Red Genesis

By Vladyslav Andrukhiv & Ilya Garbazhiy-Romanchenko

“If people didn't spend money on wars, we'd have reached Alpha Centauri by now.”

Introduction

Red Genesis by Vladyslav Andrukhiv and Ilya Garbazhiy-Romanchenko is a captivating narrative of humanity's bold and necessary venture to colonize Mars. Against a backdrop of Earth's imminent environmental crisis, NASA and an international coalition of scientists and astronauts embark on an audacious mission to establish a sustainable outpost on the red planet.

As political tensions simmer and public skepticism looms, the urgency of the mission becomes palpable as NASA and its partners race to prepare for the monumental undertaking.

In *Red Genesis*, readers are immersed in a world of high risk and scientific innovation. Against a tapestry of political maneuvering and technical precision, the race to pioneer a colony on Mars unfolds. This is a very believable story.

A diverse cadre of astronauts emerges for the mission through a rigorous selection process and intensive training. Each of them is willing to give their lives for the success of the mission. Their individual stories interweave with the larger narrative, embodying the spirit of human resilience in the face of adversity. *Red Genesis* is both riveting and credible as it blends scientific explanation with a very real portrayal of the complex challenges inherent in humanity's quest to colonize Mars. This book is highly recommended for all readers intrigued by space exploration, but it will be particularly captivating for those interested in traveling to Mars themselves one day.

Bruce Callow
Santa Ana, Costa Rica
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Mission Context

For a number of reasons the human race needs to leave Earth and colonize Mars.

NASA had been developing a crewed Mars mission for many years. There were some people who were protesting, fearing that the governments would abandon them after colonizing Mars. The United Nations managed to calm down the public enough to allow the mission to proceed.

Chapter 1
The Race to Mars

Soft, yellow light illuminates the waiting room. A skinny middle-aged man in a brown suit is sitting on a dark sofa. A young woman is sorting some papers on the table in the opposite corner. Two serious-looking men are standing near the door to the right of the table. Black suits, earphones, holsters on each's belt. Not moving, not even normal human breathing movement, just standing still like robots.

It has already been nearly an hour that the man has been waiting, but nobody shows any signs of worrying about it, nor does the man.

Suddenly one of the robot-like men holds his hand near his ear. Then he calls the men.

“The President awaits you.”

While the other one opens the door.

“The oval room is exactly as it is described: white walls, brown table with partitions and a serious man writing something on it” – thinks the Director while entering. The serious man glances at him.

“Sit down,” he says before letting his guest introduce himself. Two minutes pass. He finishes writing and finally takes a look at the visitor.

“The Chinese started working on a crewed mission to Mars two months ago. Russians announced their mission yesterday.”

The President looks at the man sternly.

“What are we waiting for?”

The Director is doing his best to not cough.

“We were planning on deploying our colonization program in two years, by the time we collected enough data to be ready for founding a sustainable base, immediately after the first landing.”

The President stands and turns to the window. The buds on the trees had blossomed several weeks ago, and the garden started to look green.

“Whoever first colonizes the solar system gets a long-term strategic benefit in the next era.” - says the President, as if declaring it - “I hope that is clear.”

Silence sets in for a moment, and then the President continues.

“I believe it is time when we must ensure our country’s role in the next chapter of the history of humanity.”

The President makes a move to turn back but holds it.

“NASA can make direct analysis of the possibilities for deploying a colony on Mars its highest priority, Mr. President, but a project of such scale will certainly require participation of other organizations, most likely including foreign ones, as well as a great deal of time.”

“You will receive assistance from any national institution. If you need scientists from across the globe, invite them. If the use of foreign industry or technologies can facilitate the mission - collaborate. The Department of the Treasury will be granting you necessary funds, on my order. ”

The President turns with the last phrase. The Director after a short pause, says.

“Yes, Mr. President. Anything else?”

The President raises his eyes above the glasses.

“Report to my administration on any significant steps.”

Chapter 2
Technical preparation

Following the agreement, NASA, CNSA and ESA, authorized persons representing the respective organizations arrived in Washington D.C.

A combined team of scientists worked on flight preparations. At a meeting at NASA headquarters in Washington DC the Director began with an announcement.

Director: And so, ladies and gentlemen, we begin our common, large-scale program, dedicated to a crewed mission to Mars! We will be sending 4 astronauts to the red planet. Our common task is to ensure their safety and the success of the mission!

