

Destination Azahar

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UNIVERSE: The Swarm Cycle

Chapter 16 - Biological Terraforming

Lt. Col. Joseph Collins initiated radio contact with Azahar as soon as *Sir Galahad* entered normal space at the inbound jump point with the message, "Good day, Azahar. This is Lieutenant Colonel Collins, Captain of *Sir Galahad*. I have some equipment for you along with about fifty souls to help with your construction activities."

McKinsey barely had time to get nervous when the alarm caused by the station's sensors detecting a ship exiting hyperspace in the vicinity of Azahar before the message from Captain Collins was delivered by the AI. She hastily put together a response that conveyed her confusion. "This is Ensign Constance McKinsey. We don't have the facilities in place to accommodate such a large number of colonists. We were told to expect six habitat pods, two greenhouses, components for a shipyard, and a space station AI pod."

The arrival point was far beyond the orbiting moons causing considerable lag in voice communications. It was several minutes before there was a laughing reply, "Your information is correct. But the bulk of this group is hardly colonists, Ensign McKinsey. It's the headquarters platoon of Delta Company, First Battalion, 504th Brigade who are here to establish a training camp that will make use of the facility that you're constructing underground. By the way, how is that progressing?"

The response from McKinsey was considerably more than what Commander Patrick Kehoe, had expected. The Marine company commander had been invited to the CIC as the ship was preparing to shut down the FTL drive and was shocked when he heard, "We've started excavation from 48 entrances and have about 240 kilometers of tunnel completed. The atmosphere here is *not* breathable, and there are *no* habitable facilities on the planet. We barely have facilities on the surface for the current population of ten adults and eleven children, but there are almost 500 habitat pods in orbit."

"Did she say kilometers?" Kehoe asked the equally shocked Collins who remained mentally stuck at the number of habitat pods available. The last report listed an inventory of 77 pods and no more than 200 cubic meters of excavation.

Captain Collins nodded to Kehoe and advised McKinsey, "Instead of the usual bombs, rockets and small arms ordinance, my ship has the core of a factory-class replicator and some key components needed to add a shipyard to your space station. It'll take about a

month to assemble it, but this replicator can fabricate a standard Mk I habitat pod in about an hour, but it doesn't sound like you have a shortage of pod production facilities. I expect to hang around your station for a while and can continue to house the marines on *Sir Galahad* until facilities are made available. I'll be using your expanded manufacturing capacity to complete some major modifications to my ship. We'll be parking next to you in about six hours."

"That sounds good, Captain." McKinsey replied. "We have plenty of room for your ship, but beware of the clusters of habitat pods floating about. I just ask that you don't put our little station in too much shade." McKinsey laughed as she delivered her quip.

"Oh, there's one other thing, Ensign." Collins shared a bit more about her cargo. "My *Leopard* is stuffed with an aircraft kit that's a rather interesting drone. If you can get started on about three kilometers of runway that faces into the prevailing winds, it can do something about increasing the ozone over Azahar. It won't be as effective as your balloon idea for a long-term solution, but it can orbit upwind and produce six metric tons of ozone a day that can give part of your little island a bit of shade as the ozone cloud blows overhead."

The morning after *Sir Galahad* entered orbit around Azahar, Naveen was puzzled when two schoolgirls followed Meghrani and Madeline into the kitchen. He asked Meghrani, "Who are these girls?"

Meghrani laughed and Madeline chuckled after their puzzled expressions evaporated. When Meghrani regained control of her voice she told him, "They are your concubines, silly master. Do you not remember Sissy and Carrie?"

"Why do they look like children?" Naveen asked a bit more brusquely than he had intended.

Sissy and Carrie remained timidly silent as their expressions vacillated between fear and indignation. Meghrani gave him an exasperated look as she replied, "Because they are children. Carrie is just a year older than Madeline and Sissy is nineteen."

The cringing girls clearly expected Naveen to physically lash out at Meghrani just for the way she was speaking to him. The fact that Madeline had ignored the exchange and casually retrieved her breakfast from the replicator with one hand as she held John in the other was equally confusing to the terrified girls.

"I see," Naveen mumbled in response as he blinked in shock. He turned to the frightened girls, "Please take a seat and make yourselves comfortable. What would you like for breakfast?"

They never took their wary eyes off of him as they sidled around the table and sat down. "Corn flakes?" Sissy said softly.

"Nonsense," Meghrani objected as she retrieved orange juice from the replicator and set a glass in front of each girl. "You need some hot oatmeal with brown sugar and raisins."

