

# FLEET OF WORLDS

LARRY NIVEN AND EDWARD  
M. LERNER



## Praise for *Fleet of Worlds*

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“A far-future SF mystery/adventure set two centuries before the discovery of the Ringworld by humans . . . Intriguing human and alien characters and lucid scientific detail.”

—*Library Journal*

“A new Known Space book, particularly one with new information about Puppeteers and their doings behind the scenes of human history, needs recommending within the science fiction community about as much as a new Harry Potter novel does—well, anywhere. But Niven and Lerner have produced a novel that can stand on its own, as well as part of the Known Space franchise.”

—*Loc*

“If you’re a Niven fan, just go buy the book. It’s that good! . . . It’s the finest Known Space work I’ve read in many, many years that I’ve had the pleasure to read. This is an essential read for anyone interested in how good science fiction can be.”

—*The Green Man Review*

“A very worthy addition to the ongoing Known Space future history.”

—*Sci Fi Weekly*

“As we have long expected from Niven, it’s a great read, and Lerner—as *Analog* readers know—has the knack as well. You’ll enjoy this one.”

—*Analog Science Fiction and Fantasy*

“Larry Niven and Edward M. Lerner have teamed up to write the prequel [to *Ringworld*], and it’s well worth reading whether you’ve read *Ringworld* and its subsequent books or not.”

—*SFReview*

“If a little knowledge is a dangerous thing, a lot of knowledge can rock worlds.”

—*The Kansas City Star*

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TOR BOOKS BY LARRY NIVEN  
AND EDWARD M. LERNER

*Fleet of Worlds*  
*Juggler of Worlds*

TOR BOOKS BY LARRY NIVEN

*N-Space*  
*Playgrounds of the Mind*  
*Destiny's Road*  
*Rainbow Mars*  
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*Fools' Experiments*

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FLEET *of*  
WORLDS



Larry Niven  
AND  
Edward M. Lerner



A TOM DOHERTY ASSOCIATES BOOK . NEW YORK

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FLEET OF WORLDS

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A Tor Book

Published by Tom Doherty Associates, LLC

175 Fifth Avenue

New York, NY 10010

[www.tor-forge.com](http://www.tor-forge.com)

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ISBN-13: 978-0-7653-5783-0

ISBN-10: 0-7653-5783-6

First Edition: October 2007

First Mass Market Edition: September 2008

Printed in the United States of America

0 9 8 7 6 5 4 3 2 1

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## DRAMATIS PERSONAE

### HUMANS / CREW OF *LONG PASS*

Diego MacMillan *Navigator*

Jaime MacMillan *Doctor*

Sayeed Malloum *Engineer*

Barbara Nguyen *Captain*

### SOL-SYSTEM HUMANS

Sigmund Ausfaller *Amalgamated Regional Militia (ARM) investigator*

Sangeeta Kudrin *Senior executive at the United Nations*

Julian Forward *Physicist (native of Jinx, in the Sirius system)*

Miguel Sullivan *Racketeer*

Ashley Klein *Racketeer*

### CONCORDANCE COLONISTS / CREW OF *EXPLORER*

Kirsten Quinn-Kovacs *Navigator and a math whiz*

Omar Tanaka-Singh *Captain*

Eric Huang-Mbeke *Engineer*

### CONCORDANCE COLONISTS / OFFICIALS OF THE ARCADIA SELF-GOVERNANCE COUNCIL

Sven Hebert-Draskovics *Colonial archivist*

Sabrina Gomez-Vanderhoff *Governor*

Aaron Tremonti-Lewis *Minister, Public Safety*

Lacey Chung-Philips *Minister, Economics*

### CONCORDANCE CITIZENS

Nessus *Political officer on Explorer; Experimentalist neophyte*

Nike *Deputy Minister, Foreign Affairs; Experimentalist radical*

Eos *Leader of out-of-power Experimentalist Party*

Hindmost / Sisyphus *Leader of the government and the Conservative Party*

Baedeker *Engineer at General Products Corporation*

Vesta Nike's *senior aide*

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# *FLEET OF WORLDS* TIMELINE

(All dates in Earth-standard)

- 2095      Ice World begins its interstellar journey.
- 2197      *Long Pass* signals to the Ice World, spotted one light-year away.
- 2198      *Long Pass* is boarded.
- 2645      A supernovae chain reaction is discovered at the galaxy's core.  
The Fleet of Worlds begins its flight to safety.
- 2650      First expedition of *Explorer* to the Gw'oth world.  
In Known Space, UN authorities renew their search for the recently vanished Puppeteers.  
Political crises brew on Earth and Hearth.  
Colonists seek the truth about their past.  
And so: Many events, on several worlds, ensue.
- 2652      New Terra charts its own course.