Applause

Director: I will start by introducing our combined team to our staff. Now, there will be three teams involved in mission preparations: The Theoretical Department will do the theoretical calculations and plan our flight, the Engineering Department will model and build the rocket for launch, and the Astronauts Selection and Training Department will select and train our astronauts.

Director: The Theoretical Department will be led by Dr. Lee, a Chinese scientist with a PhD in physics and mathematics and the best astrophysicist in China.

Director: At the head of the Engineering Department will be Mr. Podolski - a Polish engineer, ESA employee and expert in his field.

Director: The head of the Astronauts Selection and Training Department will be Mrs. Brightley - a former NASA astronaut who knows how hard and the great responsibility it is to be an astronaut, and will be able to prepare our astronauts based on her personal experience.

Each group then went to their respective departments.

Theoretical Department

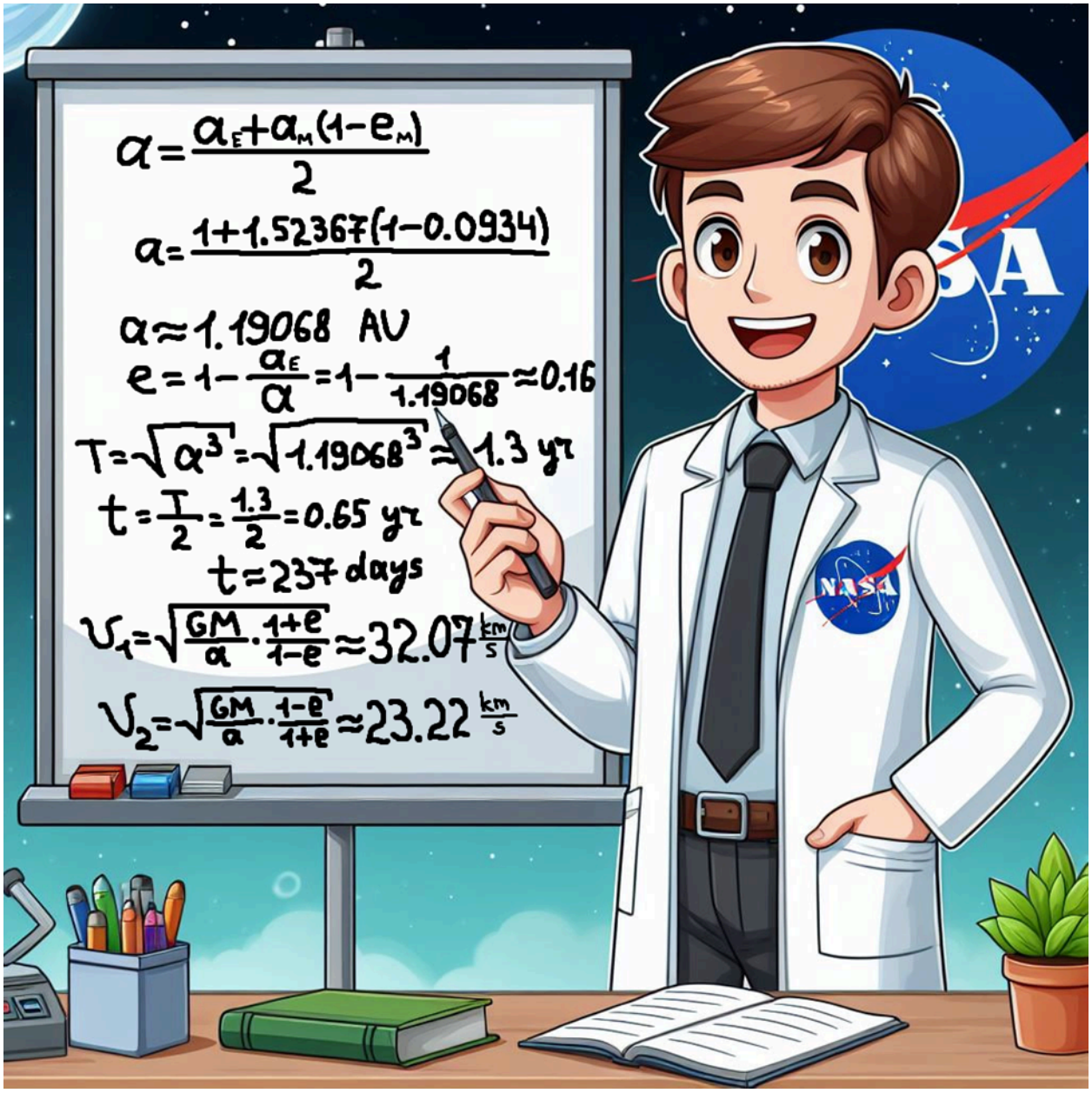
Dr. Lee: Good afternoon everyone, my name is Jao Lee and I should introduce myself, but the Director has already done it, so let's get right to it.