Naveen was distressed that Sissy and Carrie ate like frightened animals expecting a predator to attack them at any moment. He refrained from kissing Meghrani and Madeline in front of the Sissy and Carrie. He was sure they would not want him getting that close to them, and he didn't want them to feel slighted by not getting the same treatment as the other two.

A call from Commander Kehoe interrupted McKinsey while she was eating her breakfast, "Good morning Ensign. I'm Commander Patrick Kehoe. I've been ordered to assume command of the training complex and Marine facilities on Azahar. When would it be convenient to meet with you this morning?"

"Ensign Nguyen and I can meet you in the colony CIC thirty minutes from now," McKinsey offered. "If it's more urgent, you can join me in my quarters in five minutes."

Kehoe spoke evenly, without emotion. "This isn't urgent, but does need to be addressed as soon as practical. Lieutenant Peterson, Sergeant Rodriguez and I will join you in the colony's CIC next to the transporter room in thirty minutes."

McKinsey advised Nguyen that she didn't know what to expect, but her gut told her that the two of them needed to present a united front. Any perceived rift could be exploited if the new arrivals proved to be confrontational. Both of the engineers were veterans of boardroom squabbles and prepared themselves for a power play.

Thirty minutes after the call Kehoe led two other marines into the CIC. After introductions, including Nancy and Judith who were manning the Center, McKinsey ushered the group into an adjoining strategy conference room. Since he was the ranking officer in the room, McKinsey offered Kehoe the honor of the seat at the end of the table. She and Nguyen sat across from Peterson and Rodriguez.

Kehoe opened the meeting with, "As I indicated to you earlier, Ensign McKinsey, I've been put in command of the training complex and Marine facilities on Azahar. My staff and I would like to be briefed on the status of the facilities. Lieutenant Peterson will take over the CIC operations. We really shouldn't have concubines running it."

His comments clearly ruffled Nguyen's feathers, but McKinsey was the better poker player, and her annoyance wasn't telegraphed quite as clearly.

McKinsey held out her hand toward Commander Kehoe palm up, "May I have the orders that supersede the ones I have from Admiral Pirelli."

"I have no orders for you from anyone else, Ensign. I'm the ranking officer and that puts me in command of this facility," Kehoe was clearly not accustomed to having his statements questioned.

McKinsey allowed herself a small smile as she nodded her head and baited her trap, "Did you say that your orders were to take command of the Marine facilities and training complex on Azahar, Commander?"

"Yes," Kehoe responded, barely masking his irritation.

"I see," McKinsey nodded as she glanced at the equally smiling Nguyen. "To my knowledge there are no Marine facilities of any kind on Azahar, Commander. This is a Fleet Auxiliary operation. Our orders are to begin the installation of the infrastructure needed to support a Fleet Auxiliary research and manufacturing colony. We currently have an excavation in progress two or three hundred kilometers north of Barcino. We have no idea of its purpose. Could this be your training complex? If so, then Barcino or the station overhead is the nearest facility with a breathable atmosphere. Living at the excavation site will be challenging at best."

Kehoe was not amused by this unexpected turn. "But... I'm the ranking officer at this site."

McKinsey nodded, "If we were under attack, then I and everything near Azahar would be at your disposal, Commander. Ensign Nguyen and I will gladly obey any lawful order that does not conflict with those we have from Admiral Pirelli. I hope we can come to an arrangement that allows us to work together and share the resources of Azahar to our mutual benefit. If we are to discuss the allocation of resources, then I suggest we should have Lieutenant Colonel Collins in attendance. I believe that *he* is the ranking officer at Azahar, Commander. Colonel Collins has brought considerable resources with him with the expectation of using both the resources he brought and those already in place at Azahar to make major modifications to his ship."

McKinsey projected a document on the wall Kehoe was facing, "I have orders to that effect from Admiral Pirelli right here."

McKinsey turned to face Kehoe, "Let's not be adversaries, Commander. What resources do you need to accomplish your mission objectives?"

Kehoe wasn't prepared to make requests; he had expected to take command of the operation. "I... we... Lieutenant Peterson, what accommodations are needed for our troops?"

"Lieutenant Mark Wallace and Ensign Marvin Clark are the only marines aboard *Sir Galahad* with their own pods. Corporal Miller has the ten members of Second Platoon with her, I have the 45 enlisted personnel of First Platoon with me, and in addition to First Sergeant Rodriguez here you have four other enlisted members of your staff on *Sir Galahad*, sir." Lieutenant Peterson was clearly familiar with the head count.

