

Skystalk

by Charles Sheffield

Finlay's Law: Trouble comes at 3:00 A.M. That's always been my experience, and I've learned to dread the hand on my shoulder that shakes me to wakefulness. My dreams had been bad enough, blasting off into orbit on top of an old chemical rocket, riding the torch, up there on a couple of thousand tons of volatile explosives. I'll never understand the nerve of the old-timers, willing to sit up there on one of those monsters.

I shuddered, forced my eyes open, and looked up at Marston's anxious face. I was already sitting up.

"Trouble?" It was a stupid question, but you're allowed a couple of those when you first wake up.

His voice was shaky. "There's a bomb on the Beanstalk."

I was off the bunk, pulling on my undershirt and groping around for my shoes. Larry Marston's words pulled me bolt upright.

"What do you mean, *on* the Beanstalk?"

"That's what Velasquez told me. He won't say more until you get on the line. They're holding a coded circuit open to Earth."

I gave up my search for shoes and went barefoot after Marston. If Arnold Velasquez were right-and I didn't see how he could be-then one of my old horrors was coming true. The Beanstalk had been designed to withstand most natural events, but sabotage was one thing that could never be fully ruled out. At any moment, we had nearly four hundred buckets climbing the Stalk and the same number going down. With the best screening in the world, with hefty rewards for information even of *rumors* of sabotage, there was always the small chance that something could be sneaked through on an outbound bucket. I had less worries about the buckets that went down to Earth. Sabotage from the space end had little to offer its perpetrators, and the Colonies would provide an unpleasant form of death to anyone who tried it, with no questions asked.

Arnold Velasquez was sitting in front of his screen door at Tether Control in Quito. Next to him stood a man I recognized only from news pictures: Otto Panosky, a top aide to the president. Neither man seemed to be looking at the screen. I wondered what they were seeing on their inward eye.

"Jack Finlay here," I said. "What's the story, Arnold?"

There was a perceptible lag before his head came up to stare at the screen, the quarter of a second that it took the video signal to go down to Earth, then back up to synchronous orbit.

"It's best if I read it to you, Jack," he said. At least his voice was under control, even though I could see his hands shaking as they held the paper. "The president's office got this in over the telecopier about twenty minutes ago."

He rubbed at the side of his face, in the nervous gesture that I had seen during most major stages of the Beanstalk's construction. "It's addressed to us, here in Sky Stalk Control. It's quite short. 'To the head of Space Transportation Systems. A fusion bomb has been placed in one of the outgoing buckets. It is of four megaton capacity, and was armed prior to placement. The secondary activation command can be given at any time by a coded radio signal. Unless terms are met by the president and World Congress on

or before 02:00 U.T., seventy-two hours from now, we will give the command to explode the device. Our terms are set out in the following four paragraphs. One-"

"Never mind those, Arnold." I waved my hand, impatient at the signal delay. "Just tell me one thing. Will Congress meet their demands?"

He shook his head. "They can't. What's being asked for is preposterous in the time available. You know how much red tape there is in the intergovernmental relationships."

"You told them that?"

"Of course. We sent out a general broadcast." He shrugged. "It was no good. We're dealing with fanatics, with madmen. I need to know what you can do at your end."

"How much time do we have now?"

He looked at his watch. "Seventy-one and a half hours, if they mean what they say. You understand that we have no idea which bucket might be carrying the bomb. It could have been planted there days ago, and still be on the way up."

He was right. The buckets-there were three hundred and eighty-four of them each way-moved at a steady five kilometers a minute, up or down. That's a respectable speed, but it still took almost five days for each one of them to climb the cable of the Beanstalk out to our position in synchronous orbit.

Then I thought a bit more, and decided he wasn't quite right.

"It's not that vague, Arnold. You can bet the bomb wasn't placed on a bucket that started out more than two days ago. Otherwise, we could wait for it to get here and disarm it, and still be inside their deadline. It must still be fairly close to Earth, I'd guess."

"Well, even if you're right, that deduction doesn't help us." He was chewing a pen to bits between sentences. "We don't have anything here that could be ready in time to fly out and take a look, even if it's only a couple of thousand kilometers. Even if we did, and even if we could spot the bomb, we couldn't rendezvous with a bucket on the Stalk. That's why I need to know what you can do from your end. Can you handle it from there?"

I took a deep breath and swung my chair to face Larry Marston.

