

# Bowl of Heaven (Excerpt)

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## PROLOGUE

Here about the beach I wander'd, nourishing a youth sublime  
With the fairy tales of science, and the  
long result of Time

—TENNYSON, "Locksley Hall"

### The Last Party

Cliff turned from the people he was saying good-bye to and looked out at the world he would never see again.

The party roared on behind him. Laughter, shouts, hammering hard music. The laughter was a touch ragged, the music too loud, a forced edge to it all, and an electric zest fueled a murmur of anticipating talk. They had said good-bye already to relatives on Earth. Now, *SunSeeker's* crew and passengers had to say farewell forever to the starship construction teams, the training echelons, the embodied political and economic forces that were about to launch them out into a vastness beyond experience.

The view was razor sharp, but it was of course a screen, adjusted to subtract the station's centrifugal gyre. So Earth held steady and he could see the tiny silver motes of flung packages headed toward the *SunSeeker* complex. They trailed back toward the flingers on Luna, and another line of specks pointed toward the fatter dots of manufacturing complexes in higher orbits. A dingy new asteroid was gliding in on its decade-long journey. Already, silvery bee swarms of robo-factories accompanied it, hollowing out its stony core for a smelter colony. Glass-skinned biofactories waited for the work crews that would pounce on the asteroid prey, their liquid riches hiding behind fogged domes for sunlight to awaken them.

It struck him how much like artworks machines seemed in space. Here they suffered no constraints of gravity, and so looked like contorted abstracts of Euclidean geometries, cubes and ellipsoids and blunt cylinders that made mobiles without wires, moving with glacial grace against the faint jewels of brimming starlight.

Within the geostationary orbit, he could not see distinct satellites, even after he hit the magnification command and the screen narrowed in. Here, the busy swarm held luxury hotels for ancients now well over two centuries old. Religious colonies were more common but rather Spartan, and ships flitted like dappled radiance everywhere in the incessant sprawl of commerce. The solid Earth swam in a countless froth of tending machines.

He leaned sideways and caught the sheen of the Fresnel lens at the L1 point, a gauzy circle seen nearly on edge from here. It hung between Earth and the sun, deflecting sunlight from the still rather overheated planet. Adjusting patches twinkled in slow splendor.

“Y’know, it’ll all be fixed up fine by the time we even wake up.” Beth’s soft words came from behind him.

Cliff turned and his eyes brightened. “But we’ll be this same age.”

She blinked and grinned and kissed him back. “Hard not to love an optimist.”

“If I didn’t think we’ll wake up, I wouldn’t go.”

She wore a sheath dress that definitely wouldn’t be going to Glory. It clung to her lithe body, wrapped close around her neck, and anchored at amber bracelets on her wrists. Her right showed bare skin colored like chardonnay as the dress polarized, giving him quick glances of flesh. The silky dress had variable opacity and hue she could tune with the bracelets, he guessed. He hoped this show was for him. People nearby were making a great show of not noticing. Just as most ignored the profusion of plunging necklines, built-in push-up bras, spangles, feathers, slits, and peekaboos. Plus codpieces on some of the guys, muscle shirts, the hawk hats that made a man look like a predator.

“A lot of overt signaling tonight, isn’t there?” Beth said dryly.

Not his style. “Bravado, smells like.” So he simply took her in his arms and kissed her. That was the usual best move, he had learned early on, especially if he could not think of something witty. Her green eyes blinked. Everyone continued not noticing. He wouldn’t see most of them ever again, after all.

This thought got underlined when a banner rolled across the room’s suspension ceiling. It was from the assembly teams who for years had worked with the crew, outfitting and running *SunSeeker*.

HOPE YOU ENJOYED GIVING US THE BUSINESS AS MUCH AS WE ENJOYED TAKING  
YOU FOR A RIDE

Terry and Fred came by on their way to the bar, laughing at the banner. “Funny,” Terry said. “We’re going on to Glory, and tomorrow they’ll be back at work on the next ramscoop. But they’re celebrating harder than we are.”

“Yeah,” Fred said. “Odd. They’re as glad to see us leave as we are to go.”

Terry said, “We’re all scarce types. All the psychers say so. Why wouldn’t anyone grab a chance at a whole new, fresh world?”

“Instead of staying here to fix the one we screwed up?” Cliff asked. An old issue for them all, but it still clung to him.

Beth shrugged. “We finesse climate, or climate finesses us.”

“It’s good practice,” Terry said. “The previous generations terraformed Earth first. Now it’s our turn with a whole new planet.”

A tray crawled past; you couldn't use float trays in lowspin gravity. The tray was piled with exotic dishes and surrounded by diners who would not be eating this well for centuries to come. Fred joined them, then Terry, edging into the crowd with minimal courtesy.

"My, my," Beth said warmly. "Ummm . . . maybe we should leave now?"

Cliff looked out over the crowd. Some Earth bureaucrat had on a leash a dog that closely resembled a breakfast pastry with hair. The dog was lapping up someone else's vomit. Three others were laughing at the sight. Apparently most of the party was having a better time than he was.

No matter. This was surely the last time he would see most of them—the crews who had built *SunSeeker*, the endless bureaucrats who at least pretended to add to the effort, the psychers and endless engineers and trial-run crews who would never see another sun. . . . He grimaced and relished the passing moment. All moments were passing, of course. Some, more so. "My heart is full but my glass is empty."

