

# Ring Wave

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Tom Jolly

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Aleja Martinez, a refugee from the molten blob of rock that used to be Cuba, could barely believe she was alive in her little bubble of welded steel. Near the end, people had started referring to the shells as “pirate pods” or “leeches” since there was no way that the low-end designs could last more than a few weeks in space, even if they managed to avoid running into the massive globs of lava drifting everywhere or survived the varying gee-forces during the ring wave that threw them off a doomed Earth. The less optimistic called the pods “steel coffins.”

*So I'm a pirate now,* Aleja thought.

There were several versions of pirate pods. At the lowest end of the quality spectrum was a welded steel enclosure with a radio beacon on the outside, no windows, some padding on the inside to keep the high gees from killing you, and a removable door-plug large enough to climb out of. The hinged door-plug came with a small vent valve to equalize pressure so that it could actually be opened, and a rotating handle to secure the door against its silicon rubber seal. The year before impact, these were being sold as kits, with about fifteen centimeters of frame you could weld onto your own structure. All you needed to do to install it was maintain a good bead while welding. Most of the jury-rigged pods also had a source of breathing air, usually a few tanks of oxygen and a carbon dioxide scrubber so that you would last at least a few days after the ring wave threw you up into the vacuum of space.

Scaling up from there, reducing the likelihood that you would die in the first minute from the acceleration, was the addition of better cushioning; a heavily padded seat or net that would protect you from the g-forces no matter which way you were pointing. You also needed to hope that nothing inside would break free during launch and scramble you inside your eggshell.

These minimalist configurations depended on the beneficence of someone with a large surviving habitat that might pick you up out of the goodness of their heart, hearing your prayers through their steel shell and generously offering you their shelter, food, air, and space, thus reducing their own likelihood of survival.

Aleja's family had opted for a design that would keep her alive for a month. It was what they could afford. She felt despair when she thought of the number of steel balls drifting around in

space with corpses in them, battered to death during launch, or suffocating as their air supply leaked out some small crack, or boiled alive when they got too close to a lava ball. A lot of it was just the luck of the draw. She wore her own bruises and cuts from the rough flight, but she lived.

Her family had also acquired one of the millions of inexpensive spacesuits that had flooded the market, getting a mid-level quality suit with perhaps one bell and one whistle; a suit radio and some position control jets. They pressure tested it before sending off Aleja in her own steel coffin.

She remembered her brother Luis and her Papa discussing the engineering details, with some additional suggestions from an auto-mechanic welder, Ernesto, that they'd hired to help them build the pod. "There will need to be thrusters," Luis had said. "Her ball will most likely be spinning after she enters space."

"We can't afford rockets," her Papa said. "We spent all our funds on the air recycler and solar panels."

This wasn't exactly true. Aleja smiled when she remembered. They stole the thin-film solar panels from a farm a few kilometers away.

"Not rockets," Luis continued, "but air-jets. Directional nozzles on the outside that she can turn on and off, using the air pressure inside the ball. Flush with the outer surface."

"The air she needs to breathe?" Ernesto said.

"Yes. We will need to install some air bottles or oxygen tanks in addition to the recycler. And a rack for the bottles and solar panels and everything else." Luis said. "And a feed-through to the outside so the solar panels may be mounted and feed power to the batteries." He was sketching in a notebook.

Aleja, the only one in the room with an actual engineering degree, said, "We will need to put all the weight in one end, with my acceleration couch. So when the ball accelerates, the couch will always point the same direction."

Papa nodded. Her mother was cooking in the kitchen, looking in on them occasionally to make sure they weren't fighting. Half the town they lived in believed the death-asteroid was a hoax. The other half were making life-pods like their own, planning on how to get the large steel pods to the optimal ring area, or finagling for a position on one of the big spheres, the ones that were still recruiting.

They had discussed the issue of heat and cold the day before. A lot of money could buy you one of the active heat-pump radiator systems, but that was money they didn't have. Slowly spinning the sphere could equalize the temperature across the surface, but eventually it would heat up or cool down too much. They could control how much sunlight radiated onto the shell by using the solar panels as sun screens, but only if the same side of the sphere was pointed toward the sun all the time.

As far as air was concerned, ultimately they'd opted for a Cuthbert Environmental Control System, the Volkswagen of air recycling technology. Scrubbed carbon dioxide got dumped overboard, along with the hydrogen that the electrolysis subsystem generated. The high-end systems combined the two 'waste products' together to get methane and water, but that luxury wasn't as useful if you only expected to live a month on your food supplies; a hundred liters of water didn't take up a lot of space, and the water provided useful shielding against solar storms and cosmic radiation. Where they could pack extra water, they did.

Aleja drifted in her three-meter-wide crypt in space, with no window to give her a clue as to what awaited her outside. Ideally, her food and air would last nearly a month. The rest of her family was certainly dead already, she the sole survivor. The ball had started out as a slowly spinning sphere closely surrounded by billions of tons of boulders and dirt, fortunately all headed the same direction, but slowly spreading out as orbital dynamics took over. By chance, the huge globes of lava and oceanic spheres of water and mud she expected weren't anywhere in the vicinity of her own steel ball as it began to coast away from what was left of the Earth. Eventually, when the elliptical orbits of the ejected debris crossed again, Earth-orbit would become a shooting gallery.

She had launched while wearing her suit, breathing air from a tank welded with steel straps to a wall. After unbuckling herself from her seat, she made her way over to the vent controls, trailing the breathing-air line behind her. Manually venting a small amount of gas, she halted the ball's slow rotation.

There was enough air in the chamber and air tanks to allow her roughly thirty EVAs, that is, since any excursion vented the atmosphere in the chamber, she had enough to refill it thirty times before she ran out. On the plus side, venting the air in the chamber after using her plastic-bag toilet every day would be a good thing. Thirty days, her father had told her, to figure out some way to live, to find refuge somewhere else.

"There will be many deaths," he'd said. "Many enclosures will be too large and ungainly to survive, and will be structurally damaged during launch. The occupants will be dead. You must find one of these in thirty days, and patch it."

A pirate. A scavenger. A vulture.

For now, she had to install the solar panels. They powered a small air-jet manifold that would keep the pod rotated for maximum insolation, keeping the panels perpendicular to the sun's rays. As long as the debris field around her pod was thin enough, she could keep her batteries charged. After that, she'd be in business. For a month, anyway, until her food ran out.

She suited up, did a careful pressure check to make sure her seals were good, and then, past the trauma of being flung into space and the shocking realization she was still alive, the fact that her entire family was dead finally struck her like a second meteor, and she floated and cried inside her steel bubble, one of millions that tried to escape Earth's destruction by riding the ring wave. After her sobs subsided, she got back to work, knowing there was little time to waste and limited resources to spend. The inside of her helmet was spotted with dried tears, and droplets still floated in her helmet, but she couldn't be bothered to remove her helmet to deal with them. The air currents from the suit's rebreather would evaporate the droplets, eventually.

She turned on the suit radio and switched slowly through the forty channels available. There was nothing but static, which she had expected. Dense clouds of dirt weren't a particularly good transmission medium. Eventually, they would disperse, and the radios would become useful. Channel nine was supposed to be the emergency channel, which made her laugh, thinking about it. Millions of people, stranded in space. Was that an emergency? It was all relative; she wasn't dying at the moment, not today, so it wasn't an emergency. She turned off the suit radio to preserve her battery, saving it in case she actually saw someone she wanted to talk to.

She hoped that all the other devices crammed into the pod would work without fault. There was no way to repair them and no backup.

Aleja opened the vent to evacuate the pod, then cautiously pulled open the hatch. She stuck her head outside and looked around the pod. Sunward, there was a broad field of millions of objects, some glistening like diamonds and too round to be anything but water-ice, and others haloed by the sun's rays. And lots of dirt. A dark haze, like a mourner's black veil, obscured much of what she could see, but a lot of that was mixed with smaller balls of ice, shining like little sequins on the veil. On the spaceward side, the gray field of haze looked more like a blanket covering half the universe, interspersed with bright spots of boulders and sparkling globes of ice reflecting the sun's rays. Most of it was slowly spreading apart, and most was moving the same direction. The random rocks that entered the field of debris too quickly collided with others and slowed, soon matching the velocity of the rest of the field.

There had to be molten rock somewhere. The surface would harden quickly, but it would still be hot. She would have to be careful.