"Larry, four megatons would vaporize a few kilometers of the main cable. How hard would it be for us to release ballast at the top end of the cable, above us here, enough to leave this station in position?"

"Well..." He hesitated. "We could do that, Jack. But then we'd lose the power satellite. It's right out at the end there, by the ballast. Without it, we'd lose all the power at the station here, and all the buckets too-there isn't enough reserve power to keep the magnetic fields going. We'd need all our spare power to keep the recycling going here."

That was the moment when I finally came fully awake. I realized the implications of what he was saying, and was nodding before he'd finished speaking. Without adequate power, we'd be looking at a very messy situation.

"And it wouldn't only be us," I said to Velasquez and Panosky, sitting there tense in front of their screen. "Everybody on the Colonies will run low on air and water if the supply through the Stalk breaks down. Damn it, we've been warning Congress how vulnerable we are for years. All the time, there've been fewer and fewer rocket launches, and nothing but foot-dragging on getting the second Stalk started with a

Kenya tether. Now you want miracles from us at short notice.”

If I sounded bitter, that's because *I was* bitter. Panosky was nodding his head in a conciliatory way.

“We know, Jack. And if you can pull us through this one, I think you'll see changes in the future. But right now, we can't debate that. We have to know what you can do for us *now*, this minute.”

I couldn't argue with that. I swung my chair again to face Larry Marston.

“Get Hasse and Kano over here to the Control Room as soon as you can.” I turned back to Velasquez. “Give us a few minutes here, while we get organized. I'm bringing in the rest of my top engineering staff.”

While Larry was rounding up the others, I sat back and let the full dimensions of the problem sink in. Sure, if we had to we could release the ballast at the outward end of the Stalk. If the Beanstalk below us were severed we'd have to do that, or be whipped out past the Moon like a stone from a slingshot, as the tension in the cable suddenly dropped.

But if we did that, what would happen to the piece of the Beanstalk that was still tethered to Earth, anchored down there in Quito? There might be as much as thirty thousand kilometers of it, and as soon as the break occurred it would begin to fall. Not in a straight line. That wasn't the way that the dynamics went. It would begin to curl around the Earth, accelerating as it went, cracking into the atmosphere along the equator like a billion-ton whip stretching halfway around the planet. Forget the carrier buckets, and the superconducting cables that carried electricity down to the drive train from the solar power satellite seventy thousand kilometers above us. The piece that would do the real damage would be the central, load-bearing cable itself. It was only a couple of meters across at the bottom end, but it widened steadily as it went up. Made of bonded and doped silicon whiskers, with a tensile strength of two hundred million Newtons per square centimeter, it could handle an incredible load—almost two-thirds of a billion tons at its thinnest point. When that stored energy hit that atmosphere, there was going to be a fair amount of excitement down there on the surface. Not that we'd be watching it—the loss of the power satellite would make us look at our own survival problems; and as for the Colonies, a century of development would be ended.

By the time that Larry Marston came back with Jen Hasse and Alicia Kano, I doubt if I looked any more cheerful than Arnold Velasquez down there at Tether Control. I sketched out the problem to the two newcomers; we had what looked like a hopeless situation on our hands.

“We have seventy-one hours,” I concluded. “The only question we need to answer is, what will we be doing at this end during that time? Tether Control can coordinate disaster planning for the position on Earth. Arnold has already ruled out the possibility of any actual *help* from Earth—there are no rockets there that could be ready in time.”

“What about the repair robots that you have on the cable?” asked Panosky, jumping into the conversation. “I thought they were all the way along its length.”

“They are,” said Jen Hasse. “But they're special purpose, not general purpose. We couldn't use one to look for a radioactive signal on a bucket, if that's what you're thinking of. Even if they had the right sensors for it, we'd need a week to reprogram them for the job.”

“We don't have a week,” said Alicia quietly. “We have seventy-one hours.” She was small and dark haired, and never raised her voice much above the minimum level needed to reach her audience—but I had grown to rely on her brains more than anything else on the station.

“Seventy-one hours, if we act now,” I said. “We've already agreed that we don't have time to sit here

and wait for that bucket with the bomb to arrive-the terrorists must have planned it that way.”

