No Moon and Flat Calm A short story about panic in space. By Elizabeth Bear May 25, 2019 (7AM)

Each month, Future Tense Fiction—a series of short stories from Future Tense and ASU's Center for Science and the Imagination about how technology and science will change our lives—publishes a story on a theme. The theme for April–June 2019: space settlement.

The world was glass.

It was a tiny, artificial world called Waystation Hab, and my four classmates and I were approaching it in a shuttle we'd been crammed into for four months. My classmates and I were all postgraduate apprentices in the safety engineering internship program.

We humans are a hardy, adventurous folk. We take to the void in our frail little craft. We always have—reed boats, dugout canoes, Viking longboats. Fabric biplanes and the tin cans we used to shoot into space.

Waystation was bigger, but not much: home to 156 souls, and the steppingstone to the outer solar system. One hundred and fifty-six, plus the five of us. A lot of people, out in the dark and cold. Not a lot at all in the grand scheme of things. But necessary: Waypoint was our gateway to the outer solar system.

A spinning silver doughnut slung to a long, axel-like hub by a series of tension cables, Waystation held itself together and generated spin gravity through a careful balance of forces. Its smallness made its frailty seem all the more apparent—but our homeworld is a frail little craft as well. So easy to disrupt or destroy. It's just so much bigger than us that we can fool ourselves about its resilience. About our own resilience.

The curve of the hab loomed over our shuttle. We came up on the inside to dock, our little ship matching velocity to slide between the cables that kept the station in trim.

From the moment we docked, I couldn't stop thinking of everything that could go wrong. I was the first one out. I dropped off the ladder two meters above the deck and landed lightly in the partial gravity. Pushing my nose against all that glass, I gawked at the whir of space. From here I could see the towering hub, the web of cables, and a bit of the shuttle's hull all seemingly "above" me, because with spin gravity, out is down.

I had no sense of acceleration. The universe seemed to be revolving around Waystation.

I was nauseous, but I stayed there until Rico, Mei, and Ife joined me. Danika was behind them. She had piloted us, so the post-flight check and shutdown had been her responsibility.

My classmates and I moved carefully, moonwalking without the bounce. Bouncing here would send you into the low ceilings—nobody's idea of a good time.

"This is a long way to go for a classroom exercise," Rico said disgustedly.

"Continuing education is a pain in the ass," Danika answered.

I hate group projects. I hate working with other people—to their schedule and to their standards.

I didn't get the training assignment I wanted. That's how it works sometimes.

I said, "Don't you think somebody should be here to meet us?"

"The briefing did not tell us where to go once we arrived," Ife said. "You would think there would be a message waiting."

Danika rapped on the wall. "Maybe figuring out where we're supposed to be is a part of the curriculum."

"That would be a stupid curriculum." Have I mentioned how much I hate group projects?

"And what would be a good one?" Danika shot back. I hadn't meant to offend her, and from her stiffness I was certain I somehow had. "Something focused on the Titanic, maybe?"

Mei held up a hand. "Don't get Marisol started again. I need us to not spend the entire time we're here talking about transportation disasters."

"Hello," I shot back, stung by the unfairness. "Safety engineer. Also I didn't bring up Titanic this time. Danika did."

Mei and Rico laughed at me. Mei said, "Disasters are caused by human error and bad design. We can prevent those things."

Mei was right as far as it went, but there were other factors: the profit motive, for example. Or small problems that caused unforeseen consequences and multiplied. Catastrophic failures too big to engineer against.

But I didn't want to give them any more ammunition, about seeming obsessed, so I moved on. "I don't think much of their protocols if they're going to allow clueless interns wander around."

"I'm not clueless." Ife had been born on Luna. "It's probably a scheduling error. Let's take Marisol's advice and see if we can find Ops."

Rico muttered as he walked past me. "Creep."

Danika put a hand on my shoulder and spoke softly. "We've been cooped up together a long time, and we're all stressed."

"I don't know why I try," I answered. "Nobody is ever going to like me. People say you should be yourself, but then people tell me I'm a freak. And if I try to act like other people, they tell me I'm a fake and a poser."

"Station engineering often involves working with a lot of people in close quarters, as we just were. Sure it's a good career choice for you?"

