

The Math of Tides

My great-grandfather's boot prints are still on the moon. On our twenty-fifth lunar day, I went to where he stood 110 years ago. My grandmother told me her father wasn't the best at any one thing but he showed NASA he'd do anything to make the cut. There was going to moon and there was his family. Nothing else much mattered.

And the view? Still all that blue he loved. Today, in 2082, it's all that water to fight. That's the task for me (Mara) and the five other women on our crew. Plus Tree, our android. Tree got his name because he is what they call a growable android. Can go beyond his set programming, learn and adapt. Also, he's over seven feet tall and his artificial DNA includes plant life as well.

I didn't sign up for this job. For not really saving the world. But the government is drafting engineers now. Only three of us know what we are really up to-- Claire, our mission commander, me (deputy commander) and Tree.

Tree's virtual DNA drives him to protect nearby humans. He'll do any work involving radiation or risks to the rest of us. He even maintains a link to our individual vital signs so he can provide emergency care if need be.

The other four team members-Cheng, Tamika, Nina and Lorna all believe Claire and I are simply testing anti-matter engine technology while they concentrate on collecting rare earth minerals like helium 3 and 4 and thorium. And that mining will help offset our mission's costs. They won't know the real mission until day 210 or so out of 230 days plus or minus three.

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That real mission? Move the moon. Just a tiny bit. Geoengineering the earth's atmosphere in response to climate change hasn't worked out so well (Sorry, Tuvalu). It's time to try a 'moonshot' that can protect certain coastal areas. Okay, our country's east coast area. Using a large number of advanced anti-matter engines, we going to tweak the lunar orbit. That will lower the highest tides, 'king' tides and reduce flood damage.

Hundreds of millions of people will benefit from our efforts. Hundreds of millions will lose out. I don't know the exact numbers. Up here we leave the big math problems to Tree.

I do know this could affect the remaining whales. A marine biologist from the team that found a way to communicate with them just got elected prime minister of what is left of Sri Lanka. He is pledging to lead other less well-off nations in a last-ditch fight for the seas.

The only math I care about is what I get if we pull this thing off. My family-my wife Terry, our kids, our siblings and their kids will get prime living space in one of the best remaining places: Livingston, Montana. With guaranteed healthy food and access to solid health care for the next seventy-five years. Beats the hell out of New Biloxi. A few generations more of the Murphy's all but guaranteed. Claire gets a similar deal. The rest of the crew will get a small amount of bonus pay if the mining works out.

Because of the positions of the sun and the earth and their gravitational effects, there is a narrow window for success. We've got to be well away from the lunar surface when we light off our anti-matter engines. It's day 26 out of 230 +/- 3 as I write this log, the one I promised Terry I'd keep.

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Day 41

We are a full week behind schedule. Producing anti-matter fuel is sensitive stuff. The mining work is causing more small moonquakes than expected, pushing my work to the edge of tolerances. But I can't ask the mining team to change their operations. Too many questions.

Day 83

We are only five days off schedule now. My family says things are wonderful in Livingston. The kids even saw a real cutthroat trout, not one of the reverse hybridizations out of rainbow trout versions. The news elsewhere is not so good. We are not supposed to get access to it but Tamika (communications/data management) tapped into the satellite for RTE Radio One-Ireland. Even the announcer's lilt can't hide her fear. The fading of the North Atlantic Current is happening faster than scientists predicted. The British Isles are going to experience a major temperature drop. Good thing we aren't British.

Day 109

After a lot of short sleep, I got us to only three days behind. Tree informs me that in his semi-professional opinion, I look like hell. My family sent me a new video. The kids were excited to show me the fall colors. And they've each put on some healthy pounds.

Day 145

We are five days behind again. Lorna (maintenance specialist) keeps pulling equipment out of service. Stuff that Tree says is working fine. There are two possibilities. Lorna got wise and doesn't approve of the true mission. Second, she doesn't know what she is doing. My mom taught me to never assume malice in light of possible incompetence.

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Claire says she'll only act against Lorna if I can get proof of intentional sabotage. I don't know how she expects that to happen. Not with the others still in the dark. Even one of them helping me might be enough. Claire says no to that. But I can't afford any more delays.

There's a protocol to put us into stasis in the event of an illness or injury Tree can't manage. The process isn't perfect. It carries a chance of permanent intestinal damage if you are in it too long. Still, it's a small chance.

That night, for our weekly vidcall, Terry is far from the house. Wants to show me the night sky our kids can see. Says our youngest, Jason refused to believe that all those things were stars or planets. Even after she explained that I am on that big white thing.

It takes twenty minutes to put Lorna into stasis and another hour to doctor up a realistic looking medical crisis for her. All done while the others were sleeping and Tree was recharging, meaning his bio-link with her wasn't live. When I tell Claire what happened to Lorna, she starts to ask me questions but then stops herself. We move on to planning the next week's work.

Day 186

It's a big risk. I hoped that getting Lorna out of the way would speed things up. But we've only made up one day since her 'illness.' I don't just want the others to modify the mining work. I want them to drop it entirely. Because I need more hands on the real project.

Tamika, Nina and Cheng are in the gym doing their muscle loss/low gravity work. Claire is off finalizing engine placement sites with Tree.

I walk into the gym and tell them all what we are really up to up here. I also tell them the financial deal Claire and I have. At first, they are just plain angry. At the government. At me. At Claire. Then they're divided. Tamika wants to stop the project, go public. Cheng wants the same deal Claire and I are getting. Nina, who is a mining tech and the lowest paid team member wants

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to think about. After a lot of debate, they agree to keep working as usual but give Nina a day she can think things over.