“I know.” Alicia did not raise her voice. “Sitting and waiting won't do it. But the total travel time of a carrier from the surface up to synchronous orbit, or back down again, is a little less than a hundred and twenty hours. That means that the bucket carrying the bomb will be at least *halfway* here in sixty hours. And a bucket that started down from here in the next few hours-”

“-would have to pass the bucket with the bomb on the way up, before the deadline,” broke in Hasse. He was already over at the control board, looking at the carrier schedule. He shook his head. “There's nothing scheduled for a passenger bucket in the next twenty-four hours. It's all cargo going down.”

“We're not looking for luxury.” I went across to look at the schedule. “There are a couple of ore buckets with heavy metals scheduled for the next three hours. They'll have plenty of space in the top of them, and they're just forty minutes apart from each other. We could squeeze somebody in one or both of them, provided they were properly suited up. It wouldn't be a picnic, sitting in suits for three days, but we could do it.”

“So how would we get at the bomb, even if we did that?” asked Larry. “It would be on the other side of the Beanstalk from us, passing at a relative velocity of six hundred kilometers an hour. We couldn't do more than wave to it as it went by, even if we knew just which bucket was carrying the bomb.”

“That's the tricky piece.” I looked at Jen Hasse. “Do you have enough control over the mass driver system to slow everything almost to a halt whenever an inbound and an outbound bucket pass each other?”

He was looking doubtful, rubbing his nose thoughtfully. “Maybe. Trouble is, I'd have to do it nearly a hundred times, if you want to slow down for every pass. And it would take me twenty minutes to stop and start each one. I don't think we have that much time. What do you have in mind?”

I went across to the model of the Beanstalk that we kept on the control room table. We often found that we could illustrate things with it in a minute that would have taken thousands of words to describe.

“Suppose we were here, starting down in a bucket,” I said. I put my hand on the model of the station, thirty-five thousand kilometers above the surface of the Earth in synchronous orbit. “And suppose that the bucket we want to get to, the one with the bomb, is here, on the way up. We put somebody in the inbound bucket, and it starts on down.”

I began to turn the drive train, so that the buckets began to move up and down along the length of the Beanstalk.

“The people in the inbound bucket carry a radiation counter,” I went on. “We'd have to put it on a long arm, so that it cleared all the other stuff on the Stalk, and reached around to get near the upbound buckets. We can do that, I'm sure-if we can't, we don't deserve to call ourselves engineers. We stop at each outbound carrier, and test for radioactivity. There should be enough of that from the fission trigger of the bomb, so that we'll easily pick up a count when we reach the right bucket. Then you, Jan, hold the drive train in the halt position. We leave the inbound bucket, swing around the Stalk, and get into the other carrier. Then we try and disarm the bomb. I've had some experience with that.”

“You mean we get out and actually *climb* around the Beanstalk?” asked Larry. He didn't sound pleased at the prospect.

“Right. It shouldn't be too bad,” I said. “We can anchor ourselves with lines to the ore bucket, so we can't fall.”

Even as I was speaking, I realized that it didn't sound too plausible. Climbing around the outside of the Beanstalk in a space suit, twenty thousand kilometers or more up, dangling on a line connected to an ore bucket-and then trying to take apart a fusion bomb wearing gloves. No wonder Larry didn't like the sound of that assignment. I wasn't surprised when Arnold Velasquez chipped in over the circuit connecting us to Tether Control.

“Sorry, Jack, but that won't work-even if you could do it. You didn't let me read the full message from the terrorists. One of their conditions is that we mustn't stop the bucket train on the Stalk in the next three days. I think they were afraid that we would reverse the direction of the buckets, and bring the bomb back down to Earth to disarm it. I guess they don't realize that the Stalk wasn't designed to run in reverse.”

“Damnation. What else do they have in that message?” I asked. “What can they do if we decide to stop the bucket drive anyway? How can they even tell that we're doing it?”

“We have to assume that they have a plant in here at Tether Control,” replied Velasquez. “After all, they managed to get a bomb onto the Stalk in spite of all our security. They say they'll explode the bomb if we make any attempt to slow up or stop the bucket train, and we simply can't afford to take the risk of doing that. We have to assume they can monitor what's going on with the Stalk drive train.”

There was a long, dismal silence, which Alicia finally broke.

“So that seems to leave us with only one alternative,” she said thoughtfully. Then she grimaced and pouted her mouth. “It's a two-bucket operation, and I don't even like to think about it-even though I had a grandmother who was a circus trapeze artiste.”

