

[08:12] WATNEY: Test.

[08:25] JPL: Received! You gave us quite a scare there. Thanks for the “A-okay” message. Our analysis of satellite imagery shows a complete detachment of Airlock 1. Is that correct? What’s your status?

[08:39] WATNEY: If by “detachment” you mean “shot me out like a cannon” then yeah. Minor cut on my forehead. Had some issues with my EVA suit (I’ll explain later). I patched up the Hab and repressurized it (main air tanks were intact). I just got power back online. The farm is dead. I’ve recovered as many potatoes as I could and stored them outside. I count 1841. That will last me 184 days. Including the remaining mission rations, I’ll start starving on Sol 584.

[08:52] JPL: Yeah, we figured. We’re working on solutions to the food issue. What’s the status of the Hab systems?

[09:05] WATNEY: Primary air and water tanks were unharmed. The rover, solar array, and Pathfinder were out of the blast range. I’ll run diagnostics on the Hab’s systems while I wait for your next reply. By the way, who am I talking to?

[09:18] JPL: Venkat Kapoor in Houston. Pasadena relays my messages. I’m going to handle all direct communication with you from now on. Check the oxygenator and water reclaimer first. They’re the most important.

[09:31] WATNEY: Duh. Oxygenator functioning perfectly. Water reclaimer is completely offline. Best guess is water froze up inside and burst some tubing. I’m sure I can fix it. The Hab’s main computer is also functioning without any problems. Any idea what caused the Hab to blow up?

[09:44] JPL: Best guess is fatigue on the canvas near Airlock 1. The pressurization cycle stressed it until it failed. From now on, alternate Airlock 2 and 3 for all EVAs. Also, we’ll be getting you a checklist and procedures for a full canvas exam.

[09:57] WATNEY: Yay, I get to stare at a wall for several hours! Let me know if you come up with a way for me to not starve.

[10:11] JPL: Will do.

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“IT’S SOL 122,” Bruce said. “We have until Sol 584 to get a probe to Mars. That’s four hundred and sixty-two sols, which is four hundred and seventy-five days.”

The assembled department heads of JPL furrowed their brows and rubbed their eyes.

He stood from his chair. “The positions of Earth and Mars aren’t ideal. The trip will take four hundred and fourteen days. Mounting the probe to the booster and dealing with inspections will take thirteen days. That leaves us with just forty-eight days to make this probe.”

Sounds of whispered exasperation filled the room. “Jesus,” someone said.

“It’s a whole new ball game,” Bruce continued. “Our focus is food. Anything else is a luxury. We don’t have time to make a powered-descent lander. It’ll have to be a tumbler. So we can’t put anything delicate inside. Say good-bye to all the other crap we’d planned to send.”

“Where’s the booster coming from?” asked Norm Toshi, who was in charge of the reentry process.

“The EagleEye 3 Saturn probe,” Bruce said. “It was scheduled to launch next month. NASA put it on hold so we can have the booster.”

“I bet the EagleEye team was pissed about that,” Norm said.

“I’m sure they were,” Bruce said. “But it’s the only booster we have that’s big enough. Which brings me to my next point: We only get one shot at this. If we fail, Mark Watney dies.”

He looked around the room and let that sink in.

“We do have some things going for us,” he finally said. “We have some of the parts built for the Ares 4 presupply missions. We can steal from them, and that’ll save us some time. Also, we’re sending food, which is pretty robust. Even if there’s a

reentry problem and the probe impacts at high velocity, food is still food.

“And we don’t need a precision landing. Watney can travel hundreds of kilometers if necessary. We just need to land close enough for him to reach it. This ends up being a standard tumble-land presupply. All we have to do is make it quickly. So let’s get to it.”

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[08:02] JPL: We’ve spun up a project to get you food. It’s been in progress for a week or so. We can get it to you before you starve, but it’ll be tight. It’ll just be food and a radio. We can’t send an oxygenator, water reclaimer, or any of that other stuff without powered descent.

