

MAJOR TOM

A Story of Hope

by Dennis O'Brien

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DEDICATION

To my Mother and Father
who encouraged my interest in science and the law

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Your editing, suggestions, and encouragement were essential.

To David Bowie, who first sang about an astronaut who questioned his mission in the song *Space Oddity*.

Finally, to Sarah Bailey, who helped restoke the fire of creativity when I thought it had gone out forever.

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CHAPTER ONE – President

The President of the United States was sitting on a couch in the Oval Office, and he was not happy.

Four other people were in the room with him: his political advisor, the Director of National Intelligence, and the Director and Deputy Director of NASA. They were all standing. No one sits in the Oval Office unless they're invited, and this President rarely did so.

The two NASA administrators were standing next to a large screen television that had been wheeled into the room. On the screen was a video clip from NHK Newslines, the English-language news service of Japan. The picture showed a rocket ship on a launch pad, venting gasses as it was fueled for launch.

"For the first time, a married couple, Tom Liping and Tom Enloi of China, will be going into space on the same mission," said the announcer. In the background, the song "Space Oddity" by David Bowie began to play. The scene shifted to inside a building, where the two astronauts – taikonauts, to be precise – were going through final preparations.

Ground Control to Major Tom. Ground Control to Major Tom. Take you protein pills and put your helmet on. "Tom Enloi, the husband, will have 'TOM' in red letters on his helmet," said the announcer as the taikonauts put their helmets on, "while his wife, Tom Liping, will have 'TOM' in blue letters on hers, to help ground control keep track of who's who."

Ground Control to Major Tom (10, 9, 8, 7). Commencing countdown, engines on (6, 5, 4, 3). Check ignition, and may God's luck be with you (2, 1, liftoff!). The scene shifted to show the taikonauts being loaded into their capsule, then sitting and waiting through the final seconds, then an external shot of the rocket taking off.

“So far, I’ve seen nothing,” said the president. “Just some clever editing to match a song. I’ve got better things to do than sit around and watch a music video, believe me.”

“Just a little farther,” said the Deputy Director, the woman who had put together the presentation. “We wanted to show you the beginning so you could see how important the Chinese viewed this mission.” The President grunted and waved his hand; his impatience with briefings was legendary.

This is Ground Control to Major Tom. You’ve really made the grade, and the papers want to know whose shirts you wear. Now it’s time to leave the capsule if you dare. The scene jumped briefly to a post-launch press conference where the reporters were asking questions of the Director of the China National Space Administration (CNSA), then to the taikonauts in space. The view of their capsule was from their latest space station, the Tiangong-3, as the capsule approached.

“As we now know,” said the Japanese announcer, “the automatic docking systems on the station had failed, and it was necessary for one of the taikonauts to take a spacewalk to enter by the emergency hatch.” The camera showed a taikonaut – Tom with red letters - leaving the capsule and maneuvering toward the station using the thrusters on his backpack. He had just reached the emergency hatch on the side of the station when an alarm went off.

Announcer: “Suddenly the proximity radar in the capsule sounded an alarm. A piece of space debris, too small to be picked up by ground radar, was approaching at high speed on a collision course. It would just miss the capsule, but it would hit the station.”

“Come back quickly,” radioed Tom Liping in the capsule (speaking Chinese, with subtitles provided by NHK). “There’s no time to enter the station and activate the thrusters.” When her husband did not respond right away, she persisted. “Major Tom, as the captain of this ship, I order you to return immediately!”

“And if I was on your ship, Major Tom, I would obey your order,” replied her husband. “But I am on my station, where I am commander, and I’m going to try to save it.” He used the handrail near the hatch to brace himself, then turned his backpack thrusters on full. The force wasn’t a lot, considering the larger mass of the station. But he could feel it pushing his body against the station, and he knew it was moving.

Meanwhile his wife maneuvered the capsule to a vantage point above the station. She watched the radar as the object approached. The station was hardly moving, but it was moving, and moving slightly faster with each second. It was enough; the camera on the capsule showed a brief flash as the debris zipped past, just missing the upper side of the station.

The technicians at Ground Control burst into cheers. Tom Enloi joked about the close call; his wife in the capsule remained silent. “In an instant, a hero was born,” said the Japanese announcer. “And a week later, when they returned from their mission, the taikonauts were given a hero’s welcome with a parade in Beijing, like the ticker tape parades the United States used to give their early space pioneers. When they reached the reviewing stand, the spacewalker spoke to the crowd awaiting them at Tiananmen Square.”

“I want to thank the people of China for supporting this glorious effort to expand China’s presence in outer space,” he said. “I especially want to thank the Chinese Communist Party, which showed once again that it is best in organizing the efforts of the people in moving our country forward. Hopefully our success will be an example for the entire world.” All the Party dignitaries who were attending the parade stood and cheered, and the crowd went wild.

The President was unimpressed. “I know all of this,” he said. “China is catching up to us because our last president had no vision when it came to space exploration. None. And now China has launched the first module of their own permanent space station. They’re already playing it up around

the world as proof they've caught up to us in technology. I don't need anyone to tell me that. A huge embarrassment for this country."

The NASA administrators looked at each other, then the Director cleared his throat. "I'm afraid it's worse than that, sir."

"Oh? Explain, and please don't make it long."

The Deputy Director took over. "We've analyzed every frame of this report. The video from the capsule that showed the space debris zipping by the station is no longer on the internet. Apparently, it was scrubbed soon after the Japanese used it to make their report, suggesting that there is something there that the Chinese don't want anyone to see. Even the NHK web page for the video now displays an "error" message. Fortunately, I had saved the report on my DVR at home." She had rewound the video while talking, and froze it at the moment she mentioned. "It was so obvious that we didn't notice it at first. Do you see the difference from our own space station?"

"I do not, but I'm not a scientist. Please get on with it."

"Yes, sir. The segments of our station are all round. Nothing has to be built with gravity in mind. There is no up or down, so all surfaces have something going on." She pushed a button on her remote, and the screen split, showing the International Space Station on one side and the Chinese station on the other. "Their station was built with a top and a bottom, as though it was going to be in a gravity environment. The top is facing the Earth now, with all the viewports and antennae. The bottom faces away from the Earth and is flatter, with nothing on it, and there are four bumps near the four corners that have no apparent purpose. We now believe they are covering engines, and perhaps retractable legs."

"Could you please get to your point?"

"Yes, sir. Tiangong-3 is not a space station. It is a module for a lunar base. The Chinese have launched the first component of their program to put a human on the Moon. We believe that the next step will be to launch a booster stage that

will be mated with the module to transfer it to lunar orbit. It will then use its own thrusters to reach the surface. A separate rocket will bring the crew return ship. We expect they will be able to do all of that within a year."

She paused, waiting for a response. It took a while, but then the President slowly leaned forward, rested his elbows on his knees, and spoke softly and slowly:

"I was voted into this office because I promised to make this country great again. Now you're telling me that the Chinese are going to beat us back to the Moon. Do you know what that's going to do to our prestige? When the Soviet Union beat us into space, first with Sputnik and then with Gagarin, they held it up as proof to the world that communism was better than capitalism when it came to getting big things done. It took us a decade and a commitment of vast resources to catch them and regain our reputation as the world leader in technology. Is there any doubt that the Chinese are trying to do that now, just as we're trying to stop their expansion in the South China Sea and blunt their growing influence in the rest of Asia, and Africa? Do you have any idea what it would mean to have the Chinese plant their flag on the Moon before we get back there?"

She didn't answer right away, thinking it was a rhetorical question. When he kept staring at her, she finally said, "It would be bad for the United States."

"It would be very, very bad. The so-called American Century would be over. And that is not going to happen while I'm president."

"Yes, sir. We've already started to put together a list of options for getting us back to the Moon sooner."

"Good. I want it on my desk tomorrow morning."

"Y-yes, sir."

"That's all. Keep me updated."

"Yes, sir." The Deputy Director and the Director left.

The President waited till the door closed, then looked at the Director of National Intelligence. "How many thousands of people do you have working for you, and it takes some broad

with a DVR to turn up the biggest piece of intelligence of the century?”

The DNI was taken aback. “Well, our expertise in spacecraft architecture . . .”

“Is nonexistent! You’ve paid so much attention to the cyber world that you’ve lost touch with the nuts and bolts. Well, now you’ve got your lead. Find out everything you can about this module, especially when they’re going to send it to the Moon. We need to know how much time we have before we make any decisions. That’s all.”

“Yes, sir.”

As the DNI left, the President waved toward another couch, and his political advisor sat down. “This could make you or break you,” he said to his boss.

“I’m aware of that. The polls are down, Congress is stalling on everything, and the press is constantly hounding me. We need something to remind people that we are the leaders of a great nation, and that all this negative stuff is just a distraction.”

“Precisely. If we can re-establish your leadership chops, then everything else will fade away. The people love a winner, and there’s no greater prize right now than beating the Chinese back to the Moon. Of course, if we lose . . .”

“We will not lose! I will do whatever is necessary, even if I have to deal with the private companies. Isn’t one of them planning to send some people around the Moon soon? They’re already flying our people to the space station”

“At the end of the year. Of course, it’s far more difficult to land someone on the Moon than it is to swing around it. Takes more fuel, and a bigger booster that we won’t have for another year.”

“Why does it take more fuel?”

“Well, they might have enough fuel to land. But then they wouldn’t have enough fuel to make it back.”

The President did not respond. Instead he sat back on the couch, the wheels in his head starting to turn.

CHAPTER TWO – Taikonauts

The parade had been exhausting for the taikonauts and their eight-year-old son. Tom Enloi and the boy had been enthusiastic throughout, but Tom Liping's smile had become more forced as time went on. At the end, the family joined the Party dignitaries on the reviewing stand. After the Premier gave a speech full of praise for the "courageous couple", Major Tom gave his thank-you speech. The crowd roared, and the assembled leaders all smiled and applauded. Young Tom looked at his father in admiration, but his mother's smile was even more forced.

They still had to endure a state dinner, with the seemingly endless toasts to their success. But eventually they were able to get away, citing their son's need to get to bed. A chauffer took them home, and their nanny/housekeeper greeted them and took young Tom to get ready for bed. The couple went to their own bedroom, their first chance to be alone all day.

