

THE DEPARTMENT heads stared at the satellite image on the projection screen.

“Jesus,” Mitch said. “What the hell happened?”

“The rover’s on its side,” Mindy said, pointing to the screen. “The trailer’s upside down. Those rectangles scattered around are solar cells.”

Venkat put a hand on his chin. “Do we have any information on the state of the rover pressure vessel?”

“Nothing obvious,” Mindy said.

“Any signs of Watney doing something after the accident? An EVA maybe?”

“No EVA,” Mindy said. “The weather’s clear. If he’d come out, there’d be visible footsteps.”

“Is this the entire crash site?” Bruce Ng asked.

“I think so,” Mindy said. “Up toward the top of the photo, which is north, there are ordinary wheel tracks. Right here,” she pointed to a large disturbance in the soil, “is where I think things went wrong. Judging by where that ditch is, I’d say the rover rolled and slid from there. You can see the trench it left behind. The trailer flipped forward onto its roof.”

“I’m not saying everything’s okay,” Bruce said, “but I don’t think it’s as bad as it looks.”

“Go on,” Venkat said.

“The rover’s designed to handle a roll,” Bruce explained. “And if there’d been pressure loss, there’d be a starburst pattern in the sand. I don’t see anything like that.”

“Watney may still be hurt inside,” Mitch said. “He could have banged his head or broken an arm or something.”

“Sure,” Bruce said. “I’m just saying the rover is probably okay.”

“When was this taken?”

Mindy checked her watch. “We got it seventeen minutes ago. We’ll get another pic in nine minutes when MGS4’s orbit brings it into view.”

“First thing he’ll do is an EVA to assess damage,” Venkat said. “Mindy, keep us posted on any changes.”

LOG ENTRY: SOL 498

Hmm.

Yeah.

Things didn’t go well on the descent into Schiaparelli Basin. To give you some indication of how unwell they went, I’m reaching up to the computer to type this. Because it’s still mounted near the control panel, and the rover is on its side.

I got bounced around a lot, but I’m a well-honed machine in times of crisis. As soon as the rover toppled, I curled into a ball and cowered. That’s the kind of action hero I am.

It worked, too. ’Cause I’m not hurt.

The pressure vessel is intact, so that’s a plus. The valves that lead to the trailer hoses are shut. Probably means the hoses disconnected. And that means the trailer junction snapped. Wonderful.

Looking around the interior here, I don’t think anything is broken. The water tanks stayed sealed. There aren’t any visible leaks in the air tanks. The bedroom came unfolded, and it’s all over the place, but it’s just canvas, so it can’t have gotten too hurt.

The driving controls are okay, and the nav computer is telling me the rover is at an “unacceptably dangerous tilt.” Thanks, Nav!

So I rolled. That's not the end of the world. I'm alive and the rover's fine. I'm more worried about the solar cells I probably rolled over. Also, since the trailer detached, there's a good chance it's fucked up, too. The balloon roof it has isn't exactly durable. If it popped, the shit inside will have been flung out in all directions and I'll have to go find it. That's my critical life support.

Speaking of life support, the rover switched over to the local tanks when the valves shut. Good boy, Rover! Here's a Scooby Snack.

I've got twenty liters of oxygen (enough to keep me breathing for forty days), but without the regulator (which is in the trailer) I'm back to chemical CO<sub>2</sub> absorption. I have 312 hours of filters left. Plus I have another 171 hours of EVA suit CO<sub>2</sub> filters as well. All told, that gives me 483 hours, which is close to twenty sols. So I have time to get things working again.

I'm really damn close to the MAV now. About 220 kilometers. I'm not going to let something like this stop me from getting there. And I don't need everything to work at top form anymore. I just need the rover to work for 220 more kilometers and the life support to work for fifty-one more sols. That's it.

Time to suit up and look for the trailer.

LOG ENTRY: SOL 498 (2)

I had an EVA and things aren't too bad. Mind you, they're not good.