"Most habs aren't as big as this one. Plenty of contracts on outposts where Station Ops is the only person," I said.

"And the nearest human might be light-minutes away. Or hours, sometimes, depending on the orbits."

"You've got to be kidding me."

She studied my face. I was pretty sure that it didn't suggest I was kidding her. But who knows for sure what their own face reveals?

"You're going to request a mining drone service depot at Saturn?"

"Maybe," I said. "Maybe Uranus. This wasn't the training rotation I asked for."

"Takes all kinds," she said, and let it go.

Mei's not the first person to consider me morbid. But I don't like the gory, pointless disasters. The ones where nobody could do anything. Those are just terrible and sad. I like the ones where things happen slowly enough for people to

respond. To mitigate. To avert the worst, or some of the worst. Or the ones where something terrible went wrong because somebody was in a hurry, not paying attention. Taking shortcuts.

- Like isn't the right word, anyway. I don't like disasters.
- I study them. You learn from the mistakes, and then hopefully you make different mistakes.
- So I focus on the interesting, useful disasters. And only transportation ones.
- Apollo 13. Challenger. The Lunar tube puncture. Aloha Airlines Flight 243. British Airways Flight 9. The Crazy Eights train runaway. Jeffries Station.
- Titanic is useful too. What's amazing about that incident is not how many people died, though that's terrible.
- What's amazing about the Titanic disaster is how many people survived.
- The docking ring was deserted. I hustled a few steps to catch up with Danika. "Does this seem right to you?"
- "Ife will figure out where we should be." Ife, ahead, was consulting her handheld. She looked irritated, but not concerned. "There will be plenty of disasters for you to love. You don't have to rush it."
- "It's not—"
- "You don't have to explain yourself to me." Danika grinned at me, flash of bright teeth. "Anyway, you hate people."
- "In the abstract, they're fine."
- "That was a joke," she said, so I laughed apologetically.
- "OK," I said. Rico glared. I lowered my voice. "But there are 161 people on this hab, counting us. Where the hell is everybody?"
- A shiver ran through the deck. It didn't feel like an impact. It felt as if Ops was using an attitude jet to adjust the station's trim.
- Rico whooped in amused surprise and grabbed one of the railings. Mei glared at him for a change.
- Half the problem with our class was that we were all good and sick of each other. The other half of the problem was that Mei probably shouldn't have made it through the antisocial index screening. Nor Rico, for that matter.
- Neither should I, honestly. But it's not like people are lined up to go to space, get irradiated, suffer bone loss, and leave their friends and families. The ones who have friends and family.
- Space was still sexy when I was little. People wanted to go. Being an astronaut was romantic.
- Now space is quotidian: just a dangerous, difficult, physically destructive job that pays well. They take who they can get.
- "Unscheduled burn?" I said. "Shouldn't there have been a warning?"
- If e looked at me. Her face did something complicated, but it wasn't hostile. "Let's get to Ops," she said.
- The first-stage alert lights began flashing—just an all-hands call to action stations, but I still expected the corridor to fill with hustling people.

It did not.

I said, "Do you smell smoke?"

Rico said, "Let's go back to the shuttle. This is not right."

I said, "Where the hell is the smoke coming from?"

It wasn't visible, but the smell of burning plastics and ionization was strong. Fire in space is hungry for oxygen, and it doesn't share.

"Here's Ops," said Ife, and opened the door.

Inside was a scene of chaos from a post-apocalyptic game.

Ops was deserted, but hardly empty. Cooling bulbs of coffee lay beside workstations lit by flashing amber alerts. Screens scrolled data and camera feeds. Bigger screens hung at the front of the room, showing the exterior surface of the hab and views of major corridors.

They were all empty.

Mei stopped inside the door. "Now I'm freaking out."

"Step to the side, please," Danika said, and moved her over with the back of one hand so we could all enter. The door sealed shut behind us with an atmosphere-retaining tch that I found reassuring. The smell of coffee overrode the smell of smoke. Also a good sign.

"OK." I moved toward the life support station. "We need to find that fire and starve it."

The easiest way to fight a fire in space is to deprive it of oxygen. We'd practiced this. Somehow, with my hands on the cold molded plastic of a real Ops station, it didn't feel like something I knew how to do.

"This has got to be a drill," Mei said.

