. "Sebastian, I'm glad we can work together on biomes. Tell Jaime to call Lisa any time; he's free to copy me as well. I think it's a shame we haven't worked together more in the past, but there's a certain amount of rivalry in Houston between our headquarters, so admittedly there's not a lot we can say. As a result we developed biomes, and you had to figure out how to adapt them to the moon; and you developed microwave power transmission, which we had to adapt to Mars.

"We're arguing that Bio-Archive is practical if we can make the kevlar, teflon film, tefzel, and related plastics here. The hundred-meter dome you're talking about would mass sixty-four tonnes, plus twelve tonnes more for support equipment; it isn't practical to lift it from the Earth twelve tonnes at a time, even to the moon. But with twenty or thirty tonnes of equipment we should be able to manufacture one roughly every year. And with proper equipment you could, too; if you need carbon dioxide and nitrogen, remember Phobos is your closest source, in terms of delta-v. So we'd be happy to work with you.

"There's another matter we'd like to collaborate on as well: power generation. We're probably going to get a plant for manufacturing solar cells based on yours, but if

you've been reading the news, the big idea here is building a reactor here at Aurorae using natural Martian uranium. Right now we're being quiet about the idea because the Bio-Archive project is supported by many environmental groups, and they would definitely oppose the reactor. But I suppose a reactor is inevitable, now that we've found uranium reserves. Some geologists say Mars could be a source for Earth in a few decades. If there's any place that needs a reactor, it's the moon, especially out of the polar zones where sunlight is lacking two weeks a month. So we have a natural alliance where nukes are concerned. I'll suggest that Rosa Stroger and Alexandra Lescov talk to your power and construction directors.

"I'm glad to hear Helmut's coming here; we're all looking forward to meeting him and making him welcome. All is going fairly well at the moment. Cassini's set up, the mining equipment is finally working pretty well, and they've come up with a system of exploiting the very richest gold deposits, thanks to the muon scattering instruments. Our third biome, Riviera, is scheduled to be pressurized next week and the outer structures of the two buildings, including the rooftop gardens, are scheduled to be completed in three months; early September. Shikoku follows six months later and will be ready before Columbus 7 arrives. Otherwise, there isn't much news up here. Marshall's seven and Lizzie's more than four and a half; she starts kindergarten this fall. They're both excited by our plans to take a four-sol family vacation together up at the escarpment this weekend. It's our first outside the Outpost, and Marshall's going outside in a spacesuit, so he's thrilled. Bye."

Will sent the message. He was about to turn back to his work videomailing Senators when a new message popped into his box from Doug Morgan himself. Will activated the Commissioner's videomail.

"Good sol, Will. You're doing an excellent job contacting the Senators; we seem to have swayed two Senators already to vote for Bio-Archive. But now a new complication has arisen and I thought I should let you know about it. Three Senators from Montana, California, and Alaska plan to introduce an amendment to the bill tomorrow—on which their support will depend—insisting that the tax money be spent on American firms to manufacture the biomes or the equipment to make the plastics needed to make the biomes on Mars. As you know, the biomes now come from Canada, though the plastic manufacturing units can come from the U.S. The amendment will also specify that the equipment must have a use toward opening the gold fields at Dawes to American mining companies. The Bio-Archive would not have to be built at Dawes, but the biome making equipment would have to be used in some way to support a Dawes Outpost. This is a fairly underhanded way to get Dawes Outpost approved, and to strengthen the hand of Consolidated or possibly of Stanwood Mining if they follow through with their interest and negotiate a lease of mineral rights. I know this will be difficult for you, but we may have to accept it. Bye."

Slightly horrified, Will immediately hit reply. "Doug, good sol. Please do anything you can to get this amendment killed! The logistics of supporting two outposts is difficult enough; three would be even harder, especially when you remember the gold fields there are at too high an altitude to use sunwings very much. We'd have to ship everything there by shuttle or robotic truck. Mars will barely have 140 people during

Columbus 7. Cassini's supposed to be occupying eight of my people and it's occupying more like eleven. I'd rather not make resource allocation even more complicated. And don't forget a small outpost needs about twice as much mass of stuff as the bare minimum to guarantee life support redundancy, whereas a larger outpost needs only twenty or thirty percent marginal capacity. It's easier to double the size of Cassini than to build Dawes, and it'll get us just as much gold! Bye." He hit send and had to sigh. That was the danger of basing Mars exploration on politics rather than science and reason; the political process could cause as much havoc as benefit.

Will turned to his other tasks. Lately there had been some strange discrepancies between the daily gold production reported at Cassini—usually around 50 kilograms each for Consolidated and Muller—and the amount credited to the companies by the Commission. The discrepancy typically was less than ten grams and no one could account for it. Dan Shapiro emailed Will that the problem seemed to be caused by conflicting estimates of the gold production; the gold particles typically had a small quantity of silicate rock fragments stuck to them, and when that was accounted for the gold production had to be adjusted downward slightly. That struck Will as a strange explanation because the gold dust was thoroughly cleaned before weighing and not weighed again, so he forwarded Dan's email to Yevgeny, with a request that he look into the matter as well. There were also complaints that the value of the gold was consistently less than expected, but it turned out that the insurance on the shipment back to Earth was higher than anticipated. He had already forwarded that concern to Silvio for checking.

When the sun began to shine across the floor of the bridge and into his office he knew the sun was getting fairly low and it was time to go to supper. He didn't even need

to use a watch to know it was about 6 p.m. He headed for Yalta to play with the kids for half an hour, then take them to supper. After they finished eating, Alexandra stopped at their table.

"So, swimming and hiking, huh?" she said to Marshall.

He nodded. "I can't wait! We're going outside!"

"Well, you're a big boy now."

"I hope so," added Will, looking at his son worriedly.

"And Sammie's going along?" asked Alexandra.

Marshall nodded. "And Corazon, and their parents!"

"Oh?" She hadn't realized Érico and Carmen were going on the trip as well. She had known about Roger and Madhu.

Ethel nodded. "It's more fun for the kids. The boys will share a bedroom, the girls will share a bedroom, and they'll have a grand old time. We're also doing a virtual tour of a few cities and of Disneyland Paris. And Will has promised to do most of the cooking."

"Not most! I said suppers!"

"Whatever," replied Ethel. "I'm advocating some vacation space at Cassini; we'll get away from our responsibilities and still have a cafeteria where we can eat."

"Of course, if we go to Cassini I'll have meetings," replied Will. "Besides, I'm not sure I'd fly kids that far. Our transportation system isn't safe enough yet."

"That's a good point," agreed Ethel.

“Well, have fun,” replied Alexandra. “Yevgeny and I went up to the dacha last month for a week and it was marvelous to have a change of pace and some peace and quiet. And Will, don’t worry; everything here will be fine.”

“Oh, I’m sure the Borough President can handle everything,” he replied. He had appointed Alexandra the Interim Commander in his absence.

“Things should be quiet. The construction is all enclosed now, so it’s safer. And tomorrow’s conjunction, so communications with Earth are quieter.”

“Not much,” replied Will. “Magellan Station will relay half of our usual traffic for us.”

“It’s not a vacation time any more,” added Ethel. “Communications don’t drop noticeably. I think the better time for vacation is opposition, when one needs time to talk to family members!”

“Most people took some vacation then,” agreed Will. “Anyway, Alexandra, my communications will work normally, so you can always reach me.”

“Better not send emails or videomails; I won’t let him look at them,” added Ethel.

“Thanks for the warning. I agree, you all need to relax. Four sols isn’t much, either. Have a good time.”

Two sols later, three families climbed into two rangers loaded with their food and clothing for four sols and drove up to the “dacha” on the top of escarpment. The facility had improved in some ways since it had first been built two years earlier, though the size had not increased significantly: inside the thirty-three by eight meter bubble was a building in the middle with a great room, kitchen, and sauna on the first floor and four

bedrooms each on the next two floors. Plans to build a second building for guests had been scrapped; the initial facility had proved large enough, and when more space was needed they would probably add another bubble. A garage for three rangers had been built on the east side of the building; its roof, “the deck,” serving as a dance floor or sports area; it had a basketball hoop. The open area to the west of the building now had a large swimming pool; for most of the first year every ranger going to the dacha had hauled up a tonne of ice, which was melted and added to the pool. Around the pool was a patio where people could sit in the sun to read; the bubble’s protective films screened out the ultraviolet. The far western tip of the crescent-shaped bubble had potted trees and flowers and was a nature corner. Part of the transparent floor extended beyond the cliff edge, so one could literally stand in the air to look down and outward at Aurorae. That corner rested on a small promontory that extended beyond the usual escarpment edge, giving one a view of the canyon system on three sides.

The children were thrilled to visit the dacha and immediately ran to the western edge to look at the canyon; the girls wouldn’t stand on the transparent floor and were teased by the older boys until Roger came along and stopped them. Everyone went to their rooms to unpack and settle in a bit.

“Let’s go outside!” shouted Marshall, running through the second and then the third floor, once he was unpacked.

“Hey calm down!” exclaimed Will, irritated. “Don’t worry, we’re just about ready.”

Ten minutes later, Roger, Madhu, Érico, and Will were suiting up and helping Marshall and Sam, seven and six years old respectively, to do the same. The boys had

special suits that adults could control remotely; all the suits could be connected together with hoses for “buddy breathing” if necessary. Under such circumstances it was safe to take the boys outside, though they had a rule that there always had to be one more adult along than the total number of children.

It was a simple excursion, but thrilling for the boys. They walked about a half kilometer eastward along the rim, though back from the edge most of the time; when they reached the point where the rim turned northward and followed Little Colorado Canyon, they turned as well and walked about a kilometer to the north until they visited the natural bridge; then they walked southwestward across the plateau for about a kilometer to a crater about 140 meters in diameter and went down to walk around. Finally, they walked back to the dacha. Sammie was utterly exhausted; Marshall was pretty tired, too, but both boys were thrilled. Other than a few ranger rides and one other excursion outside before the dust storm season, they had never been out of the terrestrial environment before.

Carmen had prepared a feast while Ethel had played with Lizzie and Corazon. They all ate together, the boys looking more and more bleary-eyed. After lunch the kids all went to take a nap. After the adults washed the dishes, Will looked at his watch. “So, we have what? Another hour before they wake up?”

“About that,” agreed Carmen, glancing at her attaché. It showed a picture of the bedroom upstairs where the two 4 ½ year old girls were sound asleep. They had been able to get permission from the Outpost to transmit the picture from the room’s camera to her attaché, to serve as a sort of baby monitor.

“Let’s go outside and enjoy the sunshine,” said Ethel, leading the six them out to the patio by the pool. They carried the attaché and glasses of iced tea to a table and sat

facing south and the spectacular view of Aurorae Valley stretching from a meter or two away from them all the way to the horizon.

"I hope the kids don't sleep too long," said Madhu. "They'll want to stay up and play all night, and there will trouble tomorrow."

"We'll take the boys out on another excursion," said Roger. "That'll prepare them for another nap!" He stood and took off his shirt, then sat on his chair to enjoy the sun.

"They're growing so fast," remarked Will. "It's hard to believe. Marshall and Sam will graduate high school and begin university in eleven years."

"Yep," agreed Roger. "And I'll be 62, and will have to wonder whether the family should go back to Earth now or never, because I won't know how long I'll be able to fly."

"Older than 62, my dear; there have been 75 year olds in space," replied Madhu.

"I wonder whether the kids will want to go to Earth for university?" said Ethel. "MarTech should be pretty good by then, though I suppose Earth will have an allure to it."

"Marshall's already fascinated," agreed Will. "It'll be hard to keep them here. By then I hope we have a free round trip policy; say, one trip every 17 years."

"It'd be the stuff of a movie," quipped Carmen. "Imagine an 18 year old arriving on Earth, never having driving in an automobile before, never having seen an ocean or big animals."

"Not to mention having weak bones and virtually no immunity to terrestrial diseases, and no familiarity with muggers and con artists." Ethel shook her head. "I'd rather have them stay here."

“I can’t see it,” replied Roger. “They’ll learn. They’re human beings; they have to experience the mother world, because that’s the only world human beings know, except a tiny handful.” He looked at Madhu. “I suppose we’ll go back then as well.”

“If Will can arrange that free round trip, we could go back for four years while Sam’s in university, then fly back here,” said Madhu. “I think I’d rather be here, health problems or not. I love the art I can do here. No place on Earth can give a similar inspiration.”

“Where do all of us want to be in ten or fifteen years?” asked Will. “I’m curious.” He looked at Carmen.

She scowled. “Will, you always want to plan, plan! We’re on vacation, remember?” She paused and saw that he didn’t seem fazed by her complaint. She shrugged. “I enjoy engineering and running our communications systems. If Corie wants to attend a university on Earth, maybe we’d go back, or maybe we’d stay here and beg her to return. There are plenty of careers here, after all. If the place keeps growing and attracting young, bright people, it’ll remain exciting.”

“True, and there will be fairly good choices for spouses here by then,” said Will. He looked at Ethel.

She shrugged. “There are always new jobs to do here, and some pretty interesting people. And after being here twelve years I have roots here. The roots on Earth are much weakened.”

“That’s true,” agreed Roger. “Say, Will, when are we going to update that Martian geology text we promised to update? It won’t earn us royalties pretty soon if we

don’t produce a second edition! I’d rather stay and continue the research. I’ve been bitten by the exploration bug.”

“Let’s schedule some time later in the summer,” replied Will. “I think my life will be in more of a routine by then. This columbiad started out crazy, as they usually do, and has gradually settled down.”

“As always,” agreed Roger.

“You know, I never thought I’d like this place,” said Érico. “When Columbus 2 left Earth I was counting the sols until I’d be back, and famous in all of Brazil. But here I am, settled down and doing good science and good engineering. I’d just like a few more expeditions, Roger.”

“We have a lot of chiefs and not many Indians,” Roger replied. “Besides, with your seniority I give you as many expeditions as Carmen will let you take!”

“Thanks; blame me!” said Carmen, though she knew it was true.

“I wish you wouldn’t go out, either,” Madhu said to her husband. “Expeditions are still dangerous. Let the younger ones go out while you stay at the Outpost to coordinate and write.”

“You know how bad I am at coordination,” replied Roger. “So, Will, you’re not off the hook.”

“Me?” Will thought a moment. “I suppose we’d go back to Earth if the kids wanted to go back. It’s a dangerous place for a pair of Mars-raised kids. The bigger question is, what will I do for the next eleven years? I’ve already been Commander for almost eight. Should someone be commander for nineteen years? But can I retire from

being Commander and stay here and loaf around? Should I retire at some point and go back to being a geologist?"