As soon as the door closed, she turned to him. "Did you have to be so lavish with your praise, Loi? It's one thing to recognize all those who worked on the project and the people who support it. But giving so much credit to the Party is just what they want. They can go on refusing essential reforms if they can make people believe that they are the key to making China a great power."

"Not so loud, Li. Nanny is just down the hall. We're lucky enough that the Party provides someone to help us out,

but she reports back to them, just like all the other assistants who are assigned to important people.”

“And you can just accept that?”

“Well, it’s not so bad. We still have our own private space when we want it.” He paused for a moment. “Look, I know how you feel about your father . . .”

“This is not about my father! This is about what’s good for the people of our country. You know as well as anyone how controlled our society is, how people only hear what our leaders want them to hear. Even our internet is controlled, and every communication is subject to monitoring. All in the name of the state. All so your glorious Party can stay in power.

“And you’ll say and do anything to support it, as long as they keep sending you into space. Everything else in your life is secondary. You’re a space junkie, Major Tom, strung out on heaven’s high. But right now, I’m hitting an all-time low.”

It was not the first time they had discussed politics and their role, but it was the worst. He felt sad that something that seemed so natural for him was causing her such pain.

“I’m sorry,” he finally said. “I will try not to glorify the Party so much at the space treaty conference. Our leaders tell us that even their power and authority come from the people. I will give that more thought.”

She looked at him and smiled, then reached up and put her hand on his cheek. “I know you will, my love. You are the most honorable man I know. It’s why I fell in love with you. There’s just so much to deal with, now that we’re national heroes.”

He took her hand and kissed it. Then they held each other close, feeling their bodies merge, taking a deep breath together. For a while they would set the cares of the world aside.

CHAPTER THREE - Conference

The International Conference on the Space Treaties had been planned for months, though it was decades in the making. As attendees gathered in San Francisco, they were well aware that the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space - aka the Outer Space Treaty - had been negotiated a half-century earlier, when only a few nations could launch satellites and the thought of mining moons and asteroids was the stuff of science fiction. But now several nations, and even some private companies, were able to do so, and the tensions between those who wanted to privatize the development of space and those who wanted to keep all activity controlled by governments was growing.

The conference was held at the University of California in San Francisco, aka Hastings College of the Law. As the third largest law school in the country, it had plenty of rooms with amphitheater seating for technical sessions, and a large hall with a stage for the opening and closing sessions. The Toms attended as part of the Chinese delegation.

After welcoming speeches by various dignitaries, there was a surprise announcement. As a way of introducing the many astronauts/cosmonauts/taikonauts in attendance, there would be a contest in receiving Morse Code. Although radio and telecommunication technology had moved far beyond the need for the Code, the commanders and pilots of space missions were still trained in it as an emergency backup. As the master of ceremonies called out their names, the

spacefarers took the stage, two dozen of the best and the brightest from countries around the globe.

Both Toms were included, she as a pilot, he as a commander. They smiled at each other as the contest was announced. Ten years earlier they had met at a similar contest during their training in China. They had quickly outlasted their fellow taikonauts as they transcribed messages from a stream of dots and dashes through headphones, whose pace kept increasing. They typed frantically onto computer screens that were projected on a wall. After several minutes, he finally made an error, and a cheer went up for the woman who had defeated the predominately male taikonaut corps. He looked at her with great respect, and she beamed back in triumph. A dinner date followed, and their mutual admiration quickly turned into affection. Within months they were married, and a year later she gave birth to their son.

Now they joined the others in putting on their headphones and preparing to type on laptops whose screens were likewise projected on the walls of the auditorium. Several contestants were eliminated quickly; it was obvious they had learned the bare minimum and would be relying on their cheat sheets should an emergency arise. But there were seven who persisted: The Toms and one each from Japan, India, Russia, the European Union, and the United States. The pace quickened, and even these began to drop out. Finally, only the Toms and the U.S. astronaut, Major Michael Harris, were left. It seemed like they could go forever, but then the astronaut finally made a mistake, followed soon after by the female taikonaut.

The crowd cheered as Tom Enloi was presented a medallion commemorating his accomplishment. He was invited to speak about his latest adventure in space; the organizers were pleased that the winner had such an interesting story to tell. Most people didn't even notice when Major Harris took the seat next to his wife while he spoke.

"Congratulations on winning the contest," he said to her, breaking the ice.

"But you are mistaken, Major Harris. It is my husband who won."

"Only because you deliberately made a mistake once everyone else was eliminated. You didn't need personal glory once you knew your husband, and your country, would prevail. Such modesty and sacrifice are uncommon these days."

"Well, he is much better at making speeches than I am, and doing what is best for the group is more important than personal glory." She paused a moment, then: "I noticed you also seemed to make a mistake on a simple entry."

"Well, it wouldn't do for the host nation to win its own contest. Much better to honor our guests, let someone new speak. God knows I'm tired of it!"

She was about to answer when she felt her phone vibrating in her pocket. She pulled it out and found a text message from their nanny. She was feeling very ill, with pain increasing in her abdomen. Could Liping please come to their suite at the hotel and watch her son for a while? The taikonaut texted back that she would be there right away. She explained herself to Major Harris, who immediately offered to drive her to the hotel.

She politely declined. "I can get a ride from one of our staff from the consulate." Then, with a smile, "It might look a bit improper for a married woman to be seen leaving the conference with a notorious womanizer."

Major Harris started to object, then also smiled. "Am I really that obvious?"

"Let's just say that your reputation has proceeded you, and a hero of the Chinese people needs to be very careful in the image she presents."

"Perhaps there might be a way we could carefully meet somewhere for a drink?"

She got up and held out her hand to shake his. "Thank you for the invitation, Major," she said, again with a smile. "Perhaps someday we will meet again."

As she walked away he could not help but watch her. Intelligence, beauty, strength of character – he was suddenly

very envious of Major Tom. Then he shook his head and turned his attention back to the taikonaut at the podium. No need to start an international incident!

Meanwhile, the man he envied was wrapping up his speech. He had talked so often about the mission that it was almost automatic, leaving plenty of room in his mind to notice Major Harris sit next to his wife, then her sudden departure a few minutes later.

“Thank you, Major Tom,” said the master of ceremonies. “A very inspiring speech. Would you be willing to take a couple questions?”

“Certainly, though I doubt I know all the answers.”

The MC looked around and called on one of the reporters covering the event. “George Walker, Associated Press. What are your views on the commercial uses of space, like mining the Moon?”

“Well, that is certainly a point of discussion, and I don’t want to compromise the fine efforts of our delegation at the technical sessions. As you know, I believe that the Chinese government has been most instrumental in realizing the aspirations of our people when it comes to space. Yet we are still able to draw upon the creativity and financial resources of a market economy. We call it ‘One Country, Two Systems’. It may be that this approach will work best in outer space, but I will leave that to the negotiators.”

“Are there any questions not related to the Outer Space Treaty?” asked the MC, trying to keep the lid on any controversies during the opening session.

“Yes. Diane Davis, The Mendocino Voice. Major, you risked your life to try to save your country’s space station. The Rescue Treaty requires all nations to come to the aid of any space travelers in case of an emergency. Do you think that requires people to risk their own lives to save others?”

“Well, there’s a lot to consider there. How dire is the emergency? How great is the risk? And there may be external factors, like the importance of the mission or the advancement

of national priorities. Sometimes the greater good requires personal sacrifice.”

“And who makes that decision?”

Major Tom paused for a moment. He had often thought about that question himself. Indeed, when he had acted to save the station, his own instincts had taken over, even when protocols said he should have returned to the safety of his capsule.

“We always try to fulfill the mission and directives of our national space agency, which acts for the government and people of China.” He paused. “And yet there may be situations when the commander of a mission may need to make a decision on the spot. Space law is in many ways based on the laws of the Age of Exploration, when ships would take to the oceans, encounter new situations, and the captain was empowered to act as he saw fit.

“Of course, we now have instant communications,” he was quick to add, “so that situation might never come up.”

“Thank you very much, Major Tom,” said the MC, stepping in before another can of worms was opened. “We will now take a short break before breaking out into our technical groups. Please enjoy some of the food and beverages set up in the back of the auditorium.”

Most people did, but the taikonaut immediately checked with his delegation, then left for the hotel. The diplomats and legal team could take care of the negotiations. A taikonaut's place was with his family.

Or in space.

CHAPTER FOUR – Conflict

Major Harris did not have any such family responsibilities, so after socializing with other attendees at the snack table, he went to the work session on the commercial development of outer space. Not that he would talk; even if he wanted to, the presentation was tightly controlled by the head of the U.S. delegation. The astronaut had been invited on the pretext of providing technical support, but he knew he was there for show. Still, his status allowed him to go to any workshop, and he knew this one would have the most action.

The head of the Chinese delegation, the Director of the CNSA, was just starting to speak when he arrived. “The People’s Republic of China would like to thank the many nations who have sent delegates to this conference to help resolve an issue that can no longer be ignored. As you all know, the Outer Space Treaty of 1967 states that ‘The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.’ But recently the United States has been encouraging private companies to move forward with plans to make use of resources in outer space for their own financial gain. Leaders of its aerospace industry have even called for the creation of ‘exclusive economic zones’ where they could operate as a monopoly.

“Such a privatization of resources would violate both the letter and the spirit of the treaty. Yet the United States

government seems fully in support of such efforts. While announcing a recent Space Policy Directive, the U.S. Vice-President stated, "Space is a warfighting domain. It is not enough to have an American presence in space. We must have American dominance in space." They have also established a space advisory board that is charged with developing "strategies to ensure U.S. economic leadership in the development of outer space." It has become obvious that the United States intends to extend its own political and economic system, including corporate control of resources, into outer space. We thus wait with anxiety to hear their position on this issue."

All eyes turned to the U.S. delegation, which was led by the President's son-in-law. He had become the Administration's de facto executive officer, the person closest to the President who handled the most important tasks. No one doubted that he spoke with the authority of the Oval Office.