She gave him a rueful nod. "We won't get booze on *SunSeeker*."

"In flight? Cap'n Redwing would frown."

"He seems more the 'throw 'em into leg irons' type."

Her laughing-eyed remark told them both that they needed celebration. It helped ward off the doubts, fears, and . . . an emotion he had no name for. *So be it*.

They stood with arms around each other's waist and watched Earth's wheeling, silent majesty. Into the rim of their view swam *SunSeeker*, looking much like a lean and hungry shark.

Yes, a shark waiting to swim in the ocean of night. The large mouth was the magnetic funnel, waiting to be turned on, furl outward, and begin the slow acceleration out of the solar system. That scoop would yawn and first dive close to the sun, swallowing great gouts of the solar wind as start-up fuel. Behind the head complex curved the hoop of the control deck, its ruby glow alive with workers. Cliff watched tiny figures in their worker pods putting finishing touches on the long, rotating cylinder of the habitat and cryostorage sandwiched between the supplies storage vaults. Then came the wrinkled, cottonball-white, cybersmart radiators that sheathed the drive system. Its cylindrically spaced vents gave in to the fat fusion chambers, big ribbed barrels that fed the final thruster nozzles. Wrapped around these in a saddle truss were the big yellow fuel pods that would feed the beast as it accelerated into the deep dark, then fall away. From there on, it would glide through the centuries inside a magnetic sheath, safe from the proton sleet ahead. *SunSeeker* was a shark for eating away at light-years.

They had all ridden her out into the Oort cloud, tried the engines, found the flaws that the previous fourteen ships had tested. Ran the AI systems, found the errors in rivets and reason, made better. In the first few generations of interstellar craft, every new ship was an experiment. Each learned from the last, the engineers and scientists did their work, and a better ship emerged. Directed evolution on the fast track.

Now they were ready for the true deeps. Deep space meant deep time, all fleeting and, soon enough, all gone.

"Beautiful, isn't it?" a man's voice said from behind them.

It was Karl, the lanky head flight engineer. He had an arm around Mei Ling and seemed a bit bleary and red faced. From a snog-fog burst, Cliff guessed. Mei Ling just seemed extraordinarily joyful, eyes glistening.

Beth said, casting a sideways glance, “Yes—and we’re counting on you to keep her happy.”

“Oh yes, I will,” Karl said, not getting the double entendre. “She’s a great ship.”

Mei Ling got it, arched an eyebrow, and nodded. “Saying good-bye to the world, are we? How do you think they’ll think of us by the time we arrive?”

Beth said, “I’d like to be remembered as the world’s oldest woman.”

They all laughed. Mei Ling asked Cliff, “Hard to say farewell to it all, isn’t it? You’ve been over here at the view most of the evening.”

She had always been quick to read people, he recalled. She would understand that he needed merriment now. That they all did. “Um, yeah. I guess I’m a man of the world; my trouble is I’m trying to find which world.”

They all nodded soberly. Then with a quick, darting grin, Karl showed off his newest trick. In the low centrifugal grav, he poured a dark red wine by letting it fall from the bottle, then cutting off the right amount with a dinner knife before it hit the glass. Three quick slices, Mei Ling rushed some glasses into place, and done. “Impressive!” Beth said. They drank.

“Got some news,” Karl said. “Those grav waves near Glory? No signal in them. Just noise.”

“How does that help us?” Beth asked. Cliff could tell from her expression that Karl was not her sort, but Karl would never know.

“It means there’s not some supercivilization on Glory, for one thing.”

“We already knew there are no electromagnetic signals,” Mei Ling said.

“Well, sure,” Karl said. “But maybe really advanced societies don’t bother with primitive—”

“Hey, this is a party!” Beth said brightly. Karl took the hint. He shrugged and led Mei Ling away. She had some trouble walking.

“Cruel, you are,” Cliff said.

“Hey, we won’t see him for centuries.”

“But it will seem like next week.”

“So they say. What do you think about the grav waves?”

Just then a Section head broke in, using a microphone to get above the party noise, which was still rising. “We just got a launch congratulations from Alpha Centauri, folks! They wish you good speed.”

Some hand clapping, then the party buzz came back even stronger. “Nice gesture,” Beth said. “They had to send that over four years ago.”

Tananareve Bailey spoke behind him. “It probably came in a year back and they’ve been saving it.” Cliff hadn’t noticed her approach. She was more covered up than most of the women, but gorgeous, an explosion of browns and orange against black face and arms. She stood with Howard Blaire, once a zookeeper and something of a bodybuilding enthusiast.

Beth nodded. “Once we’re in flight, the delay times will mean we’re talking to different generations. Spooky. But you were saying about the grav waves—?”

Howard twisted his mouth, trying to recall. “Look, *SunSeeker* was nearly built before LIGO 22 picked up those waves. It took all the time we were out on our field trials to verify the detection. More time to see if there was anything in it—and apparently there isn’t. No signal, just some noisy spectrum. No, we’re going to Glory because a biosphere is there. One of the Astros told me these grav waves probably come from just accidental superposition. A good chance there’s some pair of orbiting black holes far across the galaxy, but the Glory system is in the way—”

“That’s what I think, too,” a familiar voice said. They turned to find a red-faced Fred, back again, obviously a bit the worse for wear. “Can’t get good resolution on the source area, and Glory’s over in one corner of a degree-wide patch in the sky. The grav waves could be from anywhere in there, even in another galaxy.”

