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Project Phoenix Flight:

No Longer the Limit

An Excerpt from Challenging the Cold Silence

by Professor Asami Sato, Ph.D., FRSEME

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An Excerpt from *Challenging the Cold Silence: The Inside Story of Project Phoenix Flight*

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No Longer the Limit

Phoenix Flight Day 4 started early and fast. When Hikari, Mako, and I arrived in the Control Room at 7:30 that morning, the overnight team had already roused the crew and started the checklists. At the back of the room, the gallery was starting to fill up with our guests again; some of them would be there all day. Tendo, standing at the flight director's console, looked as fresh and crisp as he had when I'd handed over to him the night before, his bow tie as precisely tied as if a machine had done it.

"Good morning, Professor Sato," he said cheerfully, offering me the handover checklist clipboard before I asked for it. "The team's all suited up and ready to play. I make it..." He glanced at his wristwatch. "... twenty-one minutes to showtime."

"Thank you, Dr. Choi," I said, taking the clipboard. A quick look down the checklist showed that everything was running smoothly, which I expected—Tendo would have mentioned it at once if anything were the slightest bit off. One of the reasons I'd tapped him for the overnight flight director post, besides his seniority with URSA and his extensive qualifications, was that meticulous streak in his character. He was particular when it counted and not when it didn't—something I recognized as rather like myself.

"If you don't mind, I'd like to stick around for a while and see the fruits of my labor," he added, indicating the orbital plot currently up on the leftmost of the three giant monitors at the front of the room.

"Of course," I said. "Stay as long as you like." He nodded, unplugged his headset, and went over to plug in at the same backup console I'd used on Thursday night. I got mine out of the drawer, put it on, and connected it. Hikari did the same at the auxiliary port on the other end of the console, since Tendo was in her usual spot. Then I sat down, took a moment to reorient myself to the telemetry showing on my console and the big screens up front, and switched on the ground-to-space.

"*Agni V*, Crescent."

"Good morning, Professor Sato," said a pleasant voice in reply.

"Good morning, Professor Song," I said. "I see Tendo and his team have you just about set up for LOI. We're expecting loss of signal at 2:20:41 and 20 seconds."

"That's affirmative, Crescent," she confirmed, sounding calmer than I felt.

The moments that were approaching were among the most ticklish of the mission. In about twenty minutes, Yue's gravity would pull the *Agni V* around behind it. The moon's mass would block radio transmissions to and from Dìqiú for the duration, a phenomenon the mission timetable dryly called "LOS" (loss of signal). That would've been stressful enough, but the demands of orbital mechanics were such that, in order to enter a stable orbit around Yue, the crew would have to carry out a major propulsion maneuver *while back there*, out of any contact with us on Crescent Island. Ten minutes after LOS, they would fire the ship's Secondary Propulsion System in braking mode, canceling much of the speed they'd used to reach the moon. If everything went right, they would be out of contact for about forty minutes, and when they did emerge from behind the moon, they would be in orbit at an altitude of 60

miles, taking two hours to make a complete circuit.

If everything *didn't* go right, what happened next would depend on *how* it didn't go right. If the SPS failed to fire, the mission was over, because they would need it to get off the lunar surface. If it wasn't working, there was no point in landing: they would be stranding themselves on the moon forever, and the Phoenix Flight was *not* a suicide mission. Instead, they would have to use the Fireflight system in its primary mode, with Korra and Kizaki providing the power, to change course slightly and perform a modified Inward Leap, using the moon's gravity to throw themselves back onto a return course to Dìqiú. In the Control Room, we would know that had happened if we reacquired their signal[1] much sooner than anticipated. The flight would have to go into the history books as a failure, but the crew would come home alive.

On the other hand, if the SPS suffered some catastrophic failure when engaged and the ship broke up, they would crash on the far side of the moon, where no human eye could find them. Unless a spirit could be convinced to investigate, no one would know for certain just what had happened to them.[2] That was one of the contingencies that had haunted my nights since it became apparent how the flight was going to work: That they would simply pass behind the moon and never return.

I was exerting all my strength of will *not* to think about that as LOS approached. I didn't care if the many radio listeners and TV viewers we would have for this key moment in the mission knew I was tense—I had no fear of being judged by the public—but I didn't want to risk the tension filtering into my voice and putting the crew on edge as well (though I was sure they were just as aware of the possibilities as I was). I had to stay positive, and it surprised me slightly to find how challenging that was when one of my habitual emotional supports was at the other end of the soon-to-be-severed radio link. Luckily, the other was right beside me, and as the clock ticked down to the expected time of LOS, Hikari moved her chair next to mine and took my hand. In some part of my mind, I wondered idly what the RTN cameraman, his producers, and their viewers were making of that, but the rest of me didn't give a damn.

"*Agni V*, Crescent," I said, trying to sound as cool as possible. "We show you one minute from LOS. Expecting AOS at 2:21:21 and 17 seconds."