~~*Long Pass* crossed the sky in a series of shallow curves, because Diego MacMillan willed it so.~~

Interstellar space is not uniform. The tenuous interstellar medium isn't just a few atoms of hydrogen per cubic inch, forever. There are pockets of greater density, some thick enough to form strings of stars, given time. Between the dense patches there is nothing. A Bussard ramjet like *Long Pass*, which eats interstellar hydrogen and accelerates by spitting out fused helium, must coast between the denser clouds.

This is worse than it sounds. At any reasonable fraction of light speed, interstellar muck comes off like cosmic rays. As much as propulsion, a Bussard ramjet's purpose is to guide that lethal muck away from the life support system.

Every simulation run in the Sol system had reached the same inconclusive conclusion: Course tweaking to exploit density fluctuations in the interstellar medium was "likely to be" unproductive. Between Sol and the target star the muck was thick enough. Sure, a course tweak might funnel a bit more hydrogen into the ramscoop *here*, but was it enough to compensate later? A slight diversion at these velocities took a heavy toll in kinetic energy. And what would you find when you reached the end of a detour? Maybe that was where the law of averages caught up with you, and the near-vacuum of interstellar space became vacuum indeed.

Of course, flatlanders had built the models. Diego MacMillan had nodded noncommittally at their advice. Technically he was also a flatlander—spacers pinned that label on every Earthborn—but he had traveled across the solar system. Once *Long Pass* launched, whether he undertook the experiment was beyond their control.

The question had never before come up on a manned mission. *Long Pass* was experimental, a crew-rated ramscoop.

In the abstract, Diego respected the mission planners' conservatism. The ship's failure could discredit the new technology for a long time.

Flatlanders! He and his wife were aboard. That was more than enough to keep him from taking foolish chances.

So *Long Pass* had followed its wobbly curves for decades now. Maybe he'd saved a few months of travel. That was okay. Studying the variations, plotting alternate courses, assessing probabilities—they kept him busy. What had the experts imagined the ship's navigator would *do* for decades?

They could never have imagined what, in his obsessive peering ahead, he would find.

AND TO WHAT do we owe this honor?" Captain Nguyen asked.

Meaning that by the current schedule Diego would normally be asleep. It was all he could do not to blurt out the answer. *One step at a time*, he told himself. "All will be revealed," he intoned with his best mock pretension.

The ship's population numbered just above ten thousand. Most were embryos, sharing the freezer with forty-three hibernating adult passengers. The crew numbered only four, between them covering three daily shifts. Together, they filled the ship's tiny dayroom.

He had arrived early to configure the claustrophobia-denying decor. Undulating, verdant forest, the Andean foothills of his youth, receded into the digital wallpaper. Fluffy clouds scudded across the brilliant blue sky glowing overhead—he had no use for the cave-parks his Belter crewmates thought normal. Leaves rustled and insects droned softly in surround sound. Most of one wall presented a well-remembered mountain lake on which a sleek, two-toned power boat cruised. Its hundred

horsepower inboard motor was throttled down to a barely audible purr.

Nothing, alas, could mask the ubiquitous odor of endlessly recycled air, nor could the rough-hewn planks projected from the dayroom table disguise the plasteel slickness beneath his fingers. He twiddled the cabin controls, tuning chirps and twitters down a notch, while his curious shipmates took coffee and snacks from the synthesizer.

Barbara Nguyen sat first. She had the tall, gangly frame of a Belter, and her head was shaved except for a cockatoo-like Belter crest of thick black hair. She was their captain and the most cautious among them; which was cause and which effect remained stubbornly unclear to Diego. Throughout the hitherto uneventful voyage, she had let decisions emerge by consensus. With luck, consensus-seeking had become a habit.

Sayed Malloum, their engineer, was taller still but stocky for a Belter. Each of them handled the tedium in his own way. Sayeed's latest affectation, dating back several weeks, involved dyeing his crest and disposable jumpsuit in matching colors. Today's hue was chartreuse, shading to deep yellow.

Jaime MacMillan, ship's doctor and Diego's wife of fifty years, slid into the last chair. She was built to earthly scale, nearly matching his six feet, but otherwise illustrated the old adage about opposites attracting. She was lithe while he was pot-bellied, blonde where he was dark, and as fair as he was swarthy. Those were shipboard skin tones, of course. Flatlander full-body dye jobs and elaborate skin patterns had been left on far-off Earth.