A strange-looking object drifted nearby, crusted with a white coating, with a long neck and a cluster of white tufts at one end. It took a moment, but Aleja finally recognized the structure as a branch from a tree and reached out to grab it. At her sudden touch, many of the flash-frozen leaves broke off in a white haze. She held the twig for a few seconds, then sighed and released it, watching it drift away.

Looking closer at the debris field, she could see three other pods about the same size as her own. That wasn't a surprise; when the ring wave flung them all into space, there were nearly

three hundred in close proximity to her own. When the various completed pods were moved to the ring, the smaller ones naturally grouped together to prevent land-pirates from stealing their lifeboats. Nearly everyone there was armed with some sort of gun, and as the meteor got closer to Earth, there were more desperate pirates attacking the pod-owners. The large majority of the pirates went after the big family and corporate units, objects that would last more than a few weeks, which, in a way, protected the smaller, less survivable pods. The really large structures, over one hundred meters wide, had their own armies to protect them. And, of course, they were sequestered behind the steel walls of their structures. It was difficult to breach such walls. Wall thickness and launch weight weren't a limitation; the launch was free, powered by the meteor. It didn't matter how much you weighed as long as your structure was sturdy enough to survive the gee-forces during launch. You just had to be able to get your ship or your habitat to the ring perimeter after it was built, or build it in place.

Aleja attached her tether line to an external recessed lug. She drifted around the outside of her pod, looking for any damage. There were no projections; being thrown into space with tons of rock would have stripped anything off the surface, but there were several threaded and recessed connection points. Except for gouges and dents, the ball appeared to be intact.

The open door to her pod looked like a glowing eye staring out into the darkness. Despite the circumstances that put her here and the unimaginable amount of death, there was an eerie beauty to the destruction. The shadows cast by the boulders through the debris field looked like black columns of obsidian, while balls of ice sparkled like diamonds. So much beauty and so much death.

From the corner of her face shield, she caught movement and turned that way, expecting to see another rock come tumbling through. Instead, she saw a figure much like her self near another pod. Their pod was slightly larger, shaped like a cube with the corners trimmed into triangular shapes. It was at least five hundred meters away, one of the three she'd seen when she first exited her own. They would have to be preparing their own pod for survival just as she was.

The person in the suit gave a friendly wave, then drifted closer. The exhaust from the suit jets was invisible, so it was difficult to tell immediately if the person was actually coming toward her. And what purpose would they have? Borrow a wrench? A cup of sugar?

She glanced at their pod. Blue light poured out of the open door, illuminating the dust surrounding everything, and another thin blue line shone through at a seam. Their pod was cracked. So they needed a welder, perhaps. Or a new, uncracked egg before their air ran out, one they could take without too much trouble.

One hand was hidden behind the person—or pirate, she was thinking—as they neared and Aleja fumbled her own gun from its Velcroed pouch on her tool belt. As the pirate got closer, a gun appeared from behind the suit, and the pirate struggled to point and shoot at Aleja. The trigger guard on the pirate's gun had been removed so that they could still shoot using the fat fingers of the space suit.

In the moments before Aleja shot the pirate and ended his or her life, she thought about her father.

"You will need a gun," he had explained to her. "First, to protect yourself and your pod before the asteroid strikes. And again, when you are in space and someone decides that their life is more important than yours."

He'd acquired a U.S. surplus M1911 .45 pistol for her, and she'd learned how to strip it down; mandatory because everything in the gun had to be lubricated with molybdenum disulfide to keep the moving parts from cold-welding together in the vacuum. Even the ammunition needed a good coat to keep the casings from cold-welding to the inside of the chamber.

He took her shooting once a week while they prepared. "Your aim is improving. That's good," he'd told her.

"But aren't the sights set up to account for gravity?" Aleja had asked.

"Yes, of course. The bullet drops as it travels."

"But in space it will go straight. So adjusting the sights here will mean that it will miss in

space.” Aleja thought to herself for a moment, imagining the trajectory. “The bullet will go above the target.”

Papa was silent while he considered that. “Then . . .” he started.

“I need to remove the sights when I’m in space and aim along the top of the gun. Or aim low.”

“Or practice on a target in space and adjust the sights then.”

She pursed her lips and didn’t tell Papa what she thought of that idea.

Now, however, she was in space, and the damned sights were still adjusted for Earth gravity. Was the pirate aware of the problem? The pirate got off a shot before she grasped her own gun, and she could see the red flame blossom from the muzzle of the gun. The shot missed. She aimed at the pirate’s feet and fired, the red flash of her own gun temporarily blinding her. The sound of the gun in a vacuum registered only as a soft thump inside her suit as the grip slapped against her palm. The gun jumped from her clumsy grasp, trailing a tether that she suddenly realized wasn’t attached to her suit. “No, dammit!” she shouted, grabbing ineffectively for the trailing end of the thin cable. She tumbled slowly end-over-end from the recoil until she reached the limits of her lifeline tether and was jerked to a halt. She jetted gas to stabilize herself. When she could finally look around, she couldn’t see the other person or her own gun. The slug had pushed the pirate too far away, assuming it hit. Or perhaps he’d escaped? Maybe gas escaping from his own suit propelled him—or her—away. She frowned in frustration, unclipping herself so she could try to recover her gun, jetting in the direction it had flown, but it was already lost in the cloud of rocks and dust.

She probably could have used some of the parts from the pirate’s suit as spares; the mass production of pod systems and suits over the last few years made available parts highly interchangeable. She turned slowly, venting gas miserly, checking for unexpected enemies. And now, unarmed. She fumed, angry with herself for not securing the gun’s tether to her suit. It might mean her death.

Five hundred meters away, she could still see soft blue light coming out of the pirate’s pod. Still open, and now vacant.

She was shaking, but knew she had to finish what she was doing. She removed the solar panels from the storage rack in her pod and secured them to the sun-facing side of the pod. A control line from the inside of the pod could move an actuator that would allow the solar panels to act as adjustable sun shields to control heating in the pod.

While she worked, she continued to look around for other intruders. After her solar panels were secured, she removed her safety tether and used the suit jets to visit the pirate’s pod.

As she approached, the crack in the side of the pod became more obvious. With no way to weld it, the person would have been stuck in their suit for as long as they could last. A few days, perhaps. Killing Aleja for her pod probably looked like a pretty good strategy.

What if the person had come with open hands? What would she have done then? She shook her head, confused and unsure, and was almost glad the decision had been made for her.

Inside the other pod Aleja found a streak of blood spattered across one wall. It took her a moment to figure out that the blood didn’t belong to the pirate. She wouldn’t have been his first victim; the original owner of the pod was, before they ever left the ground. Her sense of guilt evaporated.

There was almost a month’s worth of food stowed inside, an air rebreather and hydrolysis system, a water recycler, and a fresh set of solar panels, poorly secured in a rack. Two were cracked, but the extensive push toward standardized and interchangeable systems in the last few years meant she could almost certainly use the remaining panels as spares for her own array, if needed. Spares were good. There were other expected supplies; a zero-gee toilet with plastic storage or disposal bags and wipes. Extra clothing, though there was no real way to wash it. From the clothing, she guessed that the pirate she shot was probably male. Much of the gear matched what she had. It would help.

Aleja examined the vent ports and eventually figured out how to move the pod closer to her own. Slow, but steady. The pods weighed a few tons each; light enough to maneuver by hand in space, but heavy enough to do serious damage if they got out of control. She positioned the

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pirate's pod close to her own, then went back inside her own pod and fetched a roll of thin steel wire, which she ran through recessed tie-downs on the outside of both pods to tie them together, positioning the new pod on the spaceward side so that her solar panels would be unobstructed. When the module showed no signs of drifting away, she finally took a breath and looked around.

Papa had told her that she would need to find a large, damaged module and take it for her own. With the addition of the pirate's module to her booty, she had potentially extended her life by a few weeks, maybe as much as a month. She tried to remember if the oddly shaped module belonged to someone she met before they had all been thrown into space, but she couldn't remember any module of that design in the field surrounding her on Earth. Just as well; it would be easier to forget the murder of a human if they remained faceless.

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Aleja knew that she would have to get as much done on the outside as possible each time she went out, since each EVA cost her all the air in her pod. There were still two other pods within sight of her own, but no one had ventured outside either of them in the four hours since their launch. Beyond the two other pods she could see nearby, rocks and clouds of debris obscured most of the sky. There could be a thousand more pods within a kilometer, but she couldn't tell. Some light penetrated the debris, but it would take a day for the field to spread out enough for the solar panels to do much good, before the pods systems could start treating the air and water at a useful level. She'd be living off the main battery pack until then.