The voice that answered me back from the ship, 2.6 seconds later, was Korra's, sounding businesslike but relaxed. "Copy that, we show the same. Hey, Asami, do me a favor?"

"What do you need, Korra?"

"The TV people are probably going to put Mom and Dad on during LOS, try to get them to talk about how they feel."

"Seems likely," I agreed.

"Well, if you get the chance," Korra said casually, "just kind of slide up while they're on camera and ask Mom for me if she's a turtleduck."

I snorted. "I'll see what I can do."[3]

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1 You guessed it, the mission plan called this "AOS" (acquisition of signal).

2 Long after the mission was over, while she was reviewing the draft of this book, Korra pointed out that once fully realized (16 to 20 years hence), her successor could consult her spirit through the Avatar State and ask *her* what had gone wrong. I'm very glad this macabre possibility never occurred to me while I was sweating out LOS.

3 I did. Somewhat to Tonraq's horror, Senna replied correctly.

"Thanks. Hey, here it comes." I could hear the grin in her voice as she said, "See you on the other side."

"'Til then," I said, and at exactly the moment predicted, the signal dissolved into static. I sat and took it on board for a moment, then switched to the open loop and announced, "This is the Phoenix Flight Control Room at mission elapsed time two days, twenty hours, forty-one minutes and thirty seconds. The *Agni V* has passed behind the moon on schedule. We expect to reacquire their signal in approximately forty minutes."

Then I switched off, sat back, and began the forty longest minutes of my life.

Other Voices: Avatar Korra

Asami's voice broke up and faded away just as the programmable time display above my station reached zero, then switched to show the countdown to lunar orbit insertion instead. I sat and listened to the static for a few seconds, feeling strangely bereft—I couldn't remember the last time I had been *literally unable* to just turn to my left, or pick up a phone, or whatever, and talk to her if I wanted. For all that I'd known this moment was coming for months, it was an unexpectedly profound feeling to be so completely out of touch, not just with her, but with virtually everyone and everything.

I pulled myself out of it, switched my earphone to the intercom instead, and turned my seat around to look at my colleagues—to focus on the connection, not the disconnection. These six people and I were the first, and so far only, in human history to experience what we were about to do.

Bolin saw me turn around out of the corner of his eye; turning to face me, he grinned through his helmet's clear inner visor and said cheerfully, "Hey, for the first time in my life, I think I can safely say that I've really gotten away from Mako."

I laughed, unbuckled my harness, and pushed myself forward, tagging his snugsuited shoulder on the way past, then stopped myself behind Bumi and Professor Song's seats. "How're we looking?" I asked.

"Just about squared away here," Bumi replied. "We're gonna do LOI on just SPS retro, yeah?"

I nodded. "That's the plan. Koharu and I will rig up anyway, just in case." Leaning forward between their seats, I looked out through the panoramic front windows at a sight only the two of them had ever seen before me: the far side of Yue.

Long before there ever were thinking beings on Dìqiú, tidal forces had locked the moon into a perpetually one-sided relationship with the planet. As she traveled across the sky, Yue always showed the same face to the world below, with the same familiar pattern of dark lowlands and bright highlands in the same orientation, only varying according to her phases. Early poets had called the side no one ever saw the "dark side", but of course that wasn't accurate; thanks to those same phases, it got the same amount of sunlight in the course of a month as the side we all saw. Right now, with Yue just past her first quarter as seen from Dìqiú, the far side was similarly about half in daylight. That wasn't ideal from a landing standpoint—in a perfect world, we'd have had a fully lighted near side to pick a landing site on—but it was what it was. Our launch window hadn't been able to take the lunar phases into account at all. To land on a full moon, we'd have had to loiter around in lunar orbit for nearly a week, which didn't really seem advisable. We were just lucky she wasn't new; then we'd have had to land and grope around on the surface in the dark.

On the positive side, that meant we could actually *see* the part of the far side that was illuminated. The *Agni V* was equipped with some very sensitive surveying cameras as part of its instrumentation package,

so we would come back with complete photographic coverage of the whole moon, near and far, light and dark; but there was no substitute in my mind for the human experience of actually *looking* at it.

"Wow," I said. "It looks so different from the side we see from Dìqiú."

"Yes," Professor Song agreed, jotting notes on her kneeboard. "It's much more heavily cratered. I can hardly see any lava plains at all. Extraordinary."

"We'll have plenty of time to check it out once we're in orbit," Bumi observed pragmatically. "Won't be anything else to do for the half of each go-round we can't be scouting for landing sites."

The professor nodded. "That's true, Commander, but in geology, one's initial impressions of the site are often of great importance later on."

I chuckled and patted both their shoulders. "Well, I'm not a geologist, and I'd better get back to work," I said.

On my way back to my post, I stopped at Siuraq's station. I wasn't sure whether it was just an artifact of the experience we were sharing, or if I really was warming to him, but I was finding him less of a jerk lately. I still wasn't interested in what he was selling, but he'd stopped trying so diligently to sell it, which was probably part of it.

Now I pitched up next to his console and asked on a private loop, "How are you feeling?"

