



Illustrated by Vincent DiFate

For All Mankind

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It must have been a hell of a sight, our mighty Saturn V gleaming in the work lights, fumes waving like the Stars and Stripes thirty-six stories over the Cosmodrome. I never saw it myself. I only saw scissor-crossed shadows rolling past the gantry lift and a flash of twilight where the breeze fluffed the camo shrouds against the companionway.

And that's about all I saw of the Soviet Union, outside the training center walls. The rest was jump seats, painted-out windows, and the inside of a sack that smelled like Yuri Gagarin's underwear.

If that sounds like a kidnapping, it wasn't, just Cold War paranoia rubbed raw by desperation. After all, we were launching from a bastion of deep Soviet secrets, and if we succeeded in saving the world, they might still be needed to put it back to the screw. It was all wasted on the two of us, though; what use are secrets to dead women?

I should back up, way up, all the way to 1963 and what might be the most important meeting ever conducted on the wing of a biplane.

I was in Corpus Christi, test flying for Covington Aero—a bunch of Texas wildcatters with oversize dreams. Their jets were just flying limos, but it beat dusting crops all to hell, and the smell of Jet-A on my hair cleared off randy flyboys faster than mange on a weasel.

I'd just finished a shakedown when Mazie stopped me at the front desk with a hand-scribbled telephone message.

Don't eat, it said, I'm taking you to lunch. ETA 13:00.—Jerry.

I smiled, lost in memories till Mazie raised an eyebrow. My heart was pounding all right, but not for the reason she thought. The only "Jerry" I knew was Jerrie Cobb, and if she was coming all this way to see me, something big was up.

Jerrie had inaugurated Randy Lovelace's *Woman in Space* program. He'd run her through the same tests as the Mercury astronauts and, when she passed with flying colors, sent her out to recruit the rest of us. Her dreams were up in orbit. I'd have been happy with a crack at Mach 1, but even that hope was too high. I washed out in the medical—ovarian cancer—but at least I got to keep on breathing.

Now here was Jerrie, back from the blue. A minute before one, she taxied up in a big yellow Stearman. We flew east and landed on a pipeline right-of-way overlooking Redfish Bay. With a basket pulled from the cockpit, we climbed up behind the engine and sat together on the upper wing where the shore breeze could reach us through the scrub oaks.

Jerrie's blond locks still hung in a ponytail, framing her sun-hardened cheeks. She poured coffee from a thermos and spiked it from a silver flask.

"A toast," she said.

"To what?"

"To getting into space if it kills us."

We drank.

Sandwiches followed. I peeled back wax paper, and she lit a cigarette, beaming with eager secrets.

"Did you hear Kennedy at the U.N. the other day?" She said.

"No, why?"

She looked askance and leaned in close, the smile suddenly gone. "What I'm about to tell you is top-secret. An honest to God, no kidding around, you will be charged with treason if you blab, United States Government secret."

"O . . . kay."

Her eyes were cold and waiting. "Really."

"I pinkie-swear, Jerrie, now spill."

The smile flooded back.

"There's an asteroid headed straight for us."

"What?"

She took a quick drag and blew her smoke skyward. "Well, not straight for us. It'll pass by in eight years, but ninety years later it'll be back and . . ." she held up her sandwich and threatened it with her fist. "Wham!"

"It's going to hit us? Oh my god! Why are you so happy?"

"Because it's *not* going to hit us," she said. "We're going to stop it, you and me."

"We are?"

"We are. It's called Asteroid 1956 KI, found by some Russian scientist looking for ways to track our missiles. He thought it was going to hit us in '71, so he contacted a colleague at MIT—scientist to scientist you know. They had a new computer big enough to pin down the orbit, and it turned out to be a near miss, but the flyby will sling it onto a collision course."

I looked up from my pastrami. "But there's plenty of time, right? In ninety years we'll have space cruisers and ray-guns—"

Jerrie shook her head. "It'll be too late. There's a mountain up there with our names on it. Even if we reach it and blow it to bits, all the bits will still orbit around and hit us. They worked

out that the only safe bet is to go give it a shove, and the sooner the better.”

“They? So we’re in this with the Russians?”

“You’d think so. I mean, we could barely put a prized pumpkin in orbit back then. But the big boys are at loggerheads, so nothing doing. That’s why Kennedy called for the Moon landing, as cover for the biggest crash program since the Manhattan Project—no pun intended.”

“Holy smokes.”

Jerrie blew smoke to the breeze. “The only thing they agree on is not to tell the public. So ’56 KI is a shared state secret, but we’re each going after it alone. Only here we are, six years later, and the wheels are off the wagon.”

“I thought Project Mercury . . .”

“Oh, the space program’s going gangbusters. It’s the asteroid plan that’s in the hooch. On paper it’s easy, just sling a giant H-bomb around the Moon and tell everyone we lost a test shot. A couple of years later, it catches KI on the far side of its orbit and boom! Practical, sneaky, god-awful expensive—everything you want in a government program. Except it just won’t work.”

“What? Why not?”

She counted off fingers splayed around her sandwich. “Mass concentrations in the Moon, influences from other planets, effects from solar storms that haven’t happened yet, thrust transfer efficiency—way too many variables. We don’t even know if KI’s solid. A robot won’t do. We need astronauts out there, people who can think and react.”

“What about radio control?”

“Too far away, fifteen or twenty minutes when things can go craps in a second. And what if something breaks? We need astronauts who can fix it. And instead of one big bomb, we need a bunch of small ones to use as the situation demands.”

“Okay, well what’s it to do with us? We’re not astronauts, just guinea pigs in heels, remember?”

“That’s where you’re wrong, *ma chère*. The laws of physics have done for us what Washington wouldn’t and Lovelace couldn’t. The new mission will take a lot more energy. They’re not even sure we can do it.”

“Even with the new Moon rocket?”

“Saturn was Plan A. We need something even bigger, and the budget’s already in orbit. That’s why Kennedy went to the U.N. last week, to propose a joint U.S.-Soviet Moon shot. That’s his way of saying we’ll share the glory if they’ll split the bill. But they’re still sore over the Bay of Pigs I guess, so . . .”

“So what do we do?”

“We need a bigger rocket or a lighter load. Someone remembered Randy Lovelace and his paper about how women astronauts would save weight.”

“You’re joking. Just because we’re a little lighter—”

“Not just us, Katie, our food, water, and air and all the fuel it takes to lift them. This mission might run for months. Every man replaced with a woman could save a thousand pounds in consumables, 150,000 pounds on the launch pad. And unless the Russians are training up Romanian gymnasts, you’re the lightest person alive who’s medically checked out for spaceflight. So how ’bout it?”

“Me? Why?”

“Well if you aren’t interested—”

“Of course I’m interested! But I washed out.”

“You had a hysterectomy didn’t you? You’re all better now, aren’t you?”

“Yes, but—”

“So you washed back in. The last thing NASA wants anyway is a bunch of astronautettes on their periods.”

“Oh, for Pete’s sake—”

“I can’t say—I blame them myself. I told Randy I’d have the surgery if they’d let me go.”

“Jerrie!” I sloshed my coffee onto the wing. “Don’t say that!”

Jerrie looked down, pulled a rag from a pocket, and cleanly wiped up the spill.

“You understand this is a one-way ticket, right?”

I hadn't thought of that.

Jerrie could see my gears turning. “I'd give anything to fly in space, Katie.” She offered me the flask. “Anything.”

I declined. She capped the flask and looked out over the bay. A shrimp boat chugged past. Egrets danced through the reeds.

“All this could be gone,” she said, flicking an ash back over the wing, “but we can save it, you and me. That's worth dying for isn't it?”

Behind us, a pair of jets streaked out from the naval air station. I recognized them by ear: T-38s, the type of jets flown by the astronauts.

This time, we weren't just lab rats. We reported to Dale Gifford, NASA's Director of Special Operations, and the doors finally opened. Sort of. We flew all over the country learning everything from celestial navigation to CO² scrubbers. But we always went as consultants, not astronauts, and our dreams were soon in a tailspin.