Jaime slipped a hand beneath the tabletop to give his knee a reassuring pat, although not even she knew what he was about to reveal. With a start, he noticed she had printed her jumpsuit in Clara MacMillan tartan: another silent vote of confidence. How anxious did he seem?

Barbara cleared her throat. "Spill it, Diego. Why did you call everyone together?"

Oh, how the details and analyses, all the terabytes of specifics in his personal journal, yearned to be free. This was not the time. "Have a look." Above the picnic-table illusion he projected a navigation holo. Amid the scattered pink, orange-white, and yellow-white specks of the nearest stars, a brilliant green asterisk blinked: You are here. As his friends nodded recognition, he superimposed, in tints of faint gray, a delicate 3-D structure. Would they see it? "Density variations in the interstellar gas and dust."

Sayed frowned, likely anticipating another pitch for rerouting the ship on one more just-a-bit-off-our-planned-course wrinkle in the void.

"You've shared density plots before. It's never involved much fanfare." Barbara eyed him shrewdly. "And you've never before struggled so hard not to bounce in your chair."

Words alone would not suffice—not for this, not with Belters. That was not a criticism. Growing up inside little rocks, they lacked the background. Diego said, "Jeeves, give us Boat One."

"On full throttle, sir, as you had specified." The virtual speedboat slewed until its stern faced the shore and the shore. With a roar, the boat's bow rose. A great vee-shaped wake formed. Diego tracked the boat as it receded, the ripples of its wake dwindling as they spread.

Sayed's gaze flicked between the simulated lake and the 3-D graphic that still hung above the table. "There's a shock wave in the interstellar gas. A . . . a bow wave."

Barbara narrowed her eyes in concentration. "I concede the resemblance, but we're comparing two simulations. Diego, are you certain about the underlying data?"

It would be so easy to dive into minutiae about years of observations patiently culled and collated, about converting those observations from the ship's accelerating frame of reference to a stationary frame, about estimating and correcting for the perturbations of stellar winds. He could have discussed at length vain efforts to match his readings to the sky survey with which they had departed Sol system

He yearned to explain the extrapolation of the full pattern from the mere fraction so far glimpsed even after so many years and light-years of observations.

He must have had a fanatical glint in his eye, because Jaime shot him the warning look that reminded: There's a fine line between scary-smart and just scary. Diego kept his response to a confident nod.

Barbara said, "I'll want to go through it later, step by step. No offense, just captain's prerogative."

"What could have made this bow wave?" Sayeed asked.

That was the right question. Diego started another simulation. A more nearly uniform background wash, modeled from a century-old survey, replaced the translucent ripples in the stellar display. "This is what we expected to encounter. And . . . now."

A new speck, this one bright violet, materialized in the holo. Gathering speed, it recreated the 3-shock wave.

Jaime stood, squeezing behind his chair to study the image from another perspective. She poked her finger into the image. "Then whatever caused the waves is here?"

"Obviously, the simulation runs faster than real-time. I've given you no way to gauge the compression factor. The object producing the wake is moving at one-tenth cee, and we're nearly a light-year apart. To look at it, we aim"—Diego tweaked a program parameter, and a backward-extrapolated trajectory materialized—"where it was."

He linked their main telescope to the display. A dark sphere shimmered, faintly aglow in a false-color substitution for IR. Mountain peaks and hints of continental outlines peered out from beneath an all-encompassing blanket of ices.

Sayeed leaned forward to read annotations floating above the globe. "An Earth-sized world. At one point, it was Earthlike, its oceans and atmosphere since frozen. It's a bit warmer than the interstellar background, which is why we can detect it, perhaps leakage from a radioactive core. And somehow, you say, it's racing by at one-tenth light speed. How can that be?"

Barbara shook her head, setting her crest to bobbing. "A fair question, but I have a more basic one. Diego, you might have *begun* by showing us what you'd found. Why didn't you?"

"Because this isn't about an out-of-place planet. I need you to accept the years of observation and the model that showed us where to look." Diego took a deep breath. Would they believe? "They prove that that world has been accelerating steadily at 0.001 gee.

"*Someone* is moving it—someone who controls technology we can't even imagine."

"ARE YOU AWAKE?"

Diego was reasonably certain he'd been prodded in the ribs to assure a positive response. "Uh-huh," he answered groggily. "What's on your mind?"