"The United States has always fully complied with the Outer Space Treaty," he began, "and will continue to do so. It is true that we are now applying the principles of a free market economy to the use of outer space, but it is our position that such use provides the greatest benefit to mankind. If we rely solely on governments to explore and develop space, we will remain stuck in low Earth orbit forever. It is only by harnessing the creative energies and resources of the marketplace that we will move humanity forward."

"Those are noble ideals," replied the Director. "But we have seen how United States corporations operate around the world, paying little heed to worker safety or the environment, extracting resources for maximum profit and then leaving a mess for others to clean up. We do not wish to extend that pattern into outer space."

"And how is that different from Chinese corporations?" asked the U.S. delegate. "Your buildings collapse from your failure to enforce construction codes, and your major cities are

darkened by the smog from your coal-burning power plants and industries.”

“Our country has had to make some difficult choices to achieve the industrial output necessary to match your country in a relatively brief time,” replied the Director. “But now that we have done so, we are already cutting back on fossil fuels and improving our workplace protections. We can do this because our government remains more powerful than our corporations. The needs of the people are always superior to the corporate bottom line. Can you honestly say that about your system?”

“We believe that the bigger the bottom line, the better for everyone. And when it comes to the use of capital, we rely on the free market to weed out the bad decisions and support the good ones. It has brought us prosperity for centuries, and we intend to continue to rely on it, even when it comes to the use of outer space.”

Major Harris felt a knot growing in his stomach. For the past decade, he had devoted himself to the noble ideals of the U.S. space program, pushing the envelope of knowledge while making outer space more accessible to everyone. But he was not at all comfortable with this new focus on being a tool of the business community; indeed, he found it demoralizing. He listened with heightened interest to the response.

“We must remember,” said the Director, “that the United States, or any state, has a duty to control its corporations. I quote: ‘The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.’ By what mechanism are you going to ensure that your corporations comply with your laws and with this Treaty?”

“The United States already has in place a licensing process to make sure that anyone launching from Earth or operating in space does so in a safe and responsible manner. We will continue to apply this process to the commercial use of outer space, including activities on the Moon and the asteroids.”

"Where you will be using space resources for commercial purposes, yes?"

"That is one of the activities we anticipate. Scientific research and tourism will also be supported."

The Chinese delegate paused for a moment, wanting to highlight his next question. He stared directly at the U.S. delegate. "And who, sir, will make the decision as to who gets to use those resources?"

"That will be a practical matter," his counterpart replied. "To the extent that a country or company has the infrastructure in place to make commercial use of some outer space resource, then they will move forward in a manner consistent with that country's laws and the Space Treaty."

"In other words, whoever gets someplace first gets to claim it for their use."

"Roughly speaking, yes."

"And yet the Treaty clearly states that, and I quote, 'Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.' It sounds like that is exactly what you are doing by having your 'infrastructure in place.' My country suffered for many years at the hands of the United States and European powers who had their 'infrastructure in place' in our port cities, our coastal provinces, even in our capital. You forced us to sign treaties while your warships threatened us; 'gunboat diplomacy' you proudly called it. You even replaced our laws with your own, the so-called extraterritoriality agreements. So please understand if we are a little skeptical about your assurances that your country and its corporations will use outer space for the benefit of all humanity."

"With all due respect," replied the U.S. delegate, "the Chinese delegation either doesn't understand our basic position or is choosing to ignore it. We believe that the free market system will ensure that the resources of outer space will be used on behalf of humanity, and in the most efficient

manner. And the United States is willing to facilitate this use through its own research and exploration.”

“So, if your country gets to a resource first, then you will get to decide who makes commercial use of it.”

“That would be most practical. It is certainly a factor to consider, wouldn’t you agree?”

The Director just sat silently, continuing to stare. He had done his job, gotten their adversary – yes, he thought, they are our adversary – to admit their basic position. He sat back as the chair of the workgroup began to solicit comments from other countries. He knew they would all support the ideal of outer space being for the benefit of all humanity, but he also knew that there would be no consensus on amending the Treaty to address how that would happen. The United States was still assuming that it had the lead in the exploration and use of outer space. Although his diplomatic poker face showed only grave concern, he was one of the few who knew otherwise.

CHAPTER FIVE – Taikonauts Redux

When Tom Enloi arrived at the hotel, he found his wife sitting in the living room of their suite. “Is everything OK?” he asked as he sat on the couch next to her.

“Everything is fine,” she replied, setting down a book she was reading. “Nanny was feeling a lot of abdominal pain; my guess is appendicitis. They took her to a local hospital. I expect she will have surgery and be back in a couple of days. Till then our son is our responsibility.”

“How is he?”

“He’s napping now. Still feeling jet lag. It’s the middle of the night in Beijing right now. I’m feeling a little sleepy myself. Flying in the day before the conference may have saved on housing for the delegation, but it’s made for a tough opening day.”

“Yes, I’m also feeling a bit out of sync. What are you reading?”

She smiled. “When I was packing, I found our old copy of the I Ching, the Book of Changes. I thought I’d bring it along as a bit of home.”

He also smiled. “You showed me that book the first evening we spent together. Till then I thought you were an engineering nerd like myself. Even the way you presented it was scientific. Six lines, either solid or broken, were chosen by throwing coins. The lines were stacked on top of each other in one of 64 possible combinations, humanity’s first binary code. Sixty-four descriptions of various aspects of our lives, all deep and full of meaning.

“And each description always had three parts to it: Artha, Kama, and Moksha. Artha describes our role within society, Kama describes our relationship with those closest to us, and Moksha describes the inner examination of ourselves. From that day on I began to see those three things going on all the time, in my life and in others.” He looked into her eyes with affection. “You opened doors for me that I didn’t even know were there, and for that I am eternally grateful.”

“As am I, dear husband. It wasn’t long after that you told me about the Three Jewels of Buddhism: the Buddha’s teachings, the sangha gatherings to talk with others of like mind, and meditation, a trinity very similar to the I Ching. We started seeing the pattern everywhere. Life became more meaningful, even more alive.” She paused briefly. “And that’s why I fell in love with you.”

She reached out and placed her hand on his cheek. He closed his eyes as she ran her hand through his hair, then down to his neck and gently back to his face. He reached up with his hand and took hers, kissing it.

“We seem to have some time alone,” he said with a smile.

“So it seems,” she replied, standing up and taking him by the hand, leading him to the master bedroom. It was pleasantly warm; they disrobed quickly and got into bed. Again she placed her hand on his cheek, and he placed his on hers. Such a simple act, and yet so intimate. The touching they shared gave them both so much strength.

He moved his hand down to her bare shoulder, then along her side. A deep breath came upon both of them as they slid into a sensuous trance, gently touching all over their bodies. They moved together and embraced, wrapping arms and legs around each other, their heads pressed together, their breathing becoming one.

At such times words seemed trivial, no matter how noble and loving. They felt the closeness that humans have felt even before words, a closeness that goes beyond language, where the simplest movement, or even no

movement, conveyed the deepest understanding, total acceptance, the gentle nobility of love.

After a while they shifted so that they were spooning, her back to his chest, keeping as much of their bodies touching as possible. He put his arm around her, and she held it to her chest.

"I love you so much," he finally said. "You make me happy, give me strength. You make me feel complete, like I can do anything."

"As do you for me," she replied, taking his hand and kissing it. "I did not like the thought of losing you to a piece of space debris." She paused, then turned and looked at him. "But I also love you for your courage. And your principles. So I can't stay mad at you for long. Just promise you'll be careful during our next mission. Our son needs his father while he's growing up."

"I promise I'll be careful. With my favorite pilot with me, it shouldn't be hard." He looked at her, saw the combination of love and concern on her face. He moved forward and kissed her, and she kissed him back. His hand went to her side, her skin so smooth, so soft. Again their bodies melted together, alone in their own world even as the rest of the world lurched toward a fateful confrontation.

CHAPTER SIX – CEO

It was already dark when a black SUV pulled up to the side entrance of the White House, where visitors can come and go without being seen by the public. The man sitting in back looked at his watch. Eight o'clock in California, still time for a walk on the beach before sunset. When the CEO of SpaceTech woke up that morning, the last place he expected to end up was in Washington, D.C., especially on a Friday night. But then the phone call came, so unexpected that he had his own security team make sure it wasn't a hoax, or worse. The heads of corporations had to be careful these days, even if their company was well-liked. But when it was confirmed, he cancelled the day's meetings and drove himself to a nearby Air Force base, where a military plane was waiting for him. Just him. Must be important, he thought.

Now he stepped out of the SUV and was saluted by the two Marine guards at the entrance. They had been added to the security mix after yet another intruder had made it into the White House. Guarding the palace guards, the man thought. The others in the portico were all uniformed Secret Service, including the woman who checked his ID and stared long at his face to make sure of who he was, and the man who made an entry into the visitor's log. Under the former president those logs would have been public, but no more.

He passed through a metal detector and was searched for weapons, then taken to the anteroom of the Oval Office. The President's secretary greeted him, then buzzed the President to let him know the visitor had arrived. She offered

him a seat, and he took it. This president liked to keep people waiting as a way of asserting his superiority at a meeting. The visitor knew the ploy and spent the time relaxing his mind rather than fretting over anxieties. Whatever was happening, he would be supported by the strength of his own convictions.

A buzzer sounded. "You can go in now," said the secretary. She opened the door for him and he entered. There were two others in the room, the President and a woman. He had his usual stern look, while she was wearing the neutral smile of government employee meeting a member of the public. He had gotten used to both in his dealings with the government; the key was to reach the person behind the look.

"Good evening," said the President. "Thank you for joining us on such short notice. Allow me to introduce Ms. Sara Bailey, Deputy Director of NASA. She's here to help explain a situation that has developed. Please have a seat, both of you. I assume you signed the classified information agreement on your flight here?"

"Yes, I did, though it seemed a bit redundant. As the CEO of SpaceTech I've been launching spy satellites for your national security agencies for a year now. I think I've shown that I and my company can keep secrets."

"You I have no doubts about. As for your company, well, it only takes one compromised employee for industrial espionage. I have to assume that someone has infiltrated your operation. That's why I took extraordinary steps to keep this meeting secret."

"Even missing your weekend golf trip?"