Apollo was a three-man ship, but without a lunar lander to fly, we could get by without its pilot. No other women had been recruited though, and that meant one of us was training as backup. Then Jerrie caught Dale in his office reading dossiers from the Air Force's Manned Orbiting Laboratory.

She went in on full afterburners. “We're not ballast, Dale! We don't need any Air Force flyboys to drive us to the prom!”

Dale glared like a doe caught with her snout down in the collard greens. He waved us inside with a nod to the door.

“Don't tell me what we need! Only twelve people know about what we're up to so far, and LBJ's top of the list. With his help, I can get anything I need cloaked in national security, no questions asked. Without it, I can't get a parking space at the VAB. If I told him I was sending up a couple of bachelorettes . . .”

Jerrie started to protest. Dale slammed a hand on his desk blotter.

“Look,” he said, “There's a thousand parts of this thing you two know nothing about. In the end, the numbers will call the shots. Right now, I need to keep the president at the table.”

I looked at Jerrie. I looked back at Dale. “Are you saying you're lying to the president?”

His eyes darted about. “I'm saying, you worry about your job and let me worry about mine.”

* * *

Two weeks later, we were joined in our incognito training by Scott Anderson and Bob Keiffer, MOL astronauts tapped from the Air Force. We were broken into crews: Bob with Jerrie, and Scott with me. For sure, only one of us would be flying, and then as a weight-saving monkey throwing switches from the backseat.

Jerrie was livid. Scott was surprisingly decent about it and always saw I took my turn in the command seat. He was a blond-haired, blue-eyed Nebraskan, an American Adonis in miniature. For appearances sake, we were never left alone. Then one day at Langley, we were in the docking simulator waiting for our run when he reached up and switched off the comm.

Here it comes, I thought, batter up.

“Can I give you a piece of advice?” he said.

“Um . . . sure.”

“Stop thinking like Jerrie's copilot.”

Excuse me?

“Look, I get it,” he said, “She brought you in, and you're her wing man. But in case you haven't figured it out yet, you and me are the prime crew. They're *our* backup.”

“But . . . Jerrie's—”

“She's a damn fine pilot with moxie to spare, but she's also been in *Life Magazine*. She's too famous for the United States government to blast off on a suicide mission. Besides which, you weigh less, you've got better test-flight experience, and you have an engineering degree. It's your pooch to screw. You need to start owning the mission.”

I've known a lot of pilots, a lot of fighter jocks. No one has false bravado down like the test pilot crowd. *This* definitely wasn't what I'd expected.

"Scott, just what are you saying?"

"Nothing, I just . . ."

I gave him *the look*, the same look Momma always used when waiting to hear who'd thrown the ball through the window.

Scott turned over his flight manual and pulled a folded sheet of paper from between its pages.

"Even with NERVA, this mission was an iffy proposition."

Was?

He handed me the paper, a mimeographed letter from the chairman of the House Space Committee. Apollo was costing way more than expected, and the Space Nuclear Propulsion Office had been talking up atomic rockets as the ticket to Mars. Congress didn't want another costly space race.

"NERVA's been sidelined?" I looked up in shock.

We weren't getting the atomic upper stage. The mission we'd been training for was over.

Scott took back the paper and tucked it away. "I'm saying you better be ready. It might be just you, all alone for six months in a bucket."

He switched on the comm and smiled. "I'd pick a good book out, if I were you."

* * *

That was the fall of '67. By Easter, there were rumors of back-channel contingency planning with the Russians. Apparently, they had their own nuclear drive, smaller than NERVA but even more miserly with fuel. It could reach '56 KI in eight months if they could get it into space. Scuttlebutt was, their Moon rocket was a shambles.

We weren't doing much better. Our program was still on hold after the *Apollo 1* fire. Throughout the summer, we visited North American to see updates to the Command and Service Modules. In October, we went to the South Dakota School of Mines, which of all places played host to a plywood mock-up of a deep-space habitat supposedly designed in Italy.

Eight months is a mighty long space-flight. We'd been planning for three, jammed like sardines in a barge adapted from our lunar lander. This thing was ten times the volume and half the weight, with every convenience for the modern spacefarer. From attitude control to docking to the zero-grav toilet, it had clearly been pieced together from Russian and American components, and not by any Italians.

The manual, with a cover portraying it out among the stars, gleaming like an Airstream trailer, called it the "Cruise Habitation and Berth Module." We just called it the camper.

* * *

In July of '69, Neil Armstrong stepped on the Moon. I was with Scott at LaGuardia, waiting on the red-eye to Moscow. The era of détente had blown in three weeks earlier when the Russians' heavy booster exploded, destroying its launchpad and their one-of-a-kind mother-of-all asteroid-killing H-bombs.

With their camper and atomic drive, the Russians had the ticket to the ballpark, but we had the ride and the bat to swing once we got there. It would require a Frankenstein's monster of technology and culture stitched together with explosive bolts, but someone had been planning ahead.

Parts for two Saturn rockets had been waiting at anchor off Istanbul, having started their journey a year earlier. Now they were en route to Baikonur, where the backup pad for the Russian's failed booster would be ready for them in September.

One Saturn would carry the Russian drive. The other would take the camper, and us in an Apollo Command and Service Module with our "Special Payload Deployment Ring" in place of its heat shield. So in addition to five million pounds of explosive fuel, I'd be riding atop a dozen A-bombs. Don't tell *me* girls don't have balls.

* * *

I'd said my goodbyes back in Houston, all except to Jerrie, who'd made herself scarce since our orders came in, and she wasn't on the roster. As Scott had foreseen, I was in command, but

my Drive Module Pilot was a Russian engineer named Tatyana Tereshchenko. She was a crack-jack, but she was no pilot. She'd never even been in a simulator.

It galled me to trade Jerrie's experience for some eggheaded Ruskie. After all we'd been through, she had to feel betrayed, and it killed me that she might think I'd had any hand in it. But Scott was my backup along with a tiny Soviet air force captain named Fyodor Danisov. If I held out for Jerrie, I was assured, either man could replace me with only a slight increase to the risk of killing everyone on Earth.

We had a month to prepare a brand new mission. There was simply no time for complaining.

* * *

Tatyana was sharp. She'd memorized all our manuals and could even quote from Buzz Aldrin's dissertation on orbital rendezvous. But the critical maneuvers during the first three days would all be on me. Assuming I didn't get us killed, she'd have eight months to learn the ropes. And so would I.

At the Gagarin Training Center, Tatyana took me to see our unproven drive module, still on a test stand awaiting its nuclear fuel. At its heart was a miniature atomic reactor designed to power a strategic bomber but never used for that purpose because, well, that would be crazy.

In space, it would sit at the end of a twelve-meter boom, with six radiators projecting around it like the fins of a dart. We'd be at the pointy end, protected from radiation by shielding, electromagnetic lenses, the boom itself, and a pair of propellant tanks.

For now it was all folded and crated, and when I moved a tarp from one of the plasma nacelles, some dust flew up, and I sneezed.

Tatyana said, "Gesundheit!" then looked away sheepishly and launched into a lecture on the assembly procedures to be performed by cosmonauts in space.

It was an awkward start, but when I suggested handholds to facilitate spacewalking repair, the chaperon balked, Tatyana barked, and in twenty minutes, a squadron of engineers had descended on the hanger, argued around a chalkboard, and agreed to a short list of changes.

I started to think my egghead might be an asset after all.

* * *

The drive was flown to Baikonur. Two weeks later, we followed. I'd have liked to have seen our Saturn rolled out and erected on its railway carriage, but this was considered unlucky. Instead, we were miles away in our hotel rooms when a deep booming drone set the windows rattling, and we ran out to the balcony to see a needle of flame climbing into the night. Below us, soldiers pointed and shouted "Poshla! Poshla!" and made encouraging noises.

We watched till the second stage faded from view. Then we hustled on to dinner, to a send-off of drinking and music, and finally to sleeping pills and bed.