Propped up on an elbow, long hair looking stirred from tossing and turning, Jaime stared at him. "Are we doing the right thing?"

For days, the four of them had gone around and around on this. Even Nguyen had come over. The big day was *tomorrow*.

But decisions feel different in the dark. "Jeeves, lights to quarter bright," he told the onboard computer. It had the good judgment to comply without speaking. "Hon, we've all agreed. We can't let Earth decide! They're almost fifteen light-years away. Whether they signal the aliens directly—which they wouldn't, since there's no guarantee the planet won't change course in the meanwhile—or they tell us to proceed, that'd be nearly a thirty-year delay. What does *that* do for us?" Despite himself,

yawn interrupted his response.

Then she surprised him. ~~“That’s not what I meant. Maybe we shouldn’t contact them at all. What they’re . . . hostile?”~~

That brought him fully awake. Ascribing violent intent was a good way to get sent for medical help—but aboard this ship, *she* was the medical help. “Advanced civilizations are peaceful,” he said cautiously.

“I know.” She raked a hand, fingers splayed, through her mussed hair. “War was a societal psychosis. With the resources of a solar system at our disposal, and with Fertility Boards to keep population levels under control, there’s been peace for more than a century. We left behind violence with the era of scarcity that the mentally ill used to excuse it.” The words came out like the secular catechism that they were. “They”—no antecedent was needed—“move entire worlds. How could they possibly covet the resources humans administer?”

She was shivering! Sitting up, he put an arm around her. “Then why are you worried?”

She snuggled against him. “Because aliens must surely *be* alien. Can we presume to predict their social development?”

“Can we presume to decide for mankind *not* to try contacting them? We’re almost a light-year apart. We’re moving at thirty percent cee. The ice world is moving at ten percent cee, and accelerating. Contacting them by comm laser already requires extrapolation and faith. Deferring to Earth could mean losing the opportunity.” He kissed the top of her head.

“We’re not making this decision only for ourselves,” she said softly.

He said, “There’s a reason our computers, like every starship’s computers, carry the UN’s standard First Contact protocol. Sending us off with the protocol means the UN recognized we might have \_\_\_”

“I mean our children.” She shifted into a sitting position, careful not to dislodge his arm. “Diego, they may be only frozen specks, two among thousands, but the decision we’ve made affects them.”

The children they were permitted only by leaving Sol system behind. “I think companionship in the universe will be a wondrous gift for them.”

For a long while, the omnipresent hum of fans was the only sound. Then she said, “I might be worried about nothing. There may be no answer to our signal. Some unknown natural phenomenon could explain that planet’s movements.” She squeezed his hand. “The first extraterrestrial intelligence or a brand-new cosmic force. Either way, you’ve made one heck of a discovery.”

If its acceleration were constant, the ice world had taken about a century to reach its current velocity. In that time, it would have crossed a bit over five light-years. A red-dwarf star lay more-or-less in its backtracked direction, at about that distance. One of its worlds, a gas giant alongside which Jupiter would seem puny, had a separation in its satellite system, a gap at odds with the accepted theory of planetary formation. “It could be a natural phenomenon,” Diego agreed.

But he didn’t believe that.

THE NORMAL COURSE of shipboard events was that there were none. One could get very bored, even at full cruising speed, between encounters with significantly sized dust motes. Every excuse for celebration was quickly embraced.

Four birthdays and New Year’s Day (despite Diego’s railing at the pointlessness of commemorating a random spot on the orbit of an increasingly remote planet) left long stretches of mind-dulling routine.

The liquid in Diego's glass was undeniably of that morning's vintage. "Jeeves, did you *taste* the stuff?"

"Harmless," the Jeeves program said. "Mostly harmless."

"Good enough," and Diego raised his glass. Fine wine would significantly overtax the synthesizer capabilities. Today the four of them celebrated something *real*. Ice World, months ago promoted to proper-noun status, should now have received the first-contact greeting lapsed more than a year earlier. Should . . . for such a simple word, it conveyed a satisfying and very newfound conclusiveness. They had signaled to where they projected the distant, speeding planet would be—if it continued without interruption on its steady course and acceleration.

It had.

A miniature Ice World, unanimous choice for the party's décor, glittered above the dayroom table. Months of continuous observation had yielded details far beyond the crude holo he had first shown his shipmates.

*His shipmates.* With a start, and to Jaime's knowing smile, he returned his attention to the party. "To new friends!" Glasses clinked, contents sloshing a little, and were enthusiastically emptied.