"You'd have earned full retirement," said Ethel.

"It'd set a bad precedent," replied Roger. "The other question is, at what age can the kids fly back to Earth? Maybe in six more years the radiation shielding will be better and it'll be safe."

"But I don't know whether I'd want to fly back to Earth in six years."

"What about if they made you High Commissioner of the Commission?"

"I'm not sure they would; the Europeans will want a European to succeed Morgan. Besides, if there's any goal to aim for, it's to reverse the current order of the chief officers. The High Commissioner of the Mars Commission should be on Mars, with the Vice Commissioner on Earth."

Roger laughed. "But when do you think that'll happen?"

"Do you really think we'll see the transfer?" added Érico. "Because what you're talking about, essentially, is a form of independence." He leaned forward in his chair, very interested.

"It would be a kind of independence, though without national sovereignty. I don't think it'll happen in a decade or two. It's unlikely, but I wouldn't rule it out. Our gold output gives us a gross domestic product larger than a few nations. The gold has had collateral effects; nations are more willing to sponsor citizens here than ever before. Columbus 7's seats are filled and there's a waiting list of people who will probably go on the Columbus 8 list. You can predict that Columbus 8 will be bigger again; maybe fifty people will fly here instead of forty. And it'll be even cheaper. The new interplanetary

habs are cheaper to build because, after eighteen years, the technology's mature. The inflatable annexes that have to be emptied and collapsed to aerobrake behind an ITV provide even more space at less cost. The new Mars shuttles that will be needed will be cheaper and better for the same reason. Let's say Consolidated and Muller manage to export eighty tonnes of gold, between Columbus 6's departure and Columbus 7's arrival. That's a billion dollars of production in two years. They're likely to manage 100 tonnes in the two years after that, and if another half billion in equipment arrives, and another sixteen workers, the next columbiad could see the export of 180 tonnes. That's over two billion dollars in sales, plus it makes imports cheaper, it makes other exports cheaper, it makes more national and corporate money flow in. . . you get the idea. The economists say we won't depress the price of gold until exports hit four to six hundred tonnes per columbiad. That's almost five to seven billion dollars."

"Even Columbus 7 will be cheaper," said Ethel. "What's the estimate? Under fifty million per person?"

Will nodded. "For the first time, especially if Bio-Archive sends more cargo our way. In six columbiads—2043—we could be receiving 75 colonists per columbiad at a cost of twenty million each, and Mars could have 400 people. That might be a good reason for Marshall and Sam to stay."

"But we have a long way to go in building our community here," replied Roger. "We're all very excited about Mars's steady growth, but we still have a lot of cultural differences, issues of language, issues of inclusion, and these aren't easy to resolve."

"We're trying," replied Will. "There have been a lot of meetings and forums this columbiad about these issues."

“Too many meetings!” replied Roger. “I think we’re talked out!”

“Especially town meetings,” agreed Carmen. “It’s been killing almost every Sunsol afternoon, lately.”

“It’s been a problem,” conceded Will. “The web discussion forums have helped digest a lot of legislation, but the last four or five months have demanded a lot of time anyway; we’ve had to shape a legal code for this place, after all.”

“It’s been important work, even though not everyone is interested in it,” agreed Érico. “Roger’s right; we’re all optimistic about this place and its future, but we haven’t resolved the issue of creating community.”

“Neither has anyone else,” replied Will. “I agree, we have a lot of work to do. But we have made progress. We have more community than one might think, considering that there are people here from thirty-seven nations. Some of it is generic democracy and some of it is science and consumerism. And we have a fairly good support system; some of it is modern psychiatry and some of it is old-fashioned friendship. And all the meetings have been a part of it.”

“We have to develop a new culture here,” said Érico. “Maybe we’ll manage to create a new synthesis that is compatible with our existing values—religious and secular—and it’ll be a example to Earth. Or maybe we won’t.”

“It’s a utopian dream that Mars will become an example to the old world,” said Will. “We will manage some social and cultural innovations here; we already have. But we’ll never be a utopia, and while we’ll contribute to humanity’s social evolution, we’ll never solve its problems.”

Alexandra was busy inside Riviera's building bubble one, supervising the robotic welding of one of the first steel beams of the building's structure, when her communicator urgently beeped. It was Kent Bytown.

"What is it, Kent?" she said, answering immediately. He was running the bridge at the time.

"Communications with Earth just went down completely. The systems are supposed to be able to cope, but as you know, with the Earth on the other side of the sun for the next two sols, communications traffic is cut in half. Demand has overwhelmed the circuits."

"Well, shut down the requests for television shows, recreational websites, and videomail and get the rest up."

"That's what I'm doing. Shall we call Will? Or Carmen, since she's the communications coordinator?"

"They're on vacation; let's try to manage without them first."

"Okay. We have communications filters; I'll set a few more of them in place to weed out more communications requests, and let you know how it goes. Bye."

"Bye." Alexandra closed the circuit and turned back to the robot, which had stopped work; it had needed instructions and, failing to get them, had stopped. She turned back to her attaché, pulled up the robot's controls, and checked the problem. She gave it a command and it resumed its welding. She checked another robot welding another beam nearby; she could run both at once.

Then Kent called again. He was having trouble with the filters; too much had accumulated and he was trying to postpone items without deleting them. In mid sentence, the screen went blank; before Alexandra was able to panic, the call reestablished itself.

“What happened?” asked Enrique, who was standing next to a robotic cart that had stopped in its tracks.

“Communications are down!” She turned to the attaché; Kent’s image was grainy and low-resolution, which meant that her attaché was connecting to Kent’s directly or via intermediary attaché’s. “So, are we in self-networking mode?”

“Yes. Shall I call Carmen?”

“Yes. Oh, wait; you can’t, they’re too far away.”

“Right. We’ll get everything back up, then. I’m calling in all the Prospector drivers to help.” They were on the other side of Habitat 1 and served as emergency monitors when needed.

“Excellent. I’ll be right there.”

Alexandra hurried to the bridge, cursing that such a disaster would strike while she was in charge. Houston would be freaking out, especially with a round trip communications link taking over forty minutes. It would hit the news, no doubt. Meanwhile, up in orbit, the ITVs and communications satellites would be switching to Cassini for control purposes. They’d have to be switched back. With no competition from Aurorae, Cassini would quickly hog the communications lines that were open via Magellan Station in Venus orbit and via, or all places, the Jupiter communications satellite system, a billion kilometers from the two worlds, which had given up some bandwidth for very slow, routine communications between Mars and Earth.

A similar problem had developed during Columbus 3's conjunction, before the Venus communications satellite system had been established. But Alexandra soon discovered that the collapse was much worse this time; Mars was a much bigger operation and communications had expanded even faster than their population. Magellan was far less adequate than they had thought it to be. Just like restoring an electrical grid, restoring a communications grid was fraught with complications and sudden surges in communications demand. Though internal communications were restored in half an hour, the link to Earth remained unstable and difficult to control the rest of the sol. Alexandra was in a fowl mood when she went to the patio in Yalta for supper. When she found that her favorite main course had run out before her arrival, her mood was not improved. But Yevgeny tried hard to cheer her up and as she contemplated her after-dinner coffee, she was feeling better. When Lal and Radha stopped by briefly, her mood improved; their two-month old baby Aditi, the thirteenth child born on Mars, was cute, even if it had a mild case of Downs Syndrome. A little later, Silvio ambled up to the table and looked at both of them. "Have you any time after supper? Maybe fifteen minutes?"

"Sure. I suppose. Why?" replied Alexandra, assuming that Silvio was speaking to her.

"I want to show you some results of the financial investigation I've been making. I want your opinion before going to Will about them."

"Okay," said Alexandra.

Silvio was looking at Yevgeny in particular, since he was in charge of exports. He nodded. "No problem; let us finish our coffee. Ten minutes or so?"

"Sure, just come to the store."

Yevgeny nodded; Silvio headed back to the store. “So, did he want your opinion or mine?” she asked.

“I’m not sure.”

Alexandra shook her head. She stood up with her tray, returned it to the kitchen, and got a cup of coffee. She returned to her table, stretched out, and tried to relax a bit.

But a movement out of the corner of her eye caught her attention. Kevin Dunbar was making a beeline for another table, walking with a purposeful, determined step that was worrisome. She turned and saw he was walking straight toward the table where Jennie, his ex-wife, was seated with Ernesto Gomes. She could see that Jennie and Ernesto were flirting; they had been flirting a lot lately. But Kevin’s attention was focused on their son Jake, who was almost three. When he reached the table he leaned over and scooped up the boy. “Come on Jake. I don’t want you to forget who your father is.”

Jennie’s eyes opened wide in anger. “Hey, I’ve got him tonight!”

“Then pay attention to your son and not other people!”

“Look who’s talking!” Kevin, after all, had been sitting with Andrea Shelton, whom he had been courting for months.

“You mind your business!”

“Then you mind yours!” Kevin walked away with Jake, who began to cry. Everyone in the patio had stopped their conversations.

Alexandra scanned the crowd and her eyes locked with Martha Vicker’s. She nodded; the psychiatrist stood up and headed to Kevin’s table.

Shinji was seated at the next table; he leaned over and said to Alexandra, “I think Martha mostly works with Jennie, not Kevin. Greg’s been counseling Kevin.”

“Greg?”

“He has counseling training and is a man. I think Kevin needed to talk to a man.”

Alexandra scanned the crowd. Greg wasn’t there. She grabbed her attaché from her belt, unfolded it, and dialed his number. It went to his message center.

“His attaché’s off,” she grumbled.

“Many people turned them off all afternoon and haven’t turned them back on,” noted Yevgeny.

“I’m sure. Computer! Emergency condition yellow. Please locate Gregory Harris.”

There was only the briefest pause. “He’s in the laundry area.”

“Computer, privacy override condition yellow. Please transmit the image of the laundry room and activate the room’s intercom system.”

“Acknowledged. Please wait.” In a second the screen flickered, then the image of the laundry room appeared from a camera located in an upper corner. Greg was sitting and sewing ripped clothes; he had quite a pile, too.

“Greg, can you hear me?”

He jumped when her voice sudden came out of the intercom. He looked up, then turned to the camera, assuming she was watching as well. The laundry room, after all, was a public area and not under the same privacy restrictions as private quarters. “Yes, Alexandra. Is there a problem?”

“We’ve just had a personal incident here in Yalta; can you come down?”

"Right away." He rose and hurried out of the room, abandoning the clothing for another time.

Alexandra went to talk to Jennie; she was visibly upset. "He sleeps with Kim, then gets mad when I sit and talk to Ernesto with Jake present? He is such a self-centered, possessive idiot!"

"Greg's coming down to talk to him; we all agree that Kevin has some issues to work out."

Jennie laughed at Alexandra's phrasing. "I want Jake back; tonight's my night."

"Martha's working on that, I'm sure, and Greg will, also."

"I hope so." Jennie looked at Ernesto, who put his hand on her shoulder.

"It's not easy, sometimes," he said.

"Thanks," she replied.

Silvio came out of his store and looked at Yevgeny and Alexandra rather urgently. He had missed the incident. Alexandra shook her head; Yevgeny rose and walked into the store.

It was another minute before Greg showed up. He went to talk to Kevin; Martha walked over to talk to Jennie. A few minutes later, after hearing from Jennie about Jake, she walked back over to Kevin and returned a few minutes later with Jake, who was still red-eyed from crying. At that point Yevgeny appeared at the door of the store, beckoning her.

It was difficult to believe anything could be more urgent than the situation she was engaged in, but the worst appeared to be over. Kevin and Greg appeared ready to walk to Greg's office. She apologized to Jennie and walked to the store.

“What is it?” she said, irritated.

“This is pretty important,” replied Yevgeny.

“How’s that possible?”

“Come on; that crisis is mostly over.” Yevgeny turned and went back inside; Alexandra followed. Silvio was sitting at a little table in the back of his office looking very solemn, almost depressed. There was a spreadsheet open on the screen of his attaché

“What is it?” she repeated.

“I’m afraid Yevgeny gave me some pieces of the puzzle I didn’t have; or maybe I should say that together, we found some pieces of the puzzle neither of us had before. Did you hear about the shortfall between gold production and gold logged into the accounts?”

“Yes. I thought it was a bookkeeping artifact.”

Yevgeny shook his head. “That’s what we thought,” replied Silvio. “But it appears Daniel Shapiro is responsible instead.”

“Why? He can’t smuggle gold back to Earth.”

“Maybe he can,” replied Silvio. “So far the mass shortage is thirty kilos; well inside the personal mass allocation of a return flight, especially if you have a partner helping you.”

“Ruth,” replied Alexandra, referring to Daniel’s wife. “But he’d have to steal some of the accumulated gold before the final weigh-in and transfer it to his luggage.”

“Unless he has an accomplice somewhere at Gateway or ISS, who could steal some of the gold after its arrival in Earth orbit.”

“Thirty kilos of gold is worth $360,000.”

“Not a vast fortune, but a tidy sum,” said Alexandra. “How much could he ship to Earth as personal property without going to Earth himself?”

“We will allow a few kilos of personal property to be shipped back, and people can purchase more mass at $1,000 per kilogram,” replied Yevgeny. “If he stayed here and shipped fifty kilograms back to Earth every columbiad, it would be a nice fortune in a few columbiads.”

“But the personal property has to be explained and described,” noted Alexandra.

“And we never verify,” replied Yevgeny. “After this, I guess we will verify.”

“I think so,” agreed Silvio.

“This is still hard to believe,” said Alexandra. “It really doesn’t make a lot of sense. This is a high-risk, relatively low gain effort. His annual salary is $300,000, after all.”

“It doubles his salary,” replied Silvio. “And it’s tax free. People have funny motivations to do things like this, sometimes. There’s a thrill to fooling people.”

“Now, how sure are we that Dan is the culprit?”

Yevgeny looked at Silvio. “There is some computer checking we could do, to be sure the data was changed from his computer, for example.”

“We had better do that.”

“We have to nail this down unambiguously,” said Alexandra.

“Come to think of it, back in December he came into the store wanting to purchase a very strong but light garment bag or duffle bag,” replied Silvio. “I didn’t have anything but suggested he talk to someone in fabrication whether they could make something for him.”

“That rings a bell; I turned down a request to make a duffle bag while I was in Cassini,” said Alexandra. “Interesting.”

“Should we talk to Will?” asked Yevgeny.

“Yes,” replied Alexandra. “But I suggest we pursue this matter as much as we can, first.”