She knew she had to check out the other two pods. At the risk of acting like a threat herself, she jettied air to visit the smaller of the two. When she reached the sphere, she could see it was spinning slowly, so she just waited in place until she got a complete view of the outside. There was no window. She knocked on the outside of the sphere, then realized that even though the person inside could probably hear her, she was unable to hear any return signal. When the door came around, she quickly examined it, but there was no way to get inside. As her father had pointed out, if someone was outside of your pod and wanted in, the chances were good that they were an enemy. There was no pressure release on the outside, and the handle on the door would have been locked on the inside. The door couldn't be opened anyway if the inside was pressurized. But if the person hadn't come outside yet, there was a good chance they were dead. If the module hadn't been positioned right during the eight-gee peak at launch, then it wouldn't have gone well for them.

She was halfway to the second module when she saw a red glow from the corner of her visor and turned to see a deep crimson splash of color appear behind a large boulder, a glowing umbra of red droplets. She stared at it curiously until she saw another red glow from another impact, then a dark ball flit past her at some high velocity; too round to be a normal rock. Then what?

A nearby boulder took a glancing hit from one of the spherical rocks, which spread out in a glowing red cloud around the boulder, and Aleja finally realized that a wave of lava balls had overtaken her own leading ring wave and was crashing through her local debris field. The surface of the blobs had cooled to a thin black shell, but the core was still molten. She jettied gas furiously, aiming for the bright yellow opening of her pod, and fell through the hole just as a hot ball of molten rock glanced off the steel sphere, spraying deadly red pellets and crushing one of the four solar panels hanging off the sun-side of her pod. A small pellet landed on the arm of her suit and sizzled, then popped off as the internal pressure of the suit pushed the pellet away, venting air. She gritted her teeth and slammed the door shut, cranked the handle then crouched there panting, waiting for impacts, hoping that her little pod wasn't going to be engulfed in an ocean of molten rock.

Her suit was still venting. She put her hand over the small puncture to no avail, cursed, and reached for the valve to repressurize the inside of the module.

Aleja sat back and listened to the hiss of air, angry that she hadn't been in space for even six hours, and her suit was already damaged. She had hoped that she'd never have to use the repair kit.

So there were overlapping waves from the ring wave; different velocities. She should have thought of that beforehand. Should have planned for it.

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Papa had told her a story about the man behind the ring wave concept. He did that; he would take an explanation, or tedious historical fact, and turn it into a story. "A story is easier to remember. Someday, you might tell it to your children."

"I don't want children. Mama says they use up all your time."

Papa smiled. "You might change your mind someday. You are young."

Aleja shrugged, not committing or arguing. Beyond the issue of bearing children, there was the additional problem of doing it in a makeshift space colony.

"So, the story of the ring wave. There was a man named Abe Jensen.

"One day, he stood on the beach and watched the waves roll in. He liked to surf the waves and had an old, waxed, fiberglass longboard. It was a heavy antique, but he wanted to get a few good rides in before the Earth ended, and it was the only board he'd ever ridden.

"He sat and watched the younger surfers dance on the faces of the tall waves, the white crests hiding the long view of the ocean. Seagulls drifted overhead, unaware that soon there would be no sky to fly in, no ocean from which to pluck their lunch, but the surfers knew; there was nothing so important to do during the next few years that it would keep them from their waves. No last notes to write, nothing to clean up or organize for the next generation of children. Just the waves, giving up their last gift before the meteor came.

"The announcement had come two weeks before; a true monster of an asteroid, over twenty kilometers wide, a chunk of nickel-iron worth trillions of dollars if anyone would be alive to mine it, headed straight for the center of the Earth. It wasn't going to graze it. It wasn't going to be deflected, it was just too big to do anything about. At best, they could only move the monster off-center by two hundred kilometers. It wasn't enough to make any difference. The leaders in every space-faring nation swore to get as many humans and equipment shipped off to Mars as they could within that five-year period, since the Moon and Earth orbits would be bombarded for years with debris from the collision. It was not going to be enough. They could only get tens of thousands of humans onto a hostile planet. Not really enough to start over, only enough to delay the inevitable.

"Abe knew this and sat and watched the waves. He picked up his board and walked down to the edge of the water, where foam drew pictures on the sand. Death was not that far away, just five years, but he would enjoy life while he could. He would avoid the riots, stay at home, read some books, and pretend that nothing had changed. But Abe Jensen watched the way the water swelled, taller and taller, accelerating forward, carrying the surfer up, faster and faster, until the surfer twisted to the side to seek out the next wave. Abe stared into the green and blue waters, and wondered. Would it work? Would five years be enough to prepare?

"With his thin thread of hope, he presented his case to other scientists that he worked with, and they talked to others, and the idea rolled forward like a fresh new wave, overcoming obstacles. The meteor, when it hit the Earth, like a pebble dropped into a pool, would create a wave of rings from its center, the thin, hard mantle flexing like a fluid. There was an ideal place along the perimeter of the impact, a giant ring, where the Earth's lifeblood would accelerate up and out, slowly at first, an unstoppable wave, then accelerating faster and faster as it rose higher, carrying any 'surfer' along with it, riding the ever accelerating wave until the crest was flung into space.

"They did not need to worry about fuel to fly into space," Papa said. "The meteor would provide the fuel. All they had to do was build airtight metal houses that would survive the ride. New homes in space. Instead of thousands, millions could go. Perhaps tens of millions."

As it turned out, with all of mankind fighting to put large, sturdy modules along the edge of the predicted ring, eight hundred kilometers from the center of the impact, over ten million humans took the perilous ride. How many of them survived was a very good question. The fluid dynamics calculations for the planetary ring wave were educated guesses, at best. Aleja thought about the four pods within her local purview. As far as she could tell, she was the only survivor.

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It was only one data point, but if she could read anything into it, then three-quarters of the surfers were dead now. Competition for the reclamation of damaged spheres would still be fierce.

The sound of pebbles pelting the outside of her shell, like hail on a tin roof, subsided. She carefully took off her helmet. It felt cold inside the pod. She checked the inside temperature of the sphere and found it to be a chilly ten Celsius.

The solar panel output still seemed to be functional, even after the one was damaged, though the current was low. The ship's battery was slowly charging. She activated the actuator that moved one of the solar panels to expose more of the of the pod's surface to the Sun. She was rewarded by the hum of a motor turning. After ten minutes, the temperature crawled up to 10.1 Celsius. She stared at the temperature gage for another ten minutes, listening to the soft whir of the air processor keeping her alive, and fell asleep in her suit.

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She woke up to a dream of falling and flailed for a moment before remembering where she was. The sound of gravel pelting the outside of her pod brought her back, and she did a quick check of the power situation, finding that the remaining solar panels were still functional. Nausea came next, and she grabbed one of the disposable plastic bags that were meant to mount on the "toilet attachment," a flexible band and tube that fit the profile of her excretory functions. She wretched dryly and realized she hadn't eaten or drunk anything in a long time.

Once the nausea had passed, she settled for a granola bar and water, nibbling slowly on the bar and trying to keep the crumbs from drifting. The air recycler fan was still purring reassuringly.

She finally removed her suit and gave herself a bath with a moisturized wipe, tossing it in a toilet bag, then realized that she actually needed to use the bag for its designated purpose. This turned out to be much worse than expected, as some things just didn't detach very well without gravity. She ended up using more wipes than she expected to. And now the inside of the pod stank. She hoped the air recycler could filter out some of that.

Thirty fresh air refills, Aleja thought. Thirty times I can dump the stink and trash and do EVAs. Thirty times before I die. Or maybe sixty with the second pod.

She checked the inside temperature. It was sitting at a fairly stable 16 °C, still a little chilly. The solar panels, strangely, were putting out quite a bit more power than expected, even though she'd seen the one get damaged. The batteries were topped off, so she used some of the current to run some heaters that were imbedded in the insulation blanket on the inner wall.

Once the basics were taken care of, she used a patch-kit to repair the small burn hole in her space suit and prayed that it would hold. She admired her repair work, but wept again when she saw the needlework Velcro patch on the chest of the suit; a five-pointed silver star with a red heart in the middle. She ran her fingers over her name, embroidered on the top of the patch, and remembered her mother telling her, "Remember us in your heart when you are among the stars." She put on the suit with pride and tried not to imagine what had happened to her mother.

A quick meal and she was ready to go. The goal for today, and possibly the next sixty days, assuming the other pod with its supplies was still attached to her own, was to find a larger home. The unthinkable dark side to that mission was that the larger pods might be full of the dead.