He turned to look at me and smiled, a little ironically. "I think you can probably guess," he said. "You may be the Avatar, but you're a waterbender first."

I smiled a little myself and nodded, because I knew exactly what he meant. The moon is the source of all waterbenders' power. We're strongest under a full moon than at any other time, and lose our abilities entirely during the totality of a lunar eclipse. But range is also a factor, and even the small variation in Yue's distance from Dìqiú over the course of an orbit makes a difference to the most sensitive of us. As close to her as we were then, I felt energized—a little like the firebending part of me had near Sozin's Comet, but fittingly, it was a gentler sort of energy. Not the fierce, blood-fizzing, heady rush of the Comet; more like a rising spring tide. It felt very good, but without that insistent, fighty, go-out-and-vanquish-something feeling.

As the crew member responsible for the operation and management of the Secondary Propulsion System, Siuraq was going to have plenty to do in a moment, so, having checked in, I left him to his work. I had just enough time to go across and check in with Ikki, and then I headed back to my Fireflight position. Hooking up and locking down was a little more work in zero G, something we hadn't been able to train for, but Kizaki and I had practiced the maneuvers on the way out, and with a little help from each other, we got ourselves situated in plenty of time.

"All right, boys and girls, my program's locked in," said Bumi on the intercom. "Pre-burn maneuvering complete. Everybody ready?" We all signaled that we were. "OK, stand by for TLI in ten. Nine. Eight..."

He reached the end of the count as the timer above my station got to zero. While it started counting up, we felt more than heard the SPS firing, the vibration running forward through the deck plating from the machinery spaces behind the bulkhead where the Fireflight intakes were. The deceleration pushed Kizaki and me toward the front of the ship, our ceiling cables snapping taut as the inertia reels locked up, exactly the opposite of the way we'd been pushed during the Outward Leap. Over the intercom, I could hear someone—Bolin, I thought—grunt softly as he was thrown against his seat harness. I glanced over my shoulder at him and saw that his eyes were closed, his fingers spread in the air before him as he concentrated on the *Agni V*'s spaceframe, feeling the stresses in it through his metalbending.

An eternal thirty-seven seconds later, the pressure abated, the vibration ceased, and Siuraq declared in a satisfied tone, "Shutdown!"

"SPS purge to MANUAL CLOSED," said Ikki.

"Purge to MANUAL CLOSED," Siuraq acknowledged.

"Fuel valves OFF."

"Fuel OFF."

"Oxidizer valves OFF."

"Oxi OFF."

"SPS purge to AUTO."

"Purge to AUTO."

"Fuel pressure check."

"Fuel press zero."

"Oxidizer pressure check."

"Oxi press zero."

"SPS master arm OFF."

"Master arm OFF."

"SPS shutdown checklist complete," Ikki reported. "System secured."

"Fine work, you two," said Bumi. "Leimin, how we lookin'?"

"One second... yes," said the professor, and then, for the benefit of the official flight tapes (since Crescent couldn't hear us right now), "Confirmed. Lunar orbit stabilized, altitude 60 nautical miles, variation plus or minus one percent. LOI complete at 02:21:10 and 57 seconds."

"Well!" said Bumi. "I guess that means we don't have to turn around and go home right away."

Conversations, technical and otherwise, in the Control Room had grown shorter and more desultory as the last ten minutes before AOS ticked by. We hadn't acquired the *Agni V*'s signal early, and that meant they hadn't experienced an abort-to-return, which was good. Now the only question was whether we would acquire it at *all*, and that, as the appointed time drew nearer, silenced us all one by one. For the last two minutes of the count, nobody spoke.

I watched the digital timer tick down, second by second, each one more agonizing than the last. Beside me, Hikari took my hand again, holding on tight. The second the timer showed zero, I reached for the button on my console that would open the ground-to-space—

—but before my finger reached it, my headset crackled and Korra's voice declared cheerfully,

"Crescent, *Agni V*. Please be advised that Tendo Choi is very good at math."

The Control Room staff broke into applause, and I could hear the muffled cheering from the visitor gallery through the glass. Hikari came out of her chair and hugged me, providing one of the day's enduring images for RTN. At the backup flight director's station, Tendo grinned and raised an eyebrow at me; I nodded, and he switched on his own mic and replied,

"Why, thank you kindly, Avatar. I'm pleased to know that my efforts were of some help to you and your colleagues."

As the uproar died down, I looked over the renewed telemetry stream from the spacecraft, checked with the relevant controllers, and determined that everything was in order. With their lunar

orbit established, the crew squared themselves away and set about the tasks programmed for them during this phase of the mission. In addition to a complete photographic survey of the lunar surface, they spent four and a half orbits—about nine hours—studying the lighted portion of the near side as they passed over it, so as to select a landing site.

There were a few options already under consideration, selected after exhaustive study of photographs taken through powerful land-based telescopes, but we had all agreed early on that the final decision should be left up to the crew based on what they could see from much closer up.