Sayeed shrugged. In the steadfastness of the Ice World's hurtling trajectory, which three of them saw as evidence of intelligent intervention, he saw a mindless, if unknown, natural force. On one point all agreed: At least one of them was spectacularly wrong. Long after the discovery of pulsars, astronomers still remembered the hasty misattribution of the celestial rhythms to aliens. None of *them* planned to be forever remembered for announcing imagined aliens—or for failing to recognize real ones.

"In another year-plus. Two if they ponder and muse for a while about how to respond." Barbara poured another round of the *vin très ordinaire*. "I wonder what, still assuming someone *is* there, they will have to say."

Any alcohol is potable by the third serving. The day was special; they imbibed enough of today's wine to render it superb. Eventually, they had Jeeves draw virtual straws. Jaime lost. She was taking a very strong stim when the rest of them headed to bed.

THE VOICE OF Jeeves brought Diego instantly awake. "All hands to the bridge!"

He burst through the cabin door shouting, "What happened?"

Barbara beat him onto the bridge, but only because her cabin was closer. He and Sayeed were left to loiter anxiously in the corridor. The bridge couldn't accommodate them all.

"Radar pulse hit us." Jaime's chair spun as she relinquished it to the captain. "There's nothing on our sensors."

"Jeeves, alarms off." The warbling screech mercifully faded. Barbara settled into her seat and triggered a ping. Above a monitoring console, a spherical volume grew and grew: the representation of the space probed by that pulse. "Nothing," she finally concluded. She downed the stim pills Jaime offered. "That's as it should be. We must have a flaky sensor."

Diego nodded jerkily. *They couldn't have reached us.*

A new alarm blared. Parallel rows of floor lights blinked, painfully bright, their sudden mania cycling drawing Diego's attention down the curved corridor. Emergency hatches slammed; the sirens and the whooshing stopped. "Hull breach in storage bay D," Barbara said. "Check that out, Sayeed."

Diego's head pounded. He dry-swallowed the pills Jaime now offered him. The alarms resumed, joined by the windstorm of a second breach aft. Something was poking holes in their ship. What,

nothing were nearby, had breached the hull? They were moving at thirty percent of light speed. What could possibly overtake the ship from behind? *Light speed! They couldn't have reached us!*——

“Jaime! Trade places.”

They squeezed past each other and he dropped into the lone chair beside the captain. Radar, lidar, maser—the instruments reported nothing, regardless of the frequency they sent.

Oh.

“Barbara, let’s just *look*. No active sensors, just Mark I eyeballs.” She spared him a sideways glance—light-years from the nearest sun, what could he expect to see, and how? But she did as he proposed.

The exterior cameras spun with the hull. Computers compensated for the gravity-simulating rotation, projecting a stationary star field onto the bridge. The stars behind were reddened and dimmed; the stars ahead flared, visibly shifted toward blue. And to one side: a large, circular patch of pitch-blackness. Whatever blocked the starlight was huge, or close, or both. Its immobile appearance meant it was orbiting them, matching the ship’s rotation.

“What the tanj *is* that?” Barbara focused their radar and lidar on the apparition. “Still no return signals. The echoes are being nulled somehow.”

“They’re——” Jaime bit it off, but Diego could finish it for her. *They’re poking holes in our ship.* Enemy aliens. She thought they were under attack.

“Sayeed, report.” Diego’s words echoed from speakers across the ship. There was no answer.

Another alarm. More wind rushing from the bridge. More emergency bulkheads slammed shut. “I’m on it.” Jaime’s voice quavered as she dashed off.

There was precious little privacy in the *Long Pass*; by mutual agreement, the corridor cameras had been powered down early in the mission. Muttering under his breath, Diego hunted for the command sequences to awaken them. The first reactivations came a tantalizing few moments late. Was the shadow disappearing around a corner Sayeed’s? Jaime’s?

One more ear-piercing alarm and again sudden wind tugged at his clothes. This alarm, too, faded. Barbara reset it. What was that scurrying sound?

“Pressure continues to drop throughout the ship. I’m closing all interior hatches,” announced the main bridge computer.

“Thank you, Jeeves. Give us the corridor cameras.”

At last they were all on. Diego cursed as one revealed Sayeed, crumpled and motionless, face down on the deck.

Black, many-limbed figures scuttled past the camera at a nearby corridor intersection, moving too fast for Diego to integrate what he was seeing into a meaningful picture. Aliens, or robots, or alien robots. . . .