"If it's a drill, you want to pass, don't you?" Ife set her handheld on the engineering station and clipped her harness to its safety ring.

I copied her. "Danika, would you get comms and see if you can find any people on this hab?"

Danika moved over to the station. As if my issuing instructions to her had shaken them loose, Mei and Rico took other consoles.

An attitude jet fired again—a definite burn this time, the deck lurching under our feet. Ife made a grab for her handheld and kept it from skittering away. "Stow your gear." She stuffed the unit into a pocket.

Nobody else had any loose gear to stow.

I was glad I was clipped in. Rico had to grab the edges of his console.

"Got the fire," I said. "Sector 3 North."

Waystation was one long circular corridor with 12 pairs of modules projecting from its sides. Those modules were divided into "North" and "South." Our shuttle was docked at Sector 5, along the inside of the wheel. Ops was in Sector

7, on the north side of the wheel. North and South were not a completely arbitrary distinction; "east" was the direction of spin.

"I'm going to need an evacuation alert in Sector 3," I said.

"Good," Danika said. "How long?"

I couldn't do this. I wasn't able to do this.

There wasn't anybody else to do it.

"Ninety seconds?" Nobody answered, so I said, "90 seconds," in a firmer voice.

An instant later, Danika said, "Done."

We should have a command structure. We should have incident leadership. We had ... nothing. Five students and a whole hab not full of missing people.

"Everybody on the hab should have an RFID locator chip so the crew could rescue or retrieve them if they went missing," Ife said.

Rico said, "Well, they're missing now." His hands moved over his console.

My countdown on the evacuation alert reached 80 seconds. I checked to make sure that the decompression doors were engaged and the circulation vents closed between 3 North and the rest of the hab. My hands shook—what if I had forgotten to do that?

They would have closed on their own, I told myself. Assuming the system worked. Which felt like a big assumption right now.

"Decompressing in eight, seven, six—"

I uncovered the shielded toggle and recognized a problem. "Damn it," I said. "I need the keys!"

Mei tossed them to me without looking. The arc was high because of the gravity, but I managed to reach up, straining at the end of my tether, and snag them.

As I fitted the key, oxygen levels dropped through Sector 3, North and South. The fire would put itself out eventually, but we'd all suffocate too.

"Rico, please check to make sure 3 South is isolated from 3 North?" I asked.

"It looks OK," he said. I'd half-expected him to ignore me, but apparently a real crisis made us temporary allies.

I turned the key.

On the screens, a puff of atmosphere and debris jetted from the outside surface of 3 North. And there weren't any bodies in it, which was a relief.

"Fire's out," Danika said. "I think, anyway. Infrared shows the temperature dropping at the source."

"Phew." said Mei.

Fire could rekindle, despite being deprived of atmosphere, if it had melted through oxygen supply lines.

Right, I should temporarily seal off all oxygen feeds to 3 North. I should have done that first. I was not ready for this job.

I used the keys and flipped another locked toggle, triple-checking that it was the right one. Belatedly I remembered to say, "Shutting down ox to 3 North."

Rico said, "I have a bunch of RFID tags in Sector 8. Looks like they're in the backup Ops center."

"Why'd they evacuate this one?" Mei asked.

"We should go back to the shuttle," Rico said again.

He might be right. I opened my mouth to say so, and the entire world lurched. A terrible rending sound, like God snapping a rubber band, rang through the hab.

We bounced off the deck as lights that had been amber flared red. Except Mei, who still hadn't clipped in. She bounced off the ceiling, cursing, then bounced off the deck like the rest of us.

She hauled herself to her feet. "It's just a drill. It's just a drill."

"That was a cable snapping," Rico said, as Ife said, "It's not a drill."

I said, "Check Mei," and Danika stretched out to touch her, not unclipping.

"I'm fine," Mei snapped, blood dripping down her face. She grabbed the rail on the edge of the console and snapped her harness leads to it. "Stupid way to get hurt."

Rico was right. On the big monitors toward the front of the room, I could see the enormous tension cable swinging majestically free. The arc ascended. My abdominal muscles clenched as I considered whether it would intersect and slice through the fragile hull.

Venting 3 North must have strained an already fatigued cable. Or one with a manufacturing flaw.

"Are there any suits in here?" Ife asked, almost calmly.