* * *

The next day, my last day on Earth, I planted a tree.

Our chaperon led us from breakfast to the little park where Yuri Gagarin had done the same before his historic flight. Tatyana laughed and said, "Is tradition," and we each took our turn at the spade.

The rest was a whirlwind of briefings and medical tests. Lunch was beef and carrot stew and a cake we never sampled. There were earnest words through a wall of glass and a darkened bus to the Cosmodrome.

As we drove, Tatyana and the chaperon chatted in Russian. I stared past the driver at the tree-limbed shadows and the afternoon light and thought of the cake and of sweet potato pie and of a thousand other flavors I'd never taste again.

We reached the pad just as dusk crept over the golden steppe. I've seen a Saturn-V standing at the Cape, a pastoral spire against the orange, red, and purple of a Florida dawn. Here she sat mummified in shadows and rags, but still she was hissing and eager. Everything stunk of the recent explosion, but when the hatch closed behind us, the cabin filled with the musk of machine oil, and I was finally home.

* * *

When the count reached zero, Tatyana yelled, "*Poyekhali!*" then turned with a smile. "Is

tradition!"

* * *

The first stage shook like a race car on gravel. The second lost its center engine early. I wondered if the sideways assembly by a mostly Russian team hadn't knocked something out of alignment. But the S-IVB third stage was smooth as ice cream on Dutch apple pie. Eleven minutes after thundering off the pad, we were floating weightless in orbit.

* * *

Control had passed from Baikonur to our mission control in Korolyov, outside Moscow. All further transmissions would be routed through Russian Kosmos and Luna spacecraft so any eavesdroppers would think we were just a Soviet moonshot simulation.

The Earth was a tear-rendering sliver of sunrise glory that bloomed into blues and whites, but we had no time for the sights. In two hours, we had caught up to the drive module, and glinting in the sunlight nearby, the second propellant tank and the Soyuz that had paced them since launch.

The radio coughed to life. Gennady Polyakov, commanding the Soyuz, spoke in Russian and made Tatyana laugh. Then he addressed me in careful English.

"Comrade Commander Katherine Ludlow," he said, "We are saddened to part in this way. Is proper to kiss on cheek, especially so pretty a hero of Earth."

I knew Gennady well from the training center. I smiled at his Russian directness. Then I remembered Jerrie, the real hero, whose struggles had brought me here.

I keyed my mike. "Thank you Gennady, and goodbye."

"*Dosvidaniya*," he said, "and good hunting. All drive module systems are ready. We are clear and standing by."

Tatyana spoke to the ground. The boosters fired, and we were off, our own little caravan to the stars.

* * *

We were headed for the Moon, but instead of dropping into orbit, we'd be swinging past and "down" to KI's orbital inclination. First, we had to get our ship assembled and the plasma drive on line.

I cut us loose from our empty third stage and the camper still resting behind us. Then I used the docking adapter like a big pair of tongs to fetch the extra propellant tank and mate it to the drive. After returning for the camper, I docked *that*, and we finally had a ship, with the drive and the CSM nose-to-nose and the boom and propellant tanks between them.

* * *

The drive proved its worth. Tatyana proved her mettle, controlling the reactor, drive, and camper from a console extension hanging where the center couch had been removed, and performing a flawless EVA to hook up external umbilicals.

A day and a half later, we shot past the Moon, lower than some of its mountains. After flipping to make a course correction with the big Service Module engine, we flipped again and engaged the drive.

From here on out, we'd be lonely. The mounting distance would soon make direct voice communication unworkable. Instead, we'd send messages through the DSE, the Data Storage Equipment, which would post messages to Earth in compressed form along with our telemetry data.

We stared out the windows at the Earth and Moon. We'd never be so near them again.

* * *

We settled into a routine: morning and evening reports off the DSE, two hours each on the treadmill, staggered sleep cycles and duties, and much double checking of stars. I learned to like borscht and rassolnik. Tatyana tried instant orange juice and freeze-dried shrimp cocktail. We sang old standards from both sides of the Iron Curtain and played microgravity hangman using stick-men made from drinking straws. I taught Tatyana to play poker. She taught me to play something called Makarenko-sakk, like chess but played on a roll-up board with a hundred felt disks for playing pieces. I read *Huckleberry Finn* aloud.

Tatyana read *Anna Karenina*—in Russian and English—and we debated Levin’s crisis of faith.

As the days turned to weeks, Scott and Fyodor started sneaking audio recordings into the DSE uplink. Like our parents around their wartime radios, we sat in rapt attention, laughing at Carole Burnett or Johnny Carson, or singing along with Barbara Streisand or Maya Krallinskaya.

One morning, early, I was in my couch drawing, trying to do the receding Earth justice with just my pen and paper. Tatyana was sleeping, and all the spacecraft systems were stable. Suddenly, a loud bang startled me, and the pen slipped out of my fingers.

“What was that?”

In her sleeping restraint bag, strapped to the floor behind me, Tatyana mumbled, “*Dayte meni . . .*”

“Tatyana, I think something hit us.” I bounced over to her right-hand couch. “Cabin pressure’s steady.”

“*Da*. I can see.” She had a clear view past the couch and my shoulder. “You are disturbing nice dream for pressure release.”

“I know what a burst-disk sounds like, Tatyana. This was more like a bullet hitting an oil drum.”

“All right, perhaps was micro-meteoroid. Pressure is good. Alarm is silent. What is to be done?”

I looked again at the gauges. “Yeah . . . yeah, sorry.”

I held my peace but didn’t stir. I buckled myself in and waited for the needle to dip or my adrenaline to clear enough to return to my drawing. My heart finally slowed, but I couldn’t shake the feeling of some looming catastrophe, so I floated up through the tunnel to start my morning ablutions.

A few minutes later, Tatyana found me in the camper, crying in front of the mirror and spigot that passed for our bathroom sink.

“What is wrong, Katherine?”

I looked at her and whined, “My brush.” I waved my paste-covered toothbrush in the cold fluorescent light.

She looked at me like I was crazy, then reached into her toiletry pouch and pulled out a little paper packet. “Here. Is cheap Russian brush from hotel. I should go to Gulag for stealing.”

I laughed. Then I looked in the mirror and laughed even harder. The tears had adhered to my eyeballs. As I moved they sloshed like a stuffed animal’s googly eyes. Tatyana blotted them with a hand towel and chided gently, “Is foolish way to drown, crying over toothbrush.”

Of course it wasn’t the brush, but the sudden realization, deep inside, that I wouldn’t be going out for a new one. Ever. That so many somedays, taken for granted, now were never to come.

Tatyana opened a tube of cottage cheese and fruit preserves, one of my favorites from the Soviet space-pantry. With hot coffee and breakfast secured across the fold-down table, she hooked her feet into the stirrups and settled down to eat.

“So, Comrade Katherine, you are feeling perhaps some regrets?”

I spooned the preserves. “You mean like not settling down to raise jackanapes before the world comes to an end?”

“World was always coming to end, Katherine. In ninety years or nine billion, is time enough for jack-and-apes.”

“Yeah, well . . . I guess it’s the finality sinking in.”

She tore open her fruit pouch.

“Gennady offered to sleep with me.”

I almost choked on my coffee. “Oh?”

“One last time for trail, he said.”

“Did you? Had you two . . . ?”

“No. Gennady is happily married to daughter of politburo member. He was, I think, 90-percent joking.”

“Only 90 percent?”

“Is man after all, *da*? He said Sasha would make you same offer, but was shy over not knowing English.”

“Sasha?”

“Soyuz Pilot. Was kozachok dancer at send-off party.”

I smiled, letting the hot coffee flow through the straw and stir my unsettled memories. Finally, I looked up and said, “Jimmy Beacham.”

“Yes?”

“It’s a long story.”

Tatyana grinned. “We have nothing but time.”

I looked down in my pouch, scraping together a spoonful. When I looked up, Tatyana had raised a stern eyebrow.

