



# SEMPER

By Rebecca Lim



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Semper nudged Shang with its head, whined.

Just sit,' Shang hissed.

Semper wriggled in under Shang's elbow. Shang, trying to listen to the commander, shook Semper off, growling deeply to show who was boss.

Semper lay down and rolled over, still whining, its feet pointed straight up in the air. Shang went hot under her spacesuit, hoping no one else had noticed.

She had the worst robo on the entire base.

When the base's computer, Masie, had assigned robos, Shang had hoped for a toothpick, one of the long, tall ones that didn't take up much space, and had saved countless lives already, or a Noid, an AMR that looked almost human. What she'd been assigned, like most of the younger Corps on the base, was a robo that looked vaguely like an animal.

One person had a smooth silver rabbit, another a metal snake that they wore draped around their shoulders like a scarf. There were a whole bunch of cats that could leap metres into the air, with incredible vision and prehensile tails. There was even a robo pig, built especially for finding things. Some had bird-like robos that sat on the Corp's shoulder. Birbos had unbelievably strong feet and diamond-hard beaks – great for missions – and they could fly. Shang would have liked one of those because they could take care of themselves.

But she'd been assigned something that looked like a giant terrier puppy. A big useless Drobo that was smooth and silver. And needy. It always wanted to play, like a real dog did. Not a single pilot, engineer, scientist and mission specialist on the base had time to play fetch, not really. But when someone came across Semper in a hallway, cargo bay or airlock, Semper wanted to do just that. Keys, clipboards, grobags – it didn't matter what it was – the person would have to throw it and Semper would bound away and bring it back to them with its jaws. The one good thing about Semper, Shang thought, was that it didn't drool like Earth dogs did.

Semper made everyone smile, except Shang.

Shang couldn't understand why she'd been paired with Semper. It couldn't fly and it couldn't leap high or far like the Crobos, Birbos or even the Rabbo could.

When Semper had loped towards her, its heavy metal feet thudding on the silica tiles of cargo bay N-11, Shang's heart had sunk down into her gravity-enhancing shoes. Everyone on board who already had a robo had whispered to those finally getting their own that Masie was actually magic – she could see into your soul and work out the perfect companion for you. But when Shang had seen Semper, something inside her had tightened in instant rejection.

Shang glanced around at the dozens of assembled Corps about to deploy. Some were still just wearing their inner thermals and the 'lower torso' of their spacesuit, others were fully suited up.

Through the nearest viewport, the entire mission had uninterrupted views of the ancient, heavily cratered surface of Callisto, one of Jupiter's moons. Years before, Callisto had been selected as the base for exploring the four largest Jovian moons – Io, Ganymede, Europa and Callisto itself – because it was the most stable, with the lowest radiation, a thin exosphere of carbon dioxide, and atmospheric hydrogen and oxygen that the base could harvest. Two generations had already been born on Callisto before Shang had arrived from Earth, wanting to see the galaxy.

Callisto was a dry chunk of ice and rock, with almost zero volcanic activity and loaded with valuable silicates. Because it sat outside Jupiter's active radiation belt, the base had flourished. Around the mess of interconnected living modules were extensive terrafarms, which supplied Callisto's people with fresh food. Someone had even built a small 'park' a little distance from the base, with a bright green, fake grass surface and a steel bench set into it that remained shiny in the dry atmosphere. Above it all, Jupiter hung so large and low that the sky never seemed dark.

Of course, if you wanted to sit out in the park, you needed to wear a full spacesuit, including a helmet. So people didn't go there very often, or for long, because it was negative 139 degrees Celsius outside.

Shang stared out at Jupiter, hanging overhead like their own cold sun. Every time she caught sight of it through one of the viewports, she'd get goosebumps. She was actually here. The Hohmann transfer from Earth had taken almost six years, most of which she'd spent sleeping. She was eager to get onto Europa, the moon she'd been assigned to explore for resources and critical minerals.

Shang had less than one Earth day on Europa to get her samples. One Europa day equalled three and a half Earth days, and she had to be back on the transport at the start of Earth day two because it was leaving, with or without them, well before Europa completed one orbit around Jupiter. Even with their spacesuits, and the shielding on their All-Terrains, many of them were likely to be sick afterwards because Europa's surface radiation was over 1,800 times greater than Earth's.

She'd sacrificed a lot to be here.

Everything, in fact.

"So, in conclusion," said Commander Chandrayaan, her dark gaze sweeping across their faces, 'take off is now, because Ganymede, Europa and Io are within 60 degrees of each other. Those going to Ganymede are facing two weeks' travel, those heading to Europa about four days' flight time. Only shield robos for Io,' she added, 'because it's too close to Jupiter for safety. Minimum delta-v expenditure, and under no circumstances do you leave your All-Terrain, you know the drill...'