“I’m in an awkward position; Will asked me to audit the books, but I am also Aurorae’s judge and therefore have to approve requests to obtain records,” said Silvio. “We’re a small operation, so it’s hard to avoid conflicts of interest. I suggest we turn over the actual investigating to Kent. He has the skills. He can make requests to me for, for example, computer records from Ruth’s personal area.”

“Okay,” agreed Alexandra. “I think we had better talk to Morgan and the Commission’s legal department in Houston. We can do that without bothering Will’s vacation.”

“Except the entire Commission headquarters in Houston has a big staff training day tomorrow, because of conjunction,” replied Yevgeny. “Don’t forget that. Then it’s the weekend there anyway. This is a lousy time to bother them with a matter like this.”

“We’d have to use emails instead of videomails, too, because of the communications limitations,” said Alexandra. She shook her head. “Okay, let’s gather information, then. When Will comes back from the escarpment direct communications with Earth will be restored anyway, unless there’s a solar storm, and none is forecast.” She sighed.

“This has been quite a sol for you,” observed Silvio, with a smile.

"Tell me about it! Communications breakdowns, a near fight at supper, and now an embezzlement. Will gets one of these once a month, and I get three in one sol!"

"And I'm sure he'll be grateful you handled them, too," added Yevgeny, with a smile.

Up on the escarpment, the interruption in communications wasn't even noticed. Once the kids woke up, the afternoon was devoted to the pool. Roger had once been a swimming instructor as a teenager and resurrected his skills to teach the two boys how to swim. The little girls were content to splash each other in a plastic wading pool Ethel set up for the purpose. The others watched or changed into bathing suits to enjoy the rather small pool. The exception was Will, who turned to the gourmet dinner he had planned.

After dinner they sat outside by the pool in the Phobos light, wearing sweaters against the chill, telling stories. The kids went to bed quickly. It wasn't until the next morning when Will called up the latest issue of the *New York Times* on his attaché when he learned of the communications snafus of the sol before.

The next three sols followed a similar pattern; hiking in the morning for the boys and play time for the girls, a nap, pool time, dinner. The other evenings they watched a movie outside, under the stars. Everyone was very sad when the time came to pack up the rangers and drive back down to Aurorae. Will hadn't been inside Yalta Biome five minutes when Alexandra called him. "When can you get to your office?"

"Office? I suppose in a few hours, why?"

"Because Silvio, Kent, and I are all here waiting for you. There's a serious criminal matter we have to resolve, and you have to be involved."

“Criminal?”

“Yes; I had better not say anything more over the phone. We’ve got the proof and need to brief you right away. As soon as an arrest is made, it’ll hit the media, too.”

“Alright, I’ll be right there. Bye.” Will closed the connection. Ethel looked alarmed.

“Sounds serious.”

“Yes, I’m afraid so. I have no idea how long it’ll take, either.”

“So much for the afterglow of vacation.”

“No such luck,” Will agreed, and he headed across the biome for Clarke Dome, and from there, to habitat 1. The three of them were waiting in his office. “Okay, I’m here. It sounds like I missed quite a lot in four sols.”

“You don’t even know about the incident on the patio between Kevin and Jennie, either,” replied Alexandra. “Silvio and Yevgeny have been checking gold production and storage records, insurance records, bank records, and a few other items.” She nodded to Silvio.

“It turns out that Dan Shapiro has been skimming a few dozen grams a sol from the gold production figures, hiding the difference in a “detrital silica” allotment, and depreciating the value of the gold by hiding the difference in a “detrital silica compensation” allotment. He has also fiddled with the gold production figures in the insurance reports so that they agree. He’s already set up a personal mass allocation for himself and placed thirty-two kilograms in it, which happens to be the mass in the detrital silica column.”

“He’s scheduled to fly to Cassini twice in the next few months,” added Yevgeny. “Perhaps he planned to steal the mass of gold while he was there—I’m not sure how he planned to get into the storage facilities. Or perhaps he planned to steal the gold after it was transferred here. We’ve started making those transfers already. We’ve checked the gold stored here and the mass is all accounted for.”

“Is Dan on the passenger list for Columbus 6?”

“No,” replied Yevgeny. “It appears he planned to ship the gold home as a personal allotment, and stay, presumably in order to steal more.”

Will shook his head. “This is extraordinary. Incredible.”

“We have been immensely saddened and shocked by this,” agreed Alexandra.

Will nodded. A tear appeared in one eye. “This is a massive violation of trust. He’s such a bright, capable man.”

“A man with a flaw,” replied Silvio. “He has a shoplifting record in Massachusetts, where he attended M.I.T. and Harvard. He didn’t report the record to the Commission and somehow the background check didn’t pick it up. We managed to get a second background check, and it found the record.”

“You have been busy!”

“We haven’t slept much in the last three sols,” agreed Alexandra. “Here, let’s show you the evidence in detail.”

“Yes,” agreed Will, with a sigh. “That’s important. Kent, can we set up another system for house arrest and confinement?”

“We have to,” replied Kent. “So we’ll do it.”

9

Organization

late June, 2032

By the end of the sol Daniel Shapiro was arrested, brought before Judge DePonte, and released on personal recognizance until his trial could proceed a week later. For the next week everyone on Mars spoke about little else, for they were shocked such an attempted theft would be made.

The trial lasted three sols and proved much more complicated than expected because Shapiro hired lawyers on Earth to help him, and the slow communications stretched out the procedures. But in the end he was found guilty and sentenced to house confinement except for half an hour a sol. He would return to Earth for final sentencing and imprisonment. Shapiro continued to insist on his innocence.

“You know, this would have been much more complicated if he had stolen gold in Cassini or on a robotic truck during a drive back here,” noted Silvio to Will after the trial had ended. “Cassini has no code of law. It has no judge or borough officers, either; just an outpost commander.”

“Of course, the Commander of Mars Operations has plenty of authority under the provisions of the Commission treaty,” noted Will. “But your point is well taken, Silvio. We should ask Cassini to adopt all of Aurorae’s laws. Longer term, we have to establish a Mars-wide approach to this problem, not solve it borough by borough. It’s time to define a Mars level of governing authority.”

“What will the Commission say about that?” asked Silvio.

“I don’t know, but I’ll find out pretty soon.” Will glanced at his watch. “I’ve got an appointment to meet with Morgan starting in five minutes.”

“How long will that take?”

“Probably four hours; that’s how long they usually take. Round trip communication takes forty minutes right now.”

“I know; I had to sit in my office half of last night exchanging slow videomails with a judge in Houston, and I didn’t have anything else to do, so I napped in between! Good luck.”

“Thanks.” Will left the courtroom and headed back to his office. He took a long detour through Riviera Biome and had to walk along a narrow path across the open space while regolith was poured onto and pushed around the floor that would be the future “yard.” It was exciting to watch the progress. As soon as he reached his office and closed its doors, Commissioner Morgan’s first message popped into his in-box. Will was surprised to see Louisa Turner sitting next to him.

“I thought Louisa should participate in this meeting because the main subject has to be our image in the media. As you can imagine, we have taken quite a beating in the last week. Two criminal acts out of a population of less than 100 adults is hardly ideal. We need a strategy. Louisa can summarize the situation.”

“It’s not good,” she said. “I can give you websites to look at if you’d like. One headline on a space news website is ‘Utopia Destroyed on Mars.’ We know Mars never was utopia, but never mind; there are tens of thousands, maybe hundreds of thousands, who project their utopian fantasies onto Mars. They generally know Mars isn’t a utopia

either, but they pin their hopes on Mars's future. That translates into property sales, political support, etc. We need to reinforce our base of support."

"Property sales appear to have dipped over the last week," added Morgan. "Of course, a week isn't very long and the dip isn't very obvious. Maybe it'll become more obvious in the next few weeks. Generally, this columbiad has done quite well. An international Gallup poll is also underway and the preliminary results are discouraging. I called the researcher today and he said that the percentage saying Mars development and settlement is 'very important' has dropped from twenty percent to twelve percent. The number saying it is 'somewhat important' was not as drastically effected; the number saying 'unimportant' rose to thirty percent. The numbers are not final, but they tell us we have a problem we need to tackle immediately."

"So we were wondering whether there is something that can be done to change the conversation to an exciting topic," continued Louisa. "Another expedition to the north pole or a trip to the top of Elysium Mons might be interesting enough to capture the public's attention. There are some possible thermal vents in southern Hellas that might be of interest as well. Finally, Mars and the asteroid Tikal are coming up on opposition in four months, and it'll be only twenty million kilometers away. Two shuttles, fully refueled at Phobos, could fly out, visit a few weeks, and come back in time for Columbus 6's return to Earth. Tikal's thirty klicks across; somewhat bigger than Phobos, and bigger than just about anything that's been visited lately. A crew of four could visit it safely and do some very interesting science."

"Maybe you have other suggestions," added Morgan. "The ideal, right now, would be discovering life on Mars! That's the sort of boost we need. It's what you got

during Columbus 1, when the conflict among the crew had come to dominate headlines and you found fossils immediately thereafter. Have you any ideas, Will? Over to you. Bye."

Puzzled, Will decided to take some time and look up Tikal. It was indeed coming close to Mars; closer than it did in fifteen years. They had been looking at expeditions of this sort for several years. Asteroids a half kilometer in diameter or more flew within ten million kilometers of Mars about six times per year. The inner edge of the asteroid belt was not much farther away than the Earth was, and some asteroids strayed even closer on occasion. Expeditions to them were inevitable, but the timing was important. He hit reply.

"Thanks Doug, Louisa. I knew we were in trouble, but I wasn't aware of the extent of the problem until your call. Perhaps that's because I've been immersed in the trial.

"I suppose our first option is to do nothing and assume this black eye will heal over time. I am sure it will heal over time, too, but I agree that right now we're smarting from it, and it has the potential to do some long-term damage to us. So I concur that we have to do something.

"But what we do is important. If we act primarily for the sake of repairing the damage done to our public image, no doubt that motivation will be obvious to many people. Under those circumstances it could backfire. The exploration schedule is set months in advance in order to allow terrestrial geologists time to plan their support roles, especially the people who have grants to study a particular area. Expeditions to asteroids ideally should be planned far enough in advance so that equipment to place on the

asteroid can be obtained from Earth, and data from telescopes and radio telescopes in the vicinity of Earth can be used to provide background. Then there is NASA's Project Argo to remember; if we appear to be trumping it, we will earn the enmity of many in the United States, and we can ill afford that right now, as we repair the damage that occurred after the change in administrations. Argo is underway in less than two years.

"What I would suggest is more utopian, flows naturally from the recent trial, but may not be popular with the Mars Commission: beginning plans for a Mars constitutional convention to lay down a basic governing structure and law for the entire planet. I was just talking to Silvio, who pointed out to me that if this theft had occurred in Cassini or on a robotic truck between the two boroughs, our legal situation would have been more ambiguous. Obviously, there are ways to prosecute crimes outside Aurorae Borough, but they involve courts in Houston or in Texas, which are a long way from here. We have been talking seriously about the need for such a gathering for almost a year.

"I know the Commission is uncomfortable about the matter, and I can understand why. But we are not talking about national sovereignty or autonomy or independence. Mars is too small for that and will be too small for decades, if not a century or more. Rather, we're talking about subsidiarity: the principle that there must be many levels of government and that they all play complementary roles. There are plenty of small towns around Earth that elect governments and run courts even though they have a hundred or so people. They do not abolish county, state, or national government in the process. Mars has a lot of bright, hard-working, articulate people who want a say in how their schools and clinics are run and what the rules are. Many people are not very active politically; they're busy with their career. But some are very active politically, both here and on

Earth via the media. And isolation here tends to breed a certain insularity, a certain pride in Mars and in our boroughs; you might call it proto-citizenship. So the time is ripe for a Mars constitutional convention. If it's done right, it has the potential to make the hearts of the utopians go pitter-patter. It will certainly stir interest in us, will be perceived as an effort to right wrongs, and will be an indicator of our long-term stability as a society. That's good for investment. It also establishes a planet-wide legal structure that will encourage the construction of Dawes and other boroughs, even though I'd prefer to avoid them. So that would be my recommendation. Back to you. Bye."

Will hit send and wondered how his proposal would be received. He had been slow to propose a convention because he knew how fiercely Morgan—and the nations of the Earth—would resist the idea. Perhaps the trial could give the idea some momentum.

While waiting for the reply, Will turned to the ephemeris and checked out the flybys of asteroids one kilometer in diameter or larger. There were fifteen of them predicted to occur in the next ten years, and some were quite close. One was a nickel-iron body; none of them had yet been explored robotically. They'd have to launch a mission some day, but not until Argo had a success.

He turned to email and waited. It was almost an hour before the reply arrived; there had been discussion at the other end. Louisa did not look happy.

"Will, let's avoid a constitutional convention, or a charter meeting, or an all-Mars conference, or whatever you want to call it," replied Morgan. "How much democracy do a bunch of overworked, and largely politically apathetic, people need? There's no guarantee the gathering would be received positively, either. Utopians—anarchists to

communists—will simply dislike the compromises that Mars would inevitably have to choose. Don't worry about the utopians. The real utopians don't buy land, anyway.

"No, let's find a practical blockbuster mission. I agree, Tikal is not politically useful, and it could look self-serving or as a snub of NASA. But a trip to Elysium Mons and the thermal vents north of it are important and interesting. Pursue that, okay? Bye."

Will frowned and thought about his response carefully. "Doug, the Elysium plateau is a good mission, but it's not something we can send out in less than two or three months, so it won't help our public image right now. I'll get it started. But the momentum for an all-Mars gathering already exists. Go look at the outpost's listservers and message boards. The matter is being discussed. The decision to call such a gathering is not in my hands, either; I'm just a humble citizen of the place. Er, I mean resident. Alexandra and Érico are the elected officers in Aurorae Borough, and presumably it's their decision. Bye."

He sent the message, angry that Morgan was so opposed to something that seemed so natural to the Mars population. *Citizens;* that was a slip of his tongue. He shouldn't have hit "send" so fast; he could have gone back and re-recorded the message, or even edited out that sentence. Now he wondered what Morgan would think.

He sat worrying, mad at himself, staring out the window at the cinnamon landscape and escarpment standing up above the habitats and biomes of Aurorae Outpost, the place they used to call "the Outpost" until a second one was established. And he realized that *citizen* indeed reflected how he felt about the place, even if it was a tiny human collective. It was home. He thought about the American flag flying over the

outpost from its flagpole at the base of Face Rock, a flag many wanted to take down and replace with a U.N. flag or, better, a Mars flag. The time to do that was fast coming.