She was leading in to something, and it wasn't like her to make a big buildup.

“That bad, eh?” I said.

“That bad, if we're lucky,” she said. “If we're unlucky, I guess we'd all be dead in a month or two anyway, as the recycling runs down. For this to work, we need a good way of dissipating a lot of kinetic energy-something like a damped mechanical spring would do it. And we need a good way of sticking to the side of the Beanstalk. Then, we use *two* ore buckets-forty minutes apart would be all right-like this...”

She went over to the model of the Beanstalk. We watched her with mounting uneasiness as she outlined her idea. It sounded crazy. The only trouble was, it was that or nothing. Making choices in those circumstances is not difficult.

* * * *

One good thing about space maintenance work-you develop versatility. If you can't wait to locate something down on Earth, then waste another week or so to have it shipped up to you, you get into the habit of making it for yourself. In an hour or so, we had a sensitive detector ready, welded on to a long extensible arm on the side of a bucket. When it was deployed, it would reach clear around the Beanstalk, missing all the drive train and repair station fittings, and hang in close to the out-bound buckets. Jen had fitted it with a gadget that moved the detector rapidly upward at the moment of closest approach of an upbound carrier, to increase the length of time available for getting a measurement of radioactivity. He swore that it would work on the fly, and have a better than 99 percent chance of telling us which outbound bucket contained the bomb-even with a relative fly-by speed of six hundred kilometers an hour.

I didn't have time to argue the point, and in any case Jen was the expert. I also couldn't dispute his claim

that he was easily the best-qualified person to operate the gadget. He and Larry Marston, both fully suited up, climbed into the ore bucket. We had to leave the ore in there, because the mass balance between ingoing and outbound buckets was closely calculated to give good stability to the Beanstalk. It made for a lumpy seat, but no one complained. Alicia and I watched as the bucket was moved into the feeder system, accelerated up to the correct speed, attached to the drive train, and dropped rapidly out of sight down the side of the Beanstalk.

“That’s the easy part,” she said. “They drop with the bucket, checking the upbound ones as they come by for radioactivity, and that’s all they have to do.”

“Unless they can’t detect any signal,” I said. “Then the bomb goes off, and they have the world’s biggest roller coaster ride. Twenty thousand kilometers of it, with the big thrill at the end.”

“They’d never reach the surface,” replied Alicia absentmindedly. “They’ll frizzle up in the atmosphere long before they get there. Or maybe they won’t. I wonder what the terminal velocity would be if you hung on to the Stalk cable?”

As she spoke, she was calmly examining an odd device that had been produced with impossible haste in the machine shop on the station’s outer rim. It looked like an old-fashioned parachute harness, but instead of the main chute the lines led to a wheel about a meter across. From the opposite edge of the wheel, a doped silicon rope led to a hefty magnetic grapnel. Another similar arrangement was by her side.

“Here,” she said to me. “Get yours on over your suit, and let’s make sure we both know how to handle them. If you miss with the grapnel, it’ll be messy.”

I looked at my watch. “We don’t have time for any dry run. In the next fifteen minutes we have to get our suits on, over to the ore buckets, and into these harnesses. Anyway, I don’t think rehearsals here inside the station mean too much when we get to the real thing.”

We looked at each other for a moment, then began to suit up. It’s not easy to estimate odds for something that has never been done before, but I didn’t give us more than one chance in a hundred of coming out of it safely. Suits and harnesses on, we went and sat without speaking in the ore bucket.

I saw that we were sitting on a high-value shipment—silver and platinum, from one of the belt mining operations. It wasn’t comfortable, but we were certainly traveling in expensive company. Was it King Midas who complained that a golden throne is not right for restful sitting?

No matter what the final outcome, we were in for an unpleasant trip. Our suits had barely enough capacity for a six-day journey. They had no recycling capacity, and if we had to go all the way to the halfway point we would be descending for almost sixty hours. We had used up three hours to the deadline, getting ready to go, so that would leave us only nine hours to do something about the bomb when we reached it. I suppose that it was just as bad or worse for Hasse and Marston. After they’d done their bit with the detector, there wasn’t a thing they could do except sit in their bucket and wait, either for a message from us or an explosion far above them.

“Everything all right down there, Larry?” I asked, testing the radio link with them for the umpteenth time.