[08:16] WATNEY: No complaints here! You get me the food, I’ll be a happy camper. I’ve got all Hab systems up and running again. The water reclaimer is working fine now that I replaced the burst hoses. As for water supply, I have 620 liters remaining. I started with 900 liters (300 to start with, 600 more from reducing hydrazine). So I lost almost 300 liters to sublimation. Still, with the water reclaimer operational again, it’s plenty.

[08:31] JPL: Good, keep us posted on any mechanical or electronic problems. By the way, the name of the probe we’re sending is Iris. Named after the Greek goddess who traveled the heavens with the speed of wind. She’s also the goddess of rainbows.

[08:47] WATNEY: Gay probe coming to save me. Got it.

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RICH PURNELL sipped coffee in the silent building. He ran a final test on the software he’d written. It passed. With a relieved sigh, he sank back in his chair. Checking the clock on his computer, he shook his head. 3:42 a.m.

As an astrodynamicist, Rich rarely had to work late. His job was to find the exact orbits and course corrections needed for any given mission. Usually, it was one of the first parts of a project, all the other steps being based on the orbit.

But this time, things were reversed. Iris needed an orbital path, and nobody knew when it would launch.

Planets move as time goes by. A course calculated for a specific launch date will work only for that date. Even a single day's difference would result in missing Mars entirely.

So Rich had to calculate *many* courses. He had a range of twenty-five days during which Iris might launch. He calculated one course for each.

He began an e-mail to his boss.

*Mike, he typed, Attached are the courses for Iris, in 1-day increments. We should start peer review and vetting so they can be officially accepted. And you were right, I was here almost all night.*

*It wasn't that bad. Nowhere near the pain of calculating orbits for Hermes. I know you get bored when I go into the math, so I'll summarize: The small, constant thrust of Hermes's ion drives is much harder to deal with than the large point-thrusts of presupply probes.*

*All 25 of the courses take 414 days, and vary only slightly in thrust duration and angle. The fuel requirement is nearly identical for the orbits and is well within the capacity of EagleEye's booster.*

*It's too bad. Earth and Mars are really badly positioned. Heck, it's almost easier to—*

He stopped typing.

Furrowing his brow, he stared into the distance.

"Hmm," he said.

He grabbed his coffee cup and went to the break room for a refill.

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TEDDY SCANNED the crowded conference room. It was rare to see such an assembly of NASA's most important people all in

one place. He squared a small stack of notes he'd prepared and placed them neatly in front of him.

"I know you're all busy," Teddy said. "Thank you for making time for this meeting. I need status on Project Iris from all departments. Venkat, let's start with you."

"The mission team's ready," Venkat said, looking at spreadsheets on his laptop. "There was a minor turf war between the Ares 3 and Ares 4 presupply control teams. The Ares 3 guys said they should run it, because while Watney's on Mars, Ares 3 is still in progress. The Ares 4 team points out it's their coopted probe in the first place. I ended up going with Ares 3."

"Did that upset Ares 4?" Teddy asked.

"Yes, but they'll get over it. They have thirteen other presupply missions coming up. They won't have time to be pissy."

"Mitch," Teddy said to the flight controller, "what about the launch?"

Mitch pulled the earpiece from his ear. "We've got a control room ready," he said. "I'll oversee the launch, then hand cruise and landing over to Venkat's guys."

"Media?" Teddy said, turning to Annie.

"I'm giving daily updates to the press," she said, leaning back in her chair. "Everyone knows Watney's fucked if this doesn't work. The public hasn't been this engaged in ship construction since Apollo 11. CNN's *The Watney Report* has been the number one show in its time slot for the past two weeks."

"The attention is good," Teddy said. "It'll help get us emergency funding from Congress." He looked up to a man standing near the entrance. "Maurice, thanks for flying out on short notice."

Maurice nodded.

Teddy gestured to him and addressed the room. “For those who don’t know him, this is Maurice Stein from Cape Canaveral. He was the scheduled pad leader for EagleEye 3, so he inherited the role for Iris. Sorry for the bait and switch, Maurice.”