She remembered Luis talking about the giant pods that belonged to the corporate monstrosities, the rich families, the government, and the big colony groups that had formed for mutual protection. "Some of them, you know, have two or three pods. They can only make them so big before the ring wave acceleration would crush them. Some of those pods have nothing but supplies inside, just big cargo containers. Do you know how much food you can cram into a ten-meter wide steel ball?"

"A lot?"

"Yeah, exactly, a lot. So all their pods go up with the ring wave, expecting that they'll lose track of them afterward, but they each have a ping-back transponder built in. If the main pod sends out a coded signal, they can track the location of the supply pods. Of course, if someone

else finds them first, there's going to be a fight." Luis put the last screw in to mount the small electrical hermetic feed-through panel. "We can pressure check this seal now."

The two of them climbed out of the small pod, pulled the door shut, and walked over to the air compressor. "So if you find a supply cache, you can install your own ping-back transponder on it, destroy the existing one if you can find it, and use that as a barter to get in with a big pod."

"My long-term goal," said Aleja.

"Yes. Somehow, you'll need to get into a pod group that produces its own food."

"And one that has light pipes."

"Yes, unless they can manufacture their own grow bulbs. The best models say that no one's going to be returning to Earth for at least two hundred years, maybe longer."

Aleja shook her head in dismay as Luis started up the generator for the compressor. "Ten generations? They won't even remember Earth."

"Maybe longer. Anyway, you have to link up with other survivors somehow. You're not going to live out your life scavenging. And if you have a setup that's sustainable, you're going to have to protect it. I can't understand why people don't just take off for the Mars colonies. Or the Moon," Luis said.

Aleja rubbed thumb and forefinger together. "That would cost too much. They need big, expensive rockets to land. Maybe the Mars Cyclor will come back and grab some survivors from the cloud of dirt, but it's not likely. There will be so much crap flying around that it would be suicide to try. Some people can leave for the colonies now, but I think that the twenty thousand who are already there will be on their own for a while. And the Moon Colony, they've already deserted the Moon for Mars. On the plus side, the Moon will have an atmosphere for a short time. On the minus side, a lot of that atmosphere will consist of falling rocks."

Remembering their conversation brought tears to Aleja's eyes. Luis was most likely dead by now. He said that he was going to try to get a berth on one of the big pods, selling himself on his farming experience, but there were a lot of guys like him. Weeks after the family had finished building their pod, he'd hired on with one of the transport crews that were taking pods out to the predicted ring-wave location, ready to be thrown into space on the liquefied mantel.

Aleja put on some insulating clothing, then slipped back into her spacesuit. She vented the gas from inside the pod, opened the door, and drifted outside with a bag of waste.

It was bright outside. Most of the objects were coated with a thin blanket of pure white ice; another wave from Earth that had caught up with them, or fell back on them, while she slept. The area was dense with ice crystals that caught and reflected every stray beam of the Sun's light. Snowflakes flew past her, a river of light glowing with rainbow colors.

She slowly turned, stunned for minutes, then went to check on the solar panels. There was a light coat of fluffy ice on her panels that brushed off easily, and she took the time to remove the damaged panel from the array. The pirate pod was still secured to her own, and she retrieved a new panel from its supply and connected it to her existing array.

The other two nearby pods, still sealed coffins, had drifted a few hundred meters farther away, as had most of the rocky objects close to her. Ideally, it would be good to park her pod next to a large rock, something a few hundred meters wide; at least that would block most of the potential impacts from half the sky. A crevice might be even nicer, but the odds of finding a big rock that wasn't rotating were close to zero, and being attached to a rotating asteroid would limit the efficiency of her solar array.

Mixed in with the cloud of loose dark gravel and glittering ice surrounding her own pod were thousands of much larger rocks and boulders, ranging anywhere from baseball-sized to house-sized monstrosities ten to twenty meters wide. Most were barely visible through the haze of debris, but the ones she could see were all rotating. A couple were spinning fast, likely due to grazing impacts from other boulders, moving diagonally through the field, but rare enough to be only minor hazards. There was safety in the cloud, though its eventual slow dispersion would soon neutralize that protection.

Aleja moved food, water, and spare solar panels from the other pod to her own and pulled the door shut from the outside to keep debris from drifting in, then latched and locked it with a

tethered key from her belt. She placed a magnetic ping-back transponder on her pod and tested the finder mounted on her wrist, satisfied with the signal response.

Turning slowly, she looked at the sky around her. Earth wasn't visible through the ice and dirt. Eventually the ice would sublime and she'd be back to the muddied dark skyscape that the dirt and boulders provided. Now, it seemed like she was standing on the inside of a brightly lit geode, or a slow-motion blizzard, flakes suspended mid-flight. A lot of the really large pod structures, at least in Cuba, had been to the southeast of her own area. One of the many soldiers who'd been stationed in her area, supposedly to keep pirates from pod-jacking the owners, told her where the bigwigs were stationed. "But you can't go there," she had told Aleja.

"Why?"

"Because I'd shoot you in the back." She smiled.

Aleja had been nurturing the relationship with the soldier with sandwiches for the last week and was a little surprised at the response. "Really?"

"No, Aleja. Of course not. I wouldn't know where you were going, and the place is fifty kilometers away. She pointed vaguely. "It's near Trinidad. They'll be riding the same ring as you. But they'll have a lot of Cuba flying behind them, and you'll have a lot of ocean."

Aleja wasn't sure that was completely true. No matter where you were on the main ring, there was going to be plenty of rock joining you. The ocean wasn't that thick. The center impact would produce many travelling concentric ring waves, but only one distance from that impact would provide a wave amplitude great enough to allow the riders on the surface to reach escape velocity from Earth; 11.2 kilometers per second. Anything less than that would fall back to Earth. There would be a cloud around Earth for years, and then an attenuated ring, flattening as the debris interacted or reentered. Earth would be a living hell of lava, trapped heat, and fireballs dropping from the sky for a long time. Most models predicted that that would be followed by a very short ice age, but she would be dead of old age by that time, if something didn't kill her sooner than that.

The soldier nodded toward Trinidad. "They'll be pulling the troops out two days before impact. We'll be headed for the military pods to protect the bigwigs. You'd best be locked up in your own pod by then and wait it out. The pirates will be out like cockroaches, looking to jack an easy ride."

She was glad she'd taken the soldier's advice, even though it meant being cooped up for two days, using up the precious resources she'd need in space.

The trick now was trying to figure out where the large pods would have ended up. She had a picture in her head from computer models she'd seen. The big pods would be ahead of her in orbit moving at roughly the same speed. Looking around, though, she couldn't tell which way was "forward." She could see the Sun, but that wasn't enough information. She picked a direction, spent some air, and drifted that way, looking for any tell-tail signs of other structures, living or dead. Sitting still wasn't going to solve any problems.

She had four hours of air if the suit's rebreather worked correctly. She spent thirty minutes of that time pushing small boulders closer to her own pod to obscure its location, but left a clear path for the sun to hit her solar panels. Checking her propellant bottle pressure, Aleja headed out to do some exploring.

\* \* \*

Cal Custer III peered cautiously around the edge of a house-sized boulder. It was a little disorienting since the boulder was slowly rotating a few meters from his face, giving him an enhanced feeling of falling. He choked back nausea and left the concealing shadow of the rock.

The bullet hole in the side of his suit was covered with Kapton duct tape, multiple layers wrapped around his waist. He knew he'd been hit and could feel the pain, but he wasn't sure how much blood he'd lost. The other asshole got lucky, winging him like that. The air leaking from his suit had jet-propelled him away from his own damaged pod and it was only a high flow rate that kept him from passing out while he struggled with the tape. Now, a few droplets of blood spotted the inside of his faceplate. He held his hand pressed to his side where he'd been shot and hoped for the best. His short flight left him drifting through snow-speckled rocks that

all looked the same, and in no time at all, he was lost.

Then he saw this.

The large structure ahead of him had cracked during the ring wave launch. It was a good fifteen meters in diameter, and probably had a bunch of sub-pods with supplies and grow-pods drifting around nearby with ping-backs on them. A treasure trove. If he could get the rest of his gang together, they could patch up the pod and take it for themselves.