“Can’t tell.” He sounded strained. “We’ve passed three buckets so far, outbound ones, and we’ve had no signal from the detector. I guess that’s as planned, but it would be nice to know it’s working all right.”

“You shouldn’t expect anything for at least thirty-six hours,” said Alicia.

“I know that. But it's impossible for us *not* to look at the detector whenever we pass an outbound bucket. Logically, we should be sleeping now and saving our attention for the most likely time of encounter-but neither one of us seems able to do it.”

“Don't assume that the terrorists are all that logical, either,” I said. “Remember, we are the ones who decided that they must have started the bomb on its way only a few hours ago. It's possible they put it into a bucket three or four days ago, and made up the deadline for some other reason. We think we can disarm that bomb, but they may not agree-and they may be right. All we may manage to do is advance the time of the explosion when we try and open up the casing.”

As I spoke, I felt our bucket begin to accelerate. We were heading along the feeder and approaching the bucket drive train. After a few seconds we were outside the station, dropping down the Beanstalk after Jen and Larry.

We sat there in silence for a while. I'd been up and down the Stalk many times, and so had Alicia, but always in passenger modules. The psychologists had decided that people rode those a lot better when they were windowless. The cargo bucket had no windows either, but we had left the hatch open to simplify communications with the other bucket and to enable us to climb out if and when the time came. We would have to close it when we were outside, or the aerodynamic pressures would spoil bucket stability when it finally entered the atmosphere-three hundred kilometers an hour isn't that fast, but it's a respectable speed for travel at full atmospheric pressure.

Our bucket was about four meters wide and three deep. It carried a load of seven hundred tons, so our extra mass was negligible. I stood at its edge and looked up, then down. The psychologists were quite right. Windows were a bad idea.

Above us, the Beanstalk rose up and up, occulting the backdrop of stars. It went past the synchronous station, which was still clearly visible as a blob on the stalk, then went on further up, invisible, to the solar power satellite and the great ballast weight, a hundred and five thousand kilometers above the surface of the Earth. On the Stalk itself I could see the shielded superconductors that ran its full length, from the power satellite down to Tether Control in Quito. We were falling steadily, our rate precisely controlled by the linear synchronous motors that set the accelerations through pulsed magnetic fields. The power for that was drawn from the same superconducting cables. In the event of an electrical power failure, the buckets were designed to “freeze” to the side of the Stalk with mechanical coupling. We had to build the system that way, because about once a year we had some kind of power interruption-usually from small meteorites, not big enough to trigger the main detector system, but large enough to penetrate the shields and mess up the power transmission.

It was looking down, though, that produced the real effect. I felt my heart begin to pump harder, and I was gripping at the side of the bucket with my space suit gloves. When you are in a rocket-propelled ship, you don't get any real feeling of height. Earth is another part of the universe, something independent of you. But from our position, moving along the side of the Beanstalk, I had quite a different feeling. We were *connected* to the planet. I could see the Stalk, dwindling smaller and smaller down to the Earth below. I had a very clear feeling that I could fall all the way down it, down to the big blue-white globe at its foot. Although I had lived up at the station quite happily for over five years, I suddenly began to worry about the strength of the main cable. It was a ridiculous concern. There was a safety factor of ten built into its design, far more than a rational engineer would use for anything. It was more likely that the bottom would fall out of our ore bucket, than that the support cable for the Beanstalk would break. I was kicking myself for my illogical fears, until I noticed Alicia also peering out at the Beanstalk, as though trying to see past the clutter of equipment there to the cable itself. I wasn't the only one thinking wild thoughts.

“You certainly get a different look at things from here,” I said, trying to change the mood. “Did you ever

see anything like that before?”

She shook her head ponderously—the suits weren't made for agility of movement.

“Not up here, I haven't,” she replied. “But I once went up to the top of the towers of the Golden Gate Bridge in San Francisco, and looked at the support cables for that. It was the same sort of feeling. I began to wonder if they could take the strain. That was just for a bridge, not even a big one. What will happen if we don't make it, and they blow up the Beanstalk?”

I shrugged inside my suit, then realized that she couldn't see the movement. “This is the only bridge to space that we've got. We'll be out of the bridge business and back in the ferryboat business. They'll have to start sending stuff up by rockets again. Shipments won't be a thousandth of what they are now, until another Stalk can be built. That will take thirty years, starting without this one to help us—even if the Colonies survive all right and work on nothing else. We don't have to worry about that, though. We won't be there to hassle with it.”