Rico looked across the deck at the emergency locker. He unclipped, swore, and lunged for the locker.

"Empty. The crew must have taken them when they evac'd. Let's get off this hab while we still can!"

"The cable's OK," Mei said. "It's going to wrap the hub."

The hab could survive losing one tensioner. Maybe even two or three, if they failed in the right places around the diameter. But if they failed at the hub, rather than along the wheel, they'd cut the hab to ribbons as they lashed around.

Across the diameter of the hab, the screens showed a puff of debris glittering in the sunlight, particles turning like mirrors falling in slow motion. And in the mist of that shimmer of irregular confetti, a tiny four-limbed figure, tumbling like a rag doll.

A human body in space.

The shock zapped through the deck under our feet. We all managed to hold on this time.

"Definitely not drill." Ife's complexion faded from warm brown to grayish.

"Is it terrorists?" Mei asked.

"Maybe something blew up when the deck jumped?" Ife said.

I wished I believed that answer. But I thought something much worse was going on. "The rupture is opposite the snap. I think we've got a forced resonance—a critical oscillation frequency—going on. Something like that destroyed the Tacoma Narrows Bridge back on Earth once. It vibrated to pieces in a high wind."

Mei was looking distinctly greenish, and it wasn't the wash of the alert lights. I felt just as sick. An oscillation meant Waystation was vibrating from a wheel into an oval and back to an oval in the other direction, straining the tensioner cables and stressing the fabric of the hull.

It might succumb eventually to friction and energy loss and stabilize. That was what it was supposed to do.

Or—and this seemed more likely right then—it might shake the habitation apart, as the wheel snapped back and forth like a giant, quivering jelly mold.

Mei said, "We started that when we dumped the atmosphere from 3 North, didn't we?"

"Probably," Ife said.

"Can we interrupt it?" Rico asked. "Use the attitude jets to damp it down? What if we dumped the atmosphere somewhere else?"

Much as I couldn't stand Rico, it was a good idea, though the necessary timing and force were probably too precise to manage. I was about to say so when Danika interrupted.

"I found everybody."

"Where?" Ife asked.

"Looks like they're stuck behind a series of decomp doors in 8 and 9. The evacuation pods are in 10, 11, and 12. They were mid-evac when we popped 3 North."

"We were one set of doors away from finding them," Ife said.

They're all going to die because I'm not good enough.

Danika pulled images onto the screens. Orderly groups of people, some in spacesuits and some in shirtsleeves, stood back from two people who were prying at the door seal with inadequate manual tools.

"Why the hell evac instead of putting out the fire?" There was blood all over Mei's hand from wiping at her face.

"Because they knew venting would cause an oscillation?" I guessed.

"Let's go back to the shuttle," Rico said. "Let's get the hell off this hab. These people can take care of themselves. They let us dock when they were already evac'ing."

I looked at him. I wanted to fold up and fall silent. Go along.

I squeezed the edges of my console until my fingers smarted. "You try to fly that shuttle out of here before we've managed this evac and I'll lock it to the docking bay. We're not leaving until we finish helping these people."

Rico looked at me. "Who died and made you God?"

I ignored him. "Ife, why are those decomp doors sealed?"

"Faulty sensor, it looks like," she said. "They came down all over the hab when we blew the fire out."

We could have foreseen that, I guess. But we didn't. And now, I realized, it was going to cost us dearly.

We were responsible, in some respect, for this disaster. We'd reacted to an immediate crisis without understanding the larger situation. A situation that the resident crew had understood, which was why they had started an evacuation before attempting to suppress the fire.

We're very good at what could go wrong. And we're good at how people respond to things going wrong. How people act in a crisis. We have the science to manage it. We study it. We focus on it.

We live it, over and over again, for the sake of the people who will hopefully only have to live it once. Or never.

Preparedness is how we make sure things have a chance to go right even when they've already gone wrong.

"We should evacuate too," Rico insisted. "The people who should be here doing this job already bugged out."

"They're trapped," Danika said.

"The crew?" Rico rubbed his hands together angrily. He hadn't reclipped. From the way Mei and Ife were looking at him, I thought they might be right behind him if he went.

But Ife said, "Our people. The engineers."

"They're not our people," Rico scoffed. "They should have stayed, then."