Unlike before, he was unable to work during the wait for Morgan's reply. He sat and thought for the entire forty-six minutes until Morgan's reply popped into his in-box.

"Will, please don't hide behind the excuse that Alexandra and Érico are to blame. You're in charge up there and everyone knows it. You command their respect. They'll follow you on a matter like this. There's to be no Mars Constitution at this time. The Commission has all the authority necessary to coordinate things at the planetary level, including such matters as criminal activity. Military law, private corporate law, shipboard law; this is not a unique situation. There's plenty of law available to us. Borough government and law make sense; these are settlements where people live. They need to pay taxes to support all sorts of services the Commission was not set up to provide. But the space between the settlements, and between them and Earth, is the sphere of the Commission. A millimeter past the border of each Borough, residents enter the realm of the Commission. That's always been our interpretation of the Mars Commission Treaty. And you are bound to uphold the Commission as its representative up there. Bye."

That startled Will; he was aware of that interpretation of the Commission Treaty, but had never heard it from Morgan before. He thought carefully for several minutes and scribbled a few notes before replying.

"Doug, I very much appreciate and understand the position you are taking. But I respectfully remind you that you don't live here. We do; I do. We can't go to a soccer game or a mall, vote in a national election, buy a newspaper printed on paper, watch a fireworks display. Earth is in our memories and on the screens of our televisions. We

speak almost two dozen native languages in our flats, yet eat our soy cheese and tilapia filets together in the same bubble of air, speaking to each other in the same standardized English with the same Marsisms, like 'good sol.' Our neighbors are Martians. Our elections are Martian. Our certification renewal classes are for the same things: space suits, rangers, shuttles, nukes, Prospectors. We watch amateur ballet with impossibly high leaps. We play golf outside as members of the Aurorae County Club, with an eighteenth hole that is a 550-meter par three.

"Now, if you think our emerging Mars culture isn't going to be expressed as Mars politics, you need to rethink things. This is not my doing; it is something that is emerging in the environment. I did not choose the word *citizen;* it welled up spontaneously inside me and surprised me because that is how I feel. I'm being frank with you; I'm not hiding behind anything. Please believe me, because I know the only way this videomail way of communicating can work is that everyone trusts everyone else. Otherwise it'll become a series of exchanged excuses and white lies and trust will break down. We have to maintain trust, Doug. There will almost certainly be a Mars constitutional convention in a few months. We can use the event as a way to strengthen the relationship between the Mars residents and the Commission, or not; we can use it as an opportunity to improve our image, or not. It is an inevitable opportunity. Bye."

He hit send, surprised by the emotion and honesty in his words. They had to be frank with each other, in spite of the risk that misunderstandings and biases would result. He went out to pace around the Outpost, walking as far as Riviera in the process. When he returned he saw an e-mail message from Louisa, which had arrived right after he had stepped out and therefore about fifteen minutes before his response had even reached

Mars. *Don't worry, he'll come around,* Louisa had said. Will imagined her excusing herself from Morgan's office to go to the bathroom, and hastily dictating the message from the toilet stall. When Morgan's reply arrived, it was more conciliatory.

"Look, Will, your colony is barely eleven years old. There's plenty of time to organize it later. If some sort of meeting is held, make it a 'Mars Planning Conference' and invite terrestrial speakers to address it. We've had those before, and the others at least touched on social issues. Meanwhile, get the Elysium expedition into the planning pipeline. I think everyone will be surprised how fast the scientific justification of the expedition will snowball. Bye."

That was something he could live with. He hit reply. "Okay, Doug, that will work. We'll start on this two-pronged approach right away." He hit send, then pulled up Louisa's videomail number. "Louisa, thanks for everything. Let's look at a panel discussion about 'alternative modes of governance.' In particular, I'm curious about some articles I've heard about recently that discussed non-competitive governance. One was an application of 'appreciative inquiry' to governance by, I think, Silvia Quinn. The reference was in last Sunsol's issue of the *New York Times.* Sorry, I mean last Sunday, not last Sunsol. Another was about decision making without partisan advocacy, but I don't remember a title or author. I'll get my secretary going on a research project about the matter. If we're going to create some sort of new model of governance, we need to learn to control partisanship. Thanks again. Bye."

He sent the message, then thought about whom he should talk to about the conference. He decided to find Érico and Alexandra and interrupt their work.

Two weeks passed in a whirlwind of work. The Elysium expedition did indeed move through the planning phase very fast; it was one of the last areas of the planet they hadn't explored and warranted a thorough tour. Almost as fast was the development of interest in a meeting to discuss Mars's future, including its organization, scheduled for the first weekend of September. Public interest was piqued. When the Mars Exploration Society announced plans to hold a parallel conference on Earth for all Mars landowners—who had no official legal mechanism for expressing their concerns or interests about Mars—the media, sensing controversy, became even more interested. Morgan found himself uttering platitudes about the importance to the Commission of good governance on the Red Planet.

The issue of lack of government in Cassini was more pressing and easier to solve. As soon as the live television shows of July 4th fireworks ended—shortly after the dawn of July 5 in Aurorae—a sunwing-B took off heading for Cassini. The passengers on the twenty-hour flight were two: Will Elliot and Alexandra Lescov. As soon as the sunwing landed on Cassini's landing strip, they stepped out—wearing spacesuits and carrying suitcases—and were met by a ranger driven by Emily Scoville. They climbed into the ranger, where Emily repressurized the cabin so they could remove their suits. Will was surprised to see Emily's hair covered by a scarf, but said nothing.

"Welcome to Cassini, Will! And welcome back, Alexandra!"

"Thank you; it's exciting to be here," replied Will.

"How was the flight?"

"As good as a twenty-hour flight can be," replied Will. "I guess I should be thankful this wasn't a Sunwing-A, which would have taken thirty hours instead."

“The stationery bike with arm exercisers and the hammocks help a lot,” said Alexandra. “I watched a lot of television, too.”

“I wish we had more shuttle flights, but I know that isn’t practical.” Emily put the ranger in gear and turned around. They headed toward the Outpost, a shiny enclosure six kilometers away. “How are the plans for the sunwing-C coming?”

Will shrugged. “We’ll see if it’s ready for Columbus 7. A biwing is complicated enough; a triwing is driving the designers and the software engineers crazy.”

“But it’s supposed to have a shorter wingspan, right?”

Will nodded. “Shorter, but stacking three wings means it’s taller, the propellers are bigger, and the wings are staggered behind each other to maintain the exposure to the sun, so the lift is distributed differently. We’ll see whether they can pull it off.”

“Oh, they’re solving the problems, Will. It’ll be ready,” injected Alexandra. “What I find exciting is introduction of silane-powered motors. A tonne of silane requires three tonnes of carbon dioxide to burn, which is a ratio just about as good as jet fuel-oxygen combustion on Earth.”

“Are we going to be able to make the silane?” asked Emily, skeptically.

“We’ll get seven small production units on Columbus 7,” Alexandra replied. “And motors to retrofit on the older sunwings, complete with CO2 compressors. Our aircraft will have two or three times as much power and thus will fly faster or carry more cargo.”

“That’ll help a lot,” agreed Emily. “And I gather we need silane to make some new plastics as well.”

“And solar panels,” added Alexandra. “We’ll have to import some rare materials we can’t refine here yet.”

“I like the scarf in your hair,” Will said. “It looks nice.”

“Oh, thank you.” Emily sounded embarrassed and didn’t speak further for a moment. “Muhammad Rahmani and I have been studying the Qur’an together for the last few months, and I decided to accept the Prophet Muhammad.”

“Oh? Congratulations,” said Will, trying not to sound surprised.

“What does your family think of that?” asked Alexandra.

“Oh, my kids were. . . surprised, my parents appalled.”

“So, how has it been here over the last few months?” asked Will, changing the subject.

Emily shrugged. “There’s really not much to add to the reports you already get from me. Things have finally slipped into a routine; I’d say that happened in March, not long after the construction phase ended and after the design bugs were resolved in the equipment. And as it turned out, both companies were able to be more efficient when they worked together; Consolidated’s rock crusher was better, but Muller Mining’s repair crew was more effective, and Muller was better able to blast rock loose for the rock crushers to work on. They’ve learned from each other, and with our people here they’ve surveyed the deposits better to determine the optimal recovery strategies. There’s actually some good work done at the Colorado School of Mines on the best strategy to blast and digest the various outcrops. As a result, output has climbed to five tonnes of gold per month, combined. Each company’s producing about half of the total.”

“That’s impressive.” Will calculated. “We dug fourteen tonnes in the first six months. If we manage five per month for the remaining eleven months, that’s sixty-nine tonnes to send back with Columbus 6, and fifty-four more when Columbus 7 arrives nine months later.”

“They’ll manage it, I think. Efficiency is improving as fast as the quality of the gold deposits is declining.”

“Of course, one reason they’re producing so much is because we’re providing a lot more support than contracted,” said Alexandra, who had always been critical of the support effort. “Each company’s four people can keep busy in the field, loading the rock crushers and repairing broken equipment, while operators in Aurorae keep them going twenty-four point six hours per sol.”

“We’re providing ten full time equivalents instead of eight,” admitted Will. “But we’re getting a bigger cut of the profit, too. We’ll need the billion dollars of income we’re getting, believe me. How’s morale, here?”

“Not bad, now. The work week is sixty hours, which is okay considering we’re isolated, no one has families, and all food and laundry services are provided.”

“I’m looking forward to seeing the social climate here firsthand,” said Will.

“And to calling our first Borough meeting.”

“Yes. It’s time to elect officers and adopt bylaws.”

“Who can vote? I ask because it isn’t clear who’s a resident here.”

“Everyone here right now can vote. Officers can rotate back to Aurorae, especially if we elect a vice chair, assistant clerk, and assistant treasurer.”

“Do we really need a treasurer?”

“The clerk can do the work temporarily, but it might be wiser to designate the clerk and the treasurer as assistants to each other.”

Emily nodded, absorbing the idea.

They drove on in silence for another minute. Then the ranger climbed up a steep slope, leveled off, and went around the edge of a hill, and Cassini’s Transvaal Biome sudden hove into view. “Wow!” said Will. “It looks great!”

“Home sweet home,” replied Emily.

The ranger approached the main airlock slowly. Emily pushed a button on the dashboard and the outer door swung upward, just like a garage door on Earth. Once it was up and out of the way, she drove in, then pushed the button again. The door swung downward behind them, then the pressurization cycle began automatically. “The darn thing leaks,” she grumbled.

“They always do,” replied Will. “But it’s just CO2 and electricity.”

Emily nodded. A light on the dashboard turned green; she pushed another button and the inner door swung upward and forward, allowing them to drive into the garage, a big metal room buried underground able to accommodate four rangers. They entered and once the airlock door had closed again they opened the ranger and stepped out.

Emily led them out the main door and down a tunnel. She opened the door at the far end and they were suddenly in Transvaal. The temperature and humidity told them that the climate was one of a mild savanna, not too hot or humid. Will stopped to admire the view. They had entered from the western end. On the northern side of the circular area was a completed building just like the buildings in Aurorae. The middle area was a “yard” just like Yalta or Catalina covered with fruit trees, some flowers, vegetables, and

clover. The southern side of the biome was a hole in the ground where the biome's other building would eventually be placed, the bottom covered by a thin layer of soil verdant with corn, wheat, tomatoes, beans, squash, broccoli, peas, eggplant, and other crops. Cucumbers climbed fences covering the walls of the hole. A robot crisscrossed the garden, picking anything ripe.

"You've got a garden on the roof as well?" asked Will.

Emily nodded. "And there's a nice view of the crater rim up there as well." She led them into the building. The right side was a dining area. "We've got a kitchen, television lounge, and ping pong tables on the left side. Ten of us have rooms upstairs; they're a bit small, but comfortable. The guest rooms are downstairs in the basement, which also has storage and a plant hibernation facility; it's mostly for the strawberries."

"I'd like to go down and rest before supper anyway," said Will.

Emily led them downstairs to the rooms and showed them two empty ones. Will moved into one, unpacked, and pulled out his attaché. He worked a while—it connected to the outpost's network without any problems—walked up to the roof to see the view, then pulled on his space suit and went outside with Alexandra to explore the area a bit. After washing and resting, it was time for supper.

Everyone came up to welcome him and chat. Will ended up sitting in the middle of one long table, asking questions or answering them, while everyone else listened. The relative ease everyone felt toward each other, and the fact that they usually sat at one long table together, were encouraging signs.

"So, how's it going?" Will asked Bruce Curry, when they both got up to get coffee.

Bruce shook his head. “I’m not going to hit a hundred tonnes, but I might manage seventy-five. Right now I’m striving for seventy-five, and if it looks close we’ll raise the goal to eighty. I hope we can do better during the next columbiad; 150 tonnes might be possible if we follow the gold concentrations.”

“You’re planning to stay?”

He nodded. “I’ll get a ten million dollar signing bonus for staying, and I’m trying to negotiate it upward; it’ll cost Consolidated fifty million to replace me, after all.”

“And you’re getting along alright with the Germans?”

“Sure; they’re okay. Each of us has proprietary technology, but we can help each other without compromising trade secrets. It’s working out alright.”

“I’m glad to hear it. I’ve been hearing reassuring reports in the last few months, but I was worried anyway.”

They walked back to the table. Emily watched Will approach, then stood and clinked her glass with a fork. “Attention, everyone! As you probably know, Commander Elliott has come to Cassini for a business visit. Not only does he want to see how we’re doing and encourage our work, but he wants to address us about the need to organize the borough. I don’t want to preempt his comments, though, so I turn the floor over to him.”

Will barely had time to put down his coffee, let alone sip from it. He was a bit surprised by the timing of the announcement, but he proceeded anyway. “Thank you, everyone, for your very warm and enthusiastic welcome. Things here seem better than I expected, and I expected that things would be good. I can’t tell you how happy I am that Cassini is established, up and running, and successful. It appears Cassini will produce

almost two billion dollars of exports this columbiad, which exceeds everyone's expectations.

"Cassini has eleven residents, which was the number of residents Aurorae Outpost had in 2022—ten years ago—when we decided we had to organize ourselves. As a result of many months of discussions among ourselves and consultations with lawyers and other experts, Aurorae Outpost unanimously approved a declaration of civic government. We elected a chair and secretary, and later we added a treasurer and a judge to our officers. We declared that the civic government would handle 'certification of marriages, births, deaths, divorces, and other life events of importance; adjudication of disputes; drawing up ordinances to regular behavior for the common good; providing for common needs, such as education, health, safety, and the necessities of life; regulating businesses; raising revenue through taxation and other fees; and recognizing transfer of ownership of property.' We declared the boundary of the borough to be everything between the equator and fifteen south, and between the thirtieth and forty-fifth longitudinal parallels. Since then we have adopted bylaws and an extensive legal code. We also passed a resolution about a year ago recognizing the existence of Cassini Borough.