She nodded. “We were in such a hurry to get away it never occurred to me that we'd be sitting here for a couple of days with nothing to do but worry. Any ideas?”

“Yes. While you were making the reel and grapnel, I thought about that. The only thing that's worth our attention right now is a better understanding of the geometry of the Stalk. We need to know exactly where to position ourselves, where we'll set the grapnels, and what our dynamics will be as we move. I've asked Ricardo to send us schematics and layouts over the suit videos. He's picking out ones that show the drive train, the placing of the superconductors, and the unmanned repair stations. I've also asked him to deactivate all the repair robots. It's better for us to risk a failure on the maintenance side than have one of the monitoring robots wandering along the Stalk and mixing in with what we're trying to do.”

“I heard what you said to Panosky, but it still seems to me that the robots ought to be useful.”

“I'd hoped so, too. I checked again with Jen, and he agrees we'd have to reprogram them, and we don't have the time for it. It would take weeks. Jen said having them around would be like taking along a half-trained dog, bumbling about while we work. Forget that one.”

As we talked, we kept our eyes open for the outbound buckets, passing us on the other side of the Beanstalk. We were only about ten meters from them at closest approach and they seemed to hurtle past us at an impossible speed. The idea of hitching on to one of them began to seem more and more preposterous. We settled down to look in more detail at the configuration of cables, drive train, repair stations and buckets that was being flashed to us over the suit videos.

It was a weary time, an awful combination of boredom and tension. The video images were good, but there is a limit to what you can learn from diagrams and simulations. About once an hour, Jen Hasse and Larry Marston called in from the lower bucket beneath us, reporting on the news-or lack of it-regarding the bomb detection efforts. A message relayed from Panosky at Tether Control reported no progress in negotiations with the terrorists. The fanatics simply didn't believe their terms couldn't be met. That was proof of their naivete, but didn't make them any less dangerous.

It was impossible to get comfortable in our suits. The ore buckets had never been designed for a human occupant, and we couldn't find a level spot to stretch out. Alicia and I passed into a half-awake trance, still watching the images that flashed onto the suit videos, but not taking in much of anything. Given that we couldn't sleep, we were probably in the closest thing we could get to a resting state. I hoped that Jen and Larry would keep their attention up, watching an endless succession of buckets flash past them and checking each one for radioactivity count.

The break came after fifty-four hours in the bucket. We didn't need to hear the details from the carrier below us to know they had it-Larry's voice crackled with excitement.

"Got it," he said. "Jen picked up a strong signal from the bucket we just passed. If you leave the ore carrier within thirty-four seconds, you'll have thirty-eight minutes to get ready for it to come past you. It will be the second one to reach you. For God's sake don't try for the wrong one."

There was a pause, then Larry said something I would never have expected from him. "We'll lose radio contact with you in a while, as we move farther along the Stalk. Good luck, both of you-and look after him, Alicia."

I didn't have time to think that one through-but shouldn't he be telling *me* to look after *her*? It was no time for puzzling. We were up on top of our bucket in a second, adrenaline moving through our veins like an electric current. The cable was whipping past us at a great rate; the idea of forsaking the relative safety of the ore bucket for the naked wall of the Beanstalk seemed like insanity. We watched as one of the repair stations, sticking out from the cable into open space, flashed past.

"There'll be another one of those coming by in thirty-five seconds," I said. "We've got to get the grapnels onto it, and we'll be casting blind. I'll throw first, and you follow a second later. Don't panic if I miss-remember, we only have to get one good hook there."

"Count us down, Jack," said Alicia. She wasn't one to waste words in a tight spot.

I pressed the digital readout in my suit, and watched the count move from thirty-five down to zero.

"Countdown display on channel six," I said, and picked up the rope and grapnel. I looked doubtfully at the wheel that was set in the middle of the thin rope, then even looked suspiciously at the rope itself, wondering if it would take the strain. That shows how the brain works in a crisis-that rope would have held a herd of elephants with no trouble at all.

I cast the grapnel as the count touched to zero, and Alicia threw a fraction later. Both ropes were spliced onto both suits, so it was never clear which grapnel took hold. Our bucket continued to drop rapidly toward Earth, but we were jerked off the top of it and went zipping on downward fractionally slower as the friction reel in the middle of the rope unwound, slowing our motion.