The President was miffed. "You and your liberal friends can laugh it up, but I get a lot done during those trips, believe me. No better place for confidential discussions than the middle of a fairway. But neither you nor Ms. Bailey play the game, so that would have just drawn more attention. And we must avoid attention right now."

"Why?"

"Ms. Bailey, would you please repeat what you told me during your last visit?"

The Deputy Director went over the same video and drew the same conclusions as she had a few days earlier. She highlighted the Chinese program's need for an additional orbital transfer stage to boost the module from low Earth orbit to the Moon, plus another launch for the crew return ship.

"They are using a technique that we considered for our own Moon program in the 60's," she concluded. "Back then we decided on using a lunar orbit for our staging area because we had a booster, the Saturn 5, that was powerful enough to take everything there in one shot. But the Chinese don't. They are using their smaller boosters to lift components into low-Earth orbit and assembling them there. It takes longer, but in theory it should work just as well."

"How much longer?" asked the CEO.

The Deputy Director looked at the President. She wasn't sure how much classified information she could share. He took over.

"The CIA tells me that they could probably launch the booster segment in about three months. But they're having some problem with the return ship. It won't be ready for another six months or so. That's about the time you're planning your own Moon shot, am I right?"

"Yes, it is. We hope to have our private astronauts circle the Moon around Christmas, just like the Apollo 8 crew did in 1968."

"And a remarkable achievement that would be, a great feather in your company's cap. But I'm afraid that we need your ship."

"Excuse me?"

"We need your ship. I am not going to allow the Chinese, or anyone else, to get to the Moon before we return there. Instead of circling around the Moon, your capsule is going to land there."

The CEO was stunned. "You must realize that's technically impossible. For one thing, there wouldn't be enough fuel to lift off and return to Earth. For another, the landing module separates from the service module before

landing, and only has enough battery power for about 24 hours. The solar panels are on the service module. Landing on the Moon in just the capsule would be a one-way trip, and a suicidal one at that."

The President looked at the Deputy Director.

"Actually, we believe it could be done with minor alterations," she said. "The base of the service module can be reinforced to withstand a lunar landing. We can install legs without adding too much weight. Remember, the Moon's gravity is only one-sixth that of the Earth. It should be easy to find a spot flat enough to land on"

"Tell that to Neil Armstrong," said the CEO. "He and Buzz Aldrin were about to land when he saw some boulders in the planned landing area. So he took over from autopilot and used the last of their fuel to move to a safe spot. Had they landed where they had planned, they would have fallen over. Counting on finding a perfectly flat landing spot for a craft with untested modifications a bit too much. I'm not prepared to risk my spaceship or my crew on such an adventure. Not just for someone's sense of national pride."

"This is not just pride," said the President. "This is national security. My generals tell me that we must never give up the high ground, be it on Earth or in space. That's why we excluded the Chinese from the International Space Station. But now they're about to leap-frog past us to the Moon." He paused for a moment. "I consider this to be of the highest national interest. If necessary, I am prepared to use the power of eminent domain to take control of your ship. But I hope that won't be necessary. I would much rather have a willing partner than one who is forced."

"And what of the crew? I have a couple people who are paying good money to make this trip. I'm sure they don't want to be diverted to the lunar surface on a mission that is risky at best. And you still haven't explained how they're getting back."

"That's our job," said the Deputy Director. "We've already shifted resources to Bungalow Space Systems to build a Moon base. We're about to launch the Orion capsule on the

new Space Launch System, and our contractors for the Artemis program are accelerating their work on a new lunar lander. But even with all that, we won't be able to get back till next summer, about a year from now."

"And what are my people going to do till then?"

"We will continue to pay you to deliver supplies till our ships can get there," said the President. "These will be emergency, no bid contracts. Your company will make a fortune, and everyone will be happy."

"I don't believe my customers will be happy. They didn't sign up for a six-month stay on a barren planet."

"I'm afraid you keep making a false assumption," said the President. "We will not be sending your private astronauts. We will be sending one of our own, a military man."

The CEO was silent. He had dealt with enough people in power to know that showing his anger just made them dig in their heels. So he waited a few seconds, then said calmly, "When we signed on with NASA to transport astronauts to the space station, there was an understanding that it was for peaceful purposes, that we would not be part of any militarization or weaponization of outer space. I see no reason why we need to start doing that now."

"Are you aware of the Larkin Decision?" asked the President.

"I am, but I'm surprised that you are."

"You and your liberal friends think I never read a book. Have you read *The Man Who Sold the Moon* by Robert Heinlein? I think it's his best work. Very popular at Wharton when I was there. Showed how an asset in outer space could be commodified and monetized.

"So I started to read Heinlein's *Stranger in a Strange Land*. I must admit I never finished it; too new-age for me. But the set-up was good. A corporation had sent its own people to start a base on the Moon before any national program had done so. The space-faring countries argued over who had the best claim for development rights. The World Court held that the crew, headed by Captain Larkin, were not the official

representatives of any country, so no country could assert a claim. It also refused to accept that a corporation had the legal status to assert any such claim, and decided instead that the crew itself held the claim, so long as there was a continuous presence.”

The President paused and smiled a bit. “Now, I know that the Larkin Decision is fictitious, but it was based on historical precedent. During the Age of Exploration, the European powers were planting their flags all over the Earth, and important rights were established depending who got someplace first and whether they could maintain their presence. Just look at where people are speaking Spanish, Portuguese, English and French and you’ll see the practical reality of those claims. So it is essential that whoever we send is an employee of the U.S. government, our official representative, like a member of our military.”

“But the Outer Space Treaty . . .”

“To Hell with the Space Treaty! We all know that throughout history power rules. Whoever can establish the first permanent presence on the Moon will not only win the prestige race, they will win the legal race for whatever comes next. Treaties will be modified, or interpreted differently. We’re working on that right now at the conference in San Francisco. The one-worlders are wrong. It’s national competition that drives this planet, and it’s national competition that’s going to drive the exploitation of outer space.”

“Exploitation?”

“Exploitation, commercial development, call it what you wish. The business of America is business, as one of my predecessors once said. And I intend to extend that model as far as possible.”

The CEO sat silently. He had feared this day would come. He had tried to keep his company free from government interference, from becoming a tool of someone else’s policies. But he knew it could all be taken away from him, “nationalized” for “the public good”. He saw no other choice than to cooperate, with the hope that his company and

its people could remain independent, perhaps influence events later.

“I’m still not sure we can make the necessary modifications. Six months is not a lot of time for such a major re-engineering.”

“Three months,” said the President. “We think they might launch as soon as their transfer vehicle is ready if they think we’re also trying something.”

“Three months! That’s impossible! We simply don’t have the people and resources to launch in October. And I’m not going to compromise safety just so you can have a feather in your cap before the election,” he added with a sneer.

The President ignored the bait. “Ms. Bailey will be helping you. She is being re-assigned to your operation in California. She will coordinate between your people and NASA and will have access to whatever information and resources that are needed. And she will be reporting directly to me.”

“Someone to keep an eye on us?”

“Someone to make sure things get done. We’re all in this together, my friend. I hope you can get over your reluctance and help us make this happen.”

That’s what I do, thought the SpaceTech CEO. That’s how we’ve gotten this far. But would his company lose its mojo if it became a tool of the government? He sat back on the couch as the President went over details with the Deputy Director, the wheels in his head starting to turn.

CHAPTER SEVEN – From the Mouth of Babes

“Papa, how do you know how much fuel you need?”

Tom Enloi and his son were visiting the Exploratorium, San Francisco's science museum and activity center. Though only eight years old, his son had developed a sharp mind and unbounded curiosity. They hadn't been able to spend much time with each other recently, with training and the mission and all the public appearances. But today the family had slept in and had lunch together in their hotel room. They decided that Loi would stay with their son while Li went to the conference. He had already gotten to speak during the opening session and had given his views about the best way to move ahead in space. Li would speak at the working session on the commercial use of space that afternoon, as requested by the Director. Their nanny was spending the day at the hospital recovering from an appendectomy. She would return the next day, but till then the Toms were taking the opportunity to spend some quality time with their child.

The taikonaut and his son were looking at a display of models of rockets, from the very small Redstone to the gigantic Saturn 5. In between were rockets from many nations, past and present, that were used to lift payloads into low Earth orbit and beyond, including the Long March – now called Divine Arrow - rockets of their own country.

“Well, son, there are a lot of things to consider. Perhaps the biggest is how much weight you want to move. When the Chinese invented rockets, they had small payloads that didn't go far, so they didn't need much fuel. The heavier the payload,

the more fuel you need to launch it, or change its orbit, or land it. And the more fuel you need, the heavier the rocket gets, requiring even more fuel. Eventually you reach the point where you just can't make them any bigger."

"What else?"

"It also depends on where you're going. If you're going to the Moon, it takes more fuel than if you're just going to orbit around the Earth."

"Can any of our rockets go to the Moon?"

"Actually, a couple already have. Remember our little rover that we watched a few years ago?" Loi remembered that day himself. His son had been playing with the usual toys of most infants, but when the pictures of the Moon came on the television, he became fascinated with all things space. As a father, Loi loved spending time explaining it all to him. "We were able to send the rover to the Moon because it was much smaller than the capsule that your mother and I flew in."

His son thought about that for a while. "Why don't you use two rockets, Papa."

"Excuse me?"

"Why don't you use two rockets? One could take you into orbit, and the second could bring more fuel to take you to the Moon. They could link up in orbit, just like you and Mama did."

His father looked around. For once he was glad they were in a country where few people spoke Chinese. Although his son was off in the details – it would take more than two rockets – he was very close to describing a mission that was known only to a few. He tried to sound casual.

"That's not a bad idea. When the Americans went to the Moon, they left their return ship in lunar orbit to save fuel. Even then people talked about building things in Earth orbit before sending them further. Maybe someday someone will do that."

His son looked up at the model of the Moon that was hanging over the exhibit. "That's what I want to do, Papa. I want to build spaceships and fly to the Moon."

A tear came to Loi's eye as he put his arm around his son's shoulder and held him closer. How he loved him so. He suddenly had his first doubts about spending so much time away from him on a long mission.

"How about we go out to the ocean now? It's the Pacific, the same one we go to back home. We can roll up our pants and look for seashells while we run from the waves."