He looked around carefully to make sure he was alone and that no one was drifting nearby or actively working on the cracked egg, then jetted over to the entrance and tried to open it. It was locked. He drifted over to the crack in the side of the pod and found that the hole was big enough that he could squeeze through into the interior. The edges were ragged, and he had to twist carefully to avoid snagging his suit, wincing and gasping in pain from his wound as he moved. He needed to get somewhere where he could inspect the damage and see how bad he was hit. A rig this size had to have pressurized rooms. But if that were the case, where were the people?

The crack opened up into an airlock with a recessed locker area where spacesuits and air tanks were stored. Could they really have been dumb enough to ride the wave without their suits on? He shook his head. The rich always thought they were invulnerable, which made them easy targets. An empty rack with two slots for some other equipment stood next to the suits. There was another thin structural crack further in, connecting the change-out room with a round corridor. The door between them was still working despite the twisted framing around it that had let the air out.

He opened the door. Light from a half-dozen portals in doors dimly illuminated the hallway. Locked, pressurized doors. Cal peeked in one window and saw movement. No suits, and no way to get to them. Now, that was a real shame.

He switched his suit radio onto the emergency channel. "Hey," he said. "Anybody listening?"

It only took a few seconds for a response. "*Hola?* Hello? Are you nearby?" He could hear other voices, then, "children, be quiet. Who is this? Are you close?"

"Very close," Cal said. "If this cracked ball is yours. I'm in the corridor. It's in vacuum along with your change-out room."

He could hear the voice talking to someone in the background, then, "How did you get in?"

"The crack is pretty big," he responded. "Did you all survive?"

"Yes, there are four of us." Two other voices spoke up on the radio with, "Hello!" and "Help us!"

A woman? Girl? One of the voices was soft and high. It reminded him of the reason he had to leave Florida and hide out in Cuba. The easiest way to take the place was to vent the pressurized areas to vacuum so he could get inside, get to whatever controls their were. They'd all have to die, but too bad for them. But if he could save the girl for himself . . .

"Can you repressurize the room somehow? Fix the crack?" the voice continued, hopeful.

Cal thought about it. "First, I have to take care of a hole in my side. I got hit by a fast rock. I'm bleeding, and the suit is leaking air."

"There's a first aid kit in the kitchen. Nobody's in it, so you can depressurize it, go inside, and repressurize. It's the last door at the end of the tube."

"Thanks." He headed to the suit-storage area and grabbed a fresh suit that seemed about the right size, then back to the kitchen area to patch himself up.

"What's your name?" the man asked.

Cal considered lying to him, and then figured the man would probably be dead in the next few hours, so why bother? "Cal Custer. The third."

A moment's hesitation, then, "Manuel Diaz." And no mention of his wife and kids. Like, maybe he'd forget about them. "Thank you for helping us," Manuel added.

Cal grinned mirthlessly as he headed for the kitchen. "No problem. No problem at all, my friend."

\* \* \*

Aleja had only traveled a half-kilometer, periodically checking her ping-back transponder to

make sure she still had a reading on her pod, before she saw anything of interest. What she saw was a small aluminum fishing boat, then an old pickup truck. Neither was a big surprise. They had been close to the coast, and everyone who owned a pod had to drive to get to it. When they launched, all those cars would have just been sitting there. The miracle was that the truck was still mostly intact. There would be lots of trash in orbit.

Shortly after that, she finally saw other pods. Two suits were working to modify their outer structure much as she'd done her own, working together. Three other pods were inert nearby, pulled close to the other structures. They saw her and watched warily as she passed them by, but made no aggressive moves and didn't attempt radio contact.

The link to her pod was becoming intermittent after another ten minutes. She'd started using the slow rotation of the rocks to propel herself forward instead of the suit propellant, grabbing onto the rough surface and letting it carry her around to launch herself away from it, jumping or pushing away for some bonus velocity. Most of them had drifted so that they were a few hundred meters from one another, though the density of loose dirt and small rocks was enough to slow her down before she could drift all the way to another boulder. *Asteroids and meteoroids*, she thought, *not boulders*. A flash of green and white caught her eye as she drifted by a clump of dirt; frozen grass. She grabbed at it futilely, missed, and kept drifting, unwilling to use suit gas to retrieve it. Her eyes misted up, and she blinked away the moisture, causing droplets to appear, floating, in her helmet.

Perpendicular to her drift, she spied a larger structure. There were nearly a dozen pods linked together by flexible and expandable tubes. Work lights had been stationed on nearby rocks that created a bright haze, reflecting off the last of the sublimating ice and casting narrow shadows from the smaller rocks and specks of dirt. There were at least ten people—astronauts, like her, homeless beggars—working on putting together this structure, this convoluted maze for human hamsters. One of them saw her and pointed, and one of the others pulled a stick off his back and pointed it at her.

Aleja passed behind a rock and saw a spark flash from its surface. The person who had fired the rifle tumbled backward slowly, trying to get it to bear on her again.

She put her suit jets on full and headed toward the nearest large mass before the suit could get off another shot.

Why the hell did they shoot at her? She grabbed onto the asteroid and let the spin carry her farther away from the structure, then remembered to turn her suit radio on, and flipped through the channels. “—get him,” she heard.

“Goddamn pirates are like fleas.”

“This one didn't even pretend to try to talk to us,” another voice said.

“He might come back.”

“Don't shoot!” Aleja shouted into her mike. “I'm going away!”

The rotation of the asteroid threatened to bring her back into view of the attacker, and she let go, flinging herself forward, heading for a three-meter wide ball of glistening white ice. She glimpsed the group again, and heard the cry, “There she is!” Aleja touched the white ball at the same time a bullet slammed into it, not a meter from her hand. The surface of the ice ball cracked, and her eyes got wide, suddenly remembering.

Four months before the asteroid hit Earth, there was a class being offered by the University of Havana. By this time, classes were free and they all had something to do with survival in space, including zero-gee farming and medical care, or how to build a pod that would keep you alive. The classes were always crowded but almost continuously offered by volunteers working there. Aleja was taking a class on the physical hazards they might encounter without too much time spent on countermeasures; the list of hazards was long.

Professor Ramirez was talking about black balls and white balls. “Avoid them if you can. If something looks like it's too round, then it is very likely a hazard. Black balls are likely to be molten, the surface crust cooled just enough to hide the liquid rock within. If you get close to one of these objects, you will be able to feel the infrared radiation from them on your face. Remember; your skin is an infrared eyeball, and it may save you.”

The professor then tapped his cartoon diagram of a white ball. “This is a ball of ice. It looks deceptively safe. But it may be a little bomb waiting to go off. When a globe of room-temperature water is thrown into space, the water is no longer under any pressure, and in a vacuum, it boils, even at temperatures well below zero. The outer shell of a sphere will rapidly boil off, but this will cool the water underneath, so quickly, in fact, that it will turn to ice. The internal water, still warm, will create its own back pressure as it tries to boil and push against the outer crust, breaking out, ultimately cooling and creating a thicker crust until the crust is thick enough to contain the inner pressure. Over a long period, the entire ball will continue to radiate heat until it is all solid, slowly sublimating into space. For the short term however, maybe days or weeks, depending on the size of the ball, it is a pressurized bomb waiting for someone to crack it open.”

The icy ball that Aleja meant to hide behind suddenly split open, and the exposed liquid inside immediately boiled outward against the shell of ice. A plate of ice from the outer shell of the ball slammed into her and accelerated outward from the mass, a haze of scintillating ice crystals forming all around her, hiding her from view as it pushed her away from the colony. Rocks and dirt pelted her as she flew away, slowing her down, and then she slammed painfully against a large boulder, taking her breath away.

She could still hear their voices, though she could no longer see them. It sounded like a child’s voice. “They didn’t shoot at us, so maybe they don’t have a gun.”

There was silence for a minute, then someone else said, “How the hell are we going to build up a colony if we shoot at everyone?”

“How can we trust anyone?” It was a plaintive voice and full of loss. They’d all lost people. Aleja had to remember that. Everyone she met would have lost friends. Everybody would be fighting for their lives. Trust would be a rare commodity and hard to earn.

The next boulder she grabbed threw her a little further from the budding paranoid colony into a field of more unremarkable and forgettable boulders and rocks. She looked around and realized she had no idea where she’d come from. In a panic, she tested the ping-back transponder to find her pod, and discovered that she had no signal.

She scanned the area desperately, searching for anything recognizable. Except for a hazy glow of the Sun, nothing was constant. Everything was drifting, turning, the shadows moving, a curtain of black threads depending from every tiny pebble, extending forever into a deeper darkness. An infinite, constantly changing map.