"The time has come for Cassini Borough to organize as well. In some ways your legal needs are less than ours were ten years ago. We needed in particular to establish a mechanism for legal recognition of births. The time will come when Cassini has to deal with births, deaths, marriages, and divorces as well. But in other ways, Cassini's needs for civic government are as great as Aurorae's are now. Aurorae has had to deal with two crimes in the last six months; Cassini may face the same situation at any time. Cassini has more or less permanent residents. Of the 724,000 square kilometers within the borough's

jurisdiction, a third of the land is already sold to two companies. Others may wish to purchase pieces of land, including all of you; it seems likely that within ten to fifteen years the technology to build private houses on Mars will have matured. Everyone is predicting that Cassini's future is great and that a great city will arise here by the end of the twenty-first century. That great city needs a civic foundation now.

"How Cassini is founded is not up to me, to Emily, or to the companies that recover gold here. It is up to the residents. You are free to come up with any arrangement you favor that meets certain standards, such as the Universal Declaration of Human Rights, the laws of the state of Texas, and perhaps even the standards of democracy of the European Union. The easiest path to take is to adopt the Bylaws of Aurorae Borough and modify them as you see fit. That has the added advantage that all of Mars standardizes on the same model of governance. But that is not, by any means, the only path open to you. Earlier this sol Érico Lopes, the clerk of Aurorae Borough, emailed the Aurorae Bylaws to everyone here. I see one or two paper copies around the room and I know Emily has printed out a few more. You can use them as a starting point if you wish.

"In closing, I want to add a few words. In nine months you already have a far larger facility than Aurorae had after several years. You already have a financial and economic base that Aurorae still lacks. Don't compare yourself against Aurorae this sol. Compare Cassini against what it will become. Vision, hard work, and dedication together make a place grow. I see the hard work here, and I feel the dedication. I suspect the vision is here as well." Will turned to Emily and nodded, then sat.

"Questions for the commander?" she asked.

“I have one,” said Muhammad Rahmani, a Malaysian repair specialist. He stood. “No one can accuse me of bias against our Commander here, Emily Scoville, so perhaps I’m the best one to suggest this: it may be best if this meeting be chaired by someone from outside Cassini, so no one can say the results were manipulated in some way. My suggestions is Alexandra Lescov. Many of us know her, she spent two months here and knows us, and she is chair of the Borough of Aurorae. It seems fitting.”

Emily, who was sitting next to Muhammad and was very close friends with him, immediately nodded. “Excellent idea!” Others in the room seemed to agree as well, so Alexandra stood.

“I’ll be happy to assist. Other questions for the Commander?”

There were none. Alexandra allowed a long silence to fill the room. “Perhaps we should start by going around the room and expressing our feelings frankly about organization. Do you favor? Oppose? Don’t care? Do you have a thought about the form of government to follow? About the system in Aurorae? Let’s start at this end of the table. Christina Stolz.”

Christina was a German miner, and she was sitting next to Ray Munson, a miner for Consolidated whom she had gotten fond of in the last few months. She paused to collect her thoughts. “I’m planning to stay here at least two columbiads, maybe three, so I feel I have a stake in this place as a community. I know some of us are here to earn a lot of money, and some are planning to leave with Columbus 6, unless we get a big signing bonus, that is. But I think all of us feel the need to give Cassini some long-term roots.”

Alexandra nodded and looked at Munson. “I agree with Christina. A civic authority of some sort is a good idea, in my opinion.”

Next at the table was Margaret Bailey, sitting next to Ni Gao, a Chinese engineer with whom she was fond. “I agree, and I think Aurorae’s system is fine.”

“I’m not a company person, but I’m planning to stay on Mars long term, and I may find myself in Cassini much of that time,” said Gao. “I think we need a civil government as well. Mars probably needs one also.”

Gerhard Bach, who was next, frowned. “I suppose people will say I favor a company town, but this is a pretty small place, and a place devoted to work, not family or leisure. I see no reason to change the status quo, except build another biome, of course, and haul in more equipment.”

Several people opened their mouths to speak, but Alexandra shook her head. She looked at Alma and Johann Werner, two other German miners. Alma looked at Gerhard. “Frankly, I don’t care what we do,” she said.

“Well, I do,” replied Johann. “Because we may start a family here or at Aurorae eventually. We may not have families here now, but we have couples, and a few more of them than are registered as married. We may need to celebrate marriages here pretty soon. After Columbus 7 arrives, how big will Cassini be? Sixteen? Twenty? Maybe thirty, after Columbus 8 arrives? I favor planning ahead.”

Johann looked at Bruce Curry, who was next. Curry shrugged. “I want whatever is best for Consolidated. I suspect that means growing Cassini as much as possible and organizing it so that it can compete for resources against Aurorae. Civic government? Sure.”

Alexandra looked on the other side of herself at Will, then on to Emily. “I’ll pass, for now,” she replied.

"Government modeled after Aurorae," replied Muhammad, who was next. "I read the bylaws this sol and was surprised they're in plain English."

"Very readable," agreed Alexandra. "Louise?"

"I've been on Mars five years now, and I've participated in Aurorae's system," said the nuclear engineer. "It's a good system. It helps create community because it makes all of us realize we are responsible for our outpost together. So I'd favor it." She turned to Eliseo Andaluziano, a Chilean engineer.

He nodded. "I haven't been here that long, but the little I saw after arrival impressed me. It appears I have a long-term commitment to Cassini, so I want to see it grow."

Alexandra smiled. "I'm surprised and impressed. I'm not counting votes, of course, but I have counted preferences. Many reasons were cited in favor of a civic government. Only two were opposed to the idea. No one offered alternatives to the Aurorae bylaws, which seemed generally fine. Let's refine this discussion now with questions and comments about governance. . . ."

The discussion went longer than expected; it was almost midnight before the last group left the dining area. Within half an hour of the beginning, everyone had agreed that a civic authority was needed, but few knew anything about Aurorae's system. It took a lot of explaining and discussion. The next morning after breakfast the residents of Cassini approved a modification of Aurorae's bylaws. After dinner that night they elected Ni Gao as clerk, Emily Scoville as chair, and Christina Stolz as treasurer. They also elected Silvio Deponte as their judge; he could travel back and forth as needed. The three officers

met with Alexandra the entire next sol to modify Aurorae's bylaws. Meanwhile, Will traveled all over the gold fields looking at excavations and hearing about practical problems they needed to solve.

Five sols passed before Alexandra and Will flew back to Aurorae, this time on a shuttle bearing three months of gold production. Will was at his office by 11 a.m., after spending some time with Ethel and the kids.

"You won't believe what you've missed," said Martha Vickers, shortly after Will settled into his office. "The last five sols have been the most extraordinary in Martian history, in a way."

"Really?"

She nodded. "First, Sheila Burns and Arieh Feldman announced that they plan to get married in December—"

"Really! She's still recovering from the rape!"

"She is, but the event pushed Arieh and her to reconsider their relationship, and they decided to get married. Ernesto and Jenny followed by announcing their marriage plans two sols later; Kevin is reconciled to it, though he's unhappy, of course."

"Wow, that's great!"

"But there's more, Will. Daichi and Ryoko Furukawa came to the hospital for a maternity test; they'll have a baby in February. They feel bad, since normally couples don't have children here during their first columbiad. You need to reassure them."

"Okay, I'll do that."

"Then Érico and Carmen showed up; Carmen wasn't feeling well. It turns out she's pregnant as well, much to their surprise!"

“Wow! I’ll have to congratulate them as well!”

“And there’s more! Yestersol Eve Gilmartin discovered she’s pregnant!”

“I thought they didn’t want children.”

“Well, they do now.”

“I guess so. Wow, maybe I should go away more often!”

“I suspect we’ll hear more pregnancy announcements. We haven’t had any for a while, and conjunction marks a good time to start trying for a family.”

“I’m tempted to say something at dinner tonight, but I suppose I shouldn’t; the people who have decided to remain childless or unmarried will complain about my bias. Maybe I can start by admitting my bias and congratulate everyone.”

“That might work, you sentimental guy. This’ll be good news for the Commission, too, after the crime stories dominating headlines about Mars lately.”

“That’s true.”

“How was the trip to Cassini? I read in the *Los Angles Times* that they elected the same civic government as Aurorae’s.”

“Yes. The eleven of them were surprisingly favorable toward a civic authority. I had thought the Warners were planning to leave, and maybe Munson, but now they’re all planning to stay at least one more columbiad, so they feel a stake in making Cassini a pleasant place to live. Curry was in favor; he thought it’d make Cassini a stronger community and competitor for funds. The one difference is that they favor formation of a Borough Council once Cassini gets too big and complex for town meetings.”

Martha laughed. “They’ve been talking to their friends here! We’ve been having town meetings twice a month and we’ve still got months of items on the agenda. I think

the people in favor of having the town meeting do everything are beginning to come around and accept the idea that the meeting has to appoint committees to digest matters for the meeting first."

"It's getting ridiculous." Will glanced up and saw Ruhullah Islami outside his door. "My next appointment has just arrived, so we should finish up."

"Oh, I'm finished with my report." Martha rose from her chair. "See you at lunch." She headed out of the office.

Will rose from his chair and followed her to the door, then welcomed Ruhullah. "I'm glad you could make it. I know you'll be heading for Tharsis tomorrow." He sat in a chair in the front of his office and Ruhullah sat next to him.

"Yes, the expedition there is the one that'll head for Elysium. They're excited about going, too, even though they've been unraveling the tangled volcanic sequences making up Arsia Mons. We've got the plans mostly put together; it's the fastest planning for a major expedition ever."

"There's so much data and so many previous proposals, it's relatively easy," said Will. "But I didn't call you here to discuss Elysium. Remember our conversation, some time ago, in the patio, when you asked whether there was administrative work you could do? Well, I need someone to replace Daniel Shapiro to watch the finances, oversee the accounting of the exports, and help administer things. If I remember right, you even have some accounting experience."

Ruhullah smiled broadly. "I do indeed! My parents insisted I major in business; it wasn't until graduate school that they let me switch to geology!" He laughed. "Maybe that business training will be useful, after all. I do remember accounting; all too well!"

“So, you’ll do it?”

“Yes, sure! I’d be glad to. Thank you, Commander.”

“You’re welcome. From your management of expeditions, I’ve seen you can do this sort of work, and besides; you asked.”

10

Conference

late Sept. 2032

"Look, Will, we aren't going to postpone the Mars Development Conference again," exclaimed Morgan. In spite of some fuzziness in the video, it was clear that his face had a determined look on it. "Everything is ready to go. We can't help it if the Mars Colonization Society can't get the landowners to agree on whom to invite to their parallel conference. They shouldn't have tried to exclude the big corporate land owners in the first place. The lawsuit and injunction is what they deserve. I see no reason to help them out, they're just making trouble for us. If you let the landowners run a parallel conference with video links to our gathering, they'll just stick their nose in our business. I find it hard to believe you want more hassle right now. Over to you, bye."

Will watched the comments with growing agitation. He hit reply. "Doug, the land owners are a pain in the ass sometimes, but they own land here, so they have a certain right to be! We didn't invite 55,000 people and 133 businesses to donate $600 million to the Mars Commission out of the goodness of their hearts. They bought land, a lot of it; 35 million hectares of range. Naturally they want a say about what services they can get, whether they are taxed for their land, whether land will be released to the public so fast demand will collapse and the land value will fall, etc. Now I agree there is a problem when 133 corporate landowners get more votes than 55,000 individuals because they've spent more money. I also agree there's a problem when the individuals insist on one vote per person and thereby cut corporate owners out entirely. Neither situation is completely just. Sure, we can't solve the problem for them, but let's at least *help* somehow. After all,

our conference is scheduled to start tomorrow. There's a good chance the corporate land owners' injunction will be thrown out of court; this claim of the Mars Exploration Society to be pulling together a meeting of land owners in the Borough of Aurorae only is very clever and perfectly legal, and excludes ninety percent of the corporate land ownership from the conference. But we can still invite corporate representatives to attend the Houston gathering so their voices can be heard, and that's only fair. Can we at least invite their representatives to Houston? Back to you."

Will hit send and turned to other matters while he waited half an hour for Morgan's reply to return. It was late; obviously Morgan was talking to other folks, such as Louisa. But finally the answer came.

"That might work as a compromise, Will. They won't have a vote here, but they'll have good quality access to the people making decisions. All right, you've worn me down. These time-delay teleconferences are draining. We'll invite the corporate members here and introduce them to everyone at some point. Bye."

Will smiled briefly; he had won that round of exchanges. It had taken parts of only four hours. Someone had to invent communications that went faster than the speed of light; the delays took great patience and care. He had to admit, though, that he had figured out how to use the delay to his advantage.

But even though his stomach was growling for lunch, he had time to initiate another conversation. He recorded a message to Heather Kimball, an old astronaut friend of his who was now head of the Mars Exploration Society. "Heather, this is Will. It appears we'll invite representatives to the Mars Future Conference in Houston. Look, you've got to throttle these anti-capitalist, anti-globalization, utopianists. They haven't

bought that much Martian real estate. They're noisy and organized, but they are a minority. Why can't you propose that all votes require two majorities: a majority of persons and a majority of shares. That will force everyone to listen to everyone else. Otherwise, you'll get two organizations, not one. Heather, I'd like to see us consider a bicameral legislature for Mars; the lower chamber elected by property owners, the upper chamber by residents. I don't think anyone would favor a tricameral legislature where corporations get a chamber of their own. The principle of property can be pushed only so far. I, for one, will oppose a role of property owners in the commonwealth civil authority if they can't get their act together. You're the one to bring them together. Let me know what you think. Bye." Will reviewed the message quickly, then added a blind copy to Louisa Turner; he liked to keep her in the loop when he was making theoretical observations, as she had more concern about vision than Morgan. He knew she would share some of the messages with the Commissioner; that was fine.

He attached his attaché to his belt and headed to the patio for lunch. Ethel was already there with the kids; they always sat at the same table for lunch with Sammie, Corazon, and their parents. Half way through his plate of food Heather Kimball replied. "Will, I'm trying. But thanks for telling me about the idea of the bicameral legislature. I don't think anyone has thought about that angle. Maybe I can use it to push some sort of compromise. Bye."