Dr. Lee: I can assume that the best option for us would be to fly in a modified Hohmann transfer orbit, which is the most energy-efficient rocket trajectory.

American scientist: I agree, but we should also take into account the fact that a successful Hohmann transfer orbit requires a number of conditions, above all the mutual position of Earth and Mars.

Dr. Lee: Now that you mention it, I suggest you make the appropriate orbital calculations and present them to us. And please, calculate the time of the flight.

American scientist: Ok, Sir.



American scientist: I've completed your assignment, sir. By my calculations, the flight will last approximately 237 days. The semi-major axis of the orbit is 1.19 A.U., eccentricity - 0.16. The plan of the flight is next:

The rocket gains an escape velocity of 11.2 km/s. After reaching this velocity, the velocity relative to the Sun will be 41 km/s, and it is necessary 32.07 km/s, then the rocket will drop 8.93 km/s by

switching on the engines in the opposite direction. And, after correcting the velocity vector, the rocket will enter the desired orbit.

Dr. Lee: Great, Mr. Jackson. The information about entering transfer orbit is important for the Engineering Department. Mr. Dunkler, please pass this information to them along with the calculations.

Verchichko: I agree with Mr. Jackson's calculations, however we have to take into account that the departure date is limited, by my calculations the nearest departure window will be in 10 months. And departure windows repeat every two years. I don't think we have enough time.

Dr. Lee: I think we have enough technology to prepare for a flight in 10 months. I will discuss this problem with the Director and Mr. Podolsky.

Engineering Department

Podolsky: Hello colleagues, my name is Yakov Podolsky and I will be leading the creation of the rocket that will take our four astronauts to Mars. The lives of our astronauts and the success of the mission depend on the results of our work, so let's take it very responsibly! Let's start with, what are the key components of our rocket?

Wachtman: I think we should do a multistage rocket.

Podolsky: That the rocket should be a multistage is a given, but which engines will we use, which details? Building a rocket is a very hard task, and there are many components in the rocket.

I suppose we shall use a solid rocket booster to reach Low Earth Orbit. Once on orbit, we can drop the first stage of the rocket with these engines. Then, after a few safety revolutions, we will begin accelerating to escape velocity using a liquid engine. After we leave the Earth's Hill sphere, we will perform a short ignition to reduce the velocity to the required 32.07 km/s relative to the Sun. Then the rocket will enter the Hohmann transfer orbit. When it approaches Mars in 8 months, we will turn on another engine to slow down so that the velocity relative to Mars is as low as possible. Then it will be possible to drop all the stages with engines and land the command compartment.

Liren: Well, we have to leave some RCS[1] engines on the rocket while it travels to Mars, in case it will meet some asteroids or unencountered gravitational influence.

Podolsky: Great idea, thank you, Mr. Liren. And please calculate the amount of fuel needed for each engine using Tsiolkovsky's formula. Next, we'll create a detailed plan of the rocket, automate most of the systems on it. And finally build it. We have less than 10 months to do all this, but since NASA, ESA, CNSA are all working on this project at the same time, it will be possible to realize such a huge project in such a short time.

For a long time, the department has been working hard to plan and build the ship, with the best experts working on the construction. And as a result, the rocket was successfully built and became the most modern rocket in existence.

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[1] Reactive Control System - spacecraft system of small engines, used for rotation or small velocity changes. While it is unable to dramatically influence the orbit, it is irreplaceable for controlling spacecraft’s orientation which is especially helpful on landing (authors).

Chapter 3
Public Concerns and Pressures

Soft, yellow light illuminates the waiting room. A young woman is sorting some papers on the table in the corner. The same serious-looking men are guarding the door to the right of the table.

The Director enters the oval office.

“So what’s the progress?”

The Director reports quickly.

“We are ready with the orbital parameters, vehicles are expected in a year. The crew team selection processes are underway to prepare for the flight.”

The President nods in approval.

“Anything outside the official reports?”

“People start to worry about our expenses. There were several demonstrations in front of our headquarters.”

The President takes off his glasses.

“Some complain that too much money is being spent, others are afraid the richest will be evacuated and the poor will be left on Earth which might be reconstructed into a major factory?”

The Director remained silent.