She knew she’d been moving perpendicular to the Sun, mostly. So she just had to go back the way she came. Aleja bit her lip. Which way was that? She jettied toward a boulder, hoping to sweep in a giant circle perpendicular to the sun, but knowing there was no way she could define anything like a circular search pattern. Looking down at her air supply, she saw that she had less than two hours of breathing air left, and maybe a quarter-tank of propellant. She’d have to use rotating asteroids for most of her propulsion. For a moment, she considered returning to the hamster-trail habitat and trying to talk her way in, but discovered she no longer knew which way to go.

She hovered next to a hundred-meter asteroid, paralyzed with indecision, knowing she had to move or die.

Out of the corner of her eye, she saw a bright blue object slowly drifting toward her. She twisted to meet it, grabbing for the gun that was no longer there.

The object had three small blinking lights, all different colors. It approached within a meter, then tilted up and down as though nodding, or scanning her. It carried a small high-pressure air tank to power its tiny thrusters.

A drone.

After a tense moment, she flipped through her radio channels but heard nothing but noise. The drone was operating on some other frequency. It turned from her, jettied forward, turned back around, and tipped up and down again. Follow me?

She looked into the darkness around her, and thought, *you’re the only game in town. Why not?*

She followed the drone, drifting through the light and shadows.

\* \* \*

Cal woke up from a long sleep, checked his handiwork on his grazing wound, and scrounged through the kitchen area for anything that looked like food. There were a lot of labeled vacuum-packs and dried staples, but he found canned tuna and little packets of mayonnaise, bread, and cheese, luxuries that wouldn't last very long, and he made a meal out of them. Eventually, if this family had grow-pods drifting around, he could have them harvest the crops for him. Assuming any of them was still alive at that point. Having workers was an important part of his plan. A ruler was no good without workers.

Incredibly, the kitchen was attached to a zero-gee bathroom which Cal took advantage of. He wiped himself down with a sponge in the shower bag, then vacuumed up the floating droplets of water, and wondered how long it would take before he couldn't stand the smell of being in a space suit. At least he had plenty of spares to pick from on this ball.

He suited back up in his fresh spacesuit, depressurized the kitchen area, then drifted into the corridor and down to the tear in the metal wall of the sphere. Manuel Diaz had brought along a stack of square metal plates and a couple dozen tubes of space-RTV for repairs. You could patch a sizeable hole in minutes if neither side was pressurized. Cal nodded appreciatively. He'd have to hammer out the sharp bits, but he could patch the hole without having to fire up the TIG-welder. Of course, if he did that, Manuel could repressurize the entire sphere, so maybe it was just better to wait until the family ran out of air, and then fix the hole.

He explored the rest of the sphere and found the air recycler and hydrolysis units. Pipes led off to each of the other rooms, which told him that they probably didn't have separate systems. He didn't remember seeing one in the kitchen, anyway. He shut off the feed valve for Manuel's room, then continued looking around. It would take a couple of days for Manuel's air to run out, but Cal had time. He could wait.

In a closed compartment, solar panels were stored on a rack, waiting for installation. A large storage area contained vacuum-packed food meant to last until the grow pods started producing mature crops. Steel poles were stored in the area with the spacesuits, their purpose unknown, though it looked like they could be connected end-to-end. Overall, the equipment was everything you might find in a small pod, but scaled up.

Once Manuel was dead, he could get access to the control room and start looking for the ping-backs on whatever grow pods they owned floating around out there. Seal up the crack. Re-pressurize. Put the terror of Cal into the kids to make sure they stay in line. To do that, he'd need some of his mates.

He pulled himself back to the crack and outside, then set his radio to channel three, a previously agreed-upon comm channel. "Matchstick? Cook? Nutcase?" He waited for any return signal, drifting in the shadows of Earth's debris. After a minute, a stately voice said, "Cal?"

"Matchstick?"

"Yeah, I been waiting to hear anyone, you're the first. I don't know what happened to Cook or Nut."

They'd all come up on different stolen pods, though they'd all started within a few hundred meters. When the military bailed for their own pods, it became a free-for-all. "They're probably dead. Are you close?"

"Hell if I know," Matchstick said. "I'm not reading your ping-back."

"Oh yeah, wait." Cal flipped the switch to activate the small unit. "Now?"

"Now I got you. Two kilometers, maybe less. Rocks are probably interfering with the signal strength."

"Yeah. Well, follow it in. I've got us a new home, needs a little work. Current residents may need a little training, and I can't stay awake 24/7. I need you here."

"On my way," Matchstick said.

\* \* \*

Following the drone wasn't easy. Aleja wanted to use the rotation of the boulders to propel her in the general direction, while the drone wanted to go in a straight line to conserve fuel. She

hit one odd-looking boulder and tried to grab on to a protrusion, only to discover that the ‘protrusion’ was painted on. Her hand slid across the smooth surface, camouflaged to look like an irregular, rough, gray and black rock. It was easily twenty meters in diameter and slid smoothly under her gloves as it turned. She pushed away a little to get a better look, and the drone joined her by her side. After a minute, she saw a small alcove with a ping-back transponder recessed inside, and she jetted forward to grab the side of the alcove. The transponder was bolted in place, and she had no tools to remove it. She settled for putting her own magnetically mounted transponder next to the other one. This sphere was likely crammed full of supplies; there was no hardware on the outer surface to suggest that it could support solar panels, antennae, or other equipment. It could be a valuable trade item later on if she lived long enough to retrieve it, and if the owner wasn’t around to fetch it.

The drone tipped and twisted, urging her to keep moving forward.

By the time they reached their destination, she had just under an hour of air left. The drone jetted to a stop in front of her. They were still surrounded by slowly drifting rocks and dirt with no structure in sight. The drone’s red light blinked on and off. Two blinks, then one blink. Pause. Repeat.

There were only so many things that could mean. Morse code made no sense. Papa made her memorize the codes before she left. That left, what? Radio channels. She set her comm on channel twenty-one and was rewarded with a tentative “*Hola?*” A male voice, and Aleja recognized a Cuban accent.

“*Hola!*” She continued in Spanish, “Are you driving the drone?”

“Yes. We’re in trouble. We need your help.”

“That makes two of us, then. My air is running low. Where’s your pod?”

“How much air do you have?” he asked.

“Just under an hour.”

The radio was quiet for a moment. “That should be enough. There is a man who came into my pod through a breach who said he would help us, but my scanner caught him talking to another man. They mean to enslave us for labor and take our pod for themselves. Pirates.” Manuel explained their situation; trapped in the rooms with no access to their space suits. “They are installing solar panels on the outside right now, delaying the repair of the breach. I think they are waiting for our breathing air to run out.”

“How are you watching them?” Aleja asked.

“I have a second drone. I sent them both outside through the breach when we found out that we were damaged. One is watching them from far away.”

Aleja glanced down at her air. A little less than before. Maybe fifty minutes? “Where is your pod?”

“About two hundred meters in the direction of the drone.” Even as close as she was, the comm was dirty with static. “Behind the boulders you see in front of you. The men are on the far side of our pod, installing the solar panels. You could enter now, if you hurry.”

“Are they listening to you, also?”

“They are chattering away on channel three. I don’t believe they have a scanner capability.”

Aleja nodded to herself. The market had been saturated with cheap forty-channel citizen-band radios there at the end, and most of them had no scanner built in. She jetted forward to the next boulder and let it spin her around to the far side, then coasted forward through the hazy, dirty vacuum. Sunlight glinted off of Manuel’s sphere. She could see the rough tear in the side of the sphere and headed toward it. “What’s your name?” she asked.

“Manuel,” he said.

“I am Aleja. What makes you think I am not the same as these others?”

“I don’t know you,” he replied. “I know they are bad. You are a wild card. But I think we can help each other.”

“I hope so.” Aleja landed on the side of the pod near the hole and cautiously peered inside. The drone hung back.

“Be mindful of the edges,” Manuel said. “They’re sharp.”

Aleja thought he was breathing fast. "Are you okay?"

"I think so. A little light headed. Dizzy."

"Zero-gee. You'll get used to it." She carefully stuck her head in the hole, flipped on her helmet light, and looked around. The spacesuits were hung on a rack inside a recessed closet. In another corner, there was a TIG welding rig with a battery pack that had to mass at least a hundred kilos. Next to it was a tube of steel filler rods. There were bottles of helium stored with the welder, but in a vacuum, she knew she wouldn't have to bother with the inert gas. She pulled herself inside through the narrow hole and looked around. Strapped to a rack were two dozen steel pipes. She looked at the open crack in the hull, then back at the pipes, sizing up the gap. In another area, she saw a stack of thin steel plates and tubes of RTV.