Beth looked at Cliff and gave him her covert rolled-eye look, saying, “I’m a bio type, myself.”

Fred was a trifle intense, or “focused” as the psychers put it. Some found him hard to take, but he had solved a major technical problem in systems tech, which cut him some slack with Cliff. All crew had to have overlapping abilities, but for some like Fred, breadth was their main qualification. Of course, Fred was oblivious to all these nuances. He gestured at the screen. “Hard not to look at it—beauty and importance combined. The *Mona Lisa* of planets.”

Beth murmured approval and he went on, talking faster. “Even now, I mean—hundreds of bio worlds with atmospheric signatures, but no better’s been seen anywhere.”

Irma Michaelson passed by without her husband in tow, her head turning quickly at Fred’s remark. “You mean the new Forward probe data?”

“Uh, no—”

“Forward Number Five just checked in,” Irma said. “Still pretty far out, can’t get surface maps or anything. Plenty of clouds, got a smidge view of an ocean. Shows the atmospheric thermo pretty well, I hear. We got the tightbeam relay just in time! We might need to do some atmosphere work to make it comfy.”

Beth asked, “What kind?”

“They say we may need more CO<sub>2</sub>. Glory’s a tad light on greenhouse gases,” Fred said so fast, he could barely get the words out. “Surface temperatures are more like Canada. The tropics there are like our mid-temperate zones.”

*Now that we’ve terraformed Earth back to nearly twencen levels, Cliff thought, here comes another whole world. . . .*

He shook this off and listened to Fred, who was hurtling on bright-eyed with, “Once we learn how to suck carbon out of air really well, we can make a climate that will be better than what we were born into. Maybe better than humans ever had it.”

By this time, he was lecturing to a smaller audience. He gave them a crooked smile, as if to acknowledge this, and walked off into the crowd, which was getting predictably more noisy.

“A lot of anxious energy humming through here,” Beth said.

“An emotional bath,” Cliff said dreamily, and nodded at Earth. “The big issue down there is our ever-smarter machines demanding back wages. What’s retirement look like for a multicapillary DNA sequencer?”

Beth laughed, her eyes dancing. “I got a must-answer from SSC, asking what actor would best portray me in the series about us.”

“At least we won’t have to see it.”

She thumped the screen. “I keep thinking I’ll probably never see white curtains billowing into warm sunlit rooms on a lazy summer afternoon. We haven’t left yet, and already I’m nostalgic.”

“For me, it’ll be surfing.”

“Glory has oceans. A moon, pretty small. Maybe they have waves, too.”

“I didn’t bring my board.”

He saw the Arctic Ocean ice was at least visible, a heartening symptom of a planet slowly backing down from the Hot Age. The big chunk of Antarctica that fell off a century back and caused all the flooding was slowly regrowing, too. The Pacific islands were still gone, though, and might never appear again, worn down by wave action. No surfing there, ever again.

He noticed a phalanx of officers in blue uniforms and gold braid, standing smartly in ranks. Most were from the Oort crew and would not go out on *SunSeeker*, so were here for formality. The leaner Glory-bound crew stood behind the tall, craggy figure blinking into the spotlight but still quite sure he belonged there.

“Captain Redwing is about to speak,” a deck lieutenant’s voice boomed out over the speakers. They stood at sharp attention beneath the other banner proclaiming,

#### STAR-CRAVING MAD FAREWELL

Redwing was in full dress uniform with medals blazing, beaming at everyone, face ruddy. Cliff recalled he had divorced the wife who was to go with him, but he had not heard the inside story. Redwing kept his posture at full attention except for head dips to junior officers. He maintained a kindly smile, as if he were pleased the other officers were sharing their nice little thoughts. Still, he was an imposing man in uniform.

“A great exit line,” Cliff whispered, trying to edge inconspicuously toward the door. He cast a long look at Earth on the screen.

“Last night for separate quarters, too,” Beth said. “Would you like to stay over?”

“Wow, yes, ma’am.”

“I believe it’s customary.”

“Customary where?”

“Wherever it’s Saturday night.”

They threaded their way through the crowd, but the feeling still plucked at him. The noise and strumming music, the drinks and snog-fogs and quick darting kisses, faces lined and hopeful and sad, all passing by—but still, somehow, as if he wanted to freeze them in amber.

In an eerie way, this was like a . . . ghost story. All these support people, likable and irritating and officious and sexy and, soon enough—all dead. Left behind. When he and the other crew awoke in orbit around Glory, more than half of these would be centuries gone. Even with the standard life span of 160 years now, gone to gray dry dust.

It had never struck him this way. Not knowing it, but *feeling* it. All this greatness, the human prospect—all that would be far behind them when they next awoke.

Cliff smiled a thin pale smile and thought, *This is the last time I’ll see Earth*. He looked at the swimming majesty of it, sighed with a sense of foreboding, and followed Beth.

## ONE

Life persists.

He recalled those words, his nervous mantra recited as the soft sleep came closing its grip with chilly fingers—

—and so he knew he was alive. Awake again. Up from the chill-sleep of many decades.