“Okay,” I said, “Well first you have to understand, Daddy had three heart attacks before he was thirty. When the war started, he was flying airmail out of Waco and afraid he’d keel over and crash on someone’s house.

“He was 4-F of course, but he wanted to do his part. They were opening flight schools all over, so he got hired as an instructor in a little town called Quero. We ended up renting someone’s closed-in sleeping porch, but the war was far away and we were together; a lot of other folks weren’t so lucky.

“We went fishing and picked blackberries along the Guadeloupe. I learned to milk cows and drive a tractor, and I made Daddy a crystal radio set so he could keep up with the war and his ball games without buying batteries. Once, he landed an old Curtis trainer out in the road and we flew up past the highway where the pastures were full of Indian paintbrush. It was like God himself had laid down a sunset for our picnic blanket.”

Tatyana smiled. “Bourgeois propaganda, of course.”

I shrugged. “I thought we were rich as Rockefeller, but we weren’t. Daddy worried what would happen to us after he was gone. Momma’s leg was crippled by polio, and she couldn’t even drive. They scrimped and saved to get her back in school and traded favors to get her to classes.

“When they closed the flight school, we moved to Victoria so she could teach at the colored school there, and Daddy found work as a mechanic. Then one night, Momma was pouring lemonade for our supper and suddenly looked at me funny and kind of startled. Then she fell down, right there in the kitchen, and that was that.”

Tatyana drew a breath. “She . . . died?”

I nodded. “The doctor said a stroke—a clot from her leg.”

“I’m sorry.”

“So there we were, with Daddy left to raise me by himself. We both missed Momma terribly, but also, we’d all kind of assumed he’d die first, so he wasn’t really ready, you know?”

“In Soviet Union, state would have been help to him.”

“Yeah well, Daddy wasn’t the sort to take charity, but he wasn’t the sort to give up either. He talked his way into a better job at the airfield, teaching flying and working on the older planes.

“One day I came home, and he’d boxed up Momma’s things. I was furious—said something stupid like, didn’t he love her anymore? And he said . . . I still remember . . . he said, ‘I’ve cried till all I hear is your momma standing there clucking, saying I’ll kill myself blubbering and leave you all alone.’ He teared up and grabbed me tight and said ‘She’s counting on me now.’”

“Is very sad.”

“But along with Momma’s clothes and books, he’d boxed up the liquor and cigarettes. He wasn’t a drunk or anything, but after that, he never took another drink or smoke, not till the day he died.”

“And when was that?”

“Ah, well here we come to the meat of the story. I was what you call a tomboy. After Momma died, I pestered Daddy into teaching me to fly and work on engines. I kept plenty busy helping him save for my college.

"Then came high school. My friends all found beaus and formed cliques, and I was the weird girl with grease under her nails. Worse, Daddy started acting funny, buying me dresses we couldn't afford and pushing me to go out instead of working so much at the airfield."

"A father always worries."

"Of course . . . but I felt like he was pushing me away. From him. From my independence. From who I wanted to be."

"Then one day Jimmy Beacham shows up at the hanger. The captain of the basketball team in his shiny T-bird. Six-foot, blue eyes, the boy all the girls drool over. Never said more than a how-do-you-do, and now he's got a fiver and wants to go flying. Daddy calls from his desk in back that he's suddenly got a carburetor to finish."

Tatyana laughed.

"So okay, I gave Daddy the stink-eye, but I took Jimmy up. I went easy on him too. I didn't want to clean up his puke, and all his friends were jocks with spending money. I even gave him extra time to see the sunset."

"Clever girl."

"So after we landed, he asked me out. I figured Daddy'd put him up to it and the less I fought, the less he'd push, so I agreed."

"And how was date?"

"Well, it turned out I had it all wrong. Jimmy was really nice, and Daddy could never have bought those puppy-dog eyes. We hardly had anything in common, but Jimmy was head-over-heels. I couldn't believe my luck—barely four-ten and called a 'spic' half my life. It was nice to be envied for a change—to finally fit in. I could put on a poodle skirt and go to the movies, and I could put on my leathers and get engine oil on me, and Jimmy didn't mind either way."

"But . . . you were not head over his heels?"

"No, and I started to think there was something wrong with me. So after prom, I had him drive me out to the creek where we used to go pick pecans. We jumped the fence and snuck out under the moonlight with a blanket and a rubber, and that was that."

"Very romantic."

"It was exhilarating, but it was all wrong, like kissing your uncle or something. That's when I knew I'm . . . I'm just not . . ."

Tatyana stiffened. "You are homosexual?"

I looked at my toes. "Yeah. I guess I should've said—"

"Don't be sorry for me, friend Katherine. Be happy for bourgeois democracy, *da?* In this, Soviet Union would be no help at all."

I nodded, not sure quite how to respond.

"Katherine," she said, "I am not Soviet Union. Please, continue story."

"Well, I felt really stupid. And poor Jimmy. I avoided him all summer, straight till we went off to college. I broke the poor boy's heart."

"And father? Did his heart break also?"

"No. Daddy got cancer my second year at UT. I went to see him in Houston, and you know what he said? He said the only thing that ever really scared him was dying with unfinished business. He said he'd never let a day pass at cross purposes with Momma, and that had been a comfort when she died. And now that I was provided for, he said, and I was with him, he was ready."

I blotted a tear with a napkin and started cleaning up.

"Then he hugged me and said, 'Now don't go marryin' that Beacham boy just for your old man.' He said he was already as proud as could be. That he'd always known there was something different about me, and he was sorry if he'd made me that way with all the fishing and flying."

Tatyana laughed.

"I said that was silly, that it's like being left-handed and nobody makes you that way. And he said, well then God did it, and who was he to question God?"

"Wise man, I think."

I sighed. "He left me almost enough to finish school. I put half of it down on an old Fairchild monoplane, then made it back racing and barnstorming. And that's how I met Jerrie Cobb and Randy Lovelace and ended up flying in space."

"And broken-heart boy?"

"Last I heard, he was married with kids, flying B-52s."

"So heart not broken after all, *da?*"

I didn't answer at first. Again, tears blurred my vision.

"Katherine, what is it?"

My eyes squeezed shut, and my face wrinkled up like a kid's at the start of a good ball. "Those could have been *my* kids. I could've . . . if I'd just . . . and now I'm . . ."

Tatyana stretched over and hugged me. "If . . . Is Russian proverb: if grandmother had balls, she'd be a bull."

I laughed. "What?"

"Did you love broken-heart boy?"

"No. Not really."

"Did you wish for children when learning to fly and fix engines?"

"Well no . . . but I thought someday . . ."

"And who would save world if you were home with jack and apes?"

I nodded and wiped my tears.

"So how about you? What's your long sob story?"

Tatyana let me go and started cleaning her things away, suddenly avoiding my gaze.

"Is time to start daily checklist," she said, and flew toward the tunnel.

* * *

Three times during our months-long cruise, we were directed to break radio silence. Once was to let ground stations verify our trajectory, which was right on the money, thank you very much. Another was after Tatyana complained about her eyesight. We were talked through a mutual examination and found both to have mild glaucoma and farsightedness. There were reading glasses if we needed them. The last was to diagnose a coolant leak and plan a repair EVA.

That was our only major glitch, but one night the master alarm sounded with no apparent cause. Earlier, we'd both noticed flashes—ionizing rays passing through our eyeballs and brains. Presumably, the ship had passed through a bad spot of radiation.

This brought up the topic of our cumulative dose. We tallied all our personal dosimeter readings, which after six months had reached a total ten times the annual exposure limit for nuclear workers. Twenty times the dosage generally considered safe, and no one had thought to mention it. Well why would they? There was nothing to be done and besides, we wouldn't live long enough to die of cancer.

Then came news of *Apollo 13*. We held our breath with the rest of humanity, but with added terror each time we stirred our tanks or adjusted a heater or heard a pop in the dark of night.