By midafternoon, on their third orbit, they had shortlisted three sites and were approaching a consensus. I was listening with one ear to their debate when Bolin, who hadn't been taking part, suddenly cut in,

"What about over there? There's a nice open spot by that crater."

"Which crater?" Ikki asked.

"That one," Bolin replied. "The one with the... lake... and... the trees?" he added, trailing off into confusion at the end. In the control room, heads came up, not least my own (though there was nothing to see, since they'd shut the onboard video off again before their first orbital LOS). A row in front of me at his tech station, Mako frowned in puzzlement at the blank center screen, then turned back to look a question at me. I could only shrug.

"Bolin, did you take one of the green pills?" Bumi asked. "Kya told you those were for emergencies only."

"It's right there!" Bolin protested. "Right next to—... this is *so* unfair."

"*Agni V*, Crescent, did I hear that right?" I called. "You found an *oasis* on the *moon?*"

"Uh... well, Bolin thought he did," Bumi replied. "But nobody else saw it, and he can't find it now."

"I didn't *imagine* it!" Bolin insisted, then added in a less convinced voice, "... Did I?"

"Give us another orbit to check it out," Bumi added.

"You've got as long as you need," I told him. "Keep us posted."

"Will do," said Bumi.

Bolin was able to find the crater where he thought he had seen an oasis on the next orbit, but it proved, upon closer inspection with the ship's navigation telescope, to be just a crater. However, both a frustrated Bolin and a bemused Professor Song reported that the area *next* to it looked very much like an ideal landing site, very similar to the desert test area where we had conducted the L-flights, with few loose boulders and other surface debris for Bolin to deal with as he prepared the landing surface. After a conference that took us almost all the way to that orbit's LOS, the crew concluded that it was the best available site. I concurred, and as they made their way around the far side once more, they made their preparations for powered descent. In large part, this consisted of clambering back once more into their snugsuits, but this time, they wouldn't be wearing the visored flight helmets. This time, suiting up for maneuvering was also part of the preparations for the first surface extra-vehicular activity, and so they would put on their one-piece pressure helmets and start getting accustomed to full enclosure.

Once again, we in the Control Room and our guests in the viewing gallery sweated out a silent

hour, not because there was any great danger that the ship wouldn't reappear, but because when it did, another delicate and potentially dangerous phase of the mission would begin. In order for the *Agni V* to land successfully, the whole crew had to hit all their marks at exactly the right time, and—if not catch a couple of breaks—at least avoid any strokes of serious bad luck. In the simulator, powered descent was by far the most commonly "lethal" scenario, and in the course of the L-flights, Bumi and Professor Song had written off two of the three testing aircraft. This was the point in the mission where we had no choice but to accept the largest and most varied array of imperfectly minimized risks, as the final flight plan so delicately phrased it.

Hikari held my hand once more, and once more it was as much for my benefit as hers, as we sat and listened in silence to the intercom traffic beaming down to us from the ship. Once we had given them the go-ahead to proceed, no one in the Control Room would speak to the crew until they reported themselves on the ground and stopped, unless an absolute technical emergency arose. They were going to have their hands full without any interjections from us to deal with.

Following is an excerpt from the mission's official communications transcript of the traffic from the *Agni V* during powered descent.

PILOT 5000 feet, 100 down, 220 forward.[4]

CMDR Pretty smooth so far. Smoother than the SV. Give me 10 more on the left retro.

PILOT Left retro plus 10. 4500, 110 down, 220 forward.

CMDR How you ladies doing back there?

SYSSPEC No problems here.

PROPSPEC I could do this all day.

PILOT 4000. 150 down, 240 forward. Slow it down.

CMDR She's gettin' a little feisty now. Minus 20 main.

PILOT Main thrust minus 20. 3000, 110 down, 200 forward.

FLUIDSPEC Portside flux chiller pressure's dropping.

ATSPEC Flux chiller boost to 40 percent.

FLUIDSPEC That's got it.

4 All of Professor Song's three-item numerical callouts during descent gave the ship's current altitude (in feet), rate of descent (in feet per second), and forward ground speed (also in feet per second).

PILOT 2000, 100 down, 230 forward. FV's creeping up again.

CMDR All right, kill the mains, I'll take her down on the ventrals from here.

PILOT Main thrust disengaged.

SYSSPEC Oof. She doesn't like that.

PROPSPEC Nope.

FLUIDSPEC Give me full boost on the flux chillers.

ATSPEC Flux chiller boost to 100 percent.

PROPSPEC I've got backpressure building up here. Korra, shorten your stream, I don't want my face burned off.

SYSSPEC Careful, don't let her fall off the step.

PROPSPEC I got it. I got it.

PILOT 1000, down 150, 180 forward.

CMDR Give me 20 more on the ventrals.

PILOT Ventral plus 20. 750, down 100, 160 forward. Altitude light.[5]

PROPSPEC That's your cue, babe.

SYSSPEC (almost inaudible) "Babe"?

STRUCSPEC OK, here we go.