Barbara had seen it, too. “We’ve been boarded.”

The bridge hatch burst inward before he could respond. There was a brief glimpse of serpentine limbs, an impression of something pointing at him, and a nearly subsonic vibration.

Then there was only darkness.

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Alone in his cabin, behind a triply locked hatch, within a vessel constructed from the most impenetrable material ever made, light-years removed from any conceivable hazard, Nessus cowered.

“Nessus” was a label of convenience. His actual name, Citizen speech requiring two throats for proper articulation, was unpronounceable by his crewmates on the opposite side of the sturdy hatch. He had once overheard an irreverent Colonist remark that his true name sounded like an industrial accident set to music.

Curled into a ball, heads tucked safely inside, Nessus saw and heard nothing. He unclenched only enough to breathe. The herd pheromones continuously circulating in the ship’s air would eventually calm him. Meanwhile, surely, his anxiety was appropriate.

How could he *not* panic? He represented a trillion of his kind. Only the merest fraction of the Concordance could bear to take leave of the home world. Yet here, by his own initiative, he was—because the alternative, for all of the trillion, was even more unthinkable.

The panic attack ebbed, and a head emerged for a peek. Sensors hidden throughout the ship reported that conditions remained normal. His three Colonist crew were unaware of or properly respectful of his mood. Two were within their respective cabins, one softly snoring; the last stood watch on the bridge.

Had he truly thought: normal? Normality existed only on Hearth, in the time-tested rhythms of life amid the teeming multitudes of his kind.

He rolled once more into a tight, quivering orb. Without radical changes and much luck, everything *normal* was doomed.

\* \* \*

YOU NEVER SAW hyperspace; quite the opposite. The brain refused to acknowledge that a dimension so strange could exist. Objects all around a cabin window somehow came together, the mind denying the nothingness between. You covered the window, but a coat of paint or a scrap of fabric only taunted you that oblivion lurked behind. You had to get used to hyperspace, and some never did. Hyperspace had driven many people mad.

Kirsten Quinn-Kovacs, alone on the bridge, studiously ignored the covered view port. There was much else to do, and much more to occupy her thoughts. Everything was new and wondrous. Merely to be aboard was a tremendous honor.

At every moment, the strangeness of it all threatened to overwhelm her.

The bridge of *Explorer* was a chimera, a superposition of improbable parts. Chimera: The word itself was a fanciful novelty, describing a fantasy creature. Nessus had taught it to her, claiming to have learned it on an alien world far, far away.

What could be more improbable than that *she* was on her way to study an unexplored alien planet? Though there was little chance she would set foot on that new world, this trip was an amazing opportunity. Except as a passenger or on training flights, always within sight of the Fleet of Worlds, no Colonist had been on a space ship—until now.

She stretched and her crash couch stretched with her. Whoever had built it truly understood Colonist physiology. The flight and navigation controls within her reach were likewise comfortable and intuitive. The General Products company knew their stuff. It amazed her that *Explorer* was only a prototype.

The other seat on the bridge, a padded bench, was as clearly meant for Nessus. The console before Kirsten had its analog near that empty couch. She could, in a crisis, interpret those other instruments; she could barely operate those controls. Her hands did not begin to approach the dexterity or strength of a Citizen's lips and jaws.

Although half the bridge's seating accommodated Colonist physiology, the room itself was clearly designed to Citizen standards. There was not a sharp corner to be seen. Consoles, shelves, instrumentation, the latching mechanism on the hatch—everything looked melted and recongealed. Citizens perceived an unnecessary hazard in every crisp edge and pointed corner.

The nothingness that was hyperspace whispered to Kirsten, daring her to acknowledge its presence. She fixed her eyes instead on her console. The heart of the instrumentation was a large transparent sphere: the mass pointer. Each blue line radiating from its center represented a nearby star. The direction of the thread showed the direction to the star; the length of the thread represented the star's gravitational influence: mass over distance squared. The longest thread by far pointed straight at her destination.

Logic said that a glance every shift or two was more than sufficient—even at hyperdrive speed, the trip took three days to cross a light-year—but logic seemed a flimsy thing indeed while the nothingness stalked her mind. She shuddered. Ships in hyperspace that too closely approached the singularity around a stellar mass, vanished. The mathematics was ambiguous. None knew where the disappeared had gone, or whether they even still existed.

Monitoring seemed like a process that could be easily automated—simply drop out of hyperspace when a line got too close—but it was not possible. The mass detector was inherently psionic; it required a conscious mind in the loop.