* * *

We spotted '56 KI nearly two months out when it was still just a mote pacing Earth. From that moment on, I haunted the sextant and telescope. By the time it came abreast, I had twice realigned the gyros, made a thousand calculations, and executed three burns to sidle us up to its doorstep.

"So what do you think?" I said.

I had turned the ship so KI's sunlit face filled the starboard window.

"Is more colorful than I expected."

It was at that. I ducked under the console for a look through the telescope. Much of KI's surface was black sand and gravel plowed around boulders of iron. But there were glints of light too, and stains from ocher to orange.

"Come look through the scope," I said.

KI was also much lumpier than I'd imagined. In the ultralow gravity, rocks the size of houses stood in wildly looming columns. Boulders large and small balanced precariously or lay in unmarked sand as if carefully placed in a Japanese garden.

I twisted away to let Tatyana look. She swung the scope through its various detents, then backed up one stop. “Our asteroid is venting.”

“It is?”

“*Da*. One faint plume, lower-right quadrant. Could be water ice. Perhaps is comet after all.”

I floated back and peered out the hatch window. I wiped with my palm, but it was fogged on the outside—probably residue from the thrusters.

“We can’t do anything till we know how solid it is.”

In one easy motion, Tatyana swung under the console and up beside me, straddling the equipment bags still strapped in place of the center couch. “I have tool for that.”

“Yeah?”

She pointed to the top center of the console extension, to a shielded push-button labeled “STRELYAT.”

“Means ‘fire,’” she said, “Two hundred-gram projectile, seven hundred meters per second. Automatic has been disabled.”

“Auto— You put a machine gun in a spacecraft?”

She shrugged. “Developed for Almaz surveillance platform. Repurposed as inertial penetrator.”

I should have been grateful. It *was* just what we needed, but my cheeks burned. “You should have told me! I can’t believe you guys put a potentially hazardous—”

“We have been sleeping above weapons ring, yet I am told nothing of your warheads—”

“I had orders—”

“We each had orders! Now do we fight Cold War here, out in space?”

I swallowed hard. “Of course not.”

Tatyana raised both eyebrows and canted her head. “I suggest wearing suits as precaution. Gun has never been fired in space.”

“Yeah,” I said, chagrined by the whole exchange, “good thinking.”

* * *

The gun was mounted behind the camper. Tatyana directed fire from an optical sight in aft stowage. For each shot, I steered us to broadside a specific target, then watched through the sighting scope to assess the impact. We each compared what we saw against test photos made back on Earth and so built up a map of KI’s structure.

We adjourned to the mess to cross-check our results.

Tatyana clucked. “Our friend KI is crumbly.”

“Yeah, but not like a comet.”

KI was roughly shaped like a letter “Y” or a slingshot caked with mud and gravel into a fat, lumpy disk. Expanses of nickel-iron showed through near the extremities, and most of the rest was heaped with jagged hills of dark silica rock.

“We may be looking at three major fragments of iron,” I said, “each about a kilometer across. The last thing we want is to break them apart and spread out their impacts.”

“Agreed. So what do we do?”

I pulled the Interdiction Guide from a fastener on the wall. “You make dinner. I have some light reading to do.”

* * *

The guide, in fact, was thin on guidance. It had pages and pages of calculations, tables, and rotary cardboard and plastic computers. But for all that, our options were limited: blow it up or push it aside.

We had bombs designed to do either, depending on whether KI turned out to be an asteroid made of solid rock or a comet made of ice. What we’d found instead looked like an iron backbone surrounded by a thick crust of rubble. Trying to move such a mass could just break it apart, and the solar wind wouldn’t sweep rubble and rock away like it would cometary ice.

We only had a dozen a-bombs, each about a tenth as powerful as the one dropped on Hiroshima. According to the book, their combined energy should be enough, given our estimate of KI’s mass, but we couldn’t waste them shifting gravel around.

While I walked through the decision tree, Tatyana went to work with the hot water gun and the pantry. As each food item was ready, she stuck it to a fastener at the table's edge.

"What are we eating? I said, still reading.

"We have run out of borscht. Is American beef with gravy. Very bland. What does book say?"

"It says . . . send down our data and pray."

"Why? If asked nicely, will God toss asteroid like baseball in Yankee stadium?"

"It's just an expression."

"Is foolish expression."

"Yeah, well my mother had another one: The Lord helps those who help themselves."

Tatyana nodded approval. I traded the binder for a spoon and sampled the sticky beef.

"You know, your unmanned superbomb was a bad idea. More than likely, it would only have spread the destruction out. It might have made a bad situation much worse."

"Da. Is why N1 rocket had to be destroyed."

"What?" I covered my mouth to stop the gravy floating out. "That was sabotage?"

"Not precisely. Second stage was rigged to explode, but first stage failed all on its own. So you see," she said, slipping the stirrups and making for the head, "mother in this case was right."

* * *

The recommendation came back to place one bomb and see how KI reacted.

A-bombs release energy mostly in the form of X-rays. On Earth, this super-heats the air, creating the familiar fireball and blast. There's no air in space, though, so our bombs came in canisters designed to direct their X-rays out one end, either into solid rock or a tungsten plug, which would vaporize and form a propulsive plasma.

For this first shot, the idea was to nudge KI enough to pinpoint its exact mass and maybe dig deep enough to let us glimpse its insides, but without shaking it apart.

I maneuvered to broadside KI directly over its gravelly midriff, then armed a bomb and triggered its release. The kitchen trash can-sized canister slid from our belly like a spinning, slow-motion torpedo, and as soon as it was clear, I started toward the horizon.

* * *

Sheltered by KI and the vacuum of space, we saw nothing of the detonation. Only the alarms and a few shifting boulders told us anything had happened at all.

Then we heard something odd, a faint sound like windblown sand against our hull.

I cocked my ear. "What *is* that?"

Tatyana turned, her eyes wide as she listened. I pressed my nose to the foggy window and looked out over the camper.

What the hell?

Dark grit covered the window glass, the camper hull, and the reflective insulation keeping the propellant tanks cool behind it.

Tatyana popped from her window down to look at the instruments. "Dust is obstructing radiators. Reactor temperature is rising."

As I watched, more grit danced against the window, sticking like Styrofoam on a polyester skirt. Exactly like that, in fact.

"Tatyana, can we charge the hull?"

She thought a moment. "We could use camper's ion thrusters. Electron emitters are used to neutralize beam. Emitters only will give positive charge, ion beam only will give negative."

"Do it."

She moved down into the camper to find the requisite controls. I peered through the few still-clear patches of glass. Then, as if by magic, the dust started streaming away in visible curtains, first from the camper and outside the window, then in a wave sweeping all the way aft to the drive and the radiators. In fifteen seconds, with a faint gritty rustle, the ship was completely clear.

When Tatyana came and saw the results, she quipped, "If only laundry could be cleaned in this way."

* * *

The next morning, I threw up my breakfast. As I cleaned up and mixed some juice to replace the lost fluids, Tatyana sat silently watching.

"You are ill," she said. "Is radiation sickness?"

"I'm fine." I didn't mention how green *she* looked, even for the fluorescent lighting. "Just a little morning sickness."

That struck a chord, and we laughed together, and the color returned to our faces.

* * *

We'd blasted a crater big enough to park the CSM in, but had only gotten 5 percent of the minimum required trajectory change. We were still in the game, though. Five of our twelve bombs came without the tungsten plugs and could be positioned to crater a solid surface, potentially producing far more thrust.

We were instructed to deploy three of these over the visible nickel-iron outcrops, and they didn't disappoint. Acting as one, the three gave us almost 30 percent of the required shift.

We still had eight bombs. Only two were the cratering types, but the tungsten plugs could be jettisoned from the others to convert them for cratering use. Confident of success, we deployed three more bombs into the new craters and seemed to get comparable results.

We were ecstatic. Our supplies were dwindling, the cabin stunk of sweat and mold, and the radioactive dust kept triggering the master alarm. But if the next shot went as well as the last two, we'd reach the required deflection with two bombs in reserve.