(Sound of metallic clicking as floor tracks at STRUCSPEC landing position respond to specialist stance change.)[6]

PILOT 500, down 50, 120 forward. That's more like it.

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5 The altitude light indicated that the ship was within what we had determined, in the L-flight tests, was earthbending range of the ground.

6 Bolin's landing station, like Korra's and Koharu's powered flight stations, was a standing position with ceiling cables and boot locks—in his case, directly behind and between the flight crew's seats, with the best view out the front windows.

CMDR All the way on the retros, ventrals down 20.

PILOT Retro thrust full, ventrals minus 20.

FLUIDSPEC Flux chiller overboost.

ATSPEC Flux chiller boost to one-oh-five percent. 20 seconds.[7]

SYSSPEC How you doin', Bo?

STRUCSPEC Stuff's kind of slippery. Harder to work with than the desert. Think we'll be OK, though.

PILOT 250. Down 10, forward 150. Ease her down.

CMDR Give me 5 right retro.

PILOT Right retro plus 5.

ATSPEC 10 seconds.

CMDR Come on, baby, come on. Almost there. That's a good-lookin' runway, Bolin.

STRUCSPEC Thank you.

PILOT 100, down 10, forward 100. You've got it. You've got it. 75, down 10, forward 85.

CMDR Kill the retros, ventrals plus 5.

PILOT Retro thrust disengaged, ventrals plus 5. 50, down 5, forward 100.

ATSPEC 5 seconds.

FLUIDSPEC Flux chiller boost to 100 percent.

ATSPEC Overboost disengaged. Boost 100 percent.

CMDR Gear down.

PILOT Gear down. (Sound of landing gear deploying.) Three green,

7 The flux chiller boost pump could be run at 105 percent of rated capacity for 30 seconds before failing. We limited it to 20 as a safety margin.

down and locked. 25 feet, down 5, 110 forward.

CMDR Cutoff.

PROPSPEC Cutoff!

SYSSPEC Cutoff.

(Audible bump and rolling sounds.)

PILOT We're down. Forward 100.

CMDR Braking. Give me RCS retro.

PILOT RCS retro. Ground speed 75. 50. 25... wheel stop.

CMDR Brake set?

PILOT Brake set.

CMDR RCS lockout?

PILOT RCS lockout.

CMDR Fireflight command override OFF.

PILOT Command override OFF.

CMDR Landing checklist complete. (two second pause) WOOOOOOOOO! WE MADE IT! Crescent, Agni V, we are ON THE MOON!

The tumult that erupted in the visiting gallery, and indeed in the Control Room, at that moment put the celebrations after the successful Outward Leap and the timely first AOS in the shade. Tonraq got so excited he actually pounded on the inside of the gallery window, nearly breaking the glass before Senna managed to restrain him.

The crew were busy for a few minutes after touchdown; mission rules called for the execution of an immediate emergency departure checklist, in case, for instance, the *Agni V* started sinking into the lunar surface, or one of the SPS propellant tanks started leaking after landing (meaning they would have to leave immediately or risk not leaving at all). Nothing of the kind occurred, however, and five minutes later we concurred with their analysis: They had arrived safely and could proceed with the next phase of the mission as planned.

During the planning stages, some well-meaning individual in the Procedures Working Group had inserted a rest period for the crew into the flight plan immediately following the STAY decision. Lin was the first to notice it, idly reading over a draft copy of the flight plan in my office one day while

I approved materials requisitions for the Training Center. The first I knew of it was when she gave her trademark derisive snort.

"What?" I asked, looking up.

"Have you seen this draft plan for Day 4?" she asked. "Get a load of this. What do you think the first thing after STAY/NOSTAY is?"

"Prep for EVA 1?" I hazarded.

Lin shook her head. "You would think so, but no. Crew rest period." She tossed the draft casually onto my desk. "Picture that. Korra lands on the moon, we tell her she's clear to stay and start looking around—just as soon as she's had a nap." She gave me a sardonic look. "How about it, can you envision that ever working?"

"Let me see that," I said, and checked the report. Sure enough, there it was in black and white: 6 HR CREW REST. I laughed. "No, you're right, that's clearly never going to happen. I'll take care of it. Good catch."

Lin shrugged. "That's what you hired me for," she said, even though it wasn't.

Now, several years and a quarter-million miles later, I switched on my mic and said, "*Agni V*, Crescent. I'd say it's about time you got dressed and took a look outside."

Korra's voice returned three seconds later, filled with glee: "Now that's what *I'm* talkin' about."

In training, it took the crew an average time of two hours and ten minutes to retrieve their complete Type 14 spacesuits from their storage locations within the *Agni V* and put them on, complete with crosschecks of each other's equipment, so that they would be ready for an EVA. Of course, that was in Dìqiú's gravity; on Yue, the gravitational acceleration to which they were subject was a mere one-sixth of what it would be at home, so the complete system would weigh only about 35 pounds. Also, that time is from "standing up in normal flightsuit" to fully kitted out, and after the moon landing, they were already wearing their snugsuits. Between those factors and the great motivation that was *the moon* waiting just beyond the ramp, it wasn't a surprise to any of us in the Control Room that they reported themselves ready less than an hour and a half after the wheels stopped turning.