We came to a halt about fifty meters down the Beanstalk from the grapnel, after a rough ride in which our deceleration must have averaged over seven g's. Without that reel to slow us down gradually, the jerk of the grapnel as it caught the repair station wall would have snapped our spines when we were lifted from the ore bucket.

We hung there, swinging free, suspended from the wall of the Stalk. As the reel began to take up the line that had been paid out, I made the mistake of looking down. We dangled over an awful void, with nothing between us and that vast drop to the Earth below but the thin line above us. When we came closer to the point of attachment to the Beanstalk wall, I saw just how lucky we had been. One grapnel had missed completely, and the second one had caught the very lip of the repair station platform. Another foot to the left and we would have missed it altogether.

We clawed our way up to the station rim-easy enough to do, because the gravity at that height was only a fraction of a g, less than a tenth. But a fall from there would be inexorable, and we would have fallen away from the Beanstalk, with no chance to reconnect to it. Working together, we freed the grapnel and readied both lines and grapnels for reuse. After that there was nothing to do but cling to the side of the Beanstalk, watch the sweep of the heavens above us, and wait for the outbound ore buckets to come past us.

The first one came by after seventeen minutes. I had the clock readout to prove it, otherwise I would have solemnly sworn that we had waited there for more than an hour, holding to our precarious perch. Alicia seemed more at home there than I was. I watched her moving the grapnel to the best position for casting it, then settle down patiently to wait.

It is hard to describe my own feelings in that period. I watched the movement of the stars above us, in their great circle, and wondered if we would be alive in another twenty minutes. I felt a strong communion with the old sailors of Earth's seas, up in their crow's nest in a howling gale, sensing nothing but darkness, high-blown spindrift, perilous breakers ahead, and the dipping, rolling stars above.

Alicia kept her gaze steadily downward, something that I found hard to do. She had inherited a good head for heights from her circus-performer grandmother.

"I can see it," she said at last. "All ready for a repeat performance?"

"Right." I swung the grapnel experimentally. "Since we can see it this time, we may as well throw together."

I concentrated on the bucket sweeping steadily up toward us, trying to estimate the distance and the time that it would take before it reached us. We both drew back our arms at the same moment and lobbed the grapnels toward the center of the bucket.

It came past us with a monstrous, silent rush. Again we felt the fierce accelerations as we were jerked away from the Beanstalk wall and shot upward after the carrier. Again, I realized that we couldn't have done it without Alicia's friction reel, smoothing the motion for us. This time, it was more dangerous than when we had left the downbound bucket. Instead of trying to reach the stationary wall of the Stalk, we were now hooked on to the moving bucket. We swung wildly beneath it in its upward flight, narrowly missing contact with elements of the drive train, and then with another repair station that flashed past a couple of meters to our right.

Finally, somehow, we damped our motion, reeled in the line, slid back the cover to the ore bucket and fell safely forward inside it. I was completely drained. It must have been all nervous stress—we hadn't expended a significant amount of physical energy. I know that Alicia felt the same way as I did, because after we plumped over the rim of the carrier we both fell to the floor and lay there without speaking for several minutes. It gives some idea of our state of mind when I say that the bucket we had reached, with a four-megaton bomb inside it that might go off at any moment, seemed like a haven of safety.

We finally found the energy to get up and look around us. The bucket was loaded with manufactured goods, and I thought for a sickening moment that the bomb was not there. We found it after five minutes of frantic searching. It was a compact blue cylinder, a meter long and fifty centimeters wide, and it had been cold-welded to the wall of the bucket. I knew the design.

"There it is," I said to Alicia. Then I didn't know what to say next. It was the most advanced design, not the big, old one that I had been hoping for.

"Can you disarm it?" asked Alicia.

"In principle. There's only one problem. I know how it's put together—but I'll never be able to get it apart wearing a suit. The fingerwork I'd need is just too fine for gloves. We seem to be no better off than we were before."

We sat there side by side, looking at the bomb. The irony of the situation was sinking in. We had reached it, just as we hoped we could. Now, it seemed we might as well have been still back in the station.

“Any chance that we could get it free and dump it overboard?” asked Alicia. “You know, just chuck the thing away from the bucket.”