We configured the next three bombs to eject their plugs, dropped them into the craters, and withdrew. KI's newly formed nebula flashed with atomic fire. Weak and close as we were to the end, we slept the rest of victors.

* * *

The trajectory calculation was conspicuously absent from the next morning's report. I sent a voice request for clarification. Hours passed with no reply, then Tatyana looked up at her comm. panel. "We are receiving unscheduled DSE uplink."

It was bad.

Successful deflection depended on nudging KI out of a narrow corridor as it passed Jupiter's sphere of influence. Outside that corridor, it would be flung away never to trouble us again. Inside the corridor—anywhere inside—and we'd come all this way for nothing.

The last shot had given us less than half the expected push. In order to make our target now, the remaining two bombs each had to provide nearly 14 percent of the total deflection. That didn't seem possible.

I cursed and balled my fist, but there was nothing I could hit that wouldn't endanger our lives, so instead I hugged my shaking knees.

Scott came on. The experts were working on it. The numbers were estimates. There might be something we could do to boost the yield of our remaining bombs. Nonsense.

* * *

We sank into a funk, staring at our nemesis through foggy windows and eating soggy toast cubes with rancid cocoa.

We soon thought we knew what had gone wrong. When the tungsten plugs ejected in the confines of the crater bottoms, they must have bounced back and struck the canisters. The X-rays hadn't gone where they were meant to and had largely been lost to space.

The only good news was that the last two cratering bombs had worked exceptionally well, apparently using the craters in which they were detonated like rocket nozzles and compensating for the dud. If we could solve the bouncing plug problem, we'd get at least as much thrust from our final shot and wouldn't be far shy of the mark.

Scott, recording in English, tried to cheer us. "Hold on guys," he said, "We're close."

Tatyana harrumphed and flew into the tunnel. Her voice echoed back as she moved into the camper. "You are close to your elbow, but still cannot bite it."

* * *

Days passed. We ate the last of the strawberry cubes, the spaghetti with sauce, and the Russian freeze-dried yogurt.

The daily reports advised patience and hope, but offered little to base it on. By my calculation, the best we could hope for from our last two bombs would still leave us a few percent short.

We racked our brains. What could we do with the excavation charges? The Service Module engine? The plasma drive? The attitude control thrusters? Could we harness the solar wind?

None of it would be enough. Tomorrow or the next day, they'd tell us to set off the remaining bombs, and we'd just have to pray for the best. Then we'd be left to decide what to do with the rest of our wasted lives.

We were in the camper. I was in the stirrups at the table, scratching through calculations while Tatyana jogged in the fitness niche behind me. "Life is never wasted," she said, "as long as hope remains."

"What?"

I hadn't realized I'd spoken aloud. We'd both gotten in the habit of leaving our headsets on all the time. It made it easier to talk between cabins and to store questions or comments for relay to Earth.

The DSE also recorded our voices on the fancy high-capacity wire recorder the Russians had intended for future long-duration missions. I think it was that, more than anything, that kept us always mumbling into our microphones. It was our link back to the world, even though the recordings were just as marooned here as we were.

Tatyana came to a stop and started toweling off and putting away the bungees. "You asked before for my sobbing story. I will tell it."

"Yeah? I'll drink to that." I had just rehydrated some grapefruit drink. I took a sip as Tatyana finished cleaning up.

She fetched another drink pouch, then hooked in at the table and started filling it from the spigot. "My name is Tatyana Alexandrovna Tereshchenko," she said, "Cosmonaut Engineer, Lieutenant of Aviation in Soviet Air Force. But my mother would know none of those names."

"Yeah?"

"My parents—my real parents—were East Prussian peasants. I don't know the town. I don't know their names. I don't know even if my blood is German or Lithuanian."

"You know you're on VOX, right?"

"What will they do, send me to Gulag?"

"Just thought I'd mention," I said.

"There was horse market in town, near to river, and that was my father's occupation. I don't remember my father, but I remember the horses—the smell of oats and molasses, the futch, futch of the colts eating grass through the snow, their eyes when playing behind the barn. Is suitable recollection from childhood, yes?"

"Sure."

"Then came war—like terrible storm that stole all light from the world."

"Oh Tatyana, I hadn't realized . . ." As bad as it was in the States, we were on the other side of an ocean.

Tatyana continued, "We were more fortunate than most. We had animals and a vegetable garden—potatoes to last through till springtime. The first winter, my mother fed all our neighbors. The second, we hung bells to keep prowlers from our root cellar. The third, we starved with everyone else."

"It must have been terrible." I stretched forward to suck in a stray drop of floating juice.

"When bombing became constant, we knew war was lost, that Red Army would soon arrive. Mother was terrified. Everywhere were stories of their rape and slaughter—"

"You're still on VOX."

Tatyana ignored me. "—yet we were forbidden to flee."

"What? Why? You mean by the Nazis?"

"*Da*. By party official of our region who was afterward tried as war criminal. We were loyal Germans, proud citizens who loved our neighbors and our country, you understand?"

I nodded. "Sure. Everyone naturally—"

"We were not disloyal, but it was foolish to break people like neck of rabbit caught already in

trap. So my mother persuaded young section leader to help us—persuaded in bedroom, you understand—and we were able to leave before town was overrun.

“The roads were full of Wehrmacht, and the sky was full of Soviet aeroplanes dropping bombs and strafing roads. We fled into forest with only our clothes and one sack of rotting seed potatoes. That was our great escape, cowering in snow like animals, eating garbage when we could find it.”

“Oh, Tatyana! But at least you survived, right?”

“*Da*. I survived. My mother protected me. Shielded me from cold and saved best scraps for me. I learned to forage and remain hidden. Eventually, I found good shelter in bombed-out barn, but when I returned for mother, her feet had frozen in boots.”

“Oh my God! What did you do?”

“As you say, I survived. I stayed with her to the end, then I made my way alone. There were hundreds like me. *Wolfkinder*, we were called, wolf children, fighting for scraps and rags, surviving by drudging and theft.

“By spring, Red Army was everywhere. Soldiers lured starving children with candy or cheese, just as like rats to the snare. In this way I was captured, and with some other girls, driven to cottage with yard full of half-starved, half-drunken soldiers. We were jabbed forward, prodded toward porch, past men passing around bottles and cigars. They leered and grabbed as we passed. They were waiting for turn to enter cottage and take revenge on daughters of Reich.”

“Oh my god!”

“As I climbed steps, man said I stank like swine. The others laughed and I opened mouth to protest. I knew a little Russian, enough to understand and to think, is better to smell like swine than behave like one. I held my peace, but had shown too much reaction already. I was snatched up and thrown over railing, into great metal trough beside porch.

“There was ice still on water, and men all laughed as I crashed through and sputtered and coughed. Inside cottage, my companions cried out and struggled. Was only ice bath between me and my turn in their place, so I scrubbed with ice as if with soap, and men all laughed again. Then someone grabbed from behind me, tore open my sweater and shirt. I shook with tears in freezing water, naked as only girl who has not yet known man can feel.”

“You poor thing. Did they . . . what happened?”

“Was gunshot inside cottage. Was yelling inside, stomping and breaking of glass. More shouting. My Russian was not so good then, but words were of conscience and duty and God. Door flew open and man stormed out wearing greatcoat, still shouting, red-faced, descending into yard and pointing pistol first at one man, then the next, till he finally turned on me.”

“Oh my god!”

“He stepped near, blue eyes staring till lips and gun began to tremble. He wiped corner of eye, then shoved pistol into holster. He stripped off his coat and gathered me up in his arms, wrapping the greatcoat around me.

“I remember his boots crunching through snow. He carried me past cottage and across open square to a truck. I did not know what would happen. He set me in back of truck, shouting orders to those in front. Truck was filled with wounded and smelled of blood and rot. He shouted at someone behind him, then scribbled quickly on piece of paper and folded into my shirt pocket.