In the months leading up to the flight, one of the questions that kept coming up in the press and on dignitaries' visits to Crescent Island was, "Who will be first?" One of those seven people, obviously, would be the first human being ever to set foot on Yue, and as we approached the flight, it seemed like everyone wanted to know which one—or believed they knew, without doubt, who it should be. In order to deal with the question quickly and head off the insistent suggestions from many quarters, the stock answer my office always gave was, "That is an operational decision that will be taken by the crew before the first EVA commences."[8] As such, 1) I didn't know who would be first and 2) it did no good to try to persuade me of anything regarding the decision, because I wouldn't be involved in it.

Now, as I transmitted up permission for them to get started, I still didn't know who it would be—though I could make a reasonably good guess. After all, I knew the crew very well by that point. I knew how they thought and what factors they would be taking into account.

While I was speaking on a private headset loop to Kya, who would be monitoring the crew's

8 The first time I said that to a reporter in Korra's presence, the look she gave me was priceless. "Oh, *you're* a big help," she muttered later.

life support functions from her Flight Surgeon console, I caught something colorful moving out of the corner of my eye. I turned to see Pabu scampering up the aisle from the second row, where the technical consoles were. He jumped up onto my console, deftly avoiding all the buttons and switches, and offered me a folded piece of paper he held delicately between his teeth. Puzzled, I took it, unfolded it, and found that it was a note in Mako's distinctive hand: *I've got ¥20 that says it's Korra.*

Smiling, I wrote *I notice you didn't include it, though. Anyway, no bet.* on the back of the note, folded it back up, and returned it to Pabu, who immediately darted off to deliver it.

A few moments later, Bumi's voice called on the ground-to-space, "Crescent, *Agni V*."

"Go ahead, *Agni V*," I said.

"After due consideration," said Bumi with his usual slightly mock gravity, "we have decided that the Systems Specialist will be the first one off the ship."

Mako turned around in his seat and grinned at me. I nodded, smiling, and replied to Bumi, "Understood, *Agni V*. Just make sure you let her back on before you leave."

"Ha ha, roger that," Bumi said. "Stand by."

On the giant center screen at the front of the room, the test pattern was suddenly replaced by a video feed. For a moment, the shapes were hard to make out, but as the camera's automatic focus and exposure mechanisms worked, it resolved into a slightly fisheyed view of the *Agni V*'s underside, as seen from a rearward-looking camera mounted on the main strut of the forward landing gear. A second later, the rectangular shape of the boarding ramp separated from the rest of the ship's belly, sliding out neatly, its edges stair-stepped from the interlocking pattern of the heat-resistant tiles. Slowly (and silently—there was no mic on the camera, and no way for it to pick anything up on the airless surface of Yue if there had been), it pivoted downward, extending slightly as its forward edge came to rest on the ground. At the top, the camera's exposure setting rendered the airlock's interior as only a dark void.

A moment later, the bulky E-suited form of Korra emerged from the shadow and out into the daylight. The video camera's color processor rendered the dull orange of her E-suit's outer covering as a more vivid shade than it really was, making her resemble a cartoon character as she walked slowly and cautiously down the ramp, getting used to maneuvering the suit in lunar gravity.[9] Her face was invisible behind the gold-coated bowl of her E-helmet's visor; between that and the figure-erasing bulk of the suit, the only way we could tell it was her was by the sky-blue color of her helmet and backpack. On a secondary monitor down front, the feed from the other video camera, which was fixed to a mount on her suit's chestplate, bobbed up and down with her steps.

"OK," she said, and I flipped a switch to put her on the overhead speakers throughout the Crescent and Lagos Island complexes. "I'm on the ramp. Can you see me, Crescent?"

I had to clear a lump from my throat before I could answer, "Yes, Korra. You're coming in nice and clear."

She gave a little wave for the camera. "Great. All right, I'm stepping to the end of the ramp. Walking in this gravity is kind of weird, you have to concentrate not to just bounce." She made her way to the ramp's end; one more step and she'd be standing on the surface of the moon. Whether out of genuine curiosity or just a slightly perverse urge to torture us all, she paused there to conduct a brief

9 It might only weigh 35 pounds up there, but it still had more than 200 pounds' worth of inertia.

investigation of the little hummock of grey lunar soil the ramp had pushed up ahead of it.

"The surface is covered with a very fine dust, almost like flour," Korra reported. She made a gesture with one hand, fingers stiffly splayed; some of the dust moved aside, revealing hard-packed ground the same color beneath it. "It does respond to earthbending, but it's very imprecise—like sand-bending, only worse. Seems to be about an inch deep, even out here in the middle of the runway." She paused. "OK. I'm stepping off the ramp now."