He was *cold*. His memory was blurred, but it told him he was on an odyssey no biologist had ever ventured on before, a grand epic. He was going to the stars, yes, and they had given him the stinky sulfur gas, yes, the first creeping chill ... and that was ... it.

But beyond that flash of memory, all he could think of was the incredible, muscle-shaking chill that spread like a sharp ache through him. He was too numb to shiver. Somewhere a loud rumble rolled up through his body, not heard but felt. *The cold* ... He thought hard and with effort opened his sticky eyes.

Trouble. His gummy eyelids slammed closed against a crisp actinic glare. He must be in the revival clinic. Slowly he pried them open, still numb with cold. He focused with effort, looking for the joyous faces of his fellow colonists.

Not there. Nor was Beth.

Instead, the worried frowns of Mayra and Abduss Wickramasingh made him groggily anxious as they worked over him. Their faces swam away, came back, drifting above like clouds as the cold began to recede. He was *tired*. His bones ached with it. After decades of sleep ...

Hands massaged his rubbery legs. Lungs wheezed. His heart labored, thumping in his ears. His throat rasped with a sour wind. He was finally starting to shiver. Sluggish sleep fell away like a mummy's moldy shroud.

*Think*. The Wickramsinghs were paired by ability, he recalled in a gray fog, self-sufficient and solely responsible for the three years of their watch. Mayra piloted, and Abduss was the engineer. They were fairly far down the queue, maybe twenty-seven watches.... How far along were they? It hurt to figure.

They turned him on his side to work on his stiff muscles. The massaging sent lancing pain, and he let out a muffled scream. They ignored that. At least he could see better. Against the hard ceramic glare, he could see that no others of *SunSeeker's* 436 passengers in cold sleep were being revived. A capsule was running its program, though, so someone was coming out behind him. The bay was empty. Carboceramic tiles were clean, looking like new.

As a scientist, he was not slated to come out until the infrastructure staff was up and running at Scorpii 3, the balmy world that everybody called Glory, that no eye had ever seen.

So they were maybe eighty years into the voyage. Not enough to be near Glory. Something was wrong.

Mayra's lips moved, glistening in the hard light, but he heard nothing. They worked on his neural connections and—*pop!*—he could hear. The dull rumble hammered at him. Interstellar surf.

“Okay? Okay?” Mayra said anxiously, mouth tight, her eyes intent. “What's your name?”

He coughed, hacked. Once his throat was clear of milky fluid, his first words were, “Cliff ... Kammash. But ... Why me? I'm bio. Is Beth still cold?”

They didn't answer at once, but each looked at the other.

“Don't talk,” Mayra said softly, a smile flickering.

Definitely trouble. He had known the Wickramsinghs slightly in training, remembered them as reserved and disciplined, just what a cryo passenger would wish in a caretaker watch team.

And they were good. They got his creaky body up off the slab, kind hands helping, his muscles screaming. Then into a gown, detaching the IVs. Up, creaking onto his feet. He swayed, the room reeled, he sat down. Try again. Better ... a step. First in eighty years, feet like bricks. They helped



him shuffle to a table. He sat. Minutes crawled by as he felt air swoosh in and out of his lungs. He studied this phenomenon carefully, as though it were a miracle. As perhaps it was. Food appeared. Coffee: caffeine, yes, lovely caffeine. Nobody spoke. Next course, soup. It tasted like nectar, the essence of life. Then they told him, as he eagerly slurped down a big bowl of fragrant veggie mix grown aboard. Halfway through his third bowl, he became vaguely aware that they were talking about an astrophysical observation that required his interpretation.

“What? Mayra, Astro is *you*,” he shot back. “Every pilot has to be.”

“We need a different viewpoint,” Mayra said, her dark eyes wary. “We do not want to bias your views by explaining more now.”

“We are reviving the captain, too,” Abduss said.

He blinked, startled. “Redwing?”

“It’s that important.” Abduss was unreadable. “He will awaken in another day, his capsule says.” Cliff felt a chill that was not thermal. Stores of food, water, oxygen couldn’t be recycled forever. That was the point in riding semi-frozen: They would reach Glory with enough stores to survive until they could replace what was lost.

“Four of us. Waking too many people would run us short,” he said. “What’s up?”

Again, the Wickramsinghs looked at each other and did not answer.

\* \* \*

As soon as he could walk steadily, they showed him the viewing screens, and for a long moment he could not speak.

The spectacle was striking, both for what was familiar and what was not. *SunSeeker* was forty light-years from Earth, and yet he could identify many of the constellations he had known as a child in Brazil. Their familiar faces swam among a bright swarm of lesser lights, twisted here and there. On the scale of the galaxy, light-years did not count for much.

He immediately looked for their destination. A star not much different from Sol, Glory’s primary should be a white point dead ahead. It was there, reassuringly bright, though still five light-years away. Perhaps its brilliance was enhanced by *SunSeeker*’s velocity? No, that was a small effect. More probably, brightened by his own longing to see, to breathe, to touch an Earthlike world, named Glory out of pure hope before any human eye had seen it. Pixels and spectra didn’t do the job. Other stars brimmed in the rosy night lit by *SunSeeker*’s bow shock. The ramscoop’s plowing through the interstellar gas and ionized hydrogen was an unending rainbow light show, filmy incandescent streamers curving around them as they plunged into the infinite night. Beyond that prow wash lay the spectrally shifted universe. Some of the glimmering stars were intriguing, constellations rearranged—but nothing compared to the nearby red sun.