Will closed the attaché with a smile. Ethel had seen Heather's face on the screen. "How's Heather?"

"I have no idea, but I can imagine she's a bit frazzled. The property owners conference fell apart and was replaced by an Aurorae Borough property owners'

conference, since the corporations don't own much land near here. They filed an injunction they may win, but probably won't. A group called Socialism for Mars threatened to pull out of the conference and split the property owners if the corporations were included. Louisa's going crazy over the mess, since the property owners' conference was scheduled to shape the agenda on three afternoons."

"Is it legal for the Commission to give three afternoons to the Aurorae property owners?" asked Érico.

Will nodded. "It seems to be, but we have to offer the corporations seats at the Houston event otherwise, so they have a say of some sort."

"Politics," said Roger, shaking his head. "What a mess."

"Hey, what's this?" asked Ethel, looking at the television screen on a nearby wall. It was a very large screen with the sound turned down and the audio replaced by a stream of subtitles. A British game show had been on; it had been replaced by a news anchor. Then there was a cutaway to a collapsed, smoking skyscraper.

"Whoa!" exclaimed Will. "That's serious news! Let's get the sound turned up!" He grabbed his attaché and began to click through icons to find his way to the controls, but suddenly the sound started, and loudly. Someone else with managing rights had gotten to the controls first.

"We repeat, the building had at least 6,000 people in it when the bomb went off in the underground garage. Thankfully, many had already left for the day. As you can see, the collapse of the building was total and instant. With the geiger counters going off the scale at several locations in the area, it appears that the bomb had at least a radioactive component of some sort. Evacuation of the entire Défence quarter appears inevitable and

it may be necessary to evacuate much of Paris. This absolutely unbelievable act of barbarism has caught France completely by surprise. Much of the civilized world is reeling in shock as the City of Light suffers the greatest act of terrorism in human history—"

"Oh, my God," said Will.

The entire patio erupted into shocked conversation. There was a sharp cry from the next table over. They looked to see Eve and Gaston Gilmartin; Eve was in shock. "That's where Paul works!" she exclaimed.

"Eve, who's that?"

"My brother! He works there! It's an office building for the European Union!"

"It's across the street from the new European Space Agency headquarters!" added Gaston. "And ESA has our medical and ecological support services!"

"God protect them," said Roger.

"Who would do such a thing?" added Carmen.

The journalist, almost in response to the question, turned to something new on his computer screen. "And we are now receiving information from the newspaper *Le Figaro,* which reports it just received a fax from a group calling itself *Frenchmen for a Pure France* that has claimed responsibility for the blast. It says was a blow aimed at the European Union, the Euro-Russian Alliance, the United Nations, and American corporate power. The release goes on to call on all 'true Frenchmen to defend the homeland from foreign cultural and linguistic domination and from alliances and unions that dilute French identity.'

“La Défence is an ultramodern section of Paris dominated by glass and steel skyscrapers, filled with many multinational corporations and the headquarters of many intergovernmental agencies. It is also located on the edge of the Périphérique, the beltway circling Paris. We have just received a report that the highway has been closed.”

“This is incredible!” said Madhu.

“I hope this wasn’t the U.S. Army’s missing suitcase nuke,” exclaimed Rosa Stroger.

“Isn’t that just a rumor?” asked Ethel.

Rosa shook her head emphatically. “The army has never confirmed the report, but it has been very careful not to deny it, also. It must be true.”

“But how could a suitcase nuke be smuggled from southern Korea to France?” asked Roger.

“It’s not hard in the Euro-Russian alliance,” replied Rosa. “The trick would be getting the nuke across the border from Korea to Russia; the customs procedures are pretty careful. But once in the Russian Federation, there are no tariff and customs barriers all the way to Paris.”

There was silence in the room as everyone contemplated that thought. They turned back to the screen, with private conversations and some private tears. When 1:15 came, everyone was still seated; no one headed for work. No work would be gotten done the rest of the sol as they clung to every report. Will rounded up the teachers, though, and asked them to take the children away; the story was getting too terrible, the images too frightening.

It was soon confirmed that the bomb had indeed released radioactivity. Everyone in greater Paris was ordered to stay inside, except those within five kilometers of the explosion, which included part of the center of Paris. Night had already fallen; in the dark, with the beltway highway closed, parts of Paris descended into panic and chaos.

Suppertime came and almost everyone was still watching. The children returned and the television screen went off in the patio. Father Greg stood to announce an interfaith memorial service after supper. Almost everyone—even the self-proclaimed atheists—attended. The singing, scripture, and prayers brought some comfort.

"Humanity will always have terrorists, I'm afraid," sighed Alexandra, after the service ended.

"I hope not," replied Will. "We certainly can't afford them here! Half the population of the Outpost could be killed in a minute."

"No society ever created has avoided extremism, though," replied Érico. "Fanaticism seems built into society."

"It does seem, but there is a better way, at least if the Bahá'í scriptures are to be taken seriously," replied Will. "The ideal of unity is something we can recognize and strive toward. We may never get there, but the process of working toward it produces a different culture, and that different culture has less fanaticism and partisanship."

"Partisanship?" asked Érico, surprised. "Don't liberal Bahá'ís have trouble talking to conservative Bahá'ís?"

"We don't have conservative and liberal Bahá'ís. Those terms don't mean anything in the Bahá'í context. It's quite remarkable." Will saw Érico didn't believe him. "It's true. I can refer you to publications about the topic, if you'd like. We tackle

partisanship at several levels, but one of the practical steps is that in Bahá'í elections, all nominating, campaigning, and mentioning of names is forbidden. Voting is a spiritual act; a form of prayer, you might say."

"Interesting. But not practical in a secular society, I'm afraid."

"True, I can't see all of us here praying before we vote." Will glanced at his watch. "I better catch up with Ethel and help her get the kids to bed. Good night."

"Sleep, don't watch t.v.," said Alexandra.

Will walked home, thinking about the conversation. But soon he was home and Marshall was behaving very badly; he was upset about the news but couldn't put it in words very well. After both kids went to bed, Will looked at his attaché and saw there was a message from Morgan. "Will, we have to decide what to do about tomorrow. Everyone has arrived here, but no one seems to think we can start the conference. I bet your people are distracted as well. Let's talk. Bye."

Will hit reply. "Doug, I think the attack in Paris makes some of our agenda more important than ever, especially the panel discussion about conflict and peaceful resolution of differences. I'm scheduled to speak on that panel—to introduce it—and I have a few ideas. So I suggest we keep it, but modify it slightly to fit the situation. I can work with Louisa about it. Bye."

He hit send. Ethel looked at him from the couch. "I sense something unusual, perhaps even controversial."

Will shrugged. "Maybe it's time I spoke from my convictions, rather than just acting from them."

"You've been Commander a while and have a pool of good will. But I'd be careful not to undermine it."

"I agree. I think I'm going for a walk around the Outpost. I have to think."

The conference did indeed go on as planned. The next morning the television broadcast at breakfast was followed by an image of a conference room in Houston slowly filling with people. The children were taken to school or day care, then the majority of parents hurried back to participate in the second international conference on the Future of Mars. A second screen showed a room with eight of the eleven residents of Cassini.

Morgan welcomed everyone precisely at 9 a.m. Houston time—which was 9:15 a.m. in Aurorae—with an overview. There was a long history of conferences about Mars. Columbus 2 had had a conference to review who was staying and what exploration priorities to set. Columbus 4 had seen the "Living Well" conference that had focused on quality of life on Mars. Columbus 5 had inaugurated the scientific conference at opposition to summarize and discuss the state of Mars science. Now a new sort of Mars conference was being planned, one more like the Living Well conference, but exploring Martian society. The expansion of Martian settlement to nearly one hundred people and two outposts, with an increase to almost 150 and three outposts likely in the next two years, made governance, law, and culture a new priority.

Then the panelists of the first theme—"Social Change without Dissidence"—sat on the podium and Louisa Turner introduced them quickly. Present were a conflict resolution expert, a sociologist, and a traditional Lakota healer. She explained the use of dissidence—literally, "sitting apart," meaning that dialogue had broken down—and

contrasted it with dissent, “feeling differently,” which was a natural and acceptable level of difference in any society. Then she introduced Will Elliott, the invisible panelist, who had recorded his brief comments just half an hour earlier. He leaned back in his chair to watch the videotape of his presentation.

“Thank you, everyone, for coming this sol,” Will began. “My thoughts inevitably are drawn to the terrible tragedy that occurred in Paris yesterday. This morning’s headline in the *New York Times* was ‘Today we are all French’; *Aujoud’hui nous tous sommes français*. It is a fitting echo of the headline in *Le Monde* almost exactly twenty-one years ago, ‘Today we are all Americans’ which led their story about the destruction of New York’s World Trade Center. Last night many of us discussed the implications for Mars of that gross act of terrorism and I felt moved to consider how Mars could create a culture where such wanton cruelty can never happen. We, after all, are even more vulnerable to terrorism than our terrestrial cousins, for an interruption in the oxygen supply can kill all of us in three minutes. We cannot afford to build a world where an intentional interruption of our oxygen supply is a danger.

“Is it possible to build a world free from terrorism? Perhaps it is not, but we must try, and we can do better than history might suggest. The place to start is with our assumptions about the nature of society and social conflict itself. Difference between human beings is not only inevitable, it is good, but breakdowns in communication and conflict are not always necessary and inevitable. We must not look at the problems in contemporary human society and say they cannot be ameliorated. The gradually thinning human skull and skeleton says we have been becoming less violent. Humanity has abolished cannibalism and slavery. It is on the verge of abolishing war. It has managed to

banish tyranny and dictatorship to small corners of the Earth, and in far less time than anyone might have imagined. At the dawn of the twentieth century only a handful of countries were democratic; by the end of that century, the majority of humanity lived under democracy or partial democracy; today it is the accepted standard for governance.

"Mars, obviously, will have democratic governance; nothing else is imaginable. But how does this relate to the goal of abolishing terrorism? Democracies clearly have not slain that dragon. Can we pioneer a form of governance able to reduce cultural and social conflict enough to save Mars from terrorism? Most would say no.

"Winston Churchill once commented that democracy is the worst form of government in existence, until you consider the alternatives. But perhaps Mars can do a bit better. The starting point I would identify is in the resolution of conflict. The various techniques and principles of behavior to be discussed by this panel today are not simply advice to apply when person x has a disagreement with person y. They have to permeate the political processes we use to select our leaders and the legislative processes whereby we determine our laws. Historically, for the last few centuries, democracies have utilized political parties as major players in the selection of leaders and laws. But consider where partisanship has taken democracies on Earth. Many advanced democracies today are now dominated by two political machines that exist not for the good of their societies, but for their own advancement. The principal means of advancement of the party is to play on the public's emotions in order to gain as much support and money as possible. One of the best ways to play on the public's emotions is to attack the people and ideas of the other party, painting them as misled, foolish, or evil. The result is not a focus on what is best

for the nation; rather, it is disillusionment—for the people are convinced that almost all politicians are crooks—and legislative gridlock.

"At this point people will say 'alright, Will, perhaps we agree with your point, but nothing can be done.' No, there is a lot that can be done. After all, we may assassinate the character of politicians, but we no longer poison their food. Progress in political behavior has been made; the behaviors that are considered culturally acceptable have changed, and they can continue to change. What we need to do here on Mars is resolve that we will not establish political parties at all. On Earth there are many cities and states that hold nonpartisan elections. Why not an entire planet? Especially when that planet already has vast cultural diversity; one thing it does not need is politicians who intentionally play on differences and exaggerate them for short term gain. Entire countries have been destroyed when that has happened, and terrorism follows. The disintegration of Yugoslavia is the most chilling example.

"But will abolition of parties be the solution? Of course not, it is just one step. A second, more radical step, and one Mars may not be ready to follow, would be abolishing political campaigning. So far we have done pretty well where this is concerned. When we hold elections we call a big town meeting to discuss the future of the borough and let everyone speak their mind. No one is running for anything officially, but some people obviously have things to say, and a sort of unofficial debate results that does everyone a lot of good. Why not continue in this mode? Why take formal steps to create candidates? Some will say that if there are no official candidates, then the incumbents will automatically be reelected, and that's dangerous. Perhaps, but in most democracies 99% of incumbents are reelected anyway, and that's after they've been dragged through the

mud by their opponents. Can we create a culture where there is election turnover without screaming, yelling, begging for money, insulting the other person, lying about what the other person will do, and making false promises about what you will accomplish? Let us hope so! Let us try!

"But will elimination of extreme behavior in political campaigns clean up Martian governance enough? No, because we can't eliminate it simply by policy or law; it'll creep back through the loopholes and exceptions. The third step to take is the hardest: we must change our culture. We must understand, as individuals, that we have a human right to choose whomever we want for a particular office, and we have a right to do so without interference from others. We must vote not whether we think someone will win, but because we think she or he will do the best job, and no one has the right to tell us he or she is the best choice. We must understand, as individuals, that we must seek truth, and not compromise it except under one situation: we must accept the decision of the majority, support it, and see whether it really will work. The unity of our society is the practical higher value, but it must be unity in justice and diversity, for there is no unity without justice and diversity. We must see ourselves, first and foremost, as servants to others, for if everyone seeks to be servants of all, all will be served. Servants offer their ideas to others rather than advocate them or refuse to modify them. Servants respect all, love all, are courteous to all. Servants listen to all and seek to persuade, not intimidate or fool others.

"This is the society and culture we can and must build. It is a society based on many universal human values that are common to our religious traditions. A servant

society is neither purely capitalist nor purely socialist. It is democratic without the mob or the tyranny of the majority.

"Can we create a servant society? We must try. Such a society can greatly reduce partisanship, and as a consequence it will also reduce social tensions, polarization, and ultimately the tendency toward terrorism. I have always been dedicated to establishment of a servant society, even if I have not named it heretofore. You can count on me to oppose partisanship and narrow self interest strongly as long as I live and breathe air. I have no choice; partisanship is against my religion. Indeed, I think ultimately partisanship is against the spirit of all religion and against true human values, which have always called people to love and reconciliation. Let us continue building a political system based on reconciliation instead of confrontation, unity rather than strife, unity rather than partisanship. Thank you."

Will's image flickered, then disappeared from the screen. The audience on the patio clearly was very impressed; they applauded loudly, and some even stood. "Way to go, Commander!" exclaimed Kim Irion, who was clearly moved. Several other people made similar remarks. Will smiled and nodded, then finally stood to acknowledge the appreciation. Then he sat.