“Do you think I wasn’t informed? Now it's quite a delicate balance we must strike.” - continues the President while turning back to

the window - “The exploration of space is a priority for our nation's advancement, but we cannot overlook the legitimate worries of our citizens.”

The Director remains silent.

The President turns back.

“Our media will be working on solving that problem. Make your press-center do the same. I believe we will lower your funding to quiet people, but you will receive some from the side-funds.”

The President smiles.

“Good luck, Director. And may God be with us.”

Chapter 4
Astronauts Selection and Preparation

Out of thousands of applicants, the 10 top candidates were chosen, based on the space agency's selection criteria. First of all, perfect health, scientific knowledge, and psychological stability.

All candidates who passed the selection were invited to NASA headquarters in Washington D.C. They were assembled in the appropriate department of the Astronaut Group. Mrs. Brightley began with an announcement.

Brightley: Welcome to NASA! We congratulate you on your success in the NASA astronaut selection process. As you already know, four of you will be part of the crew to Mars. It's a very demanding and challenging job, but now that you're here, I'm sure you're ready for it all. But we have a lot of work to do with you and to select the four people who will carry out this history-making mission. During this selection you will all be both competitors and teammates, therefore, I suggest that each of you introduce yourselves to each other and tell us a little about yourselves. Let’s start from you, Mr. Johnson.

Johnson: Greetings, my name is David Johnson, I’m from New York City and I'm 35 years old, my profession is surgeon.

Brightley: Thank you, David. Who wants to be next?

Shevchenko: I will go next. My name’s Andrii Shevchenko, I’m from Odessa, Ukraine. I’m 28 years old and I have a PhD in physics and I will conduct scientific investigations on Mars.

Jansui: My name is Ma Jansui, I'm from China. I work in physics and I'm going to do scientific work if I'm selected.

Borrow: My name is John Borrow, I'm a 33-year-old pilot from the UK. I have logged more than 800 hours of flight time.

Williams: My name's Fred Williams, I'm from California, I'm 25 and my profession is astrochemist.

Wu: Hello all, my name is Jui Wu, I am from Beijing, China. I'm a Chinese National Space Agency astronaut and I have a PhD in chemistry.

Schmidt: Good afternoon, ladies and gentlemen, my name's Fridrich Schmidt and I'm 27 years old and I'm a German scientist. I am, as you can tell from my surname, co-discoverer of the Schmidt-Hildenstein effect. I love physics and hopefully my skills will help on this mission.

Novak: Hello, my name's Hanna Novak, I'm from Poland and I'm a doctor.

Yan: Greetings, my name's Chu Yan. I'm from China and I am a biologist.

Davis: Hello all, I'm John Davis, I'm from the U.S. and I'm a NASA astronaut. I took part in the Artemis mission in 2029. But I was initially a doctor.

Brightley: Great, thank you all for introducing yourself. I can now announce to you the information about how the selection and training will take place. So, there will be various tests that will help us assess your physical and psychological health.Today's test will be hosted to check your physical condition, specifically your

endurance. We call it “*the beep test*”. Follow me to the physical training room where the test will take place.

The candidates followed Mrs. Brightley.

Brightley: Now, I'd like you to introduce Major Wimbledone, the astronauts' physical training coach.

Major: Hello, honored contestants! You have certainly reached great heights if you are here, but in my classes you start from scratch. I suspect Mrs. Brightley has already told you what's going to happen. You will try to pass a “*a beep test*” - when you hear the signal, you run from your starting position to the red line. As the test progresses, the time between the signals decreases and you have to run faster and faster. If you have not run 20 meters before the next signal, you are eliminated.

Major: You have 20 minutes to warm up, and then we'll begin.

The test has started and no one has passed it completely – some candidates dropped out earlier, some later. British pilot John Borrow lasted the longest. Surgeon David Johnson showed the worst result of this test.

The next test was a test of memory and brain function. The participants were shown a sequence of 10 numbers. They were given 1 minute to memorize. After 1 minute, the participants were asked a series of questions, which they had to answer orally to the jury. After answering the questions, participants were asked to recall the sequence of numbers.

The results of Ma Jansui and David Johnson were not satisfactory to Mrs. Brightley: they did not show sufficient physical fitness

during the beep test and also failed the memory test. They were excluded from the selection process. Thus, there are 8 candidates left.

The astronaut selection committee, headed by Mrs. Brightley, noticed that John Borrow was in the lead, having performed well in both tests.