With great deliberation, she took one slow, careful stride off the end of the ramp, stopping again with her feet together. For a brief eternity, she was silent, her helmet visor twinkling as she looked around. All over the world, people waited on tenterhooks, holding their breath, waiting for the instantly indelible words with which their Avatar would sum up this astonishing, unprecedented moment in human history.

Then, her voice quiet but perfectly clear, she said, "Welcome to a new age, Dìqiú... one where the sky's no longer the limit."

The Control Room fell silent for a few seconds as we all reflected on her remark and what it implied. Then, in a voice that was much more her own, she added wryly, "I hope somebody wrote that down."

It's been said that the entire world laughed then, and I'd like to think that's true. I know everyone in the Control Room did, and though the seriousness of what we were doing never left us, that much-needed leavening of the moment returned us all to an emotional level at which it was much easier to work. It was so quintessentially Korra to take such a powerful moment, reflect meaningfully upon it, and then gently remind us all that it was, after all, a thing that a flesh-and-blood human being like ourselves was experiencing.

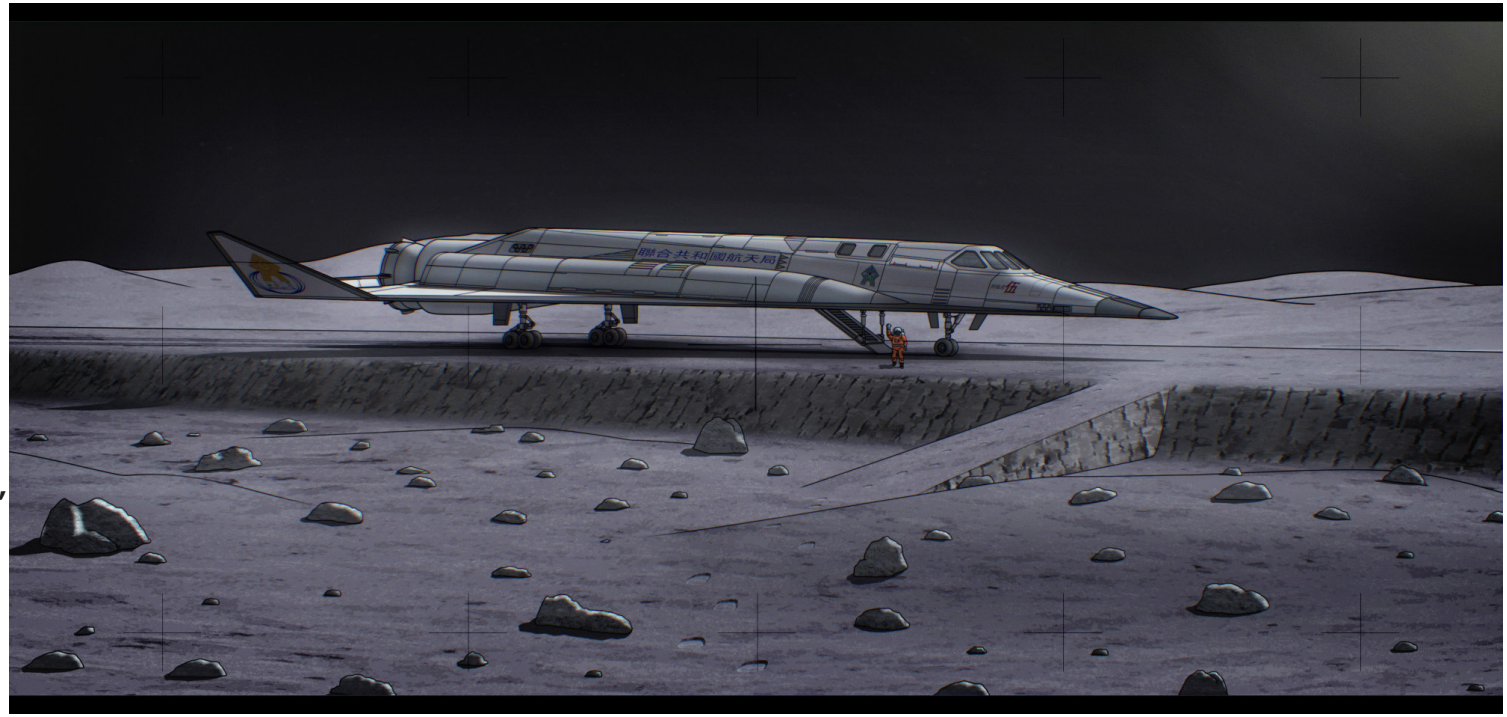
Ikki was the second member of the crew to disembark, for the simple reason that she got her Tashima loaded faster than Bumi did. She descended the ramp much less deliberately than Korra had, paused for a moment to look around and get her bearings, then tried to run to a second, earthen ramp Bolin had raised off the side of the elevated runway. Korra turned to track her with the portable video camera. Running, it turned out, was not really a thing that worked in lunar gravity, and Ikki nearly fell headlong (even through the glass I could hear Tenzin bellow, "Ikki, be *careful!*") before converting the fall into the first of a series of long, leisurely two-footed hops, her laughter ringing across the ground-to-space.