Back in Houston, Louisa Turner was several sentences into introducing the next speaker. "The applause in Houston was much more restrained and polite, Will," noted Ethel. "Clearly, we have a cultural difference."

"I'm not surprised. We've already been functioning partly along the lines I described. They haven't experienced it in Houston."

"Hey, did you see who walked out of the hall?" asked Roger, pointing at the screen. "Jeff Harrison, the White House representative, who is also a major functionary in the Democratic National Committee."

"Hum, then good news to our folks is controversial on Earth." Will shrugged. "Let it."

"It will be shocking," agreed Ethel. "Especially right now, after the bombing."

The morning panel, focusing on ways to prevent conflict and envision social change positively, generated a lot of discussion on the patio over lunch. Many people came to Will to ask questions about his statements as well, with half the outpost listening to the conversation. "Do you realize you basically said the partisanship that dominates modern politics is related to terrorism?" asked Kevin Dunbar skeptically.

"Well, yes, that's basically what I said," agreed Will. "I had just enough time to sneak a peek at my incoming messages before sitting down to eat. The Commission's office of public information has been busily categorizing and summarizing the media response to our conference. So far, my comments are dominating the news, for better or worse. I've been denounced by several people for saying that party politics is a form of terrorism, which I did *not* say. I've also been accused of going against the Constitution of the United States, a document that does not talk about parties at all."

"Will's right," exclaimed Greg. "The more I think about your analysis, the more I agree. And this is a good time for the point to be made, with the dead still being counted in Paris."

“People will just claim we’re exploiting a tragedy, though,” commented John Hunter. “Emotions will be raised very quickly about this point.”

“And no doubt I’ll have to be interviewed by a dozen journalists, so I can clarify what my point was, defend myself, and have the privilege of being misquoted all over again,” added Will. “But everyone here heard me. I’d rather that Mars really try to do something new and different, where governance is concerned. I really feel we have a chance to be an example to the rest of humanity. Our small size means we can develop new cultural conventions and values relatively easily, and our prominence means we can offer them to all of humanity. We can be a leaven for human civilization.”

“Lord knows that Earth could use it,” exclaimed Martha. “Africa is still getting poorer, wealth is getting concentrated in elites, petroleum production is beginning to decline sharply relative to demand with no developed alternative available, the world economy is inadequately regulated and therefore unstable, the developed world has massive problems with illegal immigration and therefore with xenophobic reactions, much of the Islamic world is still anti-modern in profound ways. . . it’s a real mess.”

“This afternoon I think we need to turn to the question of Mars governance,” said Érico, looking at Alexandra. “We’re scheduled to break into small groups to discuss the morning panel anyway. We could still do that, but cut it short and reserve a longer time block for a sort of town meeting about governance.”

“Don’t say town meeting!” exclaimed Roger, rolling his eyes.

“That’s part of the problem we have to deal with,” agreed Alexandra. “People have had it with town meetings. We need fewer of them, and more digesting of ideas beforehand.”

"A Borough Council," agreed Silvio. "That's in the proposal we've been drafting." Silvio was referring to bylaws for Mars that he had been drafting with the help of Alexandra, Érico, Ruhullah, Will, and some experts on Earth.

"What sort of Council?" asked Martha.

Silvio hesitated and looked at the large audience listening. "It's still rather preliminary. Each borough will elect a chair, clerk, and treasurer once per annum—Martian year—who will also serve as a Borough Council. The Council can appoint committees and must approve the budget, new ordinances, and other resolutions before they are brought to the town meeting. That should reduce the workload on the town meeting. Once a borough's population hits 100, it elects two additional members to the council. The additional members go to four when the borough population reaches 500, six when it reaches 1,000, then the council membership increases by two per two thousand thereafter, to a maximum of fifteen members. Mars will have a bicameral legislature; a Mars Council elected by the residents and a Mars Assembly elected by the land owners. The Mars Council will be selected proportionally and will have nine members plus two more for every additional thousand planetary residents. The Mars Governor will be appointed by the Mars Commission. We're debating whether to add that the people will elect a Prime Minister, whose duties will be specified by the Governor and legislature, but will be principally domestic in nature: education, health, etc. The Prime Minister will nominate judges to the legislature, which will approve them. I suspect for now, once we elect a Mars legislature and Prime Minister, the Aurorae government will have much less to do, because right now it is doing double duty."

"Why should land owners have a say in all of this?" asked Enlai, skeptically.

Silvio shrugged. “I don’t particularly like that aspect of the system, either, but the idea is simple: the property owners are pouring a lot of money into Mars, and thus should have a say in its governance. Eventually millions of people who live on Mars will dominate land ownership and thus the Mars Assembly will be elected by Martians as well.”

“But will the land owners have one vote each, or one vote per dollar invested?” asked Enlai, who was still concerned.

Silvio shrugged. “Who knows. That part isn’t drafted, yet. I suppose the landowners will have to decide. I’d favor a ‘graduated franchise’; in other words, ten square kilometers of land or less gives you one vote, one hundred square kilometers gives you ten, one thousand gives you fifty, ten thousand gives you one hundred. . . something like that.”

“That’ll be controversial,” noted Érico. “But anything we propose will be controversial.”

“Let us hope some of these positive decision making techniques can help resolve these issues,” noted Martha. “Will, what does the Commission think of this?”

“Morgan’s very unhappy. I suppose he’s officially neutral. The various national space agencies are all sour about civil government here; they maintain that there are plenty of laws already.”

Roger scoffed. “They don’t live here! Sure, one hundred people on a submarine don’t need to elect anything; but they go home after six months. We’re stuck here. Our families are here.”

“We can make those points,” said Will. “But we’re going to have to watch public opinion on this and not move too fast.”

“But if Morgan’s not helping, that could take a while,” objected Martha.

“Be thankful he’s not against. He was against the idea until June, then came around. Louisa Turner is working on him and on the space agencies.”

“How long, Will?” asked Yevgeny.

“Let’s take our time and get the ‘Fundamental Law’ or whatever it’s called, drafted. That’ll take a few months anyway. Maybe the political situation will be better by then.”

“And what are we calling the entity we’re forming?” asked Kim. “We aren’t a ‘national’ government.”

Will smiled. “That’s the most controversial question of all. How about ‘the Commonwealth of Mars’? No one knows what that means, so we can define it ourselves.”

Several laughed. “Great idea!” exclaimed Greg.

11

Celebrations

early Jan. 2033

Riviera Biome was full of flowers. The clover was fully established on the lawn and made a soft carpet for the wedding of Ananda Thanarat and Kimberley Irion. The couple stood with a semicircle of readers of scriptural passages to the right and left of them, including Will, Ethel, Marshall, Enrique, Greg, and Martha. The ceremony culminated when the couple repeated the Bahá'í wedding vows: “We will, all, verily, abide by the Will of God.” Then Ananda and Kimberly signed the wedding license, followed by the witnesses—Will and Greg—while the audience, which included the vast majority of everyone on Mars, applauded.

A reception line formed to congratulate the couple, then everyone headed to Yalta for the wedding dinner, a sumptuous meal that was basically a very early supper for everyone. The wedding party stayed in Riviera for a while to take photographs, then entered Yalta to the applause of the assembled crowd. Clinking glasses forced the couple to kiss right away several times. Then everyone went through the buffet line and filled their plates.

“I’m amazed you’ve got this much good food!” exclaimed Gerhard Bach to Will, as he joined the commander at his table.

“We won’t be eating much meat for four sols, I think, and the desserts won’t be very fancy either, until next weekend.”

“Are there more weddings scheduled then?”

Will nodded. “Two on Satursol: Kevin Dunbar’s marrying Andrea Shelton at 1, then Arieh Freeman marries Sheila Burns at 2. We’ll have the reception at 3, as usual.”

“Plus the three weddings this weekend, and the two at Cassini last weekend and the weekend before; a lot of folks are tying the knot.”

“And Jennie Dunbar married Ernesto Gomes three weeks ago, and Cornelius Beyer married Tatiana Gavrilova last year. Columbus 6 has seen nine marrriages! Which I suppose means that Columbus 7 and 8 will see about that many children.”

“It warms your heart, doesn’t it, you sentimental fool,” exclaimed Ethel.

Will nodded. “It does.”

Bach pointed. “That’s Dan Shapiro, right? You’ve let him out for this event?”

“He’s been a model prisoner, so he got some time off for good behavior. He’s proved to be a very good Prospector driver from his quarters, and he runs them about fourteen hours a sol. Frankly, I wish we didn’t have to ship him back to Earth; he’s a very hard worker. He and Ruth would prefer to stay as well, but he can’t, obviously.”

“Will he spend time in prison?”

“That’s up to the judge after he arrives. Probably at least a year. Then the Mars Commission conceivably might hire him for a job that doesn’t involve the handling of money.”

Bach looked around. “But Stoughton’s not here?”

“No, he didn’t know the couple very well, they didn’t ask for him, and besides, he hasn’t been quite as cooperative. He’s gotten better in the last few months, but he’s still in a state of denial, even about aspects of the case for which there is indisputable evidence.”

Bach pointed to Emily Scoville and Muhammad Rahmani. “Those newlyweds seem to be doing well.”

“Yes. I’m glad they descended from the Dacha to attend this wedding.”

“I’m surprised Emily is wearing a headscarf, though.”

“It’s part of her new religion, after all.”

“They came down from the dacha for Louise and Eliseo’s wedding yestersol. They’re flying back to Cassini on Monsol.”

“I’m glad you were able to get up here for both weddings, too,” added Will.

“Louise and Eliseo made an important contribution to Cassini, and besides, I wanted to get away and relax a bit. I plan to spend a few sols up at the dacha as well later in the week.”

“Congratulations on beating Consolidated, by the way.”

Bach smiled. “Thank you. It was a sweet victory. But we barely squeaked ahead, and their gold output may rise a bit faster than ours. It’ll be interesting to see what we can do during Columbus 7. The richest concentrations are just about exhausted, so we may barely match our exports this year, even with twice as much equipment and staff.”

“Oh, you’ll do better than that, I think.” Will turned to Enlai Tang, who was approaching the table.

“Will, yestersol we got very interesting samples back from the fossil location in Schiaparelli Basin,” he said. “It’s got three new species we’ve never identified before; it looks to me that Lake Schiaparelli was an isolated ecosystem for quite some time.”

“Oh? Let’s schedule a visit, then. It’s not far off the Circumnavigational.” The samples had been obtained by Prospector; no human had visited yet.

“Say, Enlai, what’s the scoop about all the Chinese leaving?” asked Bach. “Someone hinted to me the Chinese government recalled them.”

“I wouldn’t put it that way. The government has decided it prefers Chinese astronauts to stay here two columbiads only, then return home. But Li Qingtian and the Wangs will all tell you they decided to return anyway, and the Wangs have been here only one columbiad. I, for one, plan to stay at least another columbiad. In my opinion, the government position is short sighted. If this place ever does gain significant size and cultural momentum, it’s in China’s interests to have its people involved. Otherwise Mars becomes more American looking; no offense meant, Will.”

“Oh, I understand your point,” replied Will.

“So do I,” added Bach. “And I agree with you very much. We need more Chinese here.”

“There are four coming on Columbus 7, all geologists and biologists.”

“Good.”

“We’ll talk about the Schiaparelli fossils on Monsol, Enlai. We’ll schedule a visit then. I suppose you want to go along?”

“Most definitely!”

“Good, then you will.”

“Thanks. See you Monsol.” Enlai waved and headed back to his table.

“We have three Chinese leaving,” Will said to Gerhard. “Out of seven flying back to Earth. I asked your question through channels, by the way, and got even less than what you just got.”

“I’m not surprised!” Bach smiled. “So, Columbus 7’s forty people will include four more from Muller, five more from Consolidated, and six from Sibereco.”

“Yes, plus thirteen mining support staff, six Americans supporting Bio-Archive—two plastics fabricators and three ecologists—and another two American nuclear engineers. The result is the least diverse flight we’ve had in a very long time. A lot of couples are coming, too; the various governments and companies are planning long-term.”

“At least the Bio-Archive concept is catching on. I hear Russia wants to try it, and the Japanese are signed up for Columbus 8.”

“Yes, that idea has some momentum to it, surprisingly enough.”

“A shame that Cassini won’t get any, though.”

Will smiled. “Oh, we may share the wealth yet, don’t worry. Aurorae has the most number of people and could use the extra space the most, but if we get more biomes to archive species, I’m sure we’ll put some at Cassini and Dawes, especially as they grow.”

“That’s a relief. Not only does Cassini need the space and the redundancy; I need to look at more greenery!”

“I understand. We only had greenhouses for our first six years here, and it was enough to drive us crazy.”

Will rose to get a second helping of beef, which was quite good. He ran into Dr. Qingtian Li at the buffet table. “So, are you ready to command Columbus 6?”

“Thank you, I am feeling more confident. I plan to devote all of the next few weeks going over the systems again, and training the crew; well, minus the two prisoners.”

“We may want to include them in the training as well. It’d make them feel more a part of the team, will give them skills that might be essential in an emergency, and will improve their likelihood of being helpful.”

“Definitely, I would prefer that.”

Will nodded. “I’ll talk to the Commission about it.” He filled his plate and walked back to his seat. He stopped at Greg Harris’s table. “Father Greg, are you enjoying the reception?”

“Yes, of course, even if there’s no alcohol! You Bahá'ís should change that rule.”

Will smiled. “No thanks. I guess people can be thankful they can drink from 7 p.m. Frisol to 3 a.m. Sunsol. I have my doubts whether even that’s wise.”

“I know what you mean,” agreed Greg. “It is a questionable situation; we have too much high-tech equipment here. I suppose the new Mars Council can take up the matter.”

“If we can get it formed,” agreed Will. “It’s looking likely the land owners will settle their differences about representation today or tomorrow, so maybe we’ll have the last piece in place pretty soon.”

“That would be welcome news. We have a good design for governance, Will. I think it’ll make people rethink their habits on Earth.”

“I hope so, but it hasn’t helped the land owners rethink their habits!”

Greg laughed. “True enough. I guess we had better work on them, first.”

Will walked toward his table. He stopped to chat with Lal and Radha; their baby smiled at him and reached out, so he gave her a kiss. Next was a visit with Eammon, Lisa, and their three kids; the twins were almost two years old and becoming very chatty. Last week Lisa had just discovered she was pregnant with their fourth child. Will spoke

briefly to John Hunter, Sun-Hee Jung, and Susan Jung as well. Then he returned to his table.

Soon the buffet table was cleared away—the pigs would have particularly rich choices the next sol—and the wedding cake came out. Then dancing followed; a live band provided the music.