Even splitting the responsibility three ways, the stress was intense. They dropped into normal space every few days, if only for a moment to remind themselves that stars were more than hungry singularities reaching out to devour them.

“Does a thirty-day journey still seem like a simple thing?” The voice was a rich contralto that women envied and men found disturbingly alluring.

Kirsten looked up, the clatter of hooves on metal decking that should have alerted her to Nessus's approach only now making a conscious impression.

One head held high, the other low, he watched her from two directions at once. With the instinctive caution of Citizens, Nessus had paused half-inside, half-outside the hatchway, poised to dash in any direction.

Her whole life she had been beholden to Citizens. So it had been for generations. But while Kirsten knew about Citizens, and respected and revered them, she had *met* few of them. Her people, like sharp corners, were an avoidable risk.

Now, in the emptiness behind the void between the stars, Kirsten reawakened to how dissimilar Citizens and Colonists truly were.

Nessus stood on two forelegs set far apart and one complexly jointed hind leg. Two long and flexible necks emerged from between his muscular shoulders. Each flat, triangular head featured a large ear, an eye, and a mouth whose tongue and knobbed lips also served as a hand. His leathery skin was a soft off-white, with few of the tan markings common among some Citizens. The unkempt brown mane between his necks covered and padded the bony hump that encased his brain.

He raised a neck. His heads swiveled toward each other, eye briefly peering into eye, in an ironical laugh. Her brave words at the start of the journey had not gone unnoticed. Despite her embarrassment, she was relieved that he had come out of his cabin. Relieved, but not surprised: The surprise would

have been his continued absence as they neared their destination and its unknown perils.

Of course had Nessus not emerged in another shift or two to oversee the ship's arrival, she would have hit the panic button. The looped recording of a Citizen screaming in terror would bring him to the bridge, no matter what.

The room must have looked safe enough. Nessus entered and straddled his thickly padded bench, arching one neck forward to more closely examine the mass pointer. "We will arrive soon," he said. The simple statement ended with a hint of rising inflection that was surely no accident.

He had run the experimental training program for Colonist scouts. Surely questioning his protégé was by now second nature to him. But what was the question? Whether preparations had been completed while he hid in his room? No, that topic would be reserved for the captain.

Twenty of the best and brightest had been winnowed from the Colonists' millions. Whatever their avocations or interests, until this time of crisis every Colonist contributed directly or indirectly to food production. The trillion Citizens on Hearth consumed vast amounts of food, and left scant open space on which to raise it. How she, Omar, and Eric performed on this mission would be taken as proof whether any child of farmers and conservationists could rise to the occasion.

Before departing the Fleet, the biggest risk the three of them had imagined was a lack of challenge. The unsuspecting aliens whose faint radio emissions had drawn Hearth's attention might prove to be primitive. They might offer the crew no opportunity to show their talents.

How naïve those fears now seemed!

Risks motivated Citizens, risks and finding ways to avoid them. If Nessus were questioning her, most likely the unstated subject was risk. He wanted to know: Did she understand the dangers?

The only tasks in hyperspace were routine maintenance and monitoring the mass pointer. The one was tedious, and the other nerve-racking. In such a small crew, everyone took turns. They were about to emerge from hyperspace, though, and this time not only for a reassuring peek. When they did, the star that had been their target would instantly become the brightest object in their sky. In that instant the crew's roles would cease to be interchangeable.

She would be a navigator once more, once more with stars to steer by.

"We'll assume orbit well outside the singularity," she answered, guessing at his implied question. "I can't imagine how they could detect, let alone waylay us—but if they do, we'll reengage hyperdrive and be gone."

Two bobbing heads, alternating high and low, left Kirsten convinced she had guessed correctly. She smiled too, in her own Colonist way.

*EXPLORER BURST FROM hyperspace at furious speed.*

The courage that enabled Nessus to be here meant that he was, by definition, insane. Kirsten had never met a sane Citizen, because they never left Hearth. Her hands never left the flight controls, but her eyes kept darting involuntarily to the right where Nessus rested upon his crash couch. He could take control of the ship from her at any time. The knowledge was simultaneously reassuring and demeaning.

The Fleet's velocity at *Explorer's* departure was "only" 0.017 light speed. Setting out, that initial impetus had seemed a meaningless crawl in the context of the light-years they were about to cross. That same intrinsic velocity as they reentered normal space was an altogether different matter.