“No problem,” said Maurice. “Glad I can help out.”

Teddy flipped the top page of his notes facedown beside the stack. “How’s the booster?”

“It’s all right for now,” said Maurice. “But it’s not ideal. EagleEye 3 was set to launch. Boosters aren’t designed to stand upright and bear the stress of gravity for long periods. We’re adding external supports that we’ll remove before launch. It’s easier than disassembly. Also the fuel is corrosive to the internal tanks, so we had to drain it. In the meantime, we’re performing inspections on all systems every three days.”

“Good, thank you,” Teddy said. He turned his attention to Bruce Ng, who stared back at him with heavy bloodshot eyes.

“Bruce, thank you for flying out, too. How’s the weather in California these days?”

“I wouldn’t know,” Bruce said. “I rarely see the outdoors.”

Subdued laughter filled the room for a few seconds.

Teddy flipped another page. “Time for the big question, Bruce. How’s Iris coming along?”

“We’re behind,” Bruce said with a tired shake of his head. “We’re going as fast as we can, but it’s just not fast enough.”

“I can find money for overtime,” Teddy offered.

“We’re already working around the clock.”

“How far behind are we talking about?” Teddy asked.

Bruce rubbed his eyes and sighed. “We’ve been at it twenty-nine days; so we only have nineteen left. After that, the Pad needs thirteen days to mount it on the booster. We’re at least two weeks behind.”

“Is that as far behind as you’re going to get?” Teddy asked, writing a note on his papers. “Or will you slip more?”

Bruce shrugged. “If we don’t have any more problems, it’ll be two weeks late. But we always have problems.”

“Give me a number,” Teddy said.

“Fifteen days,” Bruce responded. “If we had another fifteen days, I’m sure we could get it done in time.”

“All right,” Teddy said, taking another note. “Let’s create fifteen days.”

Turning his attention to the Ares 3 flight surgeon, Teddy asked, “Dr. Keller, can we reduce Watney’s food intake to make the rations last longer?”

“Sorry, but no,” Keller said. “He’s already at a minimal calorie count. In fact, considering the amount of physical labor he does, he’s eating far less than he should. And it’s only going to get worse. Soon his entire diet will be potatoes and vitamin supplements. He’s been saving protein-rich rations for later use, but he’ll still be malnourished.”

“Once he runs out of food, how long until he starves to death?” Teddy asked.

“Presuming an ample water supply, he might last three weeks. Shorter than a typical hunger strike, but remember he’ll be malnourished and thin to begin with.”

Venkat raised a hand and caught their attention. “Remember, Iris is a tumbler; he might have to drive a few days to get it. And I’m guessing it’s hard to control a rover when you’re literally starving to death.”

“He’s right,” Dr. Keller confirmed. “Within four days of running out of food, he’ll barely be able to stand up, let alone control a rover. Plus, his mental faculties will rapidly decline. He’d have a hard time even staying awake.”

“So the landing date’s firm,” Teddy said. “Maurice, can you get Iris on the booster in less than thirteen days?”

Maurice leaned against the wall and pinched his chin. “Well...it only takes three days to actually mount it. The following ten are for testing and inspections.”

“How much can you reduce those?”

“With enough overtime, I could get the mounting down to two days. That includes transport from Pasadena to Cape Canaveral. But the inspections can’t be shortened. They’re time-based. We do checks and rechecks with set intervals between them to see if something deforms or warps. If you shorten the intervals, you invalidate the inspections.”

“How often do those inspections reveal a problem?” Teddy asked.

A silence fell over the room.

“Uh,” Maurice stammered. “Are you suggesting we don’t do the inspections?”

“No,” said Teddy. “Right now I’m asking how often they reveal a problem.”

“About one in twenty launches.”

Teddy wrote that down. “And how often is the problem they find something that would have caused a mission failure?”

“I’m, uh, not sure. Maybe half the time?”