“That’s the problem?” Cliff asked.

Abduss nodded. “It is a problem, but there is another, larger. We have been wrestling with this more difficult issue, but that can wait for the captain.”

*Can’t these people ever say anything straight?* He made himself say deliberately, “Okay, tell me what’s the big deal about this star?”

“We are overtaking it. When we came on watch, the star was not visible. There was a mild recombination source nearby, rather odd.” Switching to another channel, Abduss pointed out a diffuse ivory plume behind the dark patch.

Cliff frowned. “How long is it?”

Abduss said, “About three astronomical units. This is a signature of hydrogen recombining, after it has been ionized. This linear feature seems to be a jet, cooling off and then turning back into atoms. That’s the emission I made this map from, you see?”

“Um.” Cliff wrinkled his nose, trying to think like an Astro type. “A jet from a star. It didn’t jump out at you?”

Abduss tightened his mouth but otherwise did not move. “At first we did not even *see* the star.”

*Uh-oh...*, Cliff thought. Best to shut up, yes.

“We had much to measure. The jet did not attract much attention, as it seemed unimportant. Yet now we can see it to be related to the star—which suddenly appeared.”

Cliff nodded, smiled, tried to defuse the man’s irritation. “Perfectly understandable. Our problems are inside the ship, not outside. So ... the star popped into view because it came around the rim of this ... thing.”

Mayra murmured, “We became alarmed.”

“Nobody noticed the star before? Earlier watches?”

Abduss blinked slowly. “We could not see it.”

Cliff shrugged. In moderate close-up, the dwarf showed as a disk: it must be close. It was perched at the lip of a much larger arc of light. An ordinary star, little and reddish. He raised an eyebrow at Mayra.

“The spectral class is F9,” Mayra added helpfully. “Most likely the plasma plume means that this star must have been recently active. Early stars often display this.” Under magnification, the expelled matter looked to Cliff like a thin nebula, dim and old.

“But we don’t know it’s a young star,” he said.

“No, stars of this class have very long lifetimes.”

Cliff had never been much concerned with the fate of failed stars as they erupted and faltered. Spectacular, sure, easy to sell to contract monitors—but biology demands a stable abode. Still, he immediately guessed that this veil was a remnant of an earlier era in the star’s life, when it was blowing off shells of hot gas. A good guess, anyway—but of course, not his field. These details of stellar evolution had never interested him very much, since they had little to do with his specialty, the evolution of higher life-forms on worlds similar to Earth. A largely abstract pursuit until the Alpha Centauri discoveries of a simple but strange ecology there. That was what drew him to Glory; Beth was an accidental benefit.

So he shrugged. “Gas from a small star. Why wake me up?”

“You are the highest-ranked Scientific,” Abduss said.

Marya added, “And your specialty may be quite relevant.”

That remark just perplexed him. He felt hungry and tired and disappointed. And miffed, yes, with a raspy sore throat. He sucked in a deep breath. “I’m supposed to assess Glory’s biology, not be awakened to answer questions from the watch crew!”

They blinked, startled. He wondered if he was betraying more than the typical awakened-sleeper irritation they all had been warned about. Chill-sleep was reasonably safe, but coming out of it was not. Every crew member under its enforced hibernation cycle ran a 2 percent risk of subtle neurological damage from a revival, an irreducible price of seeking the stars. By waking him, they had forced him to double that risk. He’d be going back into the chill when he’d done what they wanted. He had rather blithely accepted the risk of several revivals when he became a senior science officer, he recalled, when it was entirely theoretical.

As well, no sleeper could be immediately returned to the vaults after revival. The medical risks were too great. So he was stuck for at least a month in the narrow rumbling quarters of the starship, eating the pallid food generated from ponics tanks. There was no way to avoid the perpetual growl of the fusion ramscoop. Filters could not erase the ever-shifting tones of turbulence as the ship surged through clumps of denser gas, riding waves of ionization—a moving electrical discharge, lighting up its neighborhood.

He had not been slated for revival on the passage at all, so his sensitivity to noise had not been an issue. And indeed, the shifting, grating clangor already irked him a bit. There was no way to damp it, so he would have to use noise-suppressing headphones. Certainly he would not have made the cut for active, awake crew.

The Wickramsinghs glanced at each other yet again, as if to say, *Humor him—he’s a senior officer.*

Both inhaled deeply. Abduss said, "Please tolerate our unveiling this anomaly so that you may experience it as we did."

"Um, yes." He still felt irked, but ordered himself to behave as an officer should.

Mayra said, "Notice that the luminous gas, as you put it, is very straight."

Cliff zoomed the image—and blinked. He had expected a ragged cloud of expelled debris, the star's outer layers blown off. The plume seemed to point at the star ahead. "Pretty, at least. Why so sharp?"

Abduss said carefully, "We wondered, too. None of the astronomical analysis systems had an explanation. But it did alert us to the infrared spectrum."

"Of this plume? Why—?"

Mayra switched to the middle infrared bands, and his mouth fell open. An orange circle stretched across the sky. The plume was an arrow stuck in the exact center of some target.