The next day more tests awaited the astronauts. After waiting for the selectees to arrive, Mrs. Brightley began with an announcement.

Brightley: As a result of the past two tests, two people dropped out of the selection process: surgeon David Johnson and physicist Ma Jansui. This is a serious and responsible astronaut selection process and any mistake you make could be critical. So your task is to show us that you are worthy to go to Mars.

This was followed by various physical, mental and psychological fitness tests. Andrii Shevchenko showed the best results on the science test, John Borrow showed the best results on the physical fitness tests. During the selection process Hanna Novak, Fridrich Schmidt were also excluded, as they did not pass the physical training tests.

There are 6 participants left: physicist Shevchenko, pilot Borrow, astrochemist Williams, astronauts Wu and Davis, and biologist Yan.

Next was a test of teamwork and communicative non-verbal skills.

The participants were divided into groups and had to complete a team task without using words.

Williams and Yan did not pass the test and did not perform at their best in previous tests, so they were excluded from selection.

At the end of the day, there were four astronauts left: Andrii Shevchenko, John Borrow, Jui Wu, John Davis.

So the selection process has been completed. 4 astronauts have been selected.

Mrs. Brightley announced:

Brightley: I congratulate you, you have passed the astronaut selection process and will be going to Mars. Now follows a more challenging training process. It is extremely important for astronauts to be physically strong and prepared for hardrocket. Major Wimbledon will give you survival lessons.

Major: Hello, future astronauts! I'll give you a few classes on survival in uncomfortable environments and prepare you for the obstacle course.

Major's lessons

Major: Okay, first question: What do you need to survive?

Wu: Warmth, food, and water?

Davis: Normal blood pressure and body temperature?

Major: Survival requires the ability to adapt! Wherever you are, you must be able to adapt, it is the law of natural selection! So being able to adapt to the conditions you are in is what I am going to teach you.

Several of the Major's lessons took place, where he taught the candidates how to survive in the most difficult conditions to live in. It was time for the obstacle course.

Mrs. Brightley, Major and participants went to the “Mars Zone”, which simulates the external conditions of Mars.

Major: On this test you will have to survive and build a place to live in the "Mars Zone" for two days. You will be given food, water, spacesuits with oxygen tanks and some other equipment. During this survival training you will additionally need to complete a number of scientific missions. It is possible that you will have technical problems, which you will have to fix by yourselves. If you fail to solve them, the mission will be terminated for your safety.

Since the area completely simulated Martian conditions, there was no water, no suitable air, and no suitable temperature. The astronaut candidates were protected by ultra-modern suits, which were equipped with oxygen supply, maintaining the temperature at 25°C. However, the oxygen supply and energy to maintain the temperature would run out, so the participants had to complete the tasks in time to avoid failing the test.

The test begins

The astronauts had the following task: to build a place to live, launch a robot researcher, take measurements of atmospheric temperature, atmospheric pressure, air humidity, measure air density, and, based on these data, measure the height of the atmosphere and its other physical and chemical properties. In addition, the astronauts had a biological task - in greenhouses to plant seeds of special plants, and to observe all the conditions for

the plants to grow. All the results obtained had to be described in detail in a notebook, which they would then hand over to the commission for verification.

Future astronauts distributed tasks amongst themselves and started performing them.

The complexity of scientific tasks was not excessive, because all astronauts have PhDs, they know science like the back of their hand. However, the problems were more technical. Astronauts are not used to doing work in suits and in conditions of lower gravity. The most difficult task for the future astronauts was building a greenhouse and growing plants in it.

But the astronauts still completed all the tasks and successfully finished the test. Mrs. Brightley was pleasantly surprised by the team's cohesiveness.

Various astronaut training sessions followed. The astronauts experienced rotation in the centrifuge, where they felt a strong overload. They were also trained physically, because in weightlessness the astronauts' muscles atrophy and they need to be in good physical shape during the flight. After all the necessary preparations, Mrs. Brightley said that the astronauts' training was ending and they were going into isolation before the flight.

Chapter 5
Farewell to Earth

In the transport industry, the whole staff never sleeps at once – otherwise it would take much more time to prepare anything. When you are working in one of such industries, you start to understand how much happens while one sleeps…

Borrow approached Shevchenko, who was watching the space town, part of which was preparing to sleep while the other part just woke up, with a cup of tea.

“May I?”

Shevchenko turned, slightly surprised.

“Sure.”

Borrow step towards the window.

“How are you doing?”

Shevchenko took a sip from his cup.

“Just trying to memorize our last hours on Earth.”