The mission cohort rose, some fastening helmets, others pulling on the hard outer shell that protected the flexible inner garments that kept them cool or warm, hydrated and fed, and removed waste. The extravehicular mobility units, or EMUs, had come a long way since the early days. They were no longer orange, but they were still heavy because of all the lifesaving tech.

'You're new, right?' her captain said. 'Where's your robo?' Shang looked around wildly. Everyone else had theirs and was ready to board.

The captain rolled her eyes inside her helmet. 'You've got one Earth hour, Corp to find it, or we're leaving, and you'll deploy the next time we decide to run a mission – which could be next Earth year. It's a long time to be cooling your heels at base, so find it.'

Shang went cold. Checking her wrist comm, which set out both Earth and Jovian time, she knew she had to hurry. The base was huge – Semper could be anywhere. This was supposed to be her first off-moon exploration since arriving. She'd been in training since she'd reached Callisto, months ago. Furious, Shang ran through base, pinging Semper on her comm.

Semper didn't come. Wasn't it programmed to obey?



Finally, although Shang had been resisting it, she switched on Find my Robo. Immediately, a voice said, 'The park.'

'Ooooooh,' Shang growled, jamming her visor down and fastening the seals around her neck and waist. She burst out of the base through a blast door, feeling her gravity-enhancing boots kick in. She ran past a whole series of brightly lit terrafarms with ground-eating strides until she reached the bench, framed beneath luminous Jupiter.

Semper was sitting beside it, just like Shang's dog on Earth, Maxima, used to do at their favourite park. Its head was even tilted to one side, like Maxima's did when she listened. Shang imagined her now, a small, sandy Scottish terrier with alert eyes and ears, bushy eyebrows and whiskers, still waiting for her, patiently.

Inside her helmet, Shang's eyes unexpectedly welled with tears that the complex life support system in her suit quickly detected and removed.

Semper was the opposite of Maxima – a big, soulless, disobedient troublemaker.

'What are you doing out here?' Shang cried. 'We have to leave.'

She almost fell over backwards when Semper replied, 'I'm forcing you to stop and smell the coffee. Your stress levels have been off the charts for days!'

'This isn't helping!' Shang replied, trying to yank Semper upright. Even with her extra-grip gloves on, she couldn't make Semper yield.

Why aren't you behaving like a dog?' Shang snarled.

'You weren't responding to dog mode,' Semper replied. 'Whenever I played fetch your stress levels rocketed. Whining and rolling elicited the same reaction. I have ceased dog mode, for now.'

'We need to go!' Shang snapped, still trying to yank Semper upright. 'I can't leave Callisto without you. Come on.'

'Why don't you like me?' Semper said, so quietly that Shang straightened in surprise. 'I like you,' it continued. 'I would do anything for you. As soon as I saw you, I thought that.'

Semper tilted its head again, just like Maxima would have. Shang took a sudden breath so deep and sharp that it hurt.

She sank to the bench and looked up. The view was immense – the strangest, most beautiful view anyone would ever see. Because Callisto was locked to Jupiter in a certain way, they saw the same side of the gas giant every day. But it never looked the same, because cloudy bands of white, brown and yellow endlessly boiled across the surface, Jupiter's red eye constantly changing. In a bustling base filled with constant noise, the park was a good place for Shang to escape to. But she'd never taken Semper here before.

'I don't hate you,' she murmured.

'You did,' Semper interrupted, always truthful. 'You just hate me less now.'

'You're imagining things,' Shang muttered. 'I just wanted...'

Something different,' Semper said, standing and coming around to face her. So tall that it reached the middle of Shang's chest.

'I didn't want a dog,' Shang whispered. 'I had to leave Maxima behind. I don't even know if she's still alive. I left Earth over six years ago. She was my only family.'

Shang's normally calm voice sounded strange with grief.

'I don't look like Maxima,' Semper murmured, 'because I'm not supposed to take her place. But I will take care of you. That's my overriding duty. I'm to keep you safe and functional.'

I don't need your help,' Shang muttered, standing and looking down at the vague suggestion of a puppy. 'Plus, you're just a collection of metallic elements and wire. Let's go, we're late.'

The four days to Europa aboard the transport, Taiko 9, seemed to take longer to the twenty-four astronauts aboard. Shang thought about the other ship hurtling towards Ganymede, and was grateful for drawing Europa. It had way more radiation, but there was less time to worry that she wouldn't make it home.

Everyone on board was quiet, even the normally talkative robos.