"The plasma apparently comes from the center of that massive infrared region. It is mostly of hydrogen, and its ions eventually find electrons and they unite," Abduss said, as if he were talking to a student. "That is the hydrogen line we see, the plume cooling off."

Mayra added, "But it did lead our attention to the huge region of soft infrared emission."

"Hey, I'm a biologist—"

"We awoke you because the infrared signature is clear. The circle we see is solid, not a gas."

His irritation vanished. Even a biologist knew enough to be startled by the implication. All he could manage to say was, "That's impossible."

Mayra said mildly, "When I first saw it, I, too, assumed it to be gas. The spectral lines prove otherwise."

He studied it, trying to allow for perspective. "A disk?... It's *huge*."

"Indeed," Mayra said.

"But it can't be a planet. It would be bigger than any star."

Abduss nodded. "We are approaching from behind it, and at present speed will come directly alongside within weeks. The ... thing ... is about three hundred AU away from us." He smiled quickly, as if embarrassed. "Allowing for that, look closer."

"This is why we awakened you," Mayra said.

He blinked. "It's ... artificial?"

"Apparently," Mayra said.

"What? How—?"

"We have just come into view of this object, by coming alongside. It drew our attention because its star suddenly appeared—presto! We could not see it before because the ... the cap, whatever it is ... blocked the starlight as we overtook it."

Abduss added helpfully, "Infrared study shows that it is not a disk. It's rounded. We witness it from behind, with the plasma plume coming through a hole at the exact rear center. The cap radiates at the temperature of lukewarm water."

"A ... sphere?" He saw it then, the image snapping into perspective. He was looking at a ball with a hole in its bottom. Through that hole, the star glowed. His imagination scrambled after an old idea.

"Maybe it's a, what was the name—?"

"A Dyson sphere," Mayra provided. "We thought so at first, too."

"So this is a shell?"

She nodded. "A hemisphere, perhaps—a sphere halfway under construction. Perhaps. Only—the old texts reveal quite clearly that Dyson did not dream of a rigid sphere at all. Rather, he imagined a spherical zone filled with orbiting habitats, enough of them to capture all of the radiant energy of a star."

Abduss thumbed up a reference to these ideas on a side screen. Good—they had done the homework before awakening him. But if not a Dyson sphere, what—?

Mayra said, “We have watched and run the Doppler programs carefully. The hemispherical cap is spinning about the same axis formed by the plume.”

Abduss said helpfully, “Only by rotating such a shell could one support it against the star’s gravity.”

“Like this ship.” He nodded, trying to guess Abduss’s point. “Centrifugal gravity. But a complete, rigid sphere ... spinning ... that would be impossible, right? Gravity would pull it in at the poles.”

They both nodded. Abduss said, “Still, the configuration is not stable.”

They both looked at him, so he went on, thinking aloud. “The shell should fall into the star—it’s not orbiting. There’s some sort of force balance at play here. Odd construction, indeed. Just spinning isn’t enough, either—the stresses would vary with curvature. You’d need internal supports.”

Mayra said, “Quite right, I believe. My first degree was in astrophysics and I have some ideas about this object, but—” She bowed her head and shrugged.

As matters developed, there was a great deal behind Mayra’s modesty. In the next day, eating five meals to build himself up, he learned as much about the Wickramsinghs’ subtleties as he did of the strange object they had discovered. They were deferential toward him, unveiling their ideas slowly, allowing him to come to his own conclusions. This helped greatly as the magnitude of implication grew.

He didn’t even ask about Scorpii 3 until hours later, when Abduss and Mayra were using the control room facilities to lecture him. The planet, their destined home, was a long way off still, and deserved the nickname Glory. Scorpii 3 was the second nearest habitable-seeming world ever found, after the Alpha Centauri base. A fast-burn probe had verified the bio-signatures found by deep space telescopes two generations before *SunSeeker*’s launch. A wonder, with strong ozone lines, a lot of water, and tantalizing hints of green chlorophyll in the spectrum. A dream world. No sign of any artificial electromagnetic emissions, after big dishes had cupped their ears toward it for decades. Plus the mysterious grav waves that made no sense, considering that there were no big masses in the system to send out such quadrupole emissions.

He looked at it in the high amplification forward scope, but it was just a flickering blur through their bow shock. Scorpii 3 was barely visible because it hung near the edge of the structure ahead, though it was many light-years away. He looked at the screens, trying to get his head around what that vast bulk could mean. But emotion overwhelmed him. Pure wonder.

Unimaginable, yes. Bigger than the orbit of Mercury, huge beyond comprehension, the hemisphere was an *artifact*, a *built* thing, the first evidence of another intelligence in the galaxy. Not a trickle of radio waves, but a giant ... riddle.

He took a long breath, relaxed into the observer’s chair and headpiece, and let the slow, long wavelength rumble of the starship run through his bones. And thought.

The Wickramsinghs felt it was a matter of biology. Wake the biologist!

Cliff wrinkled his nose. He had been irked, sure, but the Wickramsinghs were right: You see trouble, you call for help. But he wasn’t prepared for this. But as well he saw that none of that now mattered.