His son's eyes lit up. It was good that they were spending some time together, his father thought. He hoped Li was having as productive a time at the conference.

ADDRESS OF MAJOR TOM LIPING TO THE SAN FRANCISCO SPACE TREATY CONFERENCE

Fellow Delegates,

Thank you all for being here today. I know that attending this conference is a difficult and expensive task, yet the issues that face us are so important that they require a meeting of all the countries that have adopted any of the five Space Treaties so that we might consider significant changes. The future of humanity - perhaps even its best destiny - depend upon the choices we make now.

It has been a half-century since the first treaty, commonly called the Outer Space Treaty, was signed. Just ten years earlier, in October 1957, humanity had taken its first step into space with the launch of Sputnik by the Soviet Union. During those early days, only governments were launching satellites into space; the cost and technological challenges were too great for any private enterprise to bear.

Yet even then private enterprise was becoming involved, starting with ComSat, a public-private corporation that built and operated most of the early communication satellites. The benefits of satellite communications quickly became apparent, especially when it became practical to place the satellites in geosynchronous orbit for uninterrupted service. Soon other companies began building satellites which they owned and operated. But it was always the national governments that launched them. Any discussion of launches by private companies, or extending private commerce to the Moon or other celestial bodies, was literally the stuff of science fiction. The Outer Space Treaty of 1967 reflected this reality, as did the Rescue Agreement of 1968, the Liability Convention of 1972, and the Registration Convention of 1976. Only the Moon Treaty of 1979 tried to address the issue of the private use of outer space, but it has only been adopted by a handful of states.

The government monopoly on launch services began to crack in 1980, when Arianespace was founded as a private

corporation through the cooperation of several European countries. In 2006, a quarter-century later, a second private launch company, United Launch Alliance, was formed, a joint venture of United States aerospace companies. Both companies had very close relationships with their respective governments and were subject to public policy concerns. The four widely adopted space treaties, though a bit stretched, still seemed adequate.

But the last decade has seen an explosion of private enterprise's involvement in all aspects of space exploration and commerce. In part this was caused by another type of explosion, that of the shuttle Columbia in 2003. The United States and its space agency, NASA, finally decided that the shuttles were not sufficiently reliable or commercially viable to be the primary launcher for space missions, be they crewed or uncrewed. Rather than replace them with its own launch vehicle, NASA decided to outsource and fund all near-Earth launch services to private enterprise. Its own Space Launch System was dedicated to public policy missions in deep space.

Since then, private enterprise, mostly corporations, have rushed in to fill the void. And so far, they have managed to operate within the structure of the space treaties. There has been plenty of space, literally, for everyone to operate without affecting anyone else, even in the crowded neighborhood of geosynchronous orbit, home of most of our communications and weather satellites.

But this is about to change. The Moon is now within our reach, along with some asteroids, and soon Mars. These celestial bodies contain materials that are valuable, that can be used both on Earth and in outer space, for building, for fuel, and for sustaining life. Indeed, the exploration and development of outer space will likely depend on using such extraterrestrial resources, which is far more economical than launching everything from Earth. But this leads us to questions that are only partially answered by the space treaties: Who, if anyone, owns or controls those resources? What, if anything,

should a country or enterprise pay for their use? And who will determine if such development is consistent with the treaties?

The Outer Space Treaty of 1967 established some basic principles that begin to answer those questions. As I quote some of the sections, they will also appear on the screen behind me so you can read along. The first paragraph of Article One states:

“The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.”

Article Two is more specific, and reads in its entirety:

“Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.”

Article Six clarifies that the Treaty also applies not only to governments, but also to private activity in outer space:

“States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.”

This does not mean that individual countries can pass laws that allow their private entities to do whatever they want in outer space. Article Three requires that:

“States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest

of maintaining international peace and security and promoting international co-operation and understanding.”

The United Nations has tried to create a framework of international law within which all countries could operate, but it has had limited success. This is mainly because the United Nations does not have rulemaking or enforcement powers. It cannot pass laws that countries must follow. It can only pass resolutions that set guidelines while encouraging individual countries to adopt them.

This is not to say that the work of the United Nations and its components has been worthless. The Office of Outer Space Affairs and its Committee on the Peaceful Uses of Outer Space are constantly gathering and analyzing information, including annual conferences that try to bring together all interested parties to address the many continuing and unresolved issues. Their efforts produced the Rescue Treaty, the Liability Convention, and the Registration Convention.

Their most ambitious effort has been the Moon Treaty of 1979, the fifth space treaty. Because several countries have ratified or acceded to it, it is considered an official treaty by the United Nations. But none of the space-faring nations have adopted it, and neither they nor their companies are bound by it. The reason most often given is that the Treaty would force them to share the resources found on the Moon and other celestial bodies with the rest of the world, along with any technology that is necessary for such development. As a result, there is still no enforceable law concerning the use and development of outer space resources. For decades the problem has been “kicked down the road”, as politicians like to say, because there had never been a practical need to resolve it.

Fellow delegates, we can no longer delay making decisions about this issue. Many countries and many private companies have developed the technical capacity to extract and use materials from outer space. Their biggest problem now is the uncertainty about the laws concerning such

resources. Private enterprise is hesitant to move forward without knowing the costs and financial risks involved. Businesses hate uncertainty, especially when making large, long-term investments. A solid legal framework is the foundation upon which all private enterprise is built.

Even more important is the need to avoid a violent conflict over the use of resources. Throughout the history of humanity, people and nations have gone to war over the ownership and control of Earth's resources, such as water, usable land, and minerals. Unless we establish a legal regime right now to avoid such conflicts, they will happen again, in outer space, despite our commitment to its peaceful use. It is not a question of if, but when.

Achieving a consensus on how to move forward is difficult, even within individual countries. What I am about to propose is not even the official position of the Chinese government. But it has enough support that I am being allowed to present it here, in the hope of moving the discussion forward and finding a path that all can accept.

The centerpiece of the proposal is the establishment of an international agency, the Agency for the International Development of Outer Space. This agency, AIDOS, will have the authority to regulate any activity that will develop or affect any resource on the Moon or other celestial bodies. It will be empowered to curtail any commercial activity that is not consistent with the space treaties. It will also be empowered to develop a means by which the benefits of any commercial activity will be shared with the rest of humanity. Such means could include an actual sharing of the resources, a fee for their extraction, or a tax, such as a value-added tax whenever an outer space resource is first introduced into an economic system.

Such an agency is contemplated by the Moon Treaty. We should note that, despite its common name, the Agreement Governing the Activities of States on the Moon and Other Celestial Bodies applies to the entire solar system, as stated in Article 1:

“The provisions of this Agreement relating to the moon shall also apply to other celestial bodies within the solar system, other than the earth, except in so far as specific legal norms enter into force with respect to any of these celestial bodies.”

Article 11 is very specific about outer space resources and even describes the functions of an international agency:

“Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof.

...

“States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible.

...

“The main purposes of the international regime to be established shall include:

(a) The orderly and safe development of the natural resources of the moon;

(b) The rational management of those resources;

(c) The expansion of opportunities in the use of those resources;

(d) An equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon, shall be given special consideration.”

The new agency would determine the best mechanisms for attaining these purposes. It would also determine the best way to use any fees or taxes paid, such as covering its own administrative costs and funding programs that ensure universal access to the benefits of space exploration and development. The agency would also need to determine the best way to make such decisions, most likely building upon the annual conferences and committees that already inform and advise the United Nations on such matters.

The agency would also be empowered to resolve conflicts that arise concerning the use and development of outer space resources. By adopting the Moon Treaty, nations would be agreeing to submit such conflicts to the agency for adjudication, including those involving private enterprise. The agency would need to establish policies and procedures for doing so, calling upon the experience and expertise of existing international bodies such as the World Court.

But this agency would not be part of the United Nations, or the World Court, or any other currently existing organization. It would be an independent agency, empowered by the treaty signatories, established for a specific and limited purpose, but still able to call upon the expertise and experience of other organizations and their personnel.

The implications of such a proposal are, of course, enormous. National governments would be agreeing to be bound by the restrictions of an international body. Some would call this a loss of sovereignty, even though treaties with similar restrictions, such as the Law of the Seas, already exist. They would also be agreeing to controls on private companies, which economic libertarians oppose on philosophical grounds, and most corporations oppose on economic grounds. Each of you has no doubt been lobbied by such governments and economic interests as they try to shape the future of space exploration and development. The economic and political forces arrayed against any further regulation of activity in outer space are strong.

I do not mean to demonize the corporations for doing so. The mission of for-profit corporations is to maximize profits. They are usually legally required to do so and can face lawsuits from investors if they do not. Their goals include paying as little as possible for resources while monopolizing their development and distribution. This tendency ran rampant during the Industrial Revolution, without regard to its effect on workers, the general population, and the environment. But the harm they caused far outweighed the benefits of economic progress.

Those harms became so great that the people demanded government intervention to make sure that public interests were not trampled by economic interests. Worker safety, antitrust, and environmental protection laws were enacted. I understand how people in private enterprise, including those who are here today, bristle at any limitations or regulations, especially antitrust laws. But monopolies don't just drive out competition; they discourage innovation while keeping prices artificially high. Antitrust rules are necessary to maintain a truly free market with all the benefits of real competition.

The concerns of economic interests are important and should not be discounted. So, too, are the concerns of the many countries who have signed the space treaties, whose governments are charged with protecting their own national interests. But we must always remember that all economic interests, and all sovereign nations, must ultimately serve the interests and sovereignty of the people of Earth, of humanity as a whole. My country is called the Peoples Republic of China. The Constitution of the United States begins with the words "We the People". For over two centuries nations have been throwing off dictatorships and forming governments that are of the people, by the people, and for the people.

Fellow delegates, this is an extraordinary time. We have been presented with an historic opportunity as humanity is about to extend itself into outer space. Like those who went forward during the Age of Exploration some 500 years ago,

the decisions we make today will affect humanity for centuries, perhaps millennia. If ever there has been a time to determine how to implement our collective vision for the future, it is now.