"Well, they didn't expect a decomp," Mei said, her iciness turned on Rico.

She didn't look at me, but my hopes flared. Maybe she couldn't just leave all these people here to die either.

We were just interns, it was true. But we were trained, and it was our job to save them if we could.

Another oscillation wave passed. We jerked and squeaked at the end of our harnesses. Rico held on tight. On the monitors, Waypoint's crew were hurled about.

"The crew can't get out if we leave," I said. "The doors are locked. We have to override and set them to manual. Or they'll die down there."

"Somebody's going to have to stay and manage the doors, if they're on manual," Mei said.

"Us," I said. "We're staying. We'll evac back to the shuttle once the crew is in the pods."

She looked at me, and I looked at her.

"We'll die up here, if we stay." Danika said what both Mei and I were thinking. She didn't speak angrily. She spoke as if she were making sure everyone knew the risks. "Doors are down between us and the shuttle, too. They're all down."

"I'll stay," I said.

A wash of scarlet lit my panel, and the main life support alert light over the monitors went scarlet. "Pressure is

dropping throughout the hull," I reported. "We're springing leaks all over the place."

"Sectors 3 and 4 just blew," If esaid. That was our route back to the shuttle. Decision made for us: we couldn't leave.

I knew how to do this. I had done it over and over again in the simulator. This is just a drill. "Override Sector 8, 9, and 10. Mei, take control. Switch the decompression doors to manual override in all sectors. We'll open and close them in sequence to act as a series of airlocks."

"Air's gonna get thin," Ife said dubiously.

"Better than no air at all. Danika, do you have comms with the crew yet?" My hands had stopped shaking. My chest still squeezed tight.

"Affirmative," she said. "I can broadcast, at least. I've got the loudspeakers."

"Tell the crew to gather and, once we pop the doors, to get out."

Another oscillation wave hit. It seemed worse than the previous one, somehow. Another cable was going to detether any second.

I took the edge of the console in the gut and gasp-snarled, "How in Newton's busted universe is it getting worse?!"

"Damn it," Rico said. Then, "OK, they're through the first door."

He bent over his console, fingers flying, reading off a string of pressure differentials. Maybe his brain had kicked over into altruistic mode, and he was ready for a little unselfishness for a change.

"Strain on the tensioners is peaking," said Ife. "I'm going to try to dampen it with the attitude jets and see if I can buy us a little more time."

"Good," I said. "Keep us in trim. I'm diverting atmosphere to the sectors where the crew is."

Which meant diverting it away from the sectors we'd need to move through on our way out. But nobody thought we had a chance of escape. Not with three blown. Not without suits.

"They're through to Sector 9," Danika said.

The hull creaked. Mei ducked, then laughed at herself and went back to work. Popping noises followed; it was my turn to flinch.

"Sealing the Sector 8 doors," said Ife. "Opening the ones into 10. Get the pods open."

"Working on the pods," said Rico. "OK, they're unlocked."

"Orderly evacuation," Danika said. "It doesn't look like anybody's panicking. First group are into the pods."

I'm panicking, I thought, but didn't say it out loud.

Rico giggled. I guess I didn't need to.

"First load of pods away," said Mei. "Sector 9 door sealed. The door into Sector 11 is open. And I've got 12."

The hull shuddered hard enough that I thought it would drive my femurs up through my hip sockets. I gasped in pain and grabbed the rail. "Open 12," I said. "Give them a fighting chance to make the pods. There's no more time."

"Fifty percent evacuated," Danika whispered.

I slapped my hands over my ears, only aware an instant later that Waystation's entire hull had rung like a massive bell. There was another pop, even more enormous, but I felt it rather than hearing it. I was already deafened. On the monitors I saw people falling, being tossed around. Running when they could, dragging themselves along the rails where they could. In some cases, just falling and crawling.

"Oh, no," Mei whispered, transfixed.

Rico shouted. "Second wave of pods—"

All the lights went out with a tremendous rush of wind.

There should be cold. Pain. Suffocation.

There was darkness and silence, but it wasn't the silence of the void. Around me, I could hear ragged breathing.

And then the lights snapped back on—ordinary, pleasant full-spectrum light, and not the yellowish emergency lights. I blinked, half-blinded, and shaded my eyes until they adjusted. When I lifted my head, Danika was standing by the sealed door, her hand on a panel housing a perfectly ordinary light switch. The air was sweet and clean, no hint of smoke.