The radio crackled, "If you see those steel plates, you can put them on the hole with the RTV to make a good seal."

"That won't keep them out," Aleja said. "The RTV won't cure in time. Are they still installing the solar panels?"

She saw the drone drifting just outside the crack suddenly move away. Then Manuel said, "They're done with the solar panel. They are returning. You need to hide. Go to the kitchen at the end of the corridor and wait. It isn't visible from the solar panel storage area."

The door to the corridor was wide open, and Aleja pulled herself through. She hid in the kitchen behind a table and chairs that were bolted to the floor, which was also the outer wall of the sphere. She wondered if they meant to spin the ball to produce artificial gravity, but spinning a sphere this small might produce nausea from the Coriolis effect. It would also limit the mounting locations for the solar panels if they wanted to keep them sun-facing. Aleja found herself trying to engineer the whole thing in her head, then realized that the light coming in through the breach had dimmed suddenly. She said to Manuel, "I'm switching to channel three while they're in here. When they leave, I'll go back to channel twenty-one."

"Copy," said Manuel. "I'll do the same. Kids, stay on twenty-one." Aleja heard two younger voices agree, then she changed channels.

"—get these last two panels on."

"How about a break? We haven't stopped since I got here. I could use a smoke."

"Goddamn, Matchstick, you brought cigarettes up here?"

"Two cartons, man. Like gold, you know? So how about it? You said there's food in the kitchen, right?"

Aleja, hands shaking, looked around for anything that might act as a weapon, cursing herself for losing her gun earlier. There was nothing loose nearby. *Of course not*, she thought, *it would have all been secured for launch*.

"I'd have to repressurize the whole room and then vent it again so we could go finish the job," Cal said, "Air is valuable. This will take, what, maybe fifteen more minutes, then we can call it a day. Okay?"

Matchstick grunted, and they headed toward the panel storage rack, grabbed two more panels, and headed back up the corridor. After another minute listening to them jabber outside, Aleja switched her radio back to channel twenty-one, moved from her hiding place and headed for the TIG welder. "I'm going to weld one of your pipes across the gap," she said. "They won't be able to come inside."

Manuel responded, gasping, with, "I think they shut off my air. But weld first, there isn't much time. Maria and I should survive on the air in the room until you're done. There are valves at the recycler."

"Understood," she said. They would sacrifice their lives for the children if they needed to. She just had to save them. She positioned the TIG welder next to the gap, then unstrapped the steel pipes, pulled one out and slipped it outside the crack. She quickly discovered that there was no way she could get her helmeted head through the crack with the pipe in the way, and brought the pipe back inside. This wasn't necessarily a problem; it also meant that Cal and Matchstick wouldn't be able to get past the pipe.

She switched her comm back to channel three, hoping to monitor their activity as she

worked. They were talking about the mounting hardware, with long gaps between statements while they worked. Hardly exciting material.

Connecting the ground lead of the TIG welder to the end of the steel pipe, she quickly tacked one end of the pipe to the inner steel pod wall, grateful that the suit's face shield automatically darkened against the actinic glare of the tungsten welder. She glanced outside as she welded, and discovered that the bright, flickering light was illuminating the cloud of rocks and dirt as she welded. Enough to alert the two? Hopefully they were too preoccupied with the solar panels.

She moved the ground clamp to the other end of the pipe where it touched the shell of the pod. A bright light from outside suddenly illuminated her, and she heard a shout, "You!"

Aleja spun around and saw two spacesuits at the breach, staring at her. "Who . . ." one voice said, while the other said, "That's the fucker that shot me!" It was the pirate who had approached her own pod meaning to shoot her first. Still alive. She wondered for a moment how he could possibly recognize her in her suit, and then remembered the patch on her chest, the bright star and heart.

Cal, a name she could finally attach to the voice, pulled out his gun. He would have trouble missing at this range. As he drew on her, she dragged the TIG against the steel beam and bright light flared, darkening her face shield and presumably his, also. "Damn it!" the man cried, and fire flared from the barrel of his gun. Aleja felt something slam painfully into her shoulder and she dropped the TIG handle, moving away from the gap into darkness. More bursts of flame erupted from the muzzle of Cal's gun, but with no sound or impact. The pod walls were easily thick enough to stop a bullet; she just had to worry about ricochets.

She made it into the corridor but could hear the hiss of gas escaping from her suit. "I've been shot!" she said.

"Good!" Cal said.

"It's a woman?"

"Goddamn bitch."

She remembered that she was still monitoring channel three, and switched back to twenty-one. "Manuel, I've been shot!"

"We have other problems, Aleja," he gasped. "My infrared sensors are registering a field of pyroclasts coming our way."

"Lava?"

"Most of it is just small *lapilli* pellets. They've cooled enough that they won't be a hazard to us. There's something big, though. Bigger than us, and very hot. It is going to impact us. It's not moving fast, but it is steadily approaching, maybe five meters per second. You have maybe two minutes. You need to save yourself. Get out."

"I can't!" she cried out. "Cal and that other asshole are at the breach, and they're waiting for me." And, she thought, I've just welded a pipe across my exit.

"The exit port . . ."

"The door is locked!" she shouted. She was rolling out a long piece of Kapton tape from her belt supply, hoping to slow down the air gushing from the bullet hole—or holes, if it passed through—in her suit. With her wounded shoulder, she wasn't having much luck. The pain made the action nearly impossible. *And I'm almost out of air*, she thought.

"I have the key. I can drop the pressure to my room. With the pressure equalized, you can get inside."

"You will die!" she screamed.

"But you will live," Manuel said softly. "You must live."

"No! Not yet!"

She glanced around the corner of the doorway leading to the suit change-out room. The two men were trying to push the pipe out of the way, flexing the one welded end. It was bending.

She switched back to their channel. "Hey, assholes!"

"You're gonna die, bitch."

"Not before you do *pendejo*. There's a big ball of lava headed this way."

"You're really funny," Cal said.

"What's that?" Matchstick said.

"What?"

"Something's hitting us. Pebbles."

Aleja, from her doorway, saw them both turn around, then heard one say, "Oh, crap." Both of them pushed away from the opening and disappeared from sight. She pulled herself through the doorway to look out the breach. A dark circle blotted out the sky, glowing with blemishes of deep red every time it ran into another rock and swallowed it, the black surface buckling and breaking into the molten inner core.

The pipe blocked her way. The TIG sat there, calling to her. She could break the weld in seconds and be gone, and have nothing. She looked down at her wound and the air leaking from it. That wouldn't last long, either. She was almost out of air. Less than nothing; she would be dead in minutes.

She was an engineer, damn it. She could fix this. She could live. Somehow.

She looked at everything and took it all in. The lava would destroy them. Envelop the ship, melt everything, and they would all die. Cooked alive. The only thing she could do is move the ship. She quickly switched back to channel twenty-one and said, "Manuel, do you have rockets on this ball?" She realized it was a dumb question as soon as she said it; if there were rockets available, they'd be moving already.

There was no response. "Papa? Mama?" a small voice called out, "Papa? What's going on?"

Aleja switched off the comm so she could concentrate. She looked up the corridor to the breathing-air processing area. There were five large air storage tanks. Only one was connected to the distribution manifold, the other four had exposed valves. God, she hoped it was enough. She pulled herself down the corridor, grabbed the first valve, and opened it full on, the gas expanding in a white cloud, quickly filling the corridor. She grabbed onto a support strut with her wounded arm and howled in pain, but held on. She went on to the other three storage tanks, venting each one to the corridor until the corridor was filled with a cold white fog, expanding out into the vacuum through the narrow crack in the outer wall.

As the air jetted out of the crack, slowly pushing the large metal pod away from the giant ball of lava bearing down on them, Aleja could feel the slow acceleration but knew it wasn't enough. The gas was too cold to expand rapidly, to produce the propulsive thrust she'd hoped for. She moved over to the breach and watched as the molten blob moved closer and closer.

She could feel the radiated heat through her faceshield, and tears bloomed in her eyes, unable to fall away from the weak thrust her final effort had produced for the sphere. She watched hot death approach.

The dense, cold cloud spread quickly outside the thin sphere of metal and finally met the encroaching ball of lava, and explosively expanded. Aleja, caught unexpectedly, found herself once again hurled backward, hot air roaring against her suit, cold air from the tanks spinning her around in a tempest. The hot pressure wave outside slammed against the hemisphere of the pod facing the molten blob, and the sphere lunged forward. The air in the chamber carried the sound; the roar of fire, the bone-rattling thunder of a rocket. A roar that would save them all.