Day 187

We meet up while Claire is sleeping. Tamika still wants to go public. Cheng wants to throw in with me as long as everyone (including the 'sleeping' Lorna) gets the better deal. I don't balk at that, figuring the military will pony up if I make it clear that the alternative is complete failure. We are all waiting to hear from Nina, who comes in last. She won't even look at Tamika, doesn't have to say a word for us to all know which side she is on.

But Tamika won't give in. Says she did not sign up for determining the fate of all those people. And then she starts talking about the whales. Cheng is spitting hot and really goes after her. Says her own family is along the failing dikes on the new southeast coast. Then she tosses in how Tamika's got no family to speak of. I have to physically separate her and Tamika. If Tamika stops working, I might still manage the job with just Cheng and Nina's help. But not if Tamika gets in the way.

So that night I do what needs to be done. Start to put Tamika in stasis. She's bigger than me but that doesn't matter after I get the second hypo into her. I can feel her cheek's skin cooling as I slip the breathing mask on her face.

And then Tree shows up. In my sleep deprived state, I miscalculated the time it would take him to recharge. He asks why I am placing Tamika in stasis since her vital signs are normal. I tell him to stand down. He shakes his large head and says he can't allow harm to Tamika. Insists I explain myself.

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I have an override code for Tree. It's a failsafe they gave Claire and me in the unlikely event he does something dangerous. I say the code and Tree freezes. But only for a second. Then he steps in and starts reversing the stasis procedure. I say the code again, even louder.

Tree tells me I can yell it in all of the thirty languages he understands but the code will fail. Because the override can't freeze Tree if he is preventing harm to a human.

I tell Tree the others now know about the real mission. Ask him to review Cheng's vital signs, her heart rate and hormone levels from our contentious discussion about what to do. And to review Tamika's as well. I ask Tree what he concludes. He says Cheng was very angry. Tamika was very afraid.

I tell Tree that Tamika needs to be protected from Cheng. That the stasis can do that. That four families will benefit from having Tamika safely out of the way. His forehead's almost skin is wrinkling now, like he is thinking it over.

"You are saying the needs of the others outweigh the risks to Tamika, Mara?"

"Yes. There is a line from an old book about that. The needs of the many outweighing the needs of the few or the one. Do you know it, Tree?"

"I do now. An interesting concept. Do you believe this principle is always applicable?"

I am about to answer, am hoping this is part of Tree's ability to learn and adapt when Claire shows up. Of course she does. Because she gets a notice if I use the override code. Claire asks me what is going on. Before I can hatch an explanation, Tree turns to her and says "Claire, based on what I just observed, we need to review Lorna's stasis status."

Day 188

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Lorna seems to have a slight problem with the smell of citrus and can't look at poultry. Otherwise she seems unharmed by her time in stasis. Although it turns out I was right. She was sabotaging equipment.

I am confined to quarters. Tree is my minder while Claire decides what to do with me. Just before she arrives, Tree tells me he has been thinking about what I told him. About math and the number of people.

Claire has talked to command. Everyone else is getting the deal she and I were getting. If we are successful, I manage not to smile. Because we all know they need me if they want to pull this off.

Day 229

The anti-matter fuel is loaded. The engines will fire on the night of Day 231. There was no more trouble from Lorna and Tamika after Claire locked them in their quarters for the last few weeks and blocked all their comm access.

There's one hitch. We didn't have time to run final checks on all the anti-matter engines. And we've got to lift off today to avoid all that nasty gamma radiation. But if the engines don't all fire correctly, we'll have to abort. That means total failure. No more Livingston, Montana.

Only three of us are capable of fixing a balky anti-matter engine. Everyone agrees Claire gets a pass. She's held things together this last month. I am waiting for one of them to suggest I stay behind. Because they know I'll do it. Not for them. For my family. Before I can finish saying "I will..." Tree interrupts me.

"It is true Mara put Lorna and Tamika at risk. What is also true is that I cannot allow one of you to die. I must stay."

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No one says anything. Cheng walks over and puts her arms around Tree's long neck. Then Claire and Nina do too. Even Tamika and Lorna go to him. They all hug Tree while I look at my boots.

Day 231

We're a safe 150,000 kilometers from the moon, headed toward home. The anti-matter engines are ready. Claire has Tree up on the video screen. Everyone else has said their goodbyes. Then Tree asks to talk to me.

"It was you who showed what to do, Mara. As you said, it's the math."

I must look puzzled.

"178, 818, 974 versus 176, 919, 459. Those are the numbers. I checked them a number of times."

Oh, God, I think. Which way do they run?

"The engines will never fire, of course. And please do not attempt to return. The gravitational window will be closed. There is nothing any of you can do."

Cheng realizes it before Nina does. Her voice is a dying bird.

"Use the override code, Claire. Mara. Hurry."

I look over at Claire and shake my head. It won't work. Lorna is trying not to smile, right up until she does. I say in a voice I don't know: "It's the greater good."

Tree has done the math. 1,899, 915 more people on Earth would be harmed than helped by moving the moon. By the change in the tides. And I taught him to protect as many humans as possible. Even ones he doesn't know.

Before he breaks the comm link, Tree tells us he has sent our mission details to the new prime minister of Sri Lanka. Just in case. For the first time since launch day, I start crying.

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Day 236

Earth orbit. Our last day in space.

My great-grandfather's boot prints are still on the moon. Along with a lot of unused anti-matter fuel and an android who learned a little too much math.