To make such fundamental decisions, we must ask ourselves: What is our mission? What are the hopes and aspirations of the people that inspire and guide us at such a crucial time? The preamble to the original Outer Space Treaty gives us some guidance:

“The States Parties to this Treaty,

“Inspired by the great prospects opening up before mankind as a result of man’s entry into outer space,

“Recognizing the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes,

“Believing that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development,

“Desiring to contribute to broad international co-operation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful purposes,

“Believing that such co-operation will contribute to the development of mutual understanding and to the strengthening of friendly relations between States and peoples
. . . .”

These principles were adopted at the beginning of the space age and have guided us ever since. Every subsequent treaty, and all the guidelines proposed by the United Nations, are consistent with them. And they are even more relevant today. For, indeed, the prospects have never been greater, and recognizing the common interests of all humanity has never been more important. We have reached the moment of decision when we must dedicate the exploration and use of outer space to the benefit of all of humanity, and it can only be done through international cooperation.

Which brings us to our final aspiration, that such cooperation will develop mutual understanding and strengthen friendly relations between States and peoples. Up to now I

have spoken in legal and economic terms. I have tried to demonstrate that a comprehensive scheme of sharing resources will actually help private enterprise flourish, not hinder it, and that the certainty of the rule of law will allow countries and companies - even non-profits and individuals - to dare to make their dreams come true. It is now time to speak of those dreams.

When Galileo looked at Jupiter the first night he used a telescope, he was pleased but not too surprised. It was the second night, when he looked again and saw that four stars near Jupiter had all moved, that they were actually moons circling another celestial body, that he realized the universe was far different, far more fascinating and glorious, than he had ever imagined. More recently, just six decades ago, people all over the world stood outside their homes as the sun set, looking to the sky as a blinking light passed overhead, the tumbling upper stage booster of the world's first satellite, Sputnik. Because of the Cold War there was some fear, but for most the overwhelming emotions were awe and excitement. Despite all its imperfections, all its follies, and all its deadly conflicts, humanity had managed to throw off the shackles of gravity and reach the stars. All the stuff of science fiction suddenly seemed possible. And that stuff was not just about technological advances. The writers, the poets, those who dared to dream of a better future saw a day when humanity could resolve its differences by peaceful means.

This dream was enhanced in December 1968, when our view of the world literally changed. As Apollo 8 first rounded the Moon, the astronauts on board were suddenly overwhelmed as humans saw the Earth rising above the lunar horizon for the first time. The picture taken at that moment showed our beautiful planet hanging in the vastness of space. Humanity as a species began to realize that we are all one, living together on a fragile planet hurtling through the cosmos.

But even though no borders were visible, war and suffering continued to wrack our home world. In the half-century since, people have begun to lose faith in their

governments, their private institutions, even in humanity itself. Every day we wake up to the news of yet another mass killing, more terrorist attacks, the disastrous effects of climate change, and an increased threat of nuclear war. To that can now be added the threat of war in outer space. Our governments seem to care more for corporations than the people, and the corporations seem to put their bottom line above everything else. The people of Earth are beginning to despair, wondering if there is anything they can really believe in. They are losing hope.

Fellow delegates, our mission is nothing less than to restore that hope, to give the people of our planet a common future that they can believe in. To counter the despair of war and violence and neglect. We have a unique opportunity to set an example and create a new future for humanity, to build that shining city on a hill that will light the way for all.

Fellow delegates, it is our duty to make that hope a reality. I call upon each of you to voice your support for the adoption of the Moon Treaty by all nations, and to make every effort to persuade your respective national governments to do so. We need your help to establish the “international regime” that is mandated by the Treaty, an Agency for the International Development of Outer Space, that will implement and administer its provisions.

It has been 500 years since the world has had such an opportunity to start anew. At that time, we chose to perpetuate slavery, military conquest, and economic exploitation, all of which caused misery and countless wars. And when the Industrial Revolution came along, we placed profits ahead of people, resulting in economic and environmental catastrophe. Much of humanity stopped believing in our ability to control our own destiny.

We can change that. But we must act now. There will be only one time when humanity leaves its home world, only one chance to create a new pattern that will lead each of us, and all of us, to our best destiny. That time is now. Please join

in this effort to restore hope and create a better world – a better universe – for all of us.

Thank you very much for your time and attention. May we all find the wisdom, strength, and courage to do what is right.

CHAPTER EIGHT – A Small Club

Michael Harris was sitting at the bar at the hotel lounge, looking down at his near-empty glass. He thought of the old Japanese saying about sake: “The man drinks the first glass of sake, the first glass drinks the second, the third glass drinks the man.” For him it was Manhattans, bourbon and vermouth on the rocks, but the math was the same. He was just finishing his second, and had decided it would be his last, when he heard a voice behind him.

“Drinking to forget, Major?”

He turned to find Tom Liping standing next to him. “Something like that. And, please, drop the Major. I get enough of that during working hours.”

“And this is the happy hour, hosted by the People’s Republic of China. Bartender, two more of these, please.”

“Very good, ma’am. Would you also like olives with yours?”

“Yes, please.” Then, to the astronaut, “I’m not even sure what I’m drinking, but the Director has encouraged us to mingle with the astronauts of other countries, so I thought I would take you up on your offer.”

“And this wouldn’t look bad for a hero of the Chinese people?” he asked, chiding her as their drinks arrived.

“Please be kind, Maj . . . Michael. I have many roles to play. But there still aren’t many of us who have been into outer space. We are a small club, are we not? So when I saw you sitting here alone at the bar, I felt compelled to come over and make sure you were OK, perhaps even keep you company for

a while." She took a sip of her Manhattan and felt the strong rush of alcohol, filling her sinuses and burning her throat.

"The speech you gave today was most impressive," he said, trying to be friendly. "We must dedicate the exploration and use of outer space to the benefit of all of humanity.' I was a little surprised, though, by your call for ratifying the Moon Treaty and establishing an international agency to oversee the commercial development of outer space. I know your country believes in regulating business, but I didn't think you were ready to cede control to an international organization."

"It is not the official position," explained Liping. "I argued for it in our internal meetings. Although it was rejected – for now – I convinced them to allow me to mention it in my speech, a "trial balloon" to see how other nations would react. Judging from the applause, I think there might be a lot of support."

"Our mission is nothing less than to restore hope, to give the people of our planet a future that they can believe in.' It certainly is an ideal worth working for." Major Harris paused and took another drink. He suddenly felt very melancholic. Liping noticed.

"Our work is very difficult, Michael. It takes a lot of dedication. Knowing we are doing it for some higher purpose makes it more fulfilling, even easier." She paused. "I imagine it would be difficult to think that you were doing all that just to stake a claim for some corporation's bottom line."

Major Harris stared at his drink, still lost in reverie. And trying to be careful; he might be on his third Manhattan, but there were some things he just couldn't talk about. He looked up at his counterpart, saw her looking at him with genuine concern. He smiled weakly.

"Sometimes even heroes have to follow orders." He took another drink.

"You've been following orders for many years. Why do you still do it?"

He looked straight at her, a bit of fire returning to his eye. "Because this is what I'm good at. I'm a damn good pilot

and a damn good engineer. Some people go through their entire lives not getting to do what they're good at. So I'm going to keep doing what I do best and let the Fates determine my destiny."

She felt both admiration and sadness for the astronaut. Or was it affection? He is so much like Loi when I first met him, she thought. "Have you talked with anyone else about this?"

He smiled and shook his head. "There aren't many who would understand. And even fewer with a security clearance." He stopped himself short. He shouldn't even have said that, as it suggested there was something to keep secret. Again he fell silent and looked down at his drink.

Liping saw his dilemma, sensed his suffering. She felt even greater affection for her fellow space traveler, wanted somehow to help him. Perhaps it was the Manhattan affecting her inhibitions; she reached out and gently squeezed one of his hands. "It's not too late to find someone," she said. "You are a good man, Michael Harris. Please don't stop looking for someone who can share all of this with you. I'm sure there is someone who can appreciate you for who you are."

He looked at her again. He knew the taikonaut could not be that person, but he also knew she was everything he wanted that person to be. He tried to talk, but instead fell silent, closing his eyes as tears welled up, one rolling down his cheek.

Just then there was a commotion at the door. The Director of the China National Space Administration had arrived, with his retinue following him. Happy hour was about to ramp up, with people mixing socializing and politics. Liping drew her hand back and used it to lift her drink in a toast.

"Here's to you, Major Harris. The best of luck in your future missions."

He raised his glass to clink hers. "The same to you, Major Tom. And may we all return safely."

He sat his drink down and stood to leave, bowing slightly to his new friend before heading out. Somehow his

burden seemed a little lighter, the world a little brighter. You could be at the gates of Hell, he thought, facing every demon imaginable. But if just one person comes up to you and says, "Can I help?", you will prevail. The image of Liping's face came back to him, her look of affection, and he smiled.

Back inside the lounge, the Director was making his rounds, chatting with his own and other delegations. Major Tom was still sitting alone at the bar when he approached her.

"How is our friend Major Harris doing?" he asked.

"He seemed a bit tired of the conference. I don't think he likes the socializing part of the job very much. It seemed like he had something on his mind."

The Director looked around, then leaned in close. "He might have. This morning he was absent from the working sessions. One of our staff saw him leaving the conference and walking toward the government building a few blocks from here, so she followed him. The Major went to the Secret Service office there and stayed for about a half hour before returning. We're not sure what went on inside, but we do know that the Secret Service office has a secure communications facility. Did he say anything that might tell us why he went there?"

The taikonaut cringed. The thought that a moment of affection with a new friend could be turned into a moment of spying was repulsive. But she kept a straight face and answered honestly. "No, nothing at all. But it did seem that his mind was no longer on the conference, like he was already moving on to something else."

The Director considered this. He had gotten the same feeling from the head of the U.S. delegation the day before. He had seemed so confident that the United States was going to be the first nation to "have its infrastructure in place" for the commercial use of space, as though he knew something that others did not. Could it be possible that the U.S. had discovered the Chinese plans, and were planning a secret mission of their own?

“You, of course, did not say anything about your next mission?”

“No, of course not. I am surprised you even mention it here.”

The Director smiled. “One advantage of hosting the reception is that we were able to have a team come in and sweep the room for listening devices beforehand. The local Chinatown Chamber of Commerce has also been helpful in providing trusted people to facilitate our presence here. San Francisco is almost like a second home to us.