They kept to their seats until it was time, each day, for them to exercise in the All-Terrain bay. Giant humanoid exoskeletons were secured along all four sides. Each had a blank two-way screen where the face would be, and powerful, extendable arms with a gripping claw on the left, and a drill on the right. While on Europa, every Corps would be encased in an exoskeleton, which was capable of lifting tonnes of raw material and could also take samples for analysis. Each exoskeleton was heavy, crafted out of lead, tungsten and titanium to shield the person inside, and the complicated electronics hub and fuel cell, from the elements battering Europa's surface.



They were mobile radiation vaults. If they failed on the moon's surface, the wearer would die within hours. Each Corp's robo was there to help keep the path clear, suggest routes, troubleshoot and keep their astronaut alive. Exoskeletons had a habit of toppling, or getting buried, so the robos were there to steer their companions away from trouble.

As they finished up their exercise session on day four, the onboard Masie said, Buckle in. T-minus 10 minutes and counting.

Every Corps scrambled for an exoskeleton, climbing inside the portal on the machine's 'chest', which closed as soon as the safety harness was properly fastened, sealing tightly. Snug in her metal armour, Shang could make out the rigid roll cage that would cushion the impact of landing. Light-headed with fear, she wondered whether Semper felt afraid.

Abruptly, the floor fell away. Shang screamed as the exoskeletons were sucked out, one by one, into an atmosphere approaching negative 160 degrees Celsius, charged with a deadly plasma of freely flowing ions and electrons. Nothing alive on the surface of Europa witnessed the hail of robos and exoskeletons falling out of the open hold of Taiko 9.

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They'd targeted a landing area on a low mountain range surrounded by a vast wasteland, or chaos terrain, that stretched for kilometres in every direction.

As the exoskeletons and robos stood upright on the ice-covered mantle, they saw within the chaos terrain a crazed patchwork of cracks, parallel lines and ridges, ice blocks and smooth fields of sheet ice interspersed with lenticulae: areas resembling darker-coloured freckles. On one edge of the chaos terrain was a huge field of tall, razor-sharp, icy spikes that Shang knew were called penitentes.

The range they stood on shook beneath them. Despite the howling, freezing winds outside, each person could hear loud grinding noises, as if giant plates were moving beneath Europa's surface.

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No one spoke, even though they were connected via comms. Forty-eight figures climbed carefully down the mountainside to seek out mineral samples in the chaos terrain below. At the base, they spread out in pairs, moving in awe between vast, tumbled blocks of ice, and deep parallel scores in the icy surface, like frozen train tracks.

Semper's voice sounded inside Shang's helmet. 'Where to, Boss?' said the not-dog.

Shang swivelled, her exoskeleton responding. She scanned the cracked terrain through her visor.

'Let's head towards that field of penitentes,' Shang said, 'if they're anything like the ones on Earth, there may be "red" ice patches in them, indicating life – and remember your programming, Semper.' Shang wanted to be the first person to find life, or actual evidence of Europa's rumoured vast, sub-surface sea. No one had yet, so Shang had spent most of the flight fine-tuning Semper's sensors to pick up the rumoured sub-surface volcanic activity. Where there was heat or movement, there would be water.

Shang's exoskeleton began leaping across the chaos terrain – covering enormous distances in gliding steps. Semper ran alongside, calling out when particular patches looked too soft so that Shang, inside her suit, veered around, never quite overbalancing.

Drawing closer, the penitentes looked like raised swords. They stood almost fifteen metres, carved to sharp points by the atmosphere on Europa. Walking among them, looking up through their points to the cold sky above, the eerie underside of Jupiter, Shang had never seen anything so alien.

Seeing a small patch of colour within the penitentes, she set her drill and began taking samples, working her way across the field, storing them in her exoskeleton as she worked. Semper moved always a little ahead, its sensors constantly gauging gravitational pressure and temperature, the shifting concentrations of atmospheric oxygen and hydrogen, scouting for evidence of heat or water, as Shang had programmed it to do.

Sensors suddenly shrieking, Semper didn't have time to warn Shang as the ground beneath her suddenly rose into the air so quickly that the heavy exoskeleton fell backwards and could not rise, pinned to the rising ridge by its own weight.

Around the fallen exoskeleton, a plume of water – water! – one hundred kilometres high, suddenly jetted upwards, another quickly following.

Far below, on a broken ridge of ice, Semper barked in warning. A lenticula was forming beneath the icy plate that Shang's exoskeleton lay on.

'There's silicate magma under the ice crust!' Semper warned. 'Volcanoes – big ones!'

Inside her exoskeleton, as she rode the rising ridge of ice and rock into the sky, Shang thought, I did it. We did it. We found evidence of water.



She thought about Maxima, about how much she missed her. Even about Semper, its warning barks sounding inside Shang's helmet. Her life support system, the lighting inside the exoskeleton, flickered for a moment, resumed. Shang realised she'd been holding her breath. All around her, there were terrible grinding sounds.

Abruptly, all movement stopped.