He wrote that down as well. “So if we skip inspections and testing, we have a one in forty chance of mission failure?” Teddy asked.

“That’s two point five percent,” Venkat said, stepping in. “Normally, that’s grounds for a countdown halt. We can’t take a chance like that.”

“‘Normally’ was a long time ago,” Teddy said. “Ninety-seven point five percent is better than zero. Can anyone think of a safer way to get more time?”

He scanned the room. Blank faces stared back.



“All right, then,” he said, circling something on his notes. “Speeding up the mounting process and skipping inspections buys us eleven days. If Bruce can pull a rabbit out of a hat and get done sooner, Maurice can do some inspections.”

“What about the other four days?” Venkat asked.

“I’m sure Watney can stretch the food to last four extra days, malnutrition notwithstanding,” Teddy said, looking to Dr. Keller.

“I—” Keller started. “I can’t recommend—”

“Hang on,” Teddy interrupted. He stood and straightened his blazer. “Everyone, I understand your positions. We have procedures. Skipping those procedures means risk. Risk means trouble for your department. But now isn’t the time to cover our asses. We have to take risks or Mark Watney dies.”

Turning to Keller, he said, “Make the food last another four days.”

Keller nodded.

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“RICH,” said Mike.

Rich Purnell concentrated on his computer screen. His cubicle was a landfill of printouts, charts, and reference books. Empty coffee cups rested on every surface; take-out packaging littered the ground.

“Rich,” Mike said, more forcefully.

Rich looked up. “Yeah?”

“What the hell are you doing?”

“Just a little side project. Something I wanted to check up on.”

“Well...that’s fine, I guess,” Mike said, “but you need to do your assigned work first. I asked for those satellite adjustments two weeks ago and you still haven’t done them.”

“I need some supercomputer time,” Rich said.

“You need supercomputer time to calculate routine satellite adjustments?”

“No, it’s for this other thing I’m working on,” Rich said.

“Rich, seriously. You have to do your job.”

Rich thought for a moment. “Would now be a good time for a vacation?” he asked.

Mike sighed. “You know what, Rich? I think now would be an *ideal* time for you to take a vacation.”

“Great!” Rich smiled. “I’ll start right now.”

“Sure,” Mike said. “Go on home. Get some rest.”

“Oh, I’m not going home,” said Rich, returning to his calculations.

Mike rubbed his eyes. “Okay, whatever. About those satellite orbits...?”

“I’m on vacation,” Rich said without looking up.

Mike shrugged and walked away.

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[08:01] WATNEY: How’s my care package coming along?

[08:16] JPL: A little behind schedule, but we’ll get it done. In the meantime, we want you to get back to work. We’re satisfied the Hab is in good condition. Maintenance only takes you twelve hours per week. We’re going to pack the rest of your time with research and experiments.

[08:31] WATNEY: Great! I’m sick of sitting on my ass. I’m going to be here for years. You may as well make use of me.

[08:47] JPL: That’s what we’re thinking. We’ll get you a schedule as soon as the science team puts it together. It’ll be mostly EVAs, geological sampling, soil tests, and weekly self-administered medical tests. Honestly, this is the best “bonus Mars time” we’ve had since the Opportunity lander.

[09:02] WATNEY: Opportunity never went back to Earth.

[09:17] JPL: Sorry. Bad analogy.

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THE JPL Spacecraft Assembly Facility, known as the “clean room,” was the little-known birthplace of the most famous spacecraft in Mars exploration history. Mariner, Viking, Spirit, Opportunity, and Curiosity, just to name a few, had all been born in this one room.

Today, the room was abuzz with activity as technicians sealed Iris into the specially designed shipping container.

The off-duty techs watched the procedure from the observation deck. They had rarely seen their homes in the last two months; a makeshift bunk room had been set up in the cafeteria. Fully a third of them would normally be asleep at this hour, but they did not want to miss this moment.

The shift leader tightened the final bolt. As he retracted the wrench, the engineers broke into applause. Many of them were in tears.

After sixty-three days of grueling work, Iris was complete.