I trashed three solar cells. They're under the rover and cracked all to hell. They might still be able to piss out a few watts, but I'm not holding out much hope. Luckily, I did come into this with one extra solar cell. I needed twenty-eight for my daily operations and I brought twenty-nine (fourteen on the rover's roof, seven on the trailer's roof, and eight on the makeshift shelves I installed on the sides of both vehicles).

I tried pushing the rover over, but I wasn't strong enough. I'll need to rig something to get a leverage advantage. Other than being on its side, I don't see any real problems.

Well, that's not true. The tow hook is ruined beyond repair. Half of it ripped clean off. Fortunately, the trailer also has a tow hook, so I have a spare.

The trailer's in a precarious situation. It's upside down and sitting on the inflated roof. I'm not sure which god smiled down on me and kept that balloon from popping, but I'm grateful. My first priority will be righting it. The longer it puts weight on that balloon, the larger the chances it'll pop.

While I was out, I collected the twenty-six solar cells that aren't under the rover and set them up to recharge my batteries. May as well, right?

So right now, I have a few problems to tackle: First, I need to right the trailer. Or at least get the weight off the balloon. Next, I need to right the rover. Finally, I need to replace the rover's tow hook with the one on the trailer.

Also, I should spell out a message for NASA. They're probably worried.

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MINDY READ the Morse code aloud. "ROLLED. FIXING NOW."

"What? That's it?" Venkat said over the phone.

"That's all he said," she reported, cradling the phone as she typed out an e-mail to the list of interested parties.

"Just three words? Nothing about his physical health? His equipment? His supplies?"

"You got me," she said. "He left a detailed status report. I just decided to lie for no reason."

"Funny," Venkat said. "Be a smart-ass to a guy seven levels above you at your company. See how that works out."

“Oh no,” Mindy said. “I might lose my job as an interplanetary voyeur? I guess I’d have to use my master’s degree for something else.”

“I remember when you were shy.”

“I’m space paparazzi now. The attitude comes with the job.”

“Yeah, yeah,” Venkat said. “Just send the e-mail.”

“Already sent.”

LOG ENTRY: SOL 499

I had a busy day today, and I got a lot done.

I started out pretty sore. I had to sleep on the wall of the rover. The bedroom won’t work when the airlock is facing up. I did get to use the bedroom, somewhat. I folded it up and used it as a bed.

Anyway, suffice it to say, the wall of the rover wasn’t made for sleeping on. But after a morning potato and Vicodin, I was feeling much better.

At first I figured my top priority was the trailer. Then I changed my mind. After taking a good look at it, I decided I’d never be able to right it by myself. I’d need the rover.

So today was focused on getting the rover righted.

I brought all my tools along on this trip, figuring I’d need them for the MAV modifications. And along with them I brought cabling. Once I get set up at the MAV, my solar cells and batteries will be in a fixed position. I don’t want to move the rover around every time I use a drill on the far side of the MAV. So I brought all the electrical cabling I could fit.

Good thing, too. Because it doubles as rope.

I dug up my longest cable. It’s the same one I used to power the drill that destroyed *Pathfinder*. I call it my “lucky cable.”

I plugged one end into the battery and the other into the infamous sample drill, then walked off with the drill to find solid ground. Once I found it, I kept going until I’d gone as far

as the electrical line would reach. I drove a one-meter bit half a meter into a rock, unplugged the power line, and tied it around the base of the bit.

Then I went back to the rover and tied off the cord to the roof-rack bar on the high side. Now I had a long, taut line running perpendicular to the rover.

I walked to the middle of the cord and pulled it laterally. The leverage advantage on the rover was huge. I only hoped it wouldn't break the drill bit before it tipped the rover.

I backed away, pulling the line more and more. Something had to give, and it wasn't going to be me. I had Archimedes on my side. The rover finally tipped.

It fell onto its wheels, kicking up a large cloud of soft dust. It was a silent affair. I was far enough away that the thin atmosphere had no hope of carrying the sound to me.