Then the ridge she was lying on began to tilt, wildly. Shang, her exoskeleton beginning to slide down the steep slope that had suddenly formed, screamed again as she hurtled back towards the field of penitentes at a terrifying speed.

She closed her eyes, still screaming.

The exoskeleton landed with a sound like a bomb going off.

It bounced once, fell again onto its back.

Semper's featureless silver face suddenly loomed in her visor and Shang was hit by a chorus of voices – robo and human – asking her to confirm location, whether she was alive.

'I'm alive,' she shouted into the comms channel, 'but I'm in trouble. Don't come after me, any of you. It's too active, too dangerous. Semper's here.'

Shang turned off the clamouring voices. Before Semper even confirmed it, she knew.

'You've destroyed the mechanics and joints in your suit,' Semper said matter-of-factly. 'You're not going to be able to walk back to the drop point. And you need to get up high for your suit to automatically connect you to the Taiko 9. The tractor beam can't reach you down here.'

Still winded by her incredible fall, Shang thought about how people had told her that being an astronaut wasn't a job for someone who'd never been the best at maths. She was glad she'd ignored them. She closed her eyes, not regretting the decision to come all this way at all. Her only regret was leaving Maxima behind.

All the space missions they'd sent here over the years – Voyager in the 1970s, Galileo in the 1990s, the Jupiter Icy Moons Explorer in 2023 and the Europa Clipper in 2024 – none of them had seen what she'd seen. There was liquid water under the surface, and powerful volcanoes.

But she'd never be able to tell anyone herself, because her exoskeleton was broken. It would never stand again.

Semper,' Shang whispered. 'Take the samples, get to the ridge, wait with the others for the tractor beam.'

'Nope,' said Semper firmly. 'I'm staying with you.'

'Then you'll die here, like I will,' Shang said desperately. 'You know I can't leave the suit. I wouldn't survive for two seconds outside it.'

'Set off your beacon,' Semper urged. 'At least the Taiko 9 will know where you are.'

Shang did so, the sonic whump filling her helmet. 'But it's useless,' she mumbled. 'They can't fetch me from down here.'

'Fetch!' said Semper and Shang suddenly, at the same time, on exactly the same wavelength.

'I'm going to throw out the arm with the claw,' Shang said through chattering teeth, shock setting in.

'No, both arms,' Semper replied.

'And when you sense volcanic activity, something really big, like what just happened,' Shang added, 'you—'

'Fetch,' Semper replied.

'And bury,' Shang said fiercely. 'Bury, like a dog would bury a bone.'

'Dog mode, engaged,' Semper replied, as Shang threw out the tough, cabled, extendable arms of her exoskeleton like fishing line.

The moment Semper sensed a strong eruption building below them, it fetched first the claw, burying it deep in the ice, quickly followed by the drill.

'Grip fast!' Semper yelled inside Shang's helmet.

Then the ground beneath the buried 'hands' of the exoskeleton rose suddenly, like an angry fist, punching towards the sky. Dragging Shang with them.

'Semper!' Shang shrieked, but Semper had already been left far below. Turning her head weakly, the exoskeleton's head rolling slowly right, Shang thought she saw the red glow of silicate magma before the ice field below closed over again, frozen solid in an instant.



Of Semper, there was no sign.

Up above, the tractor beam caught the prone human figure strapped to the rising plate of ice and locked on, drawing it upwards towards the Taiko 9.

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Shang sat on the bench, staring up at the swirling underbelly of Jupiter, vast overhead.

She'd come to the park every day after being discharged from the MedWing.

She'd been lucky. It was her pre-programming, and Semper's quick thinking, that had allowed her to hook onto the ice plate, projected upwards with so much force by the volcanoes beneath that the tractor beam had latched on. She'd been the first to arrive back onboard, her exoskeleton shattered, although the samples she'd taken were safe. Shang had single-handedly proven that there was liquid water under Europa's icy crust, a sea filled with underwater volcanoes. They would send more astronauts soon.

She'd done a great thing, they all said. But Semper was gone. It had done what it had said it would do – kept her safe and functional.

The bitter cold began to seep into her spacesuit. Limping, she made her way back to base. As she sealed the blast door, a voice behind her said, 'Fetch?'

Feeling a bolt of pure joy, Shang spun, seeing a smooth, featureless suggestion of a terrier, standing across the cargo bay.

'Semper?' She raised her visor in wonder, watching as it thudded towards her. She wondered if it was the same AI, just in a different body. Masie could do that.

As if Semper had read her mind, it said, 'I am, and will always be, Semper.'

Semper nudged Shang's knee. She knelt and gave Semper the kind of hug that used to make Maxima squirm.

Semper is the third story in The Callistan Cycle as part of Imagining The Future.

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