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ANNIE TOOK the podium and adjusted the microphone. “The launch preparations are complete,” she said. “Iris is ready to go. The scheduled launch is 9:14 a.m.

“Once launched, it will stay in orbit for at least three hours. During that time, Mission Control will gather exact telemetry in preparation for the trans-Mars injection burn. When that’s complete, the mission will be handed off to the Ares 3 presupply team, who will monitor its progress over the following months. It will take four hundred and fourteen days to reach Mars.”

“About the payload,” a reporter asked, “I hear there’s more than just food?”

“That’s true.” Annie smiled. “We allocated one hundred grams for luxury items. There are some handwritten letters

from Mark's family, a note from the President, and a USB drive filled with music from all ages."

"Any disco?" someone asked.

"No disco," Annie said, as chuckles cascaded through the room.

CNN's Cathy Warner spoke up. "If this launch fails, is there any recourse for Watney?"

"There are risks to any launch," Annie said, sidestepping the question, "but we don't anticipate problems. The weather at the Cape is clear with warm temperatures. Conditions couldn't be better."

"Is there any spending limit to this rescue operation?" another reporter asked. "Some people are beginning to ask how much is too much."

"It's not about the bottom line," Annie said, prepared for the question. "It's about a human life in immediate danger. But if you want to look at it financially, consider the value of Mark Watney's extended mission. His prolonged mission and fight for survival are giving us more knowledge about Mars than the rest of the Ares program combined."

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"DO YOU believe in God, Venkat?" Mitch asked.

"Sure, lots of 'em," Venkat said. "I'm Hindu."

"Ask 'em all for help with this launch."

"Will do."

Mitch stepped forward to his station in Mission Control. The room bustled with activity as the dozens of controllers each made final preparations for launch.

He put his headset on and glanced at the time readout on the giant center screen at the front of the room. He turned on his headset and said, "This is the flight director. Begin launch status check."

“Roger that, Houston” was the reply from the launch control director in Florida. “CLCDR checking all stations are manned and systems ready,” he broadcast. “Give me a go/no-go for launch. Talker?”

“Go” was the response.

“Timer.”

“Go,” said another voice.

“QAM1.”

“Go.”

Resting his chin on his hands, Mitch stared at the center screen. It showed the pad video feed. The booster, amid cloudy water vapor from the cooling process, still had *EagleEye3* stenciled on the side.

“QAM2.”

“Go.”

“QAM3.”

“Go.”

Venkat leaned against the back wall. He was an administrator. His job was done. He could only watch and hope. His gaze was fixated on the far wall’s displays. In his mind, he saw the numbers, the shift juggling, the outright lies and borderline crimes he’d committed to put this mission together. It would all be worthwhile, if it worked.

“FSC.”

“Go.”

“Prop One.”

“Go.”

Teddy sat in the VIP observation room behind Mission Control. His authority afforded him the very best seat: front-row center. His briefcase lay at his feet and he held a blue folder in his hands.

“Prop Two.”

“Go.”

“PTO.”

“Go.”

Annie Montrose paced in her private office next to the press room. Nine televisions mounted to the wall were each tuned to a different network; each network showed the launch pad. A glance at her computer showed foreign networks doing the same. The world was holding its breath.

“ACC.”

“Go.”

“LWO.”

“Go.”

Bruce Ng sat in the JPL cafeteria along with hundreds of engineers who had given everything they had to Iris. They watched the live feed on a projection screen. Some fidgeted, unable to find comfortable positions. Others held hands. It was 6:13 a.m. in Pasadena, yet every single employee was present.

“AFLC.”

“Go.”

“Guidance.”

“Go.”

Millions of kilometers away, the crew of *Hermes* listened as they crowded around Johanssen’s station. The two-minute transmission time didn’t matter. They had no way to help; there was no need to interact. Johanssen stared intently at her screen, although it displayed only the audio signal strength. Beck wrung his hands. Vogel stood motionless, his eyes fixed on the floor. Martinez prayed silently at first, then saw no reason to hide it. Commander Lewis stood apart, her arms folded across her chest.