“He kissed my cheek and whispered something I couldn’t understand, then said the name Tatyana. He nodded—looking in my eyes to see I understood. He was giving me this name. Then he repeated name and kiss, and his eyes were filled with tears.”

“My god, Tatyana, what happened?”

“From that moment on, I was good Russian girl. I went to resettlement camp where I played to be shy while learning Russian language and ways. I learned also my benefactor, Lieutenant Colonel Alexander Adrianovich, had sworn in note that I was daughter and only family after flight from city of Kursk.”

“But . . . do you think he really believed that?”

“You mean was he madman? No. I think he expected to die, saw opportunity to save one

innocent child, and he took it.

"I was sent to special orphanage for children of officers. I learned to read and started education as heroic Soviet war orphan. I never saw him again."

"I'm so sorry Tatyana. I didn't know any of that about you."

"Is not end of story. One night in orphanage, I was attacked by orderly."

"Oh no! What did you do?"

"Again I survived. I complained to schoolmaster and was beaten and called liar."

"That's horrible!"

"And while orderly was on top of me, all I could think was, I have failed my mother. I pictured her face, gray and frostbitten, smiling and repeating the only German words I still remember, *Liesabeth, meine hoffnung und zukunft*, my hope and future. I had let her die, and now here I was, letting slobbering animal ruin her legacy."

"But it wasn't your fault! Tatyana—"

"I was barely ten years old. I wanted to kill pig orderly and then myself, but he had injured me . . . inside. I got fever and had to go in hospital. While I was recovering, he had poor judgment to attack my friend Marta, and she cut his throat with broken water glass."

"Oh my god!"

"So I was saved once again. Orderly was sent to mortuary. Marta was locked up in Psikhushka. I was denied vengeance and given hysterectomy, so denied future too, at least in that way."

"Oh Tatyana! You must have been devastated!"

"At first, yes. But then I remembered note from father benefactor Alexander Adrianovich. At bottom, he had written same last words as mother, that I was hope for future. Why would Russian Officer write that about German child, I thought?"

"So they would accept you . . . at the orphanage."

"Yes of course. But was message for me, I think, more than for orphanage. To raise child in one sentence only: You are hope for future. You see?"

"I don't . . ."

"I thought I had failed mother, but was wrong to think so. Father Alexander Adrianovich did not think of blood only. He thought of future—for Germany, for Soviet Union, for whole world. He could not save whole world, but he could save one child, even if child of bitter enemy. Because German child and Russian child is still child—still future of mankind, you see? Because no father's child is safe until all are safe.

"He was good man in evil time. So did what all good men do in darkness, struck spark where he could."

I rose in the stirrups and hugged her. I held her across the table for a long while, wiping my eyes with my napkin.

Finally, she said, "I committed my life to giving his meaning. And that of mother and of all good people before them."

I released her, pushed away sorrow with a laugh. "You took on a lot."

She raised an eyebrow, smiled. "I held onto spark like flame of life itself. Was diligent student, so sent to study in children's work colony at FED factory in Kharkiv. I made light meters for cameras, then was admitted to Air Force university for study of nuclear energy. Then assigned to Kuznetsov Design Bureau to develop control systems for nuclear plasma drive. Then here to save world."

"That's quite a spark, Tatyana."

She smiled, shrugging off the compliment.

I said, "Scott's right you know. We *are* close. We could squeeze another couple of percent using the plasma drive and thrusters to push KI like a tugboat. That won't work with the Service Module though. Its engine has to accelerate fast enough to keep the propellants feeding. The only way to get the energy out of that fuel is to burn it all out in space, then go out kamikaze style."

"We don't need energy in fuel," Tatyana said, "We need energy in reactor. Every gram of

propellant pushed through plasma drive is worth five in chemical rocket.”

She sucked the last from her drink pouch, then released the vacuum and let the plastic tumble before her.

Her eyes gaped wide. “*Durak!* We have over one thousand kilograms of propellant on other side of bulkhead.”

The water! Of course! Because of our mission duration and the need to keep course-correction to a minimum, we’d followed zero-venting protocol ever since passing the moon. We hadn’t used the sublimator to cool the CM and had stopped making urine dumps. Almost all the water we had at liftoff was still aboard, either as waste or supply.

I straightened. “Will that work?”

“*Da*. Water can mix with remaining ammonia propellant and should work perfectly in drive. It won’t be enough, though.”

“What about the propellants left in the Service Module?”

“*Da!*”

“But they’re hypergolic. We can’t just mix them together.”

Tatyana thought for a moment. “Hydrazine fuel can mix with water and ammonia. If secondary tank is clean, we can feed oxidizer from there.”

“Okay, but if there’s even a trace of fuel left in that tank we’ll explode, and then there’s the last two bombs. How do we deal with the propellant plugs?”

“Simple,” she said. “Catch on way out. When fusing timer runs down, plug will eject automatically, *da?*”

“Yeah, but then we have to place them by hand.”

“You will maneuver. I will place bombs.”

“Inside an atomic blast crater? That’s crazy. They’ll never approve that.”

Tatyana huffed. “They! You are commander.”

“It’s suicide!”

“Mission is suicide! Is no greater risk than faced by mother or Alexander Adrianovich for chance I might be here now. You will believe me when I say I do not mind to die to carry on spark—for smallest chance to save millions back on Earth.”

“But Tatyana . . . you won’t just die, you’ll die of radiation poisoning.”

She reached across the table and squeezed my hand. “Perhaps . . . but I will have friend at my side when I do, yes?”

Tears wicked into my eyelashes. I swallowed a lump and nodded. “I’ll start the calculations.”

* * *

The ground objected loudly and at length, but we’d left them little choice. In two days, unless they had a better plan, we were going ahead, with or without their blessing.

In-space refueling is not a contingency for which either spacecraft was designed, but mission planners had been prescient enough to equip us with adapters for connecting suit hoses to most of the fittings on board. Using these, the boys in Korolyov whipped up some ad-hoc procedures.

With Tatyana sealed in the camper, I undocked the CSM, flipped it around, and backed it alongside the camper. Then I climbed out and tied the spacecraft together using safety lanyards and duct tape.

I transferred fuel from the Service Module and waste water from the camper, both into the Drive Module’s secondary propellant tank. Tatyana dumped that mix into the primary tank, then vented the secondary to space. That done, I filled it with the camper’s fresh water supply, and we drained that into the primary just to clean everything out.

We had only tank pressure and the gentle tug of the camper’s ion thrusters to force our ersatz propellant through the narrow hose, so it was more than ten hours before I could close the hatch and maneuver to rejoin Tatyana. When I finally removed my helmet, I felt drained as the empty fuel tank, but also vindicated; if I’d been a man, I’d have run out of O₂ an hour ago.

* * *

ANALOG

With no other way to clean the secondary tank, we left it to vent overnight, then repeated the whole procedure of undocking, flipping the CSM, and tethering the ships, before filling it with the Service Module's remaining oxidizer.

We didn't explode like we might have. So far, so good.

* * *

The propellant transfer had taken two days and two risky solo EVAs by yours truly. Today was Tatyana's turn.

With her outside, tethered to the hull, I released the first bomb, and for a moment thought I'd lost her.

"Ooph! Sooksin!"

This was accompanied by sounds like raccoons wrestling on a metal roof.

"Tatyana! Are you okay?"

"Da. Am Russian girl with bear hug on American nuclear weapon. What could be wrong?"

The momentum had bowled her over was all. I stood through the hatch as she tethered the bomb. With the camper, drive, and sun at my back, her reflection shone in the bubbled surface of the mirrored Service Module like storm clouds off rain-slick pavement.

The timer ran down. Smoke puffed. The plug stayed put while the canister shot back at Tatyana's belly. That shouldn't have happened. The retro charge had fired along with the ejection pyro. No wonder the last shot had gone south. The plug ejection hadn't just caused a tumble, it had sent the canisters flying.

I undocked for the third time in three days, then climbed out and helped bungee Tatyana's shins to the inverted "V" of the docking probe. This let her stand atop the Command Module like a ballerina perched on a teepee.