"Oh, this is *easy!*" she declared, bounding down the earth ramp and out onto the rock-strewn, unmodified ground beyond. "Look, Uncle Bumi, I'm a rabbaroo!" Then, a few yards past the edge of the runway, she stopped, turned around, and called, "Smile, Korra!"

Korra raised a hand in a wave, and, since the video camera she wore on her chest was still running, the two of them took pictures of each other for a few seconds. Then she walked out from under the *Agni V* herself, paused, and tried the rabbaroo hop herself, heading out to join Ikki.

"Hey, you're right, this is a lot easier than walking. More fun, too," Korra observed, laughing. "Come on out, you guys, the water's fine!" she declared to the rest of the crew.

Once all seven of them (and Bum-Ju) were out on the surface, they frolicked about for a bit, experimenting with different ways of moving before agreeing that Ikki's discovery was best. (This was



"Smile, Korra!"
Spacecraft Agni V after landing on the surface of Yue. Systems Specialist Korra greets Atmospheric Specialist Ikki, the first crew member to venture beyond the runway.

actually in the flight plan: 10 minutes for lunar surface acclimation, or, as Lin would have preferred we immortalize it, "screwing around.") Once that was settled, and they had the initial holy-*dogcow*-guys-we're-on-the-*moon*[10] reactions out of their systems, they settled down and got to work.

The first order of business was the offering of the North Pole spirit water, which Korra had been carrying on her person in its amulet at virtually all times since her cousins had entrusted it to her. We had originally expected this ceremony to be a symbolic gesture, but given what Bolin had thought he'd seen during landing site selection, some of us were no longer completely sure it would be. The carefree atmosphere of the acclimation period gave way to a sense of nervous excitement as the seven arranged themselves in a semicircle, facing toward the crater which had signposted their landing place. Korra set her television camera up on a tripod so that they could all gather without anyone having to hold it, and the rest of us back on Dìqiú could get an unobstructed view of the proceedings.

Other Voices: Ikki

"Yue, Spirit of the Moon, hear me," said Korra, her voice low and reverent. "On this day men and women from Dìqiú have dared reach out and touch your celestial abode for the very first time, not for the sake of hubris, but as an act of love. Please accept this offering and know that we seven stand humbly before you now, in peace for all humankind."

Korra drew the ampoule-amulet she had carried from the Spirit Oasis out of her sleeve pocket, then handed it to Siuraq and carefully lowered herself to her knees in the regolith. For once, Siuraq didn't have a

10 Korra once told me she considered *those* as her first words from the surface, but I'm not sure I believe her. Even she has more of a sense of occasion than that.

clever remark to offer. Without a word he uncapped the vial and, standing off to one side, held it up before her. She took a moment to center herself, slowing her breathing. Given how loud my own seemed within my helmet at that moment, I can only imagine how deafening hers must have been to her.

Then she slowly, deliberately raised her hands and began, with delicate precision, to coax forth the spirit water.

This was the moment she'd trained so hard for, practicing the subtle movements in her stiff compression gloves over and over and over again—pushing herself to the point where she would wake the next morning with fingers that stayed cramped and useless for hours, so that Asami would have to feed her breakfast while she sat with her hands in a pan of warm water and wept with pain. Of all the many critical tasks she had to perform on this mission, *this* was the one that had to be absolutely perfect.

As it flowed out of the amulet, I could see the liquid trembling, only Korra's power and her concentration keeping it from following its natural course and freezing solid, then sublimating away to vapor in the hard vacuum and bright sunlight. She gathered it into a quivering sphere, its surface silvering with frost. None of us had expected the effect; she'd practiced this maneuver in temperatures far below freezing, but not *this* far. I found it surprisingly beautiful, almost hypnotic, as she kept the sphere constantly turning. Slowly, always moving—intangibly caressing the water as it fought to congeal and then dissipate—she began to lower it toward the ground.

Instead of reaching the lunar soil, the silvery ball of water settled gently into the palms of a cupped pair of hands: long, slim, elegant hands, ungloved, emerging from wide, flowing sleeves that rippled as if in a breeze that could not possibly be blowing here. Surprised—she had expected something to happen at this point, but hadn't known what it would be—Korra relinquished the water as gracefully as she could, drawing her own hands open and apart as the sphere lost its shape. Instead of freezing, as it surely must, the water pooled naturally in the other person's hands, its surface rippling gently. In our earphones, we all could hear Siuraq gasp in astonishment; but the next voice we heard came to us without the help of the radio.

"Thank you, Korra," said Yue, smiling gently. "Welcome to my home."

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(An Excerpt from *Challenging the Cold Silence* by Asami Sato, Ph.D., FRSEME)

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"Why don't we go to the moon?"

Yue: Dìqiú's only natural satellite. For all our recorded history, she has haunted us with her beauty and impressed us with her power. Waterbenders love her. Firebenders fear her. Young lovers pray for her intercession. And always, people have wondered: *Could we ever possibly reach high enough to touch her?*

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