Borrow looked at Shevchenko, seeing that he was tired inside, even though he tried to act relaxed.

“You know, what we are about to do is probably humanity's bravest project. We will be the first of our kind who walk on a different planet. Pioneers.”

Shevchenko turned and raised his eyes on Borrow.

“If we succeed.”

Borrow’s face became a little hard

“And if we do not?”

Shevchenko remained silent for a moment, then took another sip. Over the last months each of the crew was thinking about the odds, asking questions to themselves, trying to remain loyal to their duty - trying to do their best. Each of them came a different path along such reflections. Borrow decided their failure changes nothing. Shevchenko realized the same, but lacked Borrow’s fighting experience, so the possibility of death saddened him much more.

Borrow nodded. "It's a pretty big job we're about to do, isn't it?" he said, looking out the window at the people rushing around.

Shevchenko looked too, watching the engineers heading towards the monorail, which led straight to the Vertical Assembly Building, where the rocket should be preparing for transporting to the Launch Pad right now.

"Yeah," he agreed, taking a sip of his tea and thinking for a moment. "It's been a lot of hard work leading up to this."

Borrow leaned against the windowsill.

"You know, I'm glad we've got a good team. Everyone's got something special to put on the table."

Shevchenko just looked straight at him. Both of them were silent for a minute.

"We've come a long way," Shevchenko nodded.

Borrow looked at him, sounding determined. "And we're going to keep going," he said firmly.

…

Jui Wu was sitting at the corner of the sofa. To the left of it there was a glass-wall, where, several hours ago, astronauts said goodbye to their families. Some of the relatives cried, some remained quiet, but mostly they were just smiling with the sad smile people have when they know they are losing something important and they know they can't do anything about it, with this type of smile which is often accompanied by silence and eyes wetting.

"Would you mind?"

Wu raised her eyes on Davis, who stopped near the opposite end of the sofa.

"No, join."

John sank on the sofa. Wu resumed looking at the floor in front of her.

"Hey Wu… I know it is hard to prepare for the flight, especially if we only have tickets to one end, but don't be so sad. I am sure we will have a wonderful time on Mars, and we, most luckily, will have to call it *home* one day, but for now, just enjoy these couple of hours on Earth. Probably our last hours on Earth, though it only makes them more valuable, doesn't it?"

Wu raised her eyes on John. In the light he noticed they were wet. She didn't respond.

“You know, when I was 8 years old, we moved from a small town in Texas to New York City. I have always missed those vast plains since then. I will never forget them.”

Davis looked aside and took a sip.

“Yet it turned out life in New York is also a life. Just a different kind of it.”

Davis was silent for a second, and continued.

“Then I changed school, grew up just like a normal kid. It's just that those infinite spaces became my warmest memories.”

Davis suddenly raised his cup and finished it in one gulp.

“Have a good night.”

“You too,” replied Wu, watching as he went.

Chapter 6
The Flight

Kennedy Space Center in Florida. Countdown underway. The anxious astronauts await.

The final technical checks were completed and the rocket was ready for takeoff. The astronauts underwent a final physical check and boarded the spacecraft. Millions of people watched live and on-line the history-making mission of the world's first crewed mission to Mars.

And so, the moment arrived when the engines ignited. Everyone is anxiously watching the launch, and thankfully, everything goes well.

The rocket takes off and soars rapidly upwards. Everyone watching applauds. The astronauts begin to feel the overload. Now the rocket needs to gain an orbital velocity.

Director: Are you guys ok?

Borrow: Yes, Sir!

Davis: Yes, we are fine.

Director: Amazing. On behalf of our combined team, congratulations on a successful launch.

Wu: Thank you, Sir.

Director: And don’t forget to check in every 10 hours! Constant communication is essential.

After some time, the astronauts feel weightlessness. They have left the Earth's gravitational field and entered a heliocentric orbit.

The astronauts' routine was quite uniform. Every day they had three meals, two hours of sports training, technical inspection of the ship, and various scientific tasks. Once a week - general cleaning and maintenance of the ship. Everything would have been the same, if there had not been some curious situations.

Fifth day of flight

Director: Hello, honorable astronauts! Report on the situation on the spacecraft and the results of the daily technical check.

Wu: Everything's fine, Director. The technical check has been carried out and no faults have been found.

Director: Great!

Thirteenth day of flight

Director: Come in, report the situation!

No response

Fourteenth day of flight

Director: Come in, can you hear me?

No response

Communication with Earth has been lost. The director is in a panic.

