How to Fly to the Moon

A forgotten Fire Nation report showed the leaders of the Phoenix Flight how they could achieve their mission.

In this excerpt from the new 10th Anniversary Galactic Standard edition of Challenging the Cold Silence: The Inside Story of Project Phoenix Flight*, Professor Asami Sato describes how the chance discovery of a long-defunct Fire Nation Aeronautical Research Commission project helped her and Avatar Korra solve a critical problem that threatened to stymie their vast enterprise before it could even properly begin.*

As 195 began, the project's management system and the underlying structure of the project office were in place, the central office staffed, and the first wave of technical information, if not fully assimilated, at least filed with some semblance of order and ready to be consulted. At last we were ready to start considering the most important question we needed to answer in order to proceed – one that, to some people's consternation, had never been asked nor answered in the original project proposal:

How are we going to get to the moon?

I had considered the question at length on that first sleepless night back in March of 193, when I had decided that it was at least worth attempting. It seemed to me then, and still appeared two years later, that there were two basic options available to us at the current state of technology:

1) *Ballistic missile launch*. Essentially, this meant constructing a vehicle that could land on, and then take off again and return from, the moon, then putting it on top of a very large rocket and blasting it vertically into space. This was the obvious method, and the one most of the people we spoke to during the "recruitment" phase of the project probably assumed we were going to use all along.
2) *Mothership launch*. In this version of the process, we would put our theoretical moon vehicle on the back of another aircraft: one that couldn't reach the cold silence itself, but could carry the ship to its very edge. From there, the spacecraft would have to do the rest of the work.

The mission patch of the Phoenix Flight cleverly illustrates both the precise mission, and the collaborative, multinational nature, of the project.

Rockets, in the form of fireworks and semi-effective terror weapons like the ancient Earth Kingdom *hwacha,* had been known in Dìqiú for centuries, but only recently had people started to develop them from primitive combustible projectiles

into complex, controllable machines capable of doing useful work. Still, by 194 the Fire Nation, Earth Kingdom, United Republic, and both Water Tribes had heavy lift rocket technology. It was what all five nations, and several large corporations within them (including Future Industries) used to loft the communications, navigation, and weather satellites with which the skies sometimes seemed to be filling up by the mid-'90s. On August 14, 190, the Fire Nation's Aeronautical Research Commission had even launched a person, Fire Air Force Colonel Ayumi Takuma, into the cold silence atop one of their *Shaw*-class rockets. Even more surprisingly, they brought her back alive, two orbits of the planet later.

The Earth Kingdom put up its own taikonaut atop a somewhat-more-prosaically-named W44 missile two months later, just to prove that they could do it. Their man, Wu Xitao, hung on for three orbits, then barely made it back alive... and that was effectively the end of manned spaceflight in Dìqiú for the rest of the decade. Both agencies independently concluded that, while the technology existed to make human spaceflight *possible*, it was only barely so, and neither safe nor reliable enough to keep fooling around with for the time being. The rockets of the day weren't powerful enough to lift a really substantial spacecraft, and the sacrifices made in the name of weight savings had nearly done in poor Wu, who spent nearly a year in hospital recovering from his ordeal. After his flight, all the world's active space agencies quietly chose to pursue satellite programs and leave sending people up for some unspecified later time.

Thus, if we chose option 1, we would be reviving a branch of space technology development that had essentially been abandoned for more than three years, and then trying to push it well beyond its existing limits. In conversations I'd had with Zuko since he joined the project, I had learned that this was the area in which he'd thought – in an abstract, hypothetical way – Sozin's Comet might be able to help with. Using Comet-enhanced firebenders to boost the output of a rocket which they were aboard, so that it would be able to lift a fully equipped moonship and accelerate it to the speeds needed to escape Dìqiú's gravity, was a concept that did seem to make a certain mad sense... but however I turned it around in my mind, I couldn't think of a way in which those firebenders would *survive the attempt*.

The space rockets of the 190s were disposable affairs – they burned out and then fell away, to be destroyed in the atmosphere or plunge back to the ground. In order to avoid that fate for the firebenders powering the boosters,[1] they would have to be in the actual spacecraft, along for the ride, and how would one then direct their power all the way to the other end of the vehicle, without hopelessly compromising the integrity of the pressure vessel? The alternative would be to build the entire vehicle as a single integrated whole, and *that* would essentially

[1] The crazy part was that I suspected we would get *eager volunteers* if we did it that way. The Fire Nation Armed Forces were notorious for fostering a certain manic death-with-honor ethic in some of their hardest-core officers, even a century after the War. I was in no way willing even to consider a scenario in which we were deliberately expending lives to accomplish the mission, however, and even if I had been, Korra wouldn't have.

mean dragging along an entire spent ascent stage, all the way there and all the way back (and working out some way of landing it on the moon and taking off with it again). It simply wasn't feasible.