I untied the power line, liberated the drill bit, and returned to the rover. I gave it a full system's check. That's a boring-as-hell task, but I had to do it.

Every system and subsystem was working correctly. JPL did a damn good job making these rovers. If I get back to Earth, I'm buying Bruce Ng a beer. Though I guess I should buy all the JPL guys a beer.

Beers for everyone if I get back to Earth.

Anyway, with the rover back on its wheels it was time to work on the trailer. Problem is, I ran out of daylight. Remember, I'm in a crater.

I had gotten most of the way down the Ramp when I rolled the rover. And the Ramp is up against the western edge of the crater. So the sun sets really early from my point of view. I'm in the shadow of the western wall. And that royally sucks.

Mars is not Earth. It doesn't have a thick atmosphere to bend light and carry particles that reflect light around corners. It's damn near a vacuum here. Once the sun isn't visible, I'm in the dark. Phobos gives me some moonlight, but not enough

to work with. Deimos is a little piece of crap that's no good to anyone.

I hate to leave the trailer sitting on its balloon for another night, but there's not much else I can do. I figure it's survived a whole day like that. It's probably stable for now.

And hey, with the rover righted, I get to use the bedroom again! It's the simple things in life that matter.

LOG ENTRY: SOL 500

When I woke up this morning, the trailer hadn't popped yet. So that was a good start.

The trailer was a bigger challenge than the rover. I only had to tip the rover. I'd need to completely flip the trailer. That requires a lot more force than yesterday's little leverage trick.

The first step was to drive the rover to near the trailer. Then came the digging.

Oh God, the digging.

The trailer was upside down, with its nose pointed downhill. I decided the best way to right it was to take advantage of the slope and roll the trailer over its nose. Basically to make it do a somersault to land on its wheels.

I can make this happen by tying off the cable to the rear of the trailer and towing with the rover. But if I tried that without digging a hole first, the trailer would just slide along the ground. I needed it to tip up. I needed a hole for the nose to fall into.

So I dug a hole. A hole one meter across, three meters wide, and one meter deep. It took me four miserable hours of hard labor, but I got it done.

I hopped in the rover and drove it downhill, dragging the trailer with me. As I'd hoped, the trailer nosed into the hole and tipped up. From there, it fell onto its wheels with a huge plume of dust.

Then I sat for a moment, dumbstruck that my plan had actually worked.

And now I'm out of daylight again. I can't wait to get out of this damn shadow. All I need is one day of driving toward the MAV and I'll be away from the wall. But for now it's another early night.

I'll spend tonight without the trailer to manage my life support. It may be righted, but I have no idea if the shit inside still works. The rover still has ample supplies for me.

I'll spend the rest of the evening enjoying a potato. And by "enjoying" I mean "hating so much I want to kill people."

#### LOG ENTRY: SOL 501

I started the day with some nothin' tea. Nothin' tea is easy to make. First, get some hot water, then add nothin'. I experimented with potato skin tea a few weeks ago. The less said about that the better.

I ventured into the trailer today. Not an easy task. It's pretty cramped in there; I had to leave my EVA suit in the airlock.

The first thing I noticed was that it was really hot inside. It took me a few minutes to work out why.

The atmospheric regulator was still in perfect working order, but it had nothing to do. Without being connected to the rover, it no longer had my CO<sub>2</sub> production to deal with. The atmosphere in the trailer was perfect—why change anything?

With no regulation necessary, the air was not being pumped out to the AREC for freeze-separation. And thus it wasn't coming back in as a liquid in need of heating.

But remember, the RTG gives off heat all the time. You can't stop it. So the heat just built up. Eventually, things reached a balance point where the heat bled through the hull as fast as the RTG could add it. If you're curious, that balance point was a sweltering 41°C.



I did a full diagnostic on the regulator and the oxygenator, and I'm happy to report both are working perfectly.