Science had speculated about intelligence for centuries, as probes spread out through a desert of dead worlds. The Big Eye telescopes in the twenty-first century had found warm, rocky worlds resembling Earth, and some had the ozone spectral lines that promised oxygen atmospheres. There the promise had ended. Here and there flourished slime molds in deep caverns, or simple ocean life, maybe—cellular colonies still unable to shape themselves into complex forms, as Earth’s life had more than a billion years ago. Sure, there was life, the consensus said ... boring life.

To find an artifact of such immensity ... it made his mind reel.

Then Abduss said, almost casually, “There is something more. Why we realized the protocols demanded that you be awakened. We have detected narrow-band microwave traffic from near the star.”

Cliff realized that he should have seen this coming. “Coded?”

“Yes. It may be broadcasting from near the hole in the center—the angle is right—and we’re getting some scattered, reflected signals.”

“Are they hailing us?”

“There’s nothing obvious that we can figure out, no,” Mayra said. “There are many transmissions, not a long string. It looks like a conversation, perhaps.”

“So they don’t know we’re here, maybe.”

“We could hear the traffic once we were within view of the hole, I believe. Perhaps it comes from within the hemisphere, and leaks through. It is not broadcast for others to pick up—or so we think. And unintelligible, at least to us.”

Cliff eyed them both and said carefully, “I agree that the protocols call for my revival. But this is more than anybody ever visualized, when those protocols were invented...” He was still dazed after a day awake. And cold; he rubbed his arms to get blood moving. “I wonder if you didn’t wake me too early, though. We’re not looking at plants and animals yet. If we wake too many of us...”

“Yes,” Abduss said.

“We’d run short.”

“We’re short now,” Mayra said. “That is the other problem. It is high time someone woke the captain, we felt.”

“So you did, right after me? Me, because my secondary specialty is in rations and ship biology. Mostly, though, I’m a field biologist. But sure, call me up. Then the cap’n, to take over all the other implications. Right.”

“And now we are happy to turn both problems over to you.” Abduss gave him a broad smile without any trace of irony. Mayra beamed, too. They had faced all this together, and the weight of it showed in their evident relief.

\* \* \*

It didn’t take long to see why they were handing off to him and the captain.

The opportunity: an artifact bigger than planets.

The problem: *SunSeeker* was not performing to specs. The ramscoop drive was running at 0.081 of light speed, instead of the 0.095 engineering had promised.

Not a big difference, but in starflight it was crucial. At 0.081, their trip would take 550 years. They had stocks for a bit over 500 years.

Early space travel had been like this, with tiny margins of safety. Reaching the Moon six out of seven tries had been a miracle. They’d run aging X-planes for a quarter of a century, losing two shuttles before they built something better. Interplanetary travel still cut close to the bone, and interstellar was a crapshoot. And still there were always those who would take the gamble.

Of course, *SunSeeker* recycled everything—and, of course, the accounting never quite came out even. The flight plan had them arriving at Glory with time to find what they needed. Glory had a world with oceans and free oxygen, all carefully checked in the ozone spectral line seen from Earth orbit. And in the infrared, they had seen a broad disk of asteroids, too, comfortably farther out and with traces of iceteroids among them. The world or the rocks would give them the elements they needed: water, oxygen, dust to be turned to soil.

But this slower speed was eating their safety window.

He checked the log. Five watch cycles had worked on the problem in their ramscoop drive without really spotting a cause. None of them had wakened the captain. It was an engineering problem, not a command structure one. And they were on a centuries-long voyage.

The big magnetic fields at *SunSeeker*’s bow drove shock waves into the hydrogen ahead, ionizing it to prickly energies, then scooping it up and mixing it with fusion catalysis, burning as hot as suns—but somehow, the nuclear brew didn’t give quite the thrust it had during field trials out in the Oort cloud. Considering how new relativistic engineering was, maybe this was not truly surprising. Still, it had huge consequences. “We won’t get to Glory in time,” Cliff said.

The Wickramsinghs nodded together. Mayra said, “So...” She did not want to draw the conclusion. “We have cut our rations to a minimum, all five watches, yes,” Abduss rushed in, eyes large. “It was a major decision we made, you see—to revive you and the captain.”

Cliff slurped down more coffee. It tasted incredibly good—another symptom of revival. “You’ve done the calculation. Can we make it?”

“Marginal at best,” Mayra said precisely. “The last five watches have run at the minimum crew number: two. Plus we are pushing the hydroponics to the maximum. We fear it is not enough.”

“Damn!” Cliff grimaced. Starve to death between the stars. “That’s also why nobody woke the captain. One more gut, one more pair of lungs. Until ... yeah.” Until they saw the strange thing up ahead.

\* \* \*

He knew the deeper reason, too. What could the captain do, after all? If the engineers could not find a solution, mere managerial ability would not help. So the engineers had followed the protocols that had been drilled into them: Follow mandates and hope for the best. Especially since an error could kill them all with relativistic speed.

They gazed at him, calm and orderly and patient, the perfect types for a watch crew. Which he was not. Too restless and a touch excitable, the psych guys had said. That was fine with Cliff; he wanted to see Glory, not black interstellar space. All crew were calm, steady types, or they wouldn’t have made the first cut in the long selection filters.

The Wickramsinghs were waiting. He was in charge until the captain woke up. That he did not understand the situation did not matter; he was a superior officer, so he had to make the decisions. First, he had to rest. About that, the revival procedures were as hard-nosed as the mission protocols. At least that would give him a little time to think.