At this time on the spacecraft, the astronauts were trying to resume communications. During the technical inspection, it was discovered that the antenna navigation system was burned out due to substandard parts. Shevchenko knew electronics well. He came up with an algorithm for tuning the antenna so that it would work again.

Communications have been reestablished.

Shevchenko: Come in, this is the spacecraft, do you copy that?

The Director, who had been waiting around the clock for a response from the spacecraft, fell out of his chair upon receiving the message.

Director: Come in, I can hear you well. What's your emergency? Why didn’t you respond yesterday?

Shevchenko: The navigation system has been broken but we fixed it.

Director: Good for you! Check the spacecraft again, I'll let the President know you've made contact.

Shevchenko: Ok, sir. We'll check it again and let you know if anything's wrong.

Director: Great, take care!

No problems were found on a second technical review. Astronauts reported the situation to the Director.

The flight continued. Everything was going well, the astronauts were performing tasks from the base, doing everything as instructed. There was no sign of trouble. However, on the fiftieth day of flight Wu lost consciousness.

After a short investigation astronauts realized the oxygen pumping system activated and the oxygen concentration increased to critical. Shevchenko consulted with Earth and manually deactivated the system.

Davis monitored Wu's condition, as he is a doctor by profession. In an hour Wu awakened. The first thing she saw is worried Davis' face. After he realized Wu is awakened, he screamed:

"Finally! Are you ok?"

Wu: Thank you for your concern, I'm fine.

Davis: Due to a micro-crack that developed for some unknown reason, the oxygen pumping system began to run non-stop. The oxygen literally poisoned you and you lost consciousness.

Wu: That's terrible! But thank you for your concern and medical help. Now I feel better.

Davis hurried to radio to inform Earth of Wu's improved physical condition.

Davis: Come in, come in, do you copy?

Director: Come in. Report the situation!

Davis: Wu woke up and feels good. After the initial medical examination, no problems were identified.

Director: Great, then re-inspect the spacecraft. And re-inspect especially the oxygen pumping system!

Davis: Yes, Sir!

But all the previous problems that had occurred during the flight would seem minor compared to what happened on the eighty second day of the flight. An alarm goes off on the spacecraft. The astronauts run to the radio transmitter to hear the cause of the alarm from Earth.

Director: Come in, come in, do you copy?

Shevchenko: Come in, what's the emergency?

Director: Our sensors indicate that the missile may collide with a near-Earth object. When planning the flight we calculated the trajectory, and no collision should have happened, but just recently two massive asteroids unexpectedly collided somewhere in the large asteroid belt, so that their orbits changed as a result of the collision. And now, in about 15 hours, our spacecraft could collide with one of those asteroids. Because the flight path was precisely calculated, and any activation of the engines will change the trajectory of the orbit. Moreover, if the maneuver is performed

inaccurately, the fuel may not be enough to return to the previous orbit and make a landing.

Borrow: Sir, I'm ready to change the trajectory any way you say, you can count on me.

Director: I'm afraid we have no other choice. In half an hour our scientists will accurately calculate the new trajectory and will inform you in which direction and at what power you will need to ignite the engines. Your task is to set the engines ahead of time, and turn them on at the signal.

It's been 32 minutes. The astronauts nervously awaited orders from Earth. Finally, the Director made contact.

Director: Come in, do you copy? This is the information on how and when to execute the maneuver. We've started a countdown on the touch screen. When the clock reads 00:00, turn the engines to an angle I'll tell you the exact value of, and turn the engines on to the power I'm about to tell you. Fifteen seconds after the engines are turned on, turn them off. Do you understand me?

Borrow: Roger that. Dictate the rotation angle and engine power, please.

The director dictated the values the pilot needed to execute the maneuver. 14 hours and 15 minutes later, the astronauts had already seen the asteroid through the porthole. Ten minutes to maneuver.

Nine minutes later, the astronauts made contact.

Davis: Sir, Borrow's already in the pilot's seat with the engines turned to the proper angle and power already set. He's ready to power up as soon as he sees 00:00 on the screen.

Director: Great. And may God be with us.

The maneuver was successfully completed and the astronauts avoided a collision. After that, the director gave the crew information on how to perform the maneuver to transition to the previous orbit. Pilot John Borrow successfully completed the task.

The further flight was without incident.

On the 237th day of flight, the spacecraft approached Mars. The director gave the astronauts the information that the landing would be in 10 hours and ordered a final check of the spacecraft's condition.