The RTG's water tank was empty, which is no surprise. It has an open top, not intended to be turned upside down. The floor of the trailer has a lot of puddled water that took me quite a while to sop up with my jumpsuit. I topped the tank off with some more water from a sealed container that I'd stored in the trailer earlier. Remember, I need that water to have something for the returning air to bubble through. That's my heating system.

But all things considered, it was good news. The critical components are working fine, and both vehicles are back on their wheels.

The hoses that connected the rover and trailer were designed well, and released without breaking. I simply snapped them back into place and the vehicles were sharing life support again.

The one remaining thing to fix was the tow hook. It was absolutely ruined. It took the full force of the crash. But as I suspected, the trailer's tow hook was unscathed. So I transferred it to the rover and reconnected the two vehicles for travel.

All told, that little fender bender cost me four sols. But now I'm back in action!

Sort of.

What if I run into another powder pit? I got lucky this time. Next time I might not get off so easy. I need a way to know if the ground in front of me is safe. At least for the duration of my time on the Ramp. Once I'm in the Schiaparelli Basin proper, I can count on the normal sandy terrain I'm used to.

If I could have anything, it would be a radio to ask NASA the safe path down the Ramp. Well, if I could have *anything*, it would be for the green-skinned yet beautiful Queen of Mars to rescue me so she can learn more about this Earth thing called "lovemaking."

It's been a long time since I've seen a woman. Just sayin'.

Anyway, to ensure I don't crash again, I'll— Seriously...no women in like, years. I don't ask for much. Believe me, even back on Earth a botanist/mechanical engineer doesn't exactly have ladies lined up at the door. But still, c'mon.

Anyway. I'll drive slower. Like...a crawl. That should give me enough time to react if one wheel starts to sink. Also, the lower speed will give me more torque, making it less likely I'll lose traction.

Up till now I've been driving 25 kph, so I'm going to cut that to 5 kph. I'm still toward the top of the Ramp, but the whole thing is only 45 kilometers. I can take my time and get safely to the bottom in about eight hours.

I'll do it tomorrow. I'm already out of daylight again today. That's another bonus: Once I clear the ramp, I can start beelining toward the MAV, which will take me away from the crater wall. I'll be back to enjoying the entire day's sunlight instead of just half of it.

If I get back to Earth, I'll be famous, right? A fearless astronaut who beat all the odds, right? I bet women like that.

More motivation to stay alive.

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"SO, IT looks like he's fixed everything," Mindy explained. "And his message today was 'ALL BETTER NOW,' so I guess he's got everything working."

She surveyed the smiling faces in the meeting room.

"Awesome," Mitch said.

"Great news." Bruce's voice came in through the speakerphone.

Venkat leaned forward to the phone. "How are the MAV modification plans coming, Bruce? Is JPL going to have that procedure soon?"

“We’re working around the clock on it,” Bruce said. “We’re past most of the big hurdles. Working out the details now.”

“Good, good,” Venkat said. “Any surprises I should know about?”

“Um...,” Bruce said. “Yeah, a few. This might not be the best venue for it. I’ll be back in Houston with the procedure in a day or two. We can go through it then.”

“Ominous,” Venkat said. “But okay, we’ll pick it up later.”

“Can I spread the word?” Annie asked. “It’d be nice to see something other than the rover crash site on the news tonight.”

“Definitely,” Venkat said. “It’ll be nice to have some good news for a change. Mindy, how long until he gets to the MAV?”

“At his usual rate of 90 kilometers per sol,” Mindy said, “he should get there on Sol 504. Sol 505 if he takes his time. He always drives in the early morning, finishing around noon.” She checked an application on her laptop. “Noon on Sol 504 will be 11:41 a.m. this Wednesday here in Houston. Noon on Sol 505 will be 12:21 p.m. on Thursday.”

“Mitch, who’s handling Ares 4 MAV communications?”

“The Ares 3 Mission Control team,” Mitch replied. “It’ll be in Control Room 2.”

“I assume you’ll be there?”

“Bet your ass I’ll be there.”

“So will I.”