I shook my head, aware again of how much my suit impeded freedom of movement. “It’s spot welded. We couldn’t shift it. Anyway, free fall from here would give it an impact orbit, and a lot of people might be killed if it went off inside the atmosphere. If we were five thousand kilometers higher, perigee would be at a safe height above the surface-but we can’t afford to wait for another sixteen hours until the bucket gets up that high. Look, I’ve got another idea, but it will mean that we’ll lose radio contact with the station.”

“So what?” said Alicia. Her voice was weary. “There’s not a thing they can do to help us anyway.”

“They’ll go out of their minds with worry down on Earth, if they don’t know what’s happening here.”

“I don’t see why we should keep all of it for ourselves. What’s your idea, Jack?”

“All right.” I summoned my reserves of energy. “We’re in vacuum now, but this bucket would be airtight if we were to close the top hatch again. I have enough air in my suit to make a breathable atmosphere in this enclosed space, at least for long enough to let me have a go at the bomb. We’ve got nearly twelve hours to the deadline, and if I can’t disarm it in that time I can’t do it at all.”

Alicia looked at her air reserve indicator and nodded. “I can spare you some air, too, if I open up my suit.”

“No. We daren’t do that. We have one other big problem-the temperature. It’s going to feel really cold in here, once I’m outside my suit. I’ll put my heaters on to maximum, and leave the suit open, but I’m still not sure I can get much done before I begin to freeze up. If I begin to lose feeling in my fingers, I’ll need your help to get me back inside. So you have to stay in your suit. Once I’m warmed up, I can try again.”

She was silent for a few moments, repeating the calculations that I had just done myself.

“You’ll only have enough air to try it twice,” she said at last. “If you can’t do it in one shot, you’ll have to let me have a go. You can direct me on what has to be done.”

There was no point in hanging around. We sent a brief message to the station, telling them what we were going to do, then closed the hatch and began to bleed air out of my suit and into the interior of the bucket. We used the light from Alicia’s suit, which had ample power to last for several days.

When the air pressure inside the bucket was high enough for me to breathe, I peeled out of my suit. It was as cold as charity in that metal box, but I ignored that and crouched down alongside the bomb in my underwear and bare feet.

I had eleven hours at the most. Inside my head, I fancied that I could hear a clock ticking. That must have been only my fancy. Modern bombs have no place for clockwork timers.

By placing my suit directly beneath my hands, I found that I could get enough heat from the thermal units to let me keep on working without a break. The clock inside my head went on ticking, also without a break.

On and on and on.

* * * *

They say that I was delirious when we reached the station. That’s the only way the press could reconcile

my status as public hero with the things that I said to the president when he called up to congratulate us.

I suppose I could claim delirium if I wanted to—five days without sleep, two without food, oxygen starvation, and frostbite of the toes and ears, that might add up to delirium. I had received enough warmth from the suit to keep my hands going, because it was very close to them, but that had been at the expense of some of my other extremities. If it hadn't been for Alicia, cramming me somehow back into the suit after I had disarmed the bomb, I would have frozen to death in a couple of hours.

As it was, I smelled ripe and revolting when they unpacked us from the bucket and winkled me out of my suit—Alicia hadn't been able to reconnect me with the plumbing arrangements.

So I told the president that the World Congress was composed of a giggling bunch of witless turds, who couldn't sense a global need for more bridges to space if a Beanstalk were pushed up their backsides—which was where I thought they kept their brains. Not quite the speech that we used to get from the old-time returning astronauts, but I must admit it's one that I'd wanted to give for some time. The audience was there this time, with the whole world hanging on my words over live TV.

We've finally started construction on the second Beanstalk. I don't know if my words had anything to do with it, but there was a lot of public pressure after I said my piece, and I like to think that I had some effect.

And me? I'm designing the third Beanstalk; what else? But I don't think I'll hold my breath waiting for a congressional vote of thanks for my efforts saving the first one.

About the Author

Charles Sheffield (1935-) is a mathematician and physicist who has over ninety short stories, over a hundred technical papers, and thirty-one books. His fiction, which is mostly hard science fiction, has won major awards. He is Chief Scientist and Board Member of Earth Satellite Corporation, a Past-President of the Science Fiction Writers of America, and a Fellow and Past-President of the American Astronautical Society. Among his most recent novels are *Summertide* (1990), *Divergence* (1991), and *Transcendence* (1992) (the "Heritage Universe" series), *Cold as Ice* (1992), and *The Ganymede Club* (1995).