"Will you need personal habitat pods for each of the... 63 marines who don't have their own pods with them?" McKinsey did the math while speaking. While they had that many pods in orbit, they didn't have the infrastructure in place for that many pods on the surface.

"Not at all," Kehoe responded. "A pod for each of the five squads and another for Lieutenant Peterson and me should be more than adequate. We can partition the pod to accommodate the two of us and our staff, don't you think, Lieutenant?"

"Six pods should be more than enough, Commander," Peterson agreed. "One other item, though. Most of our troops haven't been home in three months, and there aren't enough stewards available on *Sir Galahad*. Are there concubines here who can entertain my men?"

Nguyen had not spoken other than during the introductions. He abruptly stood, knocking over his chair. "There is no brothel on Azahar and we have too much respect for ourselves and our concubines to turn any of them into whores!"

Everyone was looking at Nguyen in shock, including McKinsey. Kehoe was the first to speak, "Sit down, Ensign! Lieutenant Peterson meant no disrespect. Most colonies have a pool of concubines that are available as a distraction for marines on temporary deployment." When Nguyen made no move to retrieve his chair Kehoe repeated himself, "I said, sit down!"

McKinsey gripped Tuan's wrist, "Mr. Nguyen is correct, Commander. We have no personnel who are available to take the edge off of the sexual frustration of your men. If you anticipate trouble I suggest they remain on *Sir Galahad* until arrangements can be made for them to be isolated on the planet. Even one incident of disrespectful behavior will terminate our spirit of cooperation."

"I don't take kindly to threats, Ensign McKinsey," Kehoe cautioned with clouded brow.

McKinsey held his stare, "And I don't take kindly to being insulted in my home, Commander Kehoe."

The stare-down lasted until Nguyen retrieved his chair and resumed his seat at the table.

Kehoe finally took a breath, "We seem to have gotten started on the wrong foot, Ensign. Lieutenant Peterson meant no disrespect. It is most unusual for a planet to be populated

by only two households, and you have accomplished more than could be expected without additional personnel."

"I do apologize for giving offense," Lieutenant Peterson said convincingly. "With all the activity in so many locations I didn't realize that yours are the only families on Azahar."

When Nguyen nodded McKinsey told the Lieutenant, "Very well, apology accepted. We should be able to organize some kind of activity where your men can have social contact with our families, but not physical contact. I'll send you the details when they're finalized and leave it to your discretion to only forward the invitation to those who can be expected to behave as ladies and gentlemen at such an event."

Peterson laughed and responded, "Very elegantly put, Ensign. I look forward to receiving your invitation intended for the *civilized* members of my platoon."

The laughter seemed to dispel the dark cloud that had taken up residence in the conference room. Nguyen offered an olive branch, "I can arrange for the two ladies you met in the CIC to give you a tour of the excavation site. They're both skilled shuttle pilots. You'll need oxygen masks if you intend to exit the shuttle as we have not yet completed enough blast doors to establish a breathable atmosphere at the site."

McKinsey added, "In the meantime we'll extend the tunnel of our existing residential area and have six new pods delivered along with the two belonging to Lieutenant Wallace and Ensign Clark. It may be a few of days before they can be occupied, though. I suggest that after your tour we reconvene with Captain Collins and the two botanists. I'm certain that we can develop a plan that's acceptable to all of the stakeholders."

Celeste took Judith's place as escort in case there were questions about the construction plans and methods. Nancy and Celeste took the three Marines up to the station and boarded one of the shuttles. Nancy treated them to a breathtaking de-orbit and plunging descent to the surface through the turbulent air. Celeste covertly scowled at Judith for showing off and making the three marines gasp.

Thirty minutes later they were at the construction site where she and Judith had delivered three industrial replicators a week earlier. The army of nanites was constructing a hexagonal cluster of seven domes centered over one of the underground complex entrances.

Celeste passed around breathing masks, oxygen tanks, and communications links. "I know that you have imbedded communications devices, but I ask that you bear with us, gentlemen. Concubines don't have AI implants." After she checked everyone's masks she signaled for Nancy to lower the ramp at the rear of the shuttle. The occupants were enveloped in hot air even before stepping out of the protection of the small craft and onto the sunny plain. It was hot, but bearable. Celeste followed the group as they made their way toward the construction site.

Nancy pointed down the tunnel entrance, "The first airlock chamber in this tunnel was completed a couple of weeks ago. When the domes are completed the replicators will begin processing the atmosphere within this isolated pocket to create a mix that's breathable by humans. Unprotected housing can then be installed within the domes."