After 7 hours Mars was already clearly visible on the viewing screen. Since the astronauts had changed their trajectory during the flight, they had to adjust it again for a more accurate landing. Borrow received the proper instructions and successfully corrected the direction of travel.

Two and a half hours later, everything was ready for landing. With all systems set up, the astronauts just had to wait for the landing and hope for a successful outcome.

The landing process had begun. Thanks to the spacecraft's fine tuning, all systems worked perfectly. Finally, the spacecraft landed on Mars.

Chapter 7
Colonization

The astronauts contacted Earth, waiting for further instructions. Five minutes later, they received the command:

"Re-check the serviceability of spacesuits and equipment, if the result is positive, you may depart the spacecraft, if negative, reestablish contact with us."

The astronauts began preparations to leave the spacecraft. They all put on special suits and took the necessary equipment. Finally, when all the checks were done and the astronauts were ready to leave the spacecraft, they sent a signal back to Earth:

"We solemnly declare that humans have set foot on Mars."

The astronauts headed for the exit.

Davis: I think we should suggest that Mrs. Wu goes first.

Wu: I appreciate it, but I think that Mr. Davis should go first, it's been his lifelong dream to be the first person to set foot on Mars.

Davis: No, no, no, Mrs. Wu, how can I go before you? It's not gentlemanly! You go first.

Wu: If you insist, all right. And thank you guys!

Shevchenko: And, Jui, don't forget to say a phrase that will go down in history, as Neil Armstrong once did!

Jui Wu leaves the spacecraft and sets foot on Mars. The astronauts applauded, and congratulated her. Jui was excited. After she left, she said:

“I stepped on Mars' surface, and humanity stepped into the dawn of a new era of development.”

After that other astronauts exited the spacecraft. They looked around in awe and happiness, took photos of themselves and began the work of building the colony.

Earth, having received a signal from astronauts from Mars, solemnly announced:

“The spacecraft has reached Mars, the first humans are already standing on the surface of the red planet.”

According to the plan, the astronauts were to build polycarbonate greenhouses in the form of a hermetic dome, inside which will be maintained at a suitable temperature for habitation. There would be many such greenhouses: one would house the astronauts and the rest would grow plants. In the process of hydrolysis, oxygen will be produced inside the greenhouses, which will be breathed by the astronauts and through which photosynthesis will take place. The supply system inside the greenhouses should be automated. Once the astronauts have built these greenhouses and automated the life support system, they can start implementing scientific tasks.

The astronauts strictly followed the plan and carried out clear instructions from Earth.

When they had completely finished the buildings in which they would live, they were finally able to begin the process of completing the scientific tasks.

Chemist Wu collected samples of Martian rocks for further exploration. Davis, who is a biologist by profession, was busy planting and growing plants. Physicist Shevchenko measured radiation in various places while pilot Borrow investigated the properties of the Martian atmosphere.

Many different scientific tasks were performed by the astronauts every day. As the days went by, the astronauts adapted to Martian life.

So for two years, the astronauts lived on Mars and performed scientific tasks assigned from Mission Control. They survived by growing and eating crops and vegetables and eating chickens that they brought from Earth.

Two years passed. It was time for the next group of astronauts to arrive. So, year after year, the colony expanded.

Chapter 8
Old Astronauts Discussion

In ten years the population reaches 61 souls and the colony consists of nine major domes. The biggest is the garden, where trees produce oxygen. Two smaller ones are crop-farms. In three medium sized ones, the colonists live, and others are left for community spaces and technical needs.

There were eight additional shuttles after the first team landed, four crewed and four delivering necessary materials.

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“So, when does the next shuttle arrive?” asked Davis during lunch.

“In two weeks,” replied Wu from the opposite side of the table.

Davis leaned against the back of his chair.

“We’ve done it,” said Borrow, “we’ve founded a sustainable colony.”

“Our population is now 82 people, 20 of which are kids,” noted Davis. Amazing.”

“Quite,” Borrow added, “Yet it took us 15 years.”

All four pioneers, including Borrow himself, somehow felt saddened after hearing this phrase as so many memories flashed in their minds.

“It took us fifteen years…” Shevchenko whispered.

“Yet look at what we have,” Davis raised his eyes. “We have not only founded a town on the uninhabited planet – we founded a new era of humanity.”

“And a new generation of humans,” Wu finished.

“Genesis,” Shevchenko whispered.

Borrow gazed at the orange hills outside the window as the sun set over nearby mountains.

“Red Genesis,” he smiled.

The End