Thus prepared, I returned to my couch and maneuvered toward KI and the deepest of the previously excavated blast craters. As we eased down into the shadows, the electrically charged grit again tilted against the hull.

Tatyana called over the radio, "Oh! Is pins and needles!"

"What?"

"Is radiation, I think. Please hurry."

I switched on the docking spotlight and Tatyana guided me in. "A little to the left. Good. Forward . . . forward . . . that's good."

I watched through my window as she held a bomb over her head, down toward the crater bottom. She let go and it slopped to the side and tumbled. She caught it and tried a gentle spin, then it hung there steady, its business end directed toward the crater bottom.

I eased us away. We repeated the procedure at the bottom of the next largest crater, then retreated to the camper and drive.

Tatyana was coated with dust. I went out with a fire extinguisher and swept the worst of it away. Then we packed back inside, docked, and headed for KI's shadow.

When the alarms went off, I was in the lower equipment bay helping Tatyana out of her vomit-stained suit. I cleaned her up and gave her water, then held her and waited for the anti-nausea pills to work. By the time she fell asleep, her face and hands were pink like tender new sunburn, but her breathing had calmed to normal.

* * *

Come morning, I had one last maneuver to perform. I suited up, went outside, and strapped myself down, facing aft toward the central crater blasted by our first test shot. Then I pulled out the excavation charges, aluminum cylinders triple the size of our NASA penlights and packed with TNT. Fighting vertigo, I hurled them like throwing knives, embedding them all around the crater lip.

When the blast debris passed, I let the thrusters damp our shaking and started backing us down. We hit tail-first, hard enough to bury the engine bell but not to do any real damage unless . . .

We started to tip.

In the tenuous gravity, the landslides around us moved like cold molasses. I kept vigil for

hours, thrusting to keep the drive pointing up, charging the hull to repel the dust, and frequently checking on Tatyana. Finally, when enough rock had settled around us to cement our position, I could rest.

* * *

Earth was just a mote through the telescope. A few more days, and it would be lost in the Sun's glare and radio noise. The drive ran for four days, during which time Tatyana went from bad to better to worse. When she slept, perspiration stood on her forehead. When she woke, she coughed up fluid and couldn't keep anything down. Soon she wouldn't eat at all.

We'd been cut off from home while the drive was running, so I transmitted a plea for news. Then we waited, allowing time for a response and for the vacuum of space to boil any fuel residue out of the drive.

The reply was disappointing: "Signal weak. Continue range finding. Results soon."

When we restarted the drive, the ship shook with a palpable "whoop," but we didn't go boom in the night. Tatyana gave instructions for safing the reactor once the burn was complete. Her eyes were bloodshot and weepy.

"*Ya umru*," she kept saying. "I'm dying."

There was no use in arguing; we no longer measured our lives in months or years but in increments of delta-v. I hugged her, willing my warmth into her quaking bones, hoping she'd survive long enough to hear good news or die with her hope still intact.

* * *

I bolted awake in the darkness, flailing, lost in the noise from my headset.

"*Iskra Na dezhdy*, Korolyov. *Iskra Na dezhdy*, Korolyov." A note of excitement cut through the static, but its meaning at first escaped me.

Tatyana stirred. Her eyes fluttered open. "Is it time?"

"I don't know. Maybe." The drive had been idle for a day.

The voice called again. "*Iskra Na dezhdy* . . ."

Tatyana raised an eyebrow. "Spark of Hope?"

"We never officially named the ship." I said. "I've been calling it that in my reports. I hope you don't mind."

She dropped the eyebrow and nodded, then squeezed her push-to-talk. "Korolyov, *Iskra Na dezhdy*—What am I doing? They cannot hear. Is twenty minute round trip."

"Yeah. He's just trying to get our attention."

I reminded her about the solar interference, then fetched some water and carefully wiped the mucus and sleep from her eyes while she sipped. Between bouts of static, the voice continued, occasionally promising news.

Tatyana's tremor was gone, and she had a little color in her cheeks.

"Is Vodka in bag," she said, glancing down, looking beneath the couches.

"Your PPK?"

"*Da*."

I slipped off my headset and went to retrieve the little drawstring bag meant for personal mentos. I'd seen little point in them, but she'd thought ahead and packed two of the little bottles they hand out on airplanes.

As I stuffed her bag back in the bin, I felt something in my own bag and retrieved it. Inside was an envelope, sealed and folded around something heavy and cool like a silver dollar.

I gave Tatyana her bottles. "Russian champagne," she said, tucking them in beside her.

I opened the envelope. Inside was a medallion, gold-plated and bearing the likeness of Amelia Earhart. There was also a note, folded and scrawled in pencil:

* * *

"Katie. I hate like sin I can't see you off, but Gunter promises he'll get this to you. I'm so jealous I could spit, but so proud too. God bless and don't worry, I've found my own way to save the world. We're all riding with you.—Jerric."

* * *

I turned over the medallion and moved the delicate chain so Tatyana could see. The back

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had been engraved with the names of all the participants in the Women in Space program. I looked at Tatyana, quietly suffering while she awaited final judgment.

Using a utility light clamp as a vice, I pinned the medallion against the couch frame.

Tatyana cocked her head. "What are you doing?"

"Watch the radio."

Using a scalpel from the medical kit, I scratched a line of letters around the medallion's edge. As I worked, I explained how Earhart had founded the Ninety-Nines, the women fliers group whose medal this was, and what an honor it was that Jerrie had arranged to send it.

I showed her my handiwork, one additional name: *Tatyana (Liesabeth) Alexandrovna Tereshchenko*. She held the medal and blushed as I slipped the chain around her neck. I kissed her cheek, and she stiffened.

I thought I'd somehow offended her till her eyes went wide, and she squeezed my arm, and I heard static squeal from her headset.

I pulled at her earpiece and pressed in close. The voice was back, several Russian voices in fact, and Scott's too. All were stumbling over each other to say the same thing.

"*Sto dva!* One hundred and two! We waited to be certain. One hundred two percent of minimum deflection! You've done it!"

Through the solar interference and a hundred million miles came cheering and shouts and the slapping of palms and backs.

I loosened the caps from the vodka bottles and took a little swig, jerking my head like a goose to shake the vodka out. Tatyana was too weak to do likewise, so I shook out a glob and let her catch it on her tongue like a snowflake.

"Cheers."

"*Za vas.*"

We hugged and absorbed all the details.

Tatyana seemed herself again and had some energy back, but as I asked for the third time about the final reactor settings, she stopped me cold with a word.

"Katherine."

She was staring, chastising.

I stopped talking and floated over beside her.

"It is time," she said.

"No—"

"Katherine, we have done what we came for. I am in pain and wish to sleep before the vodka comes back up. You have made some provision, *da?*"

I looked down at myself—at the suit I'd been wearing for a day.

She said only, "I do not wish blood to boil."

"It won't. I won't let the pressure get that low. You'll pass out, then all I have to do is pop my helmet seal."

She thought briefly, then nodded.

I hugged her tight. She grasped my suit between her bandaged hands and pushed me back to kiss my cheeks.

"Was honor to fly with you."

"Me too."

"Hell of ride, *da?*"

I nodded, tears wicking into my eyelashes.

"*Poyekhali,*" she said. "Let's go."

I reached to put on my gloves.

* * *

Tatyana was sleeping, her pallid lips turned up in a hint of smile. After sealing my helmet, I opened the depress valve to slowly let the pressure drop.

Then I shut down the environmental system feeding my suit. That just left the radio, which will help with tracking KI's progress once it's clear of the sun.

And now I'm ready. I've strapped myself in and everything's set. No unfinished business. As

soon as I tuck this away, I'll open the helmet seal and close my eyes. I'll think of the spade and the smell of fresh earth, and the blue of that far away mote.

I'll dream of heroes left behind, of the names on the medallion, and below them the words proclaiming the purpose of all their struggles, fighting "FOR ALL MANKIND."

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