Under Nessus' watchful eyes, Kirsten shed excess speed using the ship's gravity drag. Three times she micro-jumped them back to hyperspace, looping them around their target for another braking pass.

*Explorer's* fusion drive would have accomplished the task much faster—but a miles-long column of fusing hydrogen, hotter than the surfaces of stars, would have shouted the news of their arrival to anyone watching.

“Well done,” Nessus finally said.

“Thanks.” Her mentor’s words seemed both sincere and tentative. As Kirsten steered *Explorer* in orbit around the distant spark named G567-X2, she initiated a deep-radar scan. It was both doctrine and enigma. Neutrinos passed right through normal matter, so what were they looking for? “It is good practice,” was the only explanation their trainer had offered. “Nessus will know what to do if there is a return signal.”

As busy as she was, Kirsten could not help wondering what the aliens called this sun. Nessus would not care. Citizens exhibited curiosity only when their safety might be imperiled. At other times, they considered inquisitiveness to be at best a distraction.

Perhaps their curiosity made Colonists better explorers, and that was why they were here. Or perhaps Colonists were only expendable. Her parents and brothers thought the latter. *And if no one were willing to scout ahead of the Fleet?* Her family had no answer to that.

With a sigh of relief, Kirsten raised her hands from the controls. “We’re in orbit,” she announced over the ship’s intercom. To Nessus, she added, “We’re safely outside the singularity, as promised.”

With one head high and the other low, he studied her. “Good. Our work here begins.”

Of the solar system they had come so far to survey, only the star that they distantly circled was visible to the naked eye. Their instruments reported one gas giant and three rocky worlds, plus an unexceptional assortment of asteroids and remote snowballs.

Radio signals had brought *Explorer* here; radio signals emanated now from only one spot in the solar system: the third moon of the gas giant. On close examination—*close* denoting high magnification, not proximity—that moon was tidally locked to its primary, airless, and sheathed in ice. Great cracks crisscrossed the icy surface. Nessus remembered seeing another world quite like this once, a long time ago. It was called Europa.

“There is probably a world-spanning water ocean under the ice,” Omar said. He was pacing the narrow aisle of the relax room, which, after the machinery-packed engine room, was the largest chamber aboard the ship. Eric and Kirsten were tucked into small spaces on either side of the treadmill.

Nessus watched from the doorway as Omar led a review of their early findings. Most of what they discussed was confirmation rather than discovery. The Fleet’s instruments were *very* sensitive. The crew’s findings would be matched to what the Fleet already knew. Nessus hoped the three of them had not figured that out.

“. . . So by process of elimination, whoever is generating the radio signals is beneath the ice,” Omar concluded. He glanced from time to time at Nessus for approval.

Captain Omar Tanaka-Singh was tall, wiry, and slope-shouldered. An unruly mop of brown hair—Nessus had wondered: Was that a conscious imitation of my mane?—emphasized the pinched features of his face. Omar organized and administered shipboard activities; he did not define them. Nessus, role if not in title, was the mission’s Hindmost: he who leads from behind. The captain coordinated such tasks as Nessus delegated.

Before his selection for training as a scout, Omar had been an agricultural logistician. In that role he balanced projected demand with long-term weather forecasts with transportation availability with plant-pest mutation probabilities with, doubtless, many more fuzzily defined factors. The work demanded multidisciplinary analytical skills and a broad tolerance for ambiguity. And yet—when deciding what to plant and when to harvest it were important, things agricultural changed *slowly*. How would thought processes attuned to the growing season adjust to scouting of the unknown?

Some things were unknowable from a distance. Were that not the case, Nessus mused, there would be no need for scouts. “Omar, how do underwater beings make radio waves?”

“Eric, why don’t you handle that?” Omar responded.

Eric Huang-Mbeke was their engineer. He was stocky and short, with ocher skin, thick lips, small teeth, and dark and intense eyes. His naturally black hair was dyed in long, colorful strands elaborately braided in imitation of Citizen style.

*Explorer*’s ability to sense through the ice was limited, but that constraint wasn’t the chief difficulty. Why would the aliens deploy radios at all? Sound was a more suitable mechanism for underwater communication. Radio waves attenuated quickly even in pure water. *Explorer* had observed enough water bursting through fresh surface cracks to measure the covered ocean’s salinity and it was high. Radio could not be a useful medium under the ice.

And even more puzzling: How could parts for a radio or its antenna be fabricated under water? While Eric hypothesized about forays above the ice, unknowingly echoing speculations of the expedition on Hearth, Nessus found his attention wandering.



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