\* \* \*

They found him twelve hours later, in the kitchen.

The first thing he ordered was a thorough study of the star they were approaching. The Wickramsinghs called up screens of data and vibrant images. This gave him a jumpy image of a star massing about nine-tenths of Sol’s mass. There were plenty of those in the galaxy, but this one was not behaving like a serene, longer-lived orange dwarf. Fiery tendrils forked and seethed at the center of the apparent disk. “There is blurring in the image,” Abduss remarked, “by the plasma plume.” Squinting, at first he did not understand the implication of the roiling spikes that leaped from a single hot spot, a blue white furnace. “Ah—that spot is directly under the center of the artificial bowl, the cap.”

Abduss nodded. “Something is disturbing the star, making it throw out great flaming tongues. Very dangerous, I would think.”

They were coming up on this system pretty fast. Cliff thumbed in the whole data field. The obviously artificial disk—okay, call it the cap, because he could sense from the image that it was curved away from their point of view—the cap was not at all far away, maybe a few hundred astronomical units, where an A.U. was the distance from Earth to Sol. You got used to such enormous distance measures, in the relentless training all crew had to undergo.

He tried to remember when that was ... centuries ago. Yet it seemed like just a few weeks.

He looked at the image and let his eyes see it as a curved hemisphere cupped around this side of the star.

They zoomed the optics in on the disk’s flares, having to go through several settings that blanked out the blue white hot spot on the star’s surface. The glare of the hot spot was fierce, actinic, bristling with angry storms, a tiny white sun attached to the bigger pink star like an angry leech. Above the white spot raged the filigree spikes of streaming plasma. They whirled around one another like fighting snakes, burning as they rushed up from the hot spot. It looked like they should bathe the hemispheric bowl in licking flames. But before they reached the curve of the bowl, they

dovetailed into a slender jet. Among the streamers, Cliff could see little blobs and bright flecks moving out from the star, swarming up along the jet, toward the neatly circular hole in the bowl and out into the sky.

Cliff wrestled with the images. "Let's see the earlier pictures, from the last watch."

Automatically, the ship kept records of the local sky. Its software was spectrally sophisticated and framed its own, limited hypotheses about the class and type of every luminous object it saw. They checked the records. The muted minds that murmured among themselves, struggling to understand the bowl, had spun endlessly in parameter-space confusions.

In the infrared, there was a glow where the "bottom" of the bowl would be. None of the instruments showed any image of the bowl during the years while the ship was approaching from behind. He thumbed through uninteresting pictures. The bowl blotted out a small dot on the sky, but nobody had noticed such a minor thing from light-years away.

The bowl's infrared radiation showed a temperature around 20 degrees centigrade. Room temperature.

"Ah, balmy," Abduss said. Across that vast curve, tropical conditions prevailed. The back face was cool and appeared stony. But the warmed side was at 20 degrees C. The star was less luminous than Sol—but, of course, the bowl was in continuous sunlight, so it would get pretty warm. No night. Cliff had a mind's eye picture of the bowl as a colossal construction, even though his common sense was screaming. When something appeared impossible, it seemed best to simply study it until understanding emerged. And wait for the captain to wake up, yes.

The first shock came from simple geometry. Mayra gave him distances and angles and he quickly found that the area of the inward-facing cap was two hundred million times that of Earth. Hovering over its star, the rim of the bowl would provide a vast, livable surface. (The biologist would wait for the captain's take, but ... *Air. Water. Stores to replenish a failing ship.* The Wickramsinghs nodded and smiled when he spoke of this....)

On that area, peering through the small hole they could see, Abduss picked up reflecting optical emission ... and found the spectral signatures of water. Then, with a bit more effort to see through the rippling plasma that shrouded *SunSeeker*, he found oxygen.

So it was an immense area designed for living ... by what?

Cliff checked their distance from the bowl: 320 AU—about a hundredth of a light-year. *So close!* And coming up fast.

But they were still looking at the back of the cap, in the dark. He looked at the waiting faces of the Wickramsinghs and thought. They were left with some brute astronomical facts—velocities, times, food supplies....

At their review meeting, the Wickramsinghs eyed him expectantly.

"It's beyond me," he said—and watched their faces, despite their best efforts, show disappointment.

"Surely we can learn more?" Mayra suggested hesitantly.

"Not at this distance," Abduss said. "And I doubt the captain will authorize a trajectory change to get closer."

Cliff looked at them and thought unkind thoughts. Five crews didn't wake the captain, because there wasn't an answer. They had been trained to keep the ship running. Schooled to stay steady. But here was something the Earthside planners had never imagined.

"I think we have two problems," Cliff said with what he hoped was a diplomatic tone. "Supplies, yes. And this strange ... object. Too much here for us to deal with."

Abduss said carefully, "We had thought somewhat the same."

"Look," Mayra said directly, "it's nearly time to take the captain up to his conscious stage—"

"I want Beth Marble brought up, too."

Both of them blinked. "But she is—"

"Capable, right." He could see a lot of trouble coming, and he didn't want to be alone. Who did?

“But there is no protocol requiring—”

Cliff held up his hand and looked across the table steadily, letting them think about it. “Let’s just do it.”

“She is ... not your wife.”

“No, but she has ship skills and can pilot.”

“Not until we can ask the captain,” Abduss said. His face was firm.

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