Mei leaned forward, clutching the rails on her console, dragging in long gasps. Rico stared at Danika, blinking, one hand pressed to his chest. Ife stood like a pillar, eyes closed.

"Congratulations," Danika said. "You passed."

I sat across the table from Danika, who smiled over folded hands. I tried not to be furious with her. She was only doing her job.

"What about Rico? Was he part of the test?"

"No." Danika chuckled. "He's just an asshole. Despite that, he pulled it together and did what had to be done in the end. In no small part due to your example, I suspect, Marisol."

I wanted to put my head down and sob, but that wouldn't be professional. I had coffee, at least, and I drank some. "I'm so damned sorry that I let everyone down."

Danika frowned at me over the nipple on her own coffee bulb. "What makes you say that?"

"I got my crew killed. My imaginary crew. I could have done better."

"The crew is real," she reminded. "It's just the disaster that was imaginary. And—imaginarily—you saved 63 percent of them."

I laughed bitterly. "Are those acceptable losses?"

"You know there's no such thing. It's within parameters for the situation, however."

"Sure," I said.

She put her coffee down and leaned forward. I was third in line for debrief. I knew there was cake in the mess room, because I'd been too anxious to eat any. Now, suddenly, all I wanted to do was get back there and stuff my face with

sugar.

"Marisol, are you listening to me?"

"Yes," I said.

"I know this was a tremendously stressful test. The pop quiz to end all pop quizzes."

"Pop quiz," I said. "Pop. Hah."

She snorted. It wasn't a laugh. "A brutal surprise. But now you know what you'll do when hundreds of lives depend on you."

"It's pretty damn abusive," I said.

"Fair," she admitted. "But you did fine despite that."

"You're saying that I couldn't have prevented the disaster?"

"Not in the real world, and not in the simulation. Not if there actually were a flaw in Waypoint's design that would cause it to oscillate like that. The disaster could have been prevented. But not by you."

"Huh," I said. "So Waypoint is engineered to basically come apart on command?"

"Oh, no," she said. "We just shake the fake Ops center around and pipe in terrifying footage and smoke smells. It's all make-believe."

"Tell that to Mei's scalp wound," I said.

She half-smiled. "Take the praise. Take the success. Go eat a slice of cake. Let the crew shake your hand and slap your back. They love this stuff. It's a wonderful distraction from ice barges."

I stood up. "Is there anything else I can do?"

"Yeah. Don't waste yourself on some solitary exile on Saturn. Remember that when the chips were down, you stood up to your classmates. And you just stood up to me now." She stretched, and cracked her knuckles. "And on your way out, send me Rico."

I ate my cake. I thought about Titanic.

My takeaway from that catastrophe is not the traditional narrative of hubris and arrogance, costing more than 1,500 souls. It is, rather, that an excess of preparedness and over-engineering barely managed to save 700 people, and might not even have managed that without nearly perfect weather for the season and the clime. No moon and flat calm, as the survivors said.

Was there hubris and arrogance? Were there oversights? Were there false assumptions? Were conditions unsafe for a speed record attempt? Were mistakes, to employ the passive voice to elide responsibility, made?

Of course. But in the end, the problem was not that her design was oversold.

In fact, the performance of the ship exceeded her design. Titanic was the safest ship ever built. When confronted with the overwhelming force, an impact of over 30,000 pounds at a relative velocity in excess of 20 knots, extending much of the length of her hull ... she weathered it.

She stayed afloat and in trim for over 2½ hours. Because of the heroism of crew members in the boiler rooms who knew they were sacrificing their own lives in the effort, her lights stayed on.

Titanic exceeded any reasonable expectation, and because of that, more than 700 lives were saved.

We hate that. We want terrible things to have happened for reasons. We want there to be a flaw to correct, something we could have done better. A choice we could have somehow made differently. We want horrors to be preventable.

But the world doesn't work that way.

Once the disaster became inevitable, what Titanic got was a better outcome than anybody had the right to expect.

Under the circumstances, it was the best we could have done.

https://slate.com/technology/2019/05/elizabeth-bear-no-moon-flat-calm-fiction-short-story.html