At 5:30 p.m., the bride and groom waved goodbye and were showered with rice as they headed to Joseph Hall. As they were about to exit Yalta, Eammon began to wave his attaché. “Hey, there’s a news bulletin!” he shouted. “The landowners have struck a compromise! They’re forming two associations, one for individual landowners and one for corporate landowners!” He paused to listen a moment; there was a piece in his ear. “But they’re electing twenty-five representatives to the Landowner’s Assembly based on one vote per owner, and twenty-five based on one vote per share!”

“Good news!” exclaimed Greg.

“Amazing!” added Érico.

Eammon raised his hand. “Oh, but they didn’t approve the election of a Prime Minister!”

“They didn’t?” exclaimed Will. “But they approved the rest?”

“Apparently,” said Eammon. “We’ll have watch it to hear all the details.”

“Let’s say goodbye to the bride and groom and get the big screen on,” suggested Will.

“Good bye?” replied Kim Irion. “I’m not leaving yet, with news like this!”

“Spoken like the major Mars enthusiast that you are!” added Ananda.

“She stepped off the shuttle her first sol singing ‘This Land is My Land,’” noted Will. “You’ve got time to get to the Dacha.”

Everyone headed back to the patio, where the large television screen was immediately switched to the Mars cable channel. It was rebroadcasting the BBC coverage, which reiterated the news. The property owners had approved of the resident’s Council and a Governor appointed by the Commission.

“It was premature to push for a Prime Minister,” said Will, shrugging.

“Morgan was opposed, wasn’t he?” stated Alexandra. Will nodded slightly.

“I think the owners felt that since they were on Earth, a Commission based on Earth was more likely to favor their interests than a Prime Minister elected and serving on Mars,” he replied.

“Still, we have a planet-wide civil government; that’s quite an achievement,” exclaimed Érico. “Who would have thought we’d get that, twelve years after the first landing.”

“It’s historic,” agreed Kim. She stood. “Let’s sing!” she exclaimed, and immediately launched into the song Will and Roger had spontaneously created years earlier, though with a new stanza that had been circulating over the last few months:

This land is your land, this land is my land,

From Tharsis Montes to the Hellas Basin,

From the cratered highlands to the Mariner valleys,

This land was made for you and me.

As we were walking along the cliff edge

We saw above us, the twin moons shining

We saw below us the Aurorae Valley

This land was made for you and me

And everyone laughed after they sang it a second time, then applauded quite enthusiastically. Will looked around, a bit surprised; he hadn't realized that the residents felt so positively about the development. But over three months had passed since the Mars Planning Conference, and in that time there had been a lot of discussion on the Mars listservers and message boards, not to mention frequent reports from the Committee to Formulate a Fundamental Law—the euphemism they were using instead of "Constitution"—and a lot of town meeting time to discuss progress. The town meetings of Aurorae and Cassini had ratified the Fundamental Law just two weeks earlier; the final hurdle was approval by the landowners.

Until they acted, the vote by the residents had felt quite abstract. Now their act to define a system of self-government suddenly felt very real. Will found himself cheering as well. He looked at Ethel; she was thrilled as well. He leaned over and kissed her. "This place has a future."

"Did you ever doubt it?"

"No."

Kim jumped on the stage below the television screen. "I have an idea. Let's go outside and raise the Mars flag on the flagpole to celebrate the beginning of the Commonwealth of Mars!"

There were cheers at that idea, but many people immediately looked at the Commander, who was responsible for the American flag that had flown over the public park at the base of Face Rock for the last decade.

“We’ll lose a hundred million or so of Congressional support if we do this, won’t we, Will?” said Alexandra.

“Yes,” said Will. He smiled. “But this is a request from the bride, after all. We should honor her request.”

There was a loud cheer and applause at that. Many turned toward Joseph Hall, which had one set of airlocks. Others headed toward Clarke Dome, to cross through to habitats 1 and 3 and their spacesuit donning facilities and airlocks.

“Dad, can I go outside, too?” asked Marshall, excitedly.

Will looked at Ethel, who looked worried, but not opposed. He smiled. “Sure. Why not. This is an historical event.”

“There won’t be enough windows for the kids and their parents to watch through, if the kids all stay inside,” added Ethel. “I’ll stay in. Liz and I can watch from Renfrew Hall.”

Will nodded. “We’ve never had seventy or eighty people outside before. This should be interesting.”

“It’ll take an hour for everyone to get outside. Better hurry,” added Ethel.

Will nodded. He led Marshall toward Clark Dome. Kim saw him and hurried over. “I hope I haven’t started a revolution!”

“In a sense, you have, but that’s alright.”

“Really?”

“Really. You’re right. The time has come to change the flag. If we all go outside, it’ll make quite a statement.”

“I’m afraid I’ve postponed the honeymoon,” she said to Ananda.

He shrugged. Will shook his head. “You can drive up to the Dacha after sunset, if you need to. We can send an escort of two other rangers to accompany you, and they can accompany each other back down. We’ll get you to the top of the Escarpment, don’t worry.”

They all headed toward the airlocks. Marshall was soon plunged into the world of the male locker room, with a dozen half-dressed men trying to help him and Sammie all at once to get into their space suits, for Roger had brought his son along as well. Everyone was testing backpacks, checking pressure seals, verifying the suits’ computers and their automated testing routines. Groups of five or six were clopping out of the locker room in their suits and squeezing into the airlock to exit.

By the time Will and Marshall got out, quite a crowd had formed. The sun was just minutes above the western horizon; a nearly full Phobos was high above the eastern horizon and dropping toward its setting in about an hour. The radio buzzed with a hundred conversations on the common channel. Will called Marshall’s cell phone, which was plugged into the suit, so they could talk privately and listen to the common buzz at the same time.

Kimberley and Ananda were nearly the last ones to emerge from Joseph Hall’s airlock; a wedding gown took a long time to remove. Kim had put her veil back on outside the helmet; it looked funny, but she was unmistakable. She was bearing the Mars flag she had brought from Earth. It was a rusty red field with white circles on the right and left sides representing the polar caps. Two yellow stars flew above the white circle where the flag rested along the flagpole, representing Phobos and Deimos. In the middle there had been a single green star representing Aurorae Outpost, but Will was surprised

to see that Kim had modified the flag at some point in the last two years, for it now bore two green stars.

She walked to the flagpole, ignoring the neat paths in the public park at the base of Face Rock and tramping directly on the geometric patterns Madhu had laid out with black basalt, reddish hematite, greenish malachite, yellowish sandstone, and white salt. Will turned toward Renfrew Hall and scanned the faces he could see there, to see whether Madhu was watching. But there wasn't much that could be done because the park had been laid out to be visited by small groups of people, not the entire Outpost at once. The damage was easily fixed, anyway.

Kim reached the flagpole and untied the rope. She lowered the American flag and with great care, even reverence, and removed it. She and Roger, who happened to be close by, carefully folded it according to proper flag etiquette. Then she took the Mars flag from Ananda and hooked it on the rope. The two of them slowly raised it to the top of the pole, where it fluttered in the late afternoon breeze.

"To the Commonwealth of Mars!" Kim exclaimed.

A great cheer went up through the gathered crowd. The muffled sound of applause from spacesuited gloves echoed across the common channel and through the thin air. Inside Renfrew Hall, the crowd that had not come out was applauding as well. Will looked at Bach and Curry nearby and both were clapping, though he wondered whether it was out of politeness. Will glanced at the crude profile of a human face that one could see in the silhouette of Face Rock if one were standing in the right place. He was in the right place and was surprised to notice that the evening sun, glancing across the side of the face, made it look almost like it was smiling. Mars itself seemed to be

participating in the celebration as the inhabitants of Aurorae Outpost cheered the beginning of the Commonwealth's civil government.

Plots:

Columbus 7: reactor plans advance; bioarchive advances; visits to near-Mars asteroids advance; Argo flies; Magellan has a crisis (?); moon advances; new transportation system proposed; may want to write to include Columbus 8 in the same volume

Columbus 6:

Cargo leaves Gateway: 30 Jan. 2031 (normally 20 Jan., see arrival below)

Feb. 1, 2031: Marshall's sixth birthday

C6 Leaves Gateway: 4 Mar. 2031

Late Cargo leaves low earth orbit: 4 April 2031 (delta-vee, 5.3 km/sec)

Opposition: 4 May 2031

25 Apr. 2031: Magellan 2 leaves for Venus (arr. 20 Sept.)

June 1, 2031: Magellan 1 leaves Venus (arr. Earth 20 Oct.)

Late cargo arrives at Mars: 24 August 2031 (approach velocity, 8 km/sec)

Arrives Mars: 4 Sept. 2031

Lands Mars: 14 Sept. 2031 (after maintenance visits to Phobos and Deimos)

Sept. 2031: Marshall starts first grade; MarTech opens

Cargo reaches Mars: 1 Oct. 2031 (usually 1 Nov. 2031, but must avoid storm season)

Dust storm season begins: 13 Oct. 2031

Magellan 1 reaches Earth: 20 Oct. 2031

Dust storm season ends: Mar. 5, 2032

Conjunction: 2 June 2032

Columbus 6 leaves Mars: 27 Jan. 2033

Opposition: 27 June 2033

Columbus 6 reaches Earth: 27 July 2033

Plot Summary

1. Miners 2
Columbus 6 arrives. Will meets Bruce Curry and Gerhard Bach, representatives of Consolidated Mining and Muller Mining, respectively. The two men distrust each other but are united that Cassini must have a biome.
Date: 14 September 2031

2.Beginnings 18
The rest of Columbus 6 arrives. At the inaugural dinner on Frisol, Emily tells Will of the romances on C-6 and remarks about the diversity but the high cost of food. Ananda Thanarat introduces himself to Will as a Bahá'í and they welcome him. They talk to Fatima and Husni Hijazi about Muslim prayer and fasting on Mars. Andries complains about Curry. Will gives a welcoming speech. On Monsol Will and Ethel drop Marshall off at first grade, then go to the inauguration of the Mariner Institute of Technology, where Curry nearly demands and begs to go to Cassini immediately. Alexandra proposes a simplified Cassini biome.
Date: 16-20 Sept. 2031

3. Debates 37
Will and his heads of staff meet and debate how much staffing to send to Cassini. Arieh, John, Greg, and Emily debate the sacred on Mars and hear two bits of news: Madhu's lung operation has detected cancer; and Radha's baby has Down's syndrome. Will and others debate the implications of these mortal facts on a Sunsol afternoon.
Date: late Sept. and early Oct. 2031

4. Settlement 56
Emily Scoville leads an expedition of 18 people, 2 Mobilhabs, and 3 reactors, to Cassini to set up the Outpost and start gold production. They set up the two bubbles and get started on the biome. Will exchanges emails with David and Sebastian about future exploration of Mercury, development of lunar ice, and expansion of lunar tourism. Michiko calls and tells Will that dust storms are on their way to Aurorae.
Date: late Oct. 2031

5. Crime 78
Will, Alexandra, Lisa tour Catalina, which is now finished. They see a dust devil. After discussion, Alexandra agrees to take a crew to Cassini to finish the biome there. A few days later a Mobilhab arrives from Cassini. Will hears from Eliseo and Louise that conditions are really rough. Chester Stoughton echoes their assessment. Two days later, Satursol/Sunsol night, Chester is accused of raping Sheila Burns. He is taken to the hospital for examination.
Date: late Dec. 2031

6. Trial 96
A town meeting is held and many issues about justice and court procedures are discussed. Will and a group of associates discuss the implications of the town meeting; Mars-wide

organization clearly is needed. The trial itself is swift. Will, Alexandra, and Silvio discuss the implications afterward.
DATE: late Dec. 2031

7. Proposals 108
The Secretary of the Interior calls Will to tell him about the Bio-Archive project. He talks to Lisa about it. The next day he puts on the first pair of pants made on Mars; Marshall makes fun of them and asks probing questions about Bio-Archive. Ruhullah offers his services for administration, as he plans to settle on Mars. Morgan says they will pursue Bio-Archive as a way to develop capacities to make domes and solar cells, and the reactor project will have to wait a bit.
DATE: early March, 2032

8.Vacation 130
Will lobbies Senators to favor bio-archive. Sebastian Langlais calls about coordinating the moon's needs for biomes with Mars's. Will replies that Phobos's carbon and nitrogen and Martian uranium are natural supports for the moon as well. But Bio-archive gets tied to building Dawes Outpost as well. Will notes the strange discrepancies in gold production and asks Yevgeny and Silvio to audit. At supper, they talk about vacation, and arrangements to run things in Will's absence. The next morning three families go to the Dacha. The boys go outside with parents to hike around. In the afternoon, while the kids are napping, the parents talk about the future. Meanwhile, down at the Outpost, communications with Earth collapse from overload because of conjunction, then internal communications collapse as well. At supper, Kevin makes a scene with Jennie over her new boyfriend. After dealing with that, Alexandra learns that Silvio has figured out that Dan Shapiro has been embezzling gold. Will finds out when he returns from vacation.
DATE: Conjunction (early June, 2032)

9. Organization 159
The trial raises issues of Mars's legal system, now that two boroughs exist. The Commission is upset with two criminal acts in six months; Mars now has a distopian reputation. Morgan pushes for exploration of Elysium and an asteroid mission. Will pushes for a constitutional convention. Morgan agrees to a Mars planning conference. Two weeks later, July 5, Will goes to Cassini. The residents agree to a borough government. The situation there is improved and gold production is strong.
DATE: late June, 2032

10. Conference 185
Will argues with Morgan and Turner about whether to postpone the conference again because the landowners are split. They agree to hold the conference and invite the corporate land owners to it. Will calls Heather Kimball and pushes her to push the land owners to compromise. Will explains the problems among the land owners between the "utopians" of various stripes and the corporate landowners. Then a small nuke destroys a

European Union building in the Defence, forcing evacuation of half of Paris. The next morning Will gives a speech condemning partisanship and terrorism. It is immensely controversial on Earth, but on Mars the residents think seriously about non-partisan ways of resolving differences and building a different model for civil authority.
DATE: late Sept. 2032

11. Celebrations 204
Ananda and Kim get married. Will talks about all the marriages being planned, the plans for Columbus7, and other matters. Then the news is announced that the land owners have settled their disputes and resolved their participation in the Mars Assembly. The Mars civil government is now complete. After everyone sings the informal anthem of Mars, Kim suggests they go outside and raise the Mars flag over the Outpost. The entire outpost suits up and goes out.
DATE: early Jan. 2033

Volume 6: The Commonwealth begun May 20, 2003 and finished July 6, 2003