\* \* \*

Before Aleja ran out of air, she found the valve for the air in Manuel's room and turned it back on. She hadn't heard from him yet, but hoped he was still alive. In the meantime, she'd made for the kitchen area, sealed and pressurized it, and removed her own helmet, happy to be away from the stale air.

Her shoulder, where the bullet had penetrated her suit, was bleeding but not gushing, with a clean entry and exit. It hurt like hell, but she could still move her arm. She found a first-aid kit and patched it up as well as she could with one hand.

Manuel's children were in rooms separate from Manuel and his wife, and were bewailing his silence, but he groggily reported to them within fifteen minutes of having his air restored. "We're all right. By God, we're all right. I don't understand why we are still alive."

Aleja explained what had happened. "My suit air is depleted," she told him. "If I put my suit

back on, I'll be living on whatever air is in the suit. But I can last at least a couple of minutes that way."

"If you can reach our space suits, you can steal one of the portable air tanks," Manuel said. "Then you can fix the breach."

"That was my plan," Aleja said and proceeded to execute it. After repairing her suit and acquiring the fresh air tank, she unwelded the pipe, pounded out the sharp edges of the breach, and installed the patch panels. The sphere wouldn't be perfectly sealed; somewhere, there were still bullet holes in the sphere, and she was reluctant to pressurize the corridor until the last leaks were patched. While searching for the bullet holes, in the kitchen she discovered a small bag with two cartons of cigarettes and matches. Most of the packs of cigarettes had exploded. She laughed.

She vented a small amount of air into the hall, lit a cigarette in the air stream, and watched the smoke reveal every remaining hole as it sought out a better vacuum.

An hour later, the hall was pressurized and doors were opened, Manuel and his family released. By then, Aleja had removed her helmet. Blood had splattered the side of her neck and face from her wound, and matted hair clung to her skull. *I must look like hell*, she thought. Hugs were mandatory, regardless, but they brought back memories of her last embraces as she left her own family, and brought back her tears.

\* \* \*

Manuel introduced his wife, Maria, and his two children, Andre and Clara. After Maria, a nurse, had patched up Aleja's shoulder, they fed her. Aleja knew there was work to be done yet.

"You look like death," Manuel told her. "You must rest. I know what needs to be done." He looked over at the solar panels remaining on the rack. "When we accelerated, we hit a lot of big rocks. The panels the pirates installed have probably been destroyed. We will need to use the spares." He shook his head. "Already, we need to use up our spares."

"There are a lot of dead pods out there," Aleja said. "There will be more spares. More air bottles."

"And now, we are robbing the graveyard to survive," he said.

Aleja slept. When she woke, there was gravity.

\* \* \*

The sphere was spinning. It was a slow spin, producing less than a tenth of a gravity, but it was enough to establish a down. Aleja unstrapped herself and got up groggily out of the borrowed bed, then stumbled into the kitchen area. Manuel was sitting at the bolted-down table, dressed in his own space suit, helmet on the floor beside him. "Good morning," he said.

"We're still alive," Aleja said. "So, yes, it is."

"Would you like some coffee?"

"You have coffee?" she said, surprised.

He nodded. "For now. We have a year's worth of food, more or less. After a year, the grow pods should be producing enough food so that we can survive. Perhaps we will salvage more units from the dead that will help further." He stood up, filled a cup from a faucet, then put it in a microwave to heat. Aleja stared at the microwave forlornly, wondering what they would heat with when their technological wonders began to break down. How many years until everything was broken?

"Your pod is spinning," she said. "How?"

Manuel smiled. "We have detachable, portable rockets. Hydrogen-oxygen, since our electrolysis unit provides us with the propellant. They are small but effective. Of course, we could not launch from Earth with them attached, or they would have been torn off."

She looked around the room. "Where are the others?"

"Maria and the children are out recovering some of the grow pods, following the ping-back signals. She is keeping a watchful eye on the children, though this is a learning process for all of us. The rockets are programmed to return the pods to within a hundred meters of the main pods. We have ten of these pods, and each one is supposed to produce enough food for one person, given the proper attention. Once we have some grow pods nearby, we will start preparing

them.”

The microwave pinged. Manuel pulled out the cup of hot water and dropped a metal tea ball full of ground coffee into it. Steam drifted slowly over the rim.

“This low gravity, eventually it will . . .” she started.

“ . . . cause health issues,” he interrupted. “Yes, that would become a problem after some time. Eventually we will need to convert our pod to a different configuration. That pole you welded across the hole will be part of a fifty-meter extension to another ballast mass, perhaps an asteroid or another pod, and we will spin around like two balls at the ends of a rope. This should provide us enough artificial gravity to maintain our health. We won’t do that until the debris field spreads out and settles down a little bit. Our solar panels will be positioned for continuous sunlight, of course.”

“Won’t the spin make it hard to get out of the pod to work on the gardens?” Aleja asked.

Manuel smiled at the use of the word “gardens.” “Yes. It will. But not impossible.” He removed the tea ball from the coffee cup and handed it to her. “I hope you like it black.”

She took the cup and sipped at the coffee, closing her eyes and breathing in the steam. “I would have died without your drone leading me here,” she said.

“We should have died when we left Earth and our eggshell was cracked. We should have died when that evil man came into our pod, meaning to . . .” He turned his head away for a moment, anger suffusing his face, then back. He took a slow breath. “We should have died horribly inside a ball of lava. It is a miracle that we are still here at all. We are greatly indebted to you.”

Aleja sipped more coffee to hide her embarrassment. “So what’s next?” she asked.

Manuel shrugged. “Join up with others, if we can do so safely. We will need to protect ourselves from pirates, and we need more people for that. Salvage what we can. There will be trees, parts of buildings, ice balls, and other raw materials of high value. We can collect them and begin trading. There will be items that we will need.”

“I have a ping-back on a large storage pod that I placed on the way here.”

He nodded. “I know. I was flying the drone when you placed it. If the owner hasn’t claimed it already, it can only be good for us. If we can protect it. There will be small colonies nearby. With enough people, we can begin to gather together asteroids as an impact shield, keeping the pods we’ve collected together in the core. Eventually, we will have to contact the big manufacturing pods for replacements. There was a large group in Trinidad. No doubt they are many thousands of kilometers away by now, but so close when we started. We will trade to survive, if their soldiers aren’t too trigger-happy.”

“An asteroid shield? Won’t the asteroids move?” Aleja asked.

“There are stable orbits that are synchronized yet mobile. Like the braided orbits of Saturn’s rings. I do not pretend to understand how that works. If nothing else, we can use structural beams to tie them together and make a cage. There will be plenty of work for idle hands.”

“You know, the two men, Cal and Matchstick. They’re still out there. They didn’t die.” Aleja said. “Is your family safe gathering the grow pods?”

Manuel looked smug. “Cal took one of our spacesuits. Each suit has a built-in ping-back for safety. I know where he is, and I assume his friend is with him. There is no immediate threat. Certainly, they’ll come back. Soon, I’m guessing, before they run out of air, if they don’t find another pod to hijack. They both took fresh tanks from our supply, so they might last a while. They will have to be dealt with, though. I thought I’d offer that job to you, if you’re willing. It would be a shame if they ran off with serviceable spacesuits.”

Aleja looked embarrassed. “I . . . I lost my pistol earlier.”

Manuel smiled grimly. “We have guns.”

\* \* \*

Aleja floated in darkness near an asteroid, comfortable in Manuel’s camouflaged suit, tethered rifle tucked under one arm, and waited. It took the eyes and the mind awhile to adjust to the clutter and the striations of sunlight as the beams threaded through the slowly moving debris. But eventually, she saw what she was looking for; two men in bright spacesuits, creeping closer to the pod, waiting to ambush anyone exiting the pod, waiting to get inside, waiting for leverage

and revenge.

She raised the rifle and aimed carefully, considering which parts of the suits would be most worth saving.

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*Tom Jolly is a retired astronomical/electrical engineer who now spends his time writing SF and fantasy, designing board games (such as Wiz-War, and Manhattan Project: Energy Empire), and creating obnoxious puzzles. He lives with his wife Penny in Santa Maria, California, in a place where mountain lions and black bears still visit on occasion. You can find more of his stories at [www.silcom.com/~tomjolly/tomjolly2.htm](http://www.silcom.com/~tomjolly/tomjolly2.htm).*