#### LOG ENTRY: SOL 502

Every Thanksgiving, my family used to drive from Chicago to Sandusky, an eight-hour drive. It’s where Mom’s sister lived. Dad always drove, and he was the slowest, most cautious driver who ever took the wheel.

Seriously. He drove like he was taking a driver’s test. Never exceeded the speed limit, always had his hands at ten and two,

adjusted mirrors before each outing, you name it.

It was infuriating. We'd be on the freeway, cars blowing by left and right. Some of them would blare their horns because, honestly, driving the speed limit makes you a road hazard. I wanted to get out and push.

I felt that way all damn day today. Five kph is literally a walking pace. And I drove that speed for eight hours.

But the slow speed ensured that I wouldn't fall into any more powder pits along the way. And of course I didn't encounter any. I could have driven full speed and had no problems. But better safe than sorry.

The good news is I'm off the Ramp. I camped out as soon as the terrain flattened out. I've already overdone my driving time for the day. I could go further, I still have 15 percent battery power or so, but I want to get as much daylight on my solar cells as I can.

I'm in the Schiaparelli Basin at last! Far from the crater wall, too. I get a full day of sunlight every day from now on.

I decided it was time for a very special occasion. I ate the meal pack labeled "Survived Something That Should Have Killed Me." Oh my god, I forgot how good real food tastes.

With luck, I'll get to eat "Arrival" in a few sols.

#### LOG ENTRY: SOL 503

I didn't get as much recharge as I usually would yesterday. Because of my extended driving time, I only got up to 70 percent before night fell. So today's driving was abbreviated.

I got 63 kilometers before I had to camp out again. But I don't even mind. Because I'm only 148 kilometers from the MAV. That means I'll get there the sol after tomorrow.

Holy hell, I'm really going to make it!

#### LOG ENTRY: SOL 504

Holy shit, this is awesome! Holy shit! Holy shit!

Okay calm. Calm.

I made 90 kilometers today. By my estimate, I'm 50 kilometers from the MAV. I should get there sometime tomorrow. I'm excited about that, but here's what I'm really stoked about: I caught a blip from the MAV!

NASA has the MAV broadcasting the Ares 3 Hab homing signal. Why wouldn't they? It makes perfect sense. The MAV is a sleek, perfectly functional machine, ready to do what it's told. And they have it pretending to be the Ares 3 Hab, so my rover will see the signal and tell me where it is.

That is an *exceptionally* good idea! I won't have to wander around looking for the thing. I'm going straight to it.

I only caught a blip. I'll get more as I get closer. It's strange to think that a sand dune will stop me from hearing what the MAV has to say when it can talk to Earth no problem. The MAV has three redundant methods of communicating with Earth, but they're all extremely directed and are designed for line-of-sight communication. And there aren't any sand dunes between it and Earth when they talk.

Somehow they messed with things to make a radial signal, however weak it may be. And I heard it!

My message for the day was "GOT BEACON SIGNAL." If I'd had enough rocks, I would have added, "AWESOME IDEA!!!" But it's a really sandy area.

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THE MAV waited in southwestern Schiaparelli. It stood an impressive twenty-seven meters tall, its conical body gleaming in the midday sun.

The rover crested a nearby dune with the trailer in tow. It slowed for a few moments, then continued toward the ship at top speed. It came to a stop twenty meters away.

There it remained for ten minutes while the astronaut inside suited up.

He stumbled excitedly out of the airlock, falling to the ground then scrambling to his feet. Beholding the MAV, he gestured to it with both arms, as if in disbelief.

He leaped into the air several times, arms held high with fists clenched. Then he knelt on one knee and fist-pumped repeatedly.

Running to the spacecraft, he hugged Landing Strut B. After a few moments, he broke off the embrace to perform another round of leaping celebrations.

Now fatigued, the astronaut stood with arms akimbo, looking up at the sleek lines of the engineering marvel before him.

Climbing the ladder on the landing stage, he reached the ascent stage and entered the airlock. He sealed the door behind him.