“Speaking of which,” he said, pulling a small box out of his jacket pocket, “the Chamber wanted me to pass along a gift from them.” Liping opened the box and found two matching locket on gold chains, the kind that are worn around the neck. She picked one up and saw that it opened so that a small picture could be put inside. “Something to remind you and your husband of each other, help you stay close whenever you’re apart.” He had an odd look on his face when he said that. He had seen her with Major Harris when he arrived? Was he suggesting there was something improper, perhaps the mildest of warnings?

“How very generous of them,” she said with a straight face. “I’m sorry we missed them today. We’ll make sure to stop by tomorrow before we leave. We wanted to take our son to Chinatown anyway. They’ll be delighted to meet him.”

“I’m sure they will, Major Tom, I’m sure they will.” But his mind was also moving beyond the conference. Indeed, he would soon need to make a secure communication of his own to the Party. Something was up, and there might be a need to change plans, a change that would test his hero taikonauts to their limit.

CHAPTER NINE – Chinatown

May Leesung was the unofficial mayor of San Francisco's Chinatown, and she was very happy.

Her official title was President of the Chinatown Chamber of Commerce, but she was the one who people went to when they wanted something done. When an earthquake destroyed the freeway that led to Chinatown, she lobbied for an extension of the city's subway to make sure residents and tourists had ease of access. When a Chinese-American ran for mayor, she rallied support for him, both financially and at the ballot box, and he won. She was a community organizer who knew that things don't just happen; people make them happen.

Today the Chamber was hosting a luncheon that featured the two Chinese taikonauts and their son. With less than 24 hours' notice, they had put together a major event, attended by dignitaries and common folk, and it had gone off without a hitch. The hall was set up with tables and chairs, local restaurants had provided plenty of food, and a sophisticated social network made sure that there were no empty seats. The Toms had been very gracious, sitting through the many tributes from community leaders before making short speeches of their own, thanking their hosts and praising their work in maintaining a vibrant Chinese culture so far from its home. They even stood in a receiving line to shake hands with anyone who wanted.

The rest of the delegation from China had already started back as scheduled, including the Toms' nanny.

Though released from the hospital, she had been too sore and weak for another social event; she would resume her duties when they returned home. The young Tom had done his best to keep up with his parents, even shaking some hands in the reception line. But he had become tired and restless, and May Lee had asked a couple of her most trusted people to keep him entertained for a while. The parents had not minded at all; they had been welcomed with open arms and felt more at ease here than they did at events back home. They had quickly grown to admire and trust the people of this enclave.

The line eventually ended, the last hand shaken, the last pleasantries exchanged. Tom Enloi had gone to retrieve their son, while Tom Liping had gone in search of their hostess to express their gratitude. She found her in the rear of the hall, making sure that everything was cleaned up properly, an organizer till the end.

“Madame President, I’m glad I found you. We are just about to leave, and I wanted to thank you personally for making us feel so welcome today. We all enjoyed our time here very much.”

“You are very welcome, Major Tom. It was our honor to welcome two heroes of the Chinese people. We were disappointed when we missed you yesterday, but we understood your need to be with your son. Confucius tells us that caring for our family is even more important than our duties to the state.”

“Well, we try to balance both. Loi and I have so many responsibilities now, and we are very grateful for any help we get.”

“Yes, we have watched your ascent with interest for years. Your speech yesterday at the conference was televised locally on our Chinese-language television station. I understand you had something to do with that?”

“Yes, I did. I have been trying to encourage our government to be more open about its proceedings. It is difficult to do at home, but at an international conference there is a greater expectation of access.”

"Yes, we know how difficult it can be to champion change in our home country." She paused for a moment, then added, "I noticed you didn't mention the Party in your speech, focusing instead of the interests of the people in the use of outer space."

"Well, that is the focus of the space treaties, so I decided to use the same language while advocating for change. And I didn't want to alienate those who might disagree with the way the Party does things."

"Yes," replied May Lee, "There are certainly many who feel that way." That was as close as the two women would get to criticizing the Chinese Communist Party that controlled their home country. Even thousands of miles away, in private conversation, one was very careful when discussing politics.

"By the way," she continued, "Did you receive the pendants we left with the Director of your space agency?"

"Yes, we did. They are quite fascinating. We've already started wearing them." She reached into her collar and pulled hers out. "We haven't put any pictures inside yet, but we already feel closer wearing them. Thank you very much for your generous gift."

"You should thank one of our members, a jewelry store owner. He hand-made them with his daughter, an electrical engineer with one of the hi-tech industries in this area."

"An electrical engineer?" asked Liping, looking confused.

Her host smiled. "If you pry open the back you will find a small battery that powers an even smaller diode. If you squeeze the locket it will emit a high frequency sound, just beyond the range of human hearing. The other locket is tuned to resonate to the same pitch. It will vibrate and emit a very faint sound, also high pitched but just audible, so only the other person can hear it. It will work across a crowded room, and is so close to the audible range that it can even be picked up by a microphone and transmitted by radio. We know that you and your husband are experts in Morse Code. We thought you might benefit from a way to communicate with each other

that is, shall we say, more private.” This would be as close as either of them would come to acknowledging the constant surveillance that was part of living in an authoritarian state.

“Thank you again. We will treasure them even more. I can’t wait to try them.”

May Lee nodded, then stepped closer to the taikonaut and lowered her voice. “There are many of us who support your efforts on behalf of the people, Major Tom. We know you are trying to change things, and that you are facing much resistance. Our country, our people, have faced many challenges and changes for thousands of years. Many dynasties have come and gone. But whatever the government, we have always believed that it has a duty to do what is best for the people just as the people have a duty to respect their government.” She reached out and took the taikonaut’s hands in hers, looked her straight in the eye. “I have done all I can to make that happen. It’s time for the next generation to carry the torch.”

Tom Liping looked at her face and saw both deep compassion and the wisdom of the ages. She saw tears in the older woman’s eyes and felt them welling up in her own. “I will do the best I can,” she finally said.

“That is all any of us can do. Please give my best wishes to your husband and son for me. They are both very remarkable. Who knows what they might do for our people? Or even the world?”

They shared another smile, an affectionate squeeze of the hands, and then parted. So much to think about, thought Liping as she looked for her family. So many forces at work. Could she possibly balance them all? She shuddered to think about it, then decided to put it aside. An eight-year-old boy was running toward her right now, happy and excited over his adventure. She would give him all her attention now; her own destiny would come in its own time.

CHAPTER TEN – CEO Redux

“This is insane. You folks are ignoring every protocol for human space flight that’s been developed over the past 50 years. I agreed to go along with this project, but I don’t want to be an accessory to murder!”

The CEO of SpaceTech had been resigned to the task that had been forced upon him and his company, but after a month it seemed like a good time to throw a fit. He was in his office with the Deputy Director of NASA and Major Michael Harris, the astronaut chosen for the mission. They were doing their best to calm him down.

“We have no intention of murdering anyone, sir, nor facilitating a suicide,” said the Deputy Director. “Our engineers are convinced your capsule can be safely modified for a landing on the Moon. We have crunched the numbers back and forth several times, and the plans have gone through a vigorous peer review with two independent teams. We are very confident that this will work.”

“Confident? When you haven’t flight-tested a single component? Even the Mercury astronauts flew in a capsule that had been flown before. The only time we sent people into space on the first flight of a new system was the Space Shuttle, and that’s only because it couldn’t land itself. The design was inherently unsafe, and we lost a dozen astronauts before we retired it. We all vowed we wouldn’t make that mistake again. So much for vows!”

Sarah Bailey tried to stay calm. “We appreciate your concerns, but you are not quite accurate. Your capsule has

been well tested, and recently brought a crew back from the Space Station for the first time.”

“In its proper configuration, you might add! The capsule was designed to separate from its service module, then land using its own thrusters and landing legs. But the capsule can only operate on its own for a short time, using battery power. The solar panels for powering anything longer are on the service module, along with other supplies. You are proposing leaving the service module attached to the capsule and landing them both on the Moon. Do you realize the additional stress that’s going to put on the service module? It was designed to work in the weightlessness of space, not a gravity environment.”

“Again, not quite accurate,” said Major Harris. “The service module bears quite a load at liftoff, as the weight of the capsule presses down on it. And the reinforced bottom rim and landing legs have undergone additional stress tests in your engineering laboratory.”

“The service module can hold that weight because it is evenly distributed around its rim while it is mated to the second stage of the booster rocket,” countered the CEO. “You’re talking about landing it on the uneven surface of a planetoid a quarter-million miles away. One boulder in the wrong place could cause a catastrophe.”

“And what about the solar panels? They were never meant to be folded up and stored while the descent thrusters on the capsule fired. They’ll be burnt to a crisp.”

“The engines on the capsule are flared out to the side,” replied the Deputy Director, “and we’re installing shielding that will protect the solar panels during decent.”

“But what if something fails? There is no redundancy in this mission for a catastrophe, no back-up plan for a return to Earth, no possible rescue mission. It’ll take three months before another capsule is ready to deliver supplies, and perhaps a year before NASA’s lunar lander is ready to deliver a new crew and bring Major Harris back. I have seen the risk management summaries. The chances of something

catastrophic happening during landing are about one-in-four. The chances of something going wrong before returning to Earth are one-in-two. Without in-flight testing and further development, we cannot improve those odds. No nation, and no company, would ever take that risk. Or at least," he added, glaring at them, "they shouldn't."

"We feel confident in the testing of all the components," the Deputy Director replied. "Even the collision-avoidance system has had years of testing under actual conditions in automobiles. It will be scanning the area all around the capsule for impediments. If it detects something, Major Harris can take over the controls and find a good landing spot."

"And what if he doesn't find one in 30 seconds?"

"Excuse me?"

"Apollo 11 had to change its landing spot because it was coming down in a boulder field with only a half-minute of fuel left. Had the field been much larger, they would have had to abort and fire the return engine. Your Major Harris will not have that option."

"I am prepared to take that risk," said the major. He considered saying more about technical considerations, but chose not to. He knew from experience that engineers could argue the details of a mission to the point where nothing might be done. *The enemy of a good plan is the desire for a perfect plan* he thought to himself. Sometimes the best argument was simply for the person performing the mission to say that he was ready.