Celeste added, "You could erect apartment buildings that would easily accommodate an entire company of Marines. We can have the nanites put airlocks between the domes and concentrate on completing the center dome and one of the others."

"That would be excellent," Kehoe remarked; then asked, "What is that structure to the south?"

Celeste responded without looking, "That's a cooling tower. As you can tell it's pretty hot out here on the surface and these domes will need some serious cooling. A water pipe is under construction from water processing plants on the coast to supply de-mineralized water to the tower."

Celeste checked her PDA and displayed her engineering orientation. "The 36-centimeter pipeline from the coastal pumping station was within 50 kilometers of the tower the last time I checked and will be completed by the time the cooling tower is ready to be charged. The water needs of this complex will hardly dent the 38,000 liters-per-minute capacity of the pumping station and pipeline. The 375-kilowatt pump is currently discharging the excess oxygen-saturated, mineral-free water into a canyon twenty kilometers from the coast, creating a small freshwater lake. The primary purpose of the pumping station is to extract minerals from the local waters. The clean, fresh water is just a byproduct. The pair of 750-kilowatt chillers going into the engine room at the base of the tower over there will evaporate about 3,000 kilograms of water per hour to cool the domes."

Kehoe asked, "That was a bit more information than I required, but thank you for that detailed report. Are there really over 200 kilometers of tunnels completed?"

Celeste showed him the figures on her PDA, but the tiny screen couldn't represent such a massive project. Nancy was feeling a bit like showing off some more, "I'll fly us down to the main chamber; then let you guys pick our exit." Celeste frowned where only Nancy could see, "I've already done it once," she whispered to Celeste not realizing that the marines' enhanced hearing allowed them to overhear her.

"Seeing *is* believing," Kehoe commented. "Impress us, ladies. Just be sure to have us back for our noon meeting in the CIC,"

With the amount of progress being made on all fronts, Kehoe and Collins agreed that the manufacturing team that was already in place — McKinsey and Nguyen — should be supported and not micromanaged. However, he only stopped short of insisting that

Lieutenant Peterson take charge of the CIC operations because McKinsey reluctantly agreed as she gave Nguyen a covert wink.

Nguyen was a bit puzzled that McKinsey would give ground until he realized that the Marines would only be operating the communications and sensor packages that had been more of a nuisance for the two families than anything else.

After McKinsey made note of each group's needs and deadlines, Nguyen projected the resources required to meet everyone's expectations. Very little additional capacity was needed in order to allocate more than enough resources to keep everyone on a reasonable schedule. The assembled stakeholders were still discussing details among themselves when McKinsey asked the AI to present the results as a Gantt chart.

The clear assurance that everyone's expectations would be met quickly brought the meeting to a pleasant conclusion. Kehoe was pleased with himself, the botanists were dazed and confused by the technical details of construction, and Collins quietly smiled and nodded.

Collins hung around on the sideline until the meeting room cleared. "That was very impressive maneuvering, Ensign. Admiral Pirelli had asked me to look out for you two when the Marines tried to take over. He clearly underestimated your ability to fend for yourselves even against adversaries that outrank you. Letting them think they'd won territory when you ceded the tedium and headache of manning the CIC to them was inspired."

Nguyen blushed knowing that he didn't deserve such praise. "I must admit that I didn't realize what had happened until much later. I was just following McKinsey's lead."

"Perhaps, but you were ready with the facts and figures before McKinsey need them," Collins added with a knowing smile. "You two make an excellent team!"

McKinsey scheduled the construction of two more pod lighters and drafted Leroy, Kim, and Roni as trainee loadmaster-copilots. The concubine crews obtained a good bit of experience keeping up with the output of the 36 replicators on the station. Another twelve industrial replicators would be in operation before the shipyard facility aboard *Sir Galahad* could be unloaded, much less made functional.

Nguyen examined the fusion-powered sailplane and made sure he had replicator templates for it before it was assembled and launched. He reluctantly agreed that it was superior to his balloon idea because it could maintain a known position and concentrate ozone production in the relatively small area of Triton, compared to raising the ozone concentration over the planet as a whole. He had an industrial replicator installed at the airstrip to begin producing more of the drones. They should be able to launch one every five or six weeks.

Celeste left the transfer of pods from *Sir Galahad* to Barcino in the capable hands of Nancy and Judith. She and Leroy had their hands full using a shuttle to unload and assemble the huge replicator and shipyard facility about ten kilometers from the existing station. It was easier to get the shuttle in and out of tight spaces than the much larger lighter.