“PTC.”

“Go.”

“Launch Vehicle Director.”

“Go.”

“Houston, this is Launch Control, we are go for launch.”

“Roger,” Mitch said, checking the countdown. “This is Flight, we are go for launch on schedule.”

“Roger that, Houston,” Launch Control said. “Launch on schedule.”

Once the clock reached -00:00:15, the television networks got what they were waiting for. The timer controller began the verbal countdown. “Fifteen,” she said, “fourteen...thirteen...twelve...eleven...”

Thousands had gathered at Cape Canaveral, the largest crowd ever to watch an unmanned launch. They listened to the timer controller’s voice as it echoed across the grandstands.

“...ten...nine...eight...seven...”

Rich Purnell, entrenched in his orbital calculations, had lost track of time. He didn’t notice when his coworkers migrated to the large meeting room where a TV had been set up. In the back of his mind, he thought the office was unusually quiet, but he gave it no further thought.

“...six...five...four...”

“Ignition sequence start.”

“...three...two...one...”

Clamps released, the booster rose amid a plume of smoke and fire, slowly at first, then racing ever faster. The assembled crowd cheered it on its way.

“...and liftoff of the Iris supply probe,” the timer controller said.

As the booster soared, Mitch had no time to watch the spectacle on the main screen. “Trim?” he called out.

“Trim’s good, Flight” was the immediate response.

“Course?” he asked.

“On course.”

“Altitude one thousand meters,” someone said.

“We’ve reached safe-abort,” another person called out, indicating that the ship could crash harmlessly into the Atlantic Ocean if necessary.

“Altitude fifteen hundred meters.”

“Pitch and roll maneuver commencing.”

“Getting a little shimmy, Flight.”

Mitch looked over to the ascent flight director. “Say again?”

“A slight shimmy. Onboard guidance is handling it.”

“Keep an eye on it,” Mitch said.

“Altitude twenty-five hundred meters.”

“Pitch and roll complete, twenty-two seconds till staging.”

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WHEN DESIGNING Iris, JPL accounted for catastrophic landing failure. Rather than normal meal kits, most of the food was cubed protein bar material, which would still be edible even if Iris failed to deploy its tumble balloons and impacted at incredible speed.

Because Iris was an unmanned mission, there was no cap on acceleration. The contents of the probe endured forces no human could survive. But while NASA had tested the effects of extreme g-forces on protein cubes, they had not done so with a simultaneous lateral vibration. Had they been given more time, they would have.

The harmless shimmy, caused by a minor fuel mixture imbalance, rattled the payload. Iris, mounted firmly within the aeroshell atop the booster, held firm. The protein cubes inside Iris did not.

At the microscopic level, the protein cubes were solid food particles suspended in thick vegetable oil. The food particles



compressed to less than half their original size, but the oil was barely affected at all. This changed the volume ratio of solid to liquid dramatically, which in turn made the aggregate act as a liquid. Known as “liquefaction,” this process transformed the protein cubes from a steady solid into a flowing sludge.

Stored in a compartment that originally had no leftover space, the now-compressed sludge had room to slosh.

The shimmy also caused an imbalanced load, forcing the sludge toward the edge of its compartment. This shift in weight only aggravated the larger problem, and the shimmy grew stronger.

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“SHIMMY’S GETTING violent,” reported the ascent flight director.

“How violent?” Mitch said.

“More than we like,” he said. “But the accelerometers caught it and calculated the new center of mass. The guidance computer is adjusting the engines’ thrusts to counteract. We’re still good.”

“Keep me posted,” Mitch said.

“Thirteen seconds till staging.”

The unexpected weight shift had not spelled disaster. All systems were designed for worst-case scenarios; each did its job admirably. The ship continued toward orbit with only a minor course adjustment, implemented automatically by sophisticated software.