Unfortunately, the alternative didn't seem any *more* feasible in the early months of 195. As we approached the two-year anniversary of Korra's original suggestion, I was beginning to think that I had managed to rule out both of the available methods as impracticable. A mothership-launched moon vehicle would avoid the "enormous booster required to get off the ground" problem, but would still have to carry so much fuel to make the leap out of the upper atmosphere, and then across the quarter-million miles of void to Yue, that it would have to be enormous – far too big for any aircraft to lift it, or to lift itself the rest of the way.

Again, there was the tantalizing possibility that Sozin's Comet could provide the answer, but there seemed to be no hard information on *how* that might actually be done. Zuko had (a bit sheepishly) confessed that he'd never really followed up the idea – he was many things, but an aeronautical engineer was not one of them – and every document I'd come across in my seemingly endless trawl that mentioned the prospect at all went little further toward examining the hard technical possibilities. If we had to start from zero, even with the vast scientific and engineering apparatus we were in the process of creating, we would run out of time and the whole thing would come to nothing. It would be a bitter pill to swallow, I thought, if we had to come this far just to discover that we were never going to make it in the first place.

That was where the situation stood on the night of March 17, 195. Two years of hard work and hustle since Korra's quip about going to the moon, and I was sitting in my office at project headquarters, swimming upstream against a tide of irrelevant, uselessly speculative, and/or downright crackpot ideas from 20 years of other space agencies' work, slowly and reluctantly approaching the conclusion that we couldn't actually do what we had told everyone we were going to attempt.

I looked up from the specification for yet another Fire Nation rocketry technique that was probably not going to work and groaned softly, pinching the bridge of my nose between the thumb and forefinger of my free hand. As usual, I had completely lost track of time. My shoulders ached from hunching over the chaos of papers and drawings on my desk; my eyes stung and felt gritty, like someone had lightly dusted them with powdered salt. Through the panoramic window to the right of my desk, I could see that the lights were out in most of downtown Republic City's other high-rise buildings. I looked at the clock on the wall next to the window: three-thirty-four AM.

Luckily, Hikari wasn't at home alone when I worked long into the night like this. School was in session, so she was on Air Temple Island, where the Air Nomads and Acolytes had graciously agreed to teach her alongside their own children in the temple school. It was an ideal arrangement for both of us, really: she was well-looked-after on the island during the week, and we saw each other without fail on the weekends, which – at Korra's insistence – I guarded jealously

throughout the project. It was, Hikari once declared, like being in boarding school *and* home at the same time.

I still felt occasional pangs of guilt at the thought that I was spending so much time away from her, but when I tried to apologize to her, she would have none of it. "Relax, Mom," she said. "If I ever feel neglected, you'll be the first to hear about it. In the meantime, get to work." Sometimes I wondered which of us was the adult.

Below the clock stood a black leather sofa, where – as she had on so many nights since this mad project began – Korra had stretched out and gone to sleep hours ago. I considered waking her and sending her off to a proper bed. At one point there had been vague plans of leaving the work for a while and getting some dinner, but that had been many hours and engineering revisions ago. I wondered, not for the first time, why Korra kept putting up with being ignored this way. From anyone else, such chronically cavalier treatment would have earned a stern reprimand, at the very least.

I sighed and made to return to work, then realized with a mild start that Korra *wasn't* asleep. She was sitting crossways at the far end of the couch, forearms folded on knees, with her chin resting on her arms, facing me and regarding me with a private little grin.

"... What," I said quietly, feeling my cheeks go red.

"Nothin'," Korra replied lazily, still grinning.

I looked back at her for a moment, one eyebrow raised, and then pulled the next document from the stack and went back to work...

... and there was our answer.

"Korra," I said. "Stop smirking at me and come look at this."

Catching the urgency in my voice, she rose without comment and came around my desk, leaning down over my shoulder to see the paper I was looking at. It was an internal document from the Fire Nation ARC, dated five years before: *Final Report on Experimental Program 498 (Project Fireflight)*. She stood in silence for a few seconds, her eyes flicking back and forth as she scanned the paragraphs of the abstract on the first page – the same ones that had just caught and held my undivided attention. Then she glanced at me, and in a moment's eye contact I could see that she was thinking the same thing I was.

We took the whole file folder over to the couch and spread it out between us, trying to absorb everything it had to tell us. Dawn was breaking over the mountains to the east by the time we'd finished giving it a first reading. Korra closed the folder, rested her hand on its back cover for a moment, then looked up and met my eyes again.

"That's it," she said, and I nodded.

In addition to a full translation into the Galactic Standard language by the author herself, the 10th Anniversary GS Edition of Challenging the Cold Silence *features a fully revised and expanded text, including material never seen in print before. Revised anniversary editions in Tongyu, Kokugo, and Tukisi will also be available in selected areas.*