Tuan scheduled the station's array of replicators to construct two dozen fusion-powered payload-assist modules and scheduled the new industrial replicators floating near the construction site to produce the miscellaneous components needed by Celeste to complete the factory replicator and shipyard facility.

The space station AI with its internal gigawatt power module was also floating near the construction site where it supplied power to the units that were unfolding, expanding, and adding structural modules to the growing manufacturing and maintenance facility. By using the operational industrial replicators available at Azahar, the shipyard would be ready to begin stripping down the aft section of *Sir Galahad* in less than two weeks instead of the projected four.

Collins had agreed to allow the new factory to build the core of another factory-class replicator before starting the modifications to his ship. Even with that delay the overhaul would start earlier than originally expected and would move much faster with the help of the large array of supporting industrial replicators.

Constance asked Margret to work with Avalareddy and Brown to design an agricultural center after Nancy had taken them out in the shuttle to visually survey an area north of the iron deposit. They had found an excellent site with loose sediment on a flat plain not far from the pipeline that ran from the coast to the Marine complex.

Naveen and Jason liked the concept drawings Margret had prepared. She brought them up in three dimensions for them to review. The first one depicted six greenhouse pods arranged at 60-degree intervals around a chamber 30 meters in diameter. Four of the pods were shown expanded to 15 meters in diameter by 50-meters long and two the standard 10 by 25 meters. Each pod was connected to the central chamber by passages equipped with airlocks.

"We can bury the two greenhouse pods you brought with you along with four new pods," Margret suggested. "Then expand the four from their original 10 by 25 to 15 by 50 meters and move your existing collection into the new pods. The airlocks will allow you to maintain different atmospheres in each pod."

Jason was shaking his head, "Some of the plants shouldn't be disturbed again until they become dormant."

"There's no rush to move the contents," Margret countered, "but when the original pods are emptied they, too, can be expanded." First one; then the other smaller pods grew on

the hologram to the size of the four new pods. "An elevator in the central chamber connects to the dome above which has a transporter pad connecting the agricultural complex and the colony center's transporter station. This is Phase One.

"In Phase Two we extend six enclosed walkways from the small central dome and connect them by airlock to six triple-size domes or long Quonset-style buildings where the level of solar radiation can be controlled by the content of the pentagonal blocks set in the exterior of the structures." The hologram centered on the dome showing the six airlocks at ground level. As she spoke the corridors grew and terminated in three domes and three long half-cylinders.

"How big are the domes?" Naveen asked.

Margret added people, buses, and other familiar items to give the display a sense of scale.

"My goodness," Naveen gasped. "They must rival the sports stadium in New Orleans! Each one of those would hold hundreds if not thousands of hydroponic tanks."

"Close," Margret hedged, "Each of these domes enclose about 17 acres. The Louisiana Superdome encloses 13 acres."

Jason shrugged, "A hundred acres is a good start for a test farm, Naveen."

With the plan settled, Margret asked, "How soon will the greenhouses be ready to move?"

"Any time," Jason replied, "But, we must be able to access them twice a day."

"Whoa," Margret replied. "That could be a challenge that forces us to create a Plan-B. It'll take at least twelve hours for a pod to bury itself unless we excavate the site ahead of time. We should also consider putting the transporter in the underground hub rather than waiting for the dome. It may take us a week to prepare the site to receive the existing pods, but we can get the new ones moved down and ready in the next few days."

Two industrial replicators were moved from Barcino to the agricultural complex. Each one was tasked with excavating a 15- by 25-meter pit and creating an airlock tunnel to the underground hub. This was done with a variation of the tunneling machines, but instead of conveying the tailings to a transporter, they were piled next to the pits to be available as backfill after the pods were lowered to the moorings.

The five pods that would be configured as barracks for the marines who had traveled without their families were initially configured as temporary quarters. Marvin Clark, George Alexiou, Naveen Avalareddy, Jason Brown, and Stanley Cramer and their

families lived in them while their pods were being dropped and positioned along the hastily extended tunnel connecting the pods and facilities in Barcino.

Commander Kehoe and Lieutenant Peterson moved into the sixth pod with their staff as soon as it was in position and reconfigured to Kehoe's specifications. Lieutenant Wallace had intended to leave his pod on *Sir Galahad* until he learned that it would be in the way. Nguyen offered him the use of his second pod while Wallace's remained floating in orbit. The unexpected development from this arrangement was the proximity of Kim to Annita's thirteen-year-old son Bobby.