The first stage depleted its fuel, and the booster coasted for a fraction of a second as it jettisoned stage clamps via explosive bolts. The now-empty stage fell away from the craft as the second-stage engines prepared to ignite.

The brutal forces had disappeared. The protein sludge floated free in the container. Given two seconds, it would have re-expanded and solidified. But it was given only a quarter second.

As the second stage fired, the craft experienced a sudden jolt of immense force. No longer contending with the deadweight of the first stage, the acceleration was profound. The three hundred kilograms of sludge slammed into the back of its container. The point of impact was at the edge of Iris, nowhere near where the mass was expected to be.

Though Iris was held in place by five large bolts, the force was directed entirely to a single one. The bolt was designed to withstand immense forces; if necessary to carry the entire weight of the payload. But it was *not* designed to sustain a sudden impact from a loose three-hundred-kilogram mass.

The bolt sheared. The burden was then shifted to the remaining four bolts. The forceful impact having passed, their work was considerably easier than that of their fallen comrade.

Had the pad crew been given time to do normal inspections, they would have noticed the minor defect in one of the bolts. A defect that slightly weakened it, though it would not cause failure on a normal mission. Still, they would have swapped it out with a perfect replacement.

The off-center load presented unequal force to the four remaining bolts, the defective one bearing the brunt of it. Soon, it failed as well. From there, the other three failed in rapid succession.

Iris slipped from its supports in the aeroshell, slamming into the hull.

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“WOAH!” EXCLAIMED the ascent flight director. “Flight, we’re getting a large precession!”

“What?” Mitch said as alerts beeped and lights flashed across all the consoles.

“Force on Iris is at seven g’s,” someone said.

“Intermittent signal loss,” called another voice.

“Ascent, what’s happening here?” Mitch demanded.

“All hell broke loose. It’s spinning on the long axis with a seventeen-degree precession.”

“How bad?”

“At least five rp’s, and falling off course.”

“Can you get it to orbit?”

“I can’t talk to it at all; signal failures left and right.”

“Comm!” Mitch shot to the communications director.

“Workin’ on it, Flight,” was the response. “There’s a problem with the onboard system.”

“Getting some major g’s inside, Flight.”

“Ground telemetry shows it two hundred meters low of target path.”

“We’ve lost readings on the probe, Flight.”

“Entirely lost the probe?” he asked.

“Affirm, Flight. Intermittent signal from the ship, but no probe.”

“Shit,” Mitch said. “It shook loose in the aeroshell.”

“It’s dreideling, Flight.”

“Can it limp to orbit?” Mitch said. “Even super-low EO? We might be able to—”

“Loss of signal, Flight.”

“LOS here, too.”

“Same here.”

Other than the alarms, the room fell silent.

After a moment, Mitch said, “Reestablish?”

“No luck,” said Comm.

“Ground?” Mitch asked.

“GC” was the reply. “Vehicle had already left visual range.”

“SatCon?” Mitch asked.

“No satellite acquisition of signal.”

Mitch looked forward to the main screen. It was black now, with large white letters reading “LOS.”

“Flight,” a voice said over the radio, “US destroyer *Stockton* reports debris falling from the sky. Source matches last known location of Iris.”

Mitch put his head in his hands. “Roger,” he said.

Then he uttered the words every flight director hopes never to say: “GC, Flight. Lock the doors.”

It was the signal to start post-failure procedures.

From the VIP observation room, Teddy watched the despondent Mission Control Center. He took a deep breath, then let it out. He looked forlornly at the blue folder that contained his cheerful speech praising a perfect launch. He placed it in his briefcase and extracted the red folder, with the *other* speech in it.

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VENKAT STARED out his office windows to the space center beyond. A space center that housed mankind’s most advanced knowledge of rocketry yet had still failed to execute today’s launch.

His mobile rang. His wife again. No doubt worried about him. He let it go to voice mail. He just couldn’t face her. Or anyone.

A chime came from his computer. Glancing over, he saw an e-mail from JPL. A relayed message from *Pathfinder*:

[16:03] WATNEY: How’d the launch go?