The CEO looked at him closely. "I know you are," he finally said, his tone less argumentative, more respectful. "You and your kind have always been willing to take us to the edge of our capabilities, knowing full well the price of failure. Your nobility is matched only by your courage. It's one of the reasons I hate being part of this project." He paused, then became angry again. "Damn it, I had this all planned out. A lunar orbital mission by a private company would have been a great leap forward, a boost for our plans to go to Mars. And next year NASA's Space Launch System will be available to

send its own lander to the Moon.” He paused, again softening his voice. “But neither of you are at fault, and you’ve done as much as you can, considering your orders. I will sign off on launching as soon as the modified vehicle and our heavy launcher are ready, probably in two months. All I ask is that you continue testing each component and the integrated system as much as possible during that time.”

“We will do that, sir,” replied the Deputy Director. “Major Harris and I are working directly with your engineers. We promise we’ll take good care of your capsule.”

I would be happier if you took good care of your astronaut, thought the CEO. But he knew he was beating a dead horse. The White House had already decided to overrule any safety concerns, and Major Harris was the kind of person who would not be dissuaded by fear. His concern for the astronaut was exceeded only by his admiration. As he watched the two of them leave his office, his mind turned toward the Deputy Director. He had been working with her for a month, and still could not see beneath her stony demeanor. What did she really think, and feel, about this mission?

CHAPTER ELEVEN – Director

“Come in, Major Tom. Please have a seat.”

Tom Liping had been called to the Director's office at the end of another day of training. This was very unusual, and no reason had been given, so she was full of anxiety as she took her seat.

“Thank you, sir. What can I do for you?”

The Director paused, still not sure where to start even though he had been anticipating this meeting for a month. “There have been some changes made in the mission. It now appears that the United States is also preparing to send someone to the Moon in the near future, possibly to begin a permanent presence there. Our leadership has decided to accelerate our own program to make sure we get there first.”

“Accelerate?” replied the taikonaut. “We are already giving this mission top priority, in both training and construction. It will take at least another five months before we're ready.”

The taikonaut was one of the few who knew the details of Chinese plan to establish a base on the Moon. The first module of the base was already in orbit, with the cover story that it was the beginning of a new space station. Indeed, that story was being used to cover other activities as well. The so-called “supply ship” that would be ready in two months was actually an OTV, an orbital transfer vehicle, a space tug that would be attached to the module and transfer it from low Earth orbit to the Moon. But instead of being full of supplies, it would be full of fuel. After boosting the module into a lunar trajectory,

it would detach from it, loop around the Moon, and return to Earth orbit, ready to be refueled and boost the next payload. One of those payloads would be a crew lander and return ship, smaller than the module. The first two taikonauts would travel with the module. The second crew, and every relief crew thereafter, would travel in the smaller ship, which would then be used by the crew being relieved to return to the OTV in lunar orbit for a boost back to Earth. It was risky, but it was the only way to do it with the smaller rockets available to the Chinese space program.

To minimize the risk, the plan called for waiting until the relief ship was ready before sending the module to the Moon, so that a rescue could be mounted immediately if anything went wrong. Liping knew that the OTV would be ready in two months for the planned October launch. But there had been problems with the crew lander and return ship, and it would not be ready till April, six months later. She did not want to sacrifice safety in the name of speed.

“How do we know that they’re trying to get there first? Or that they even know what we’re doing?”

“We can’t be sure,” replied the Director. “But something interesting is going on with your friend, Major Harris. We have been keeping track of him ever since his unusual behavior at the space conference last month. He has been spending a lot of time at the SpaceTech construction facility in southern California, where they are finishing the capsule that will take two people around the Moon. The Deputy Director of NASA has also been spending a lot of time there. Our analysts now believe there is a better than even chance that they are going to change the lunar orbit mission to a lunar landing mission, and that Major Harris will be the beginning of a permanent U.S. presence on the Moon. We cannot let them do that before us.”

“But that’s impossible. Not unless it’s a suicide mission. We know that NASA’s space launch system won’t be ready for another year. That’s the earliest they could launch any sort of ship that could land on the Moon and return to Earth.”

"Yes, we thought that, too. But SpaceTech is now building more lunar-capable capsules, even though the first is supposedly reusable. It appears they will be used to take supplies to keep their astronaut alive until they can send a return ship. Again, we cannot be sure, but we are sure enough that we feel we need to change our plans."

"And what would that change be?"

"We are going to send the lunar module in October, as soon as the OTV is ready. We're not going to wait for the return ship to be finished. If the United States is willing to take that risk, then so are we."

"But we have no way of supplying it! It would need to last six months on its own, and the module can only carry enough supplies for three months. There's no way two people could survive long enough."

The Director just looked at her, waiting for the logic of her own words to sink in. It only took a few seconds. Her demeanor changed from argumentative to astonished.

"You're only going to send one person?"

The Director smiled. "It is the only way for the mission to succeed, Major. By sending one person, the supplies will last twice as long. Even more, as we can replace the weight of one taikonaut with more supplies. We are rather certain that the return ship will be ready by April, along with the first resupply module. Your husband will be safe till then."

"My husband?! But I'm the pilot, the one who's been trained to land the module. If only one of us is to go on the first mission, logic dictates that it should be me. I offer the best chance for a successful mission."

"Perhaps that is true on a technical level. But your husband has shown good judgment and great courage during his prior missions, and is a good representative of the people. And we have high confidence in our automated landing system. Your training for landing is essentially a backup. Your husband is more familiar with the module's systems, and that will be essential for surviving till the next ship arrives. You will stay on Earth till the return ship is ready, and will be part of the

two-person crew that goes to retrieve your husband. The two of you will return while the third taikonaut stays to maintain our permanent presence. Within a year we will have more supply modules, and everything will become routine. But we need to get someone there as soon as possible, and this is the best plan to do so.”

“And yet you are deliberately excluding your best pilot from the most difficult landing we have ever attempted. With all due respect for my husband, I am the most qualified person for this mission. And I don’t think my courage has ever been questioned. Is there now some reason to question my judgment?”

The Director paused before answering. His tone and manner became more somber, a bit darker.

“Major, you have been a shining example of what the Party can accomplish. At an early age, you were placed in an orphanage run by the Party. You attended Party schools, the most elite schools once we realized how talented you were. Your quick rise from officer training school to the taikonaut corps was all arranged by the Party. And it was the Party leadership who decided that you and your husband would make good heroes for our people, role models for our young and symbols to the rest of the world of the great advances we have made in science and technology. Your husband seems to understand that, praising the Party as an instrument of the will of the people and expressing gratitude for all it has done for him.

“And yet, when you had the same opportunity on the international stage, you chose not to do so. You spoke glowingly of the Chinese people, their hard work and creativity, but when it came to who could best realize their dreams and aspirations, you focused on international organizations, never even mentioning the Party. This has made some of us question your gratitude, your respect, and even your loyalty to the Party and what it stands for. We know that there are still many counterrevolutionaries within our country, those who would trade the strength and stability that

the Party provides for the chaos of an unregulated society. We are concerned that you are becoming a hero for those people, and that is something that none of us in the Administration want. Wouldn't you agree?"

Tom Liping had anticipated this moment, and her answer was very measured. "Surely I have never shown any disrespect for the Party, and certainly no disloyalty. Nothing that I said at the conference was inconsistent with the Party's positions or its policies and procedures. I would not have talked about an international agency had I not received permission to float the idea from our own internal committee. I believe such an agency would be an excellent vehicle for showcasing our way of doing things, and would guarantee that the Chinese people have a seat at the table for humanity's next great evolution."

"Very noble thoughts, Major. But, again, you fail to include the Party in your vision of the future. Nor do you contemplate the expansion of our country's sovereignty. For thousands of years, the Middle Kingdom has been following its own manifest destiny, constantly expanding and consolidating its territorial reach. We have fought off invaders and assimilated those who would have conquered us. We have expanded our borders in all directions, and have recently moved to take control of the South China Sea. And now we have the chance to expand our influence to the surface of the Moon. Most of us here at the Administration are committed to that goal. But we have come to believe that you are not, that you are in the camp of the internationalists. We're afraid that, at some crucial moment, you will make a decision that will put your one-world ideals ahead of our strategic national interests."

"This is nonsense," replied the taikonaut. "Just because I gave a speech with an international focus at an international conference does not mean I am disloyal to our own national interests. The Outer Space Treaty says that outer space should be used for the benefit of all the people of the Earth, so

that was how I framed my presentation. What have I ever done that was contrary to our national interests?”

The Director paused again. He had hoped that his hero-taikonaut would simply have accepted the decision and moved on. Her stubbornness suggested that a cult of individuality was indeed taking root in their country, a tendency that must be snuffed out. He opened a folder on his desk and pulled out a photograph.

“Major, this picture is a still shot from the video you took of the space station – the lunar module – when it was almost struck by the space debris. Do you remember that moment?”

“Yes, I do. I almost lost my husband. And we almost lost the key component in our effort to be the first back to the Moon.”

“And yet, you were told before your flight that you were not to take any pictures or videos of the upper side of the vehicle. You knew that a view from that angle might reveal its true purpose. Indeed, we now believe that the United States has accelerated its own plans precisely because they saw that view.”

“But with all the controls we have on the release of information, I would think that the Party could have kept any such video from being released.”

“Normally that’s the case. But we had made a special arrangement with the Japanese news agency to provide them with an exclusive live feed of the mission. Part of our “Outreach to Asia” project that is trying to pry away some of our neighbors from their partnerships with Western nations. And please do not try to deny knowledge of that arrangement. I went through the notes of our internal committee meetings and discovered that it was you who made the specific recommendation to share the feed from your mission. Not only does this show your internationalist tendencies, it also suggests that you deliberately tried reveal our plans to the world. If so, that would amount to treason.”

"That is ridiculous. I knew from the tracking radar that the space debris would strike the upper part of the station, and I wanted to be in position to make a record of the event."

"Yes, that is the explanation that you gave to the board of inquiry, and it was accepted at the time. But something has come up that has made us question your motives."

The Director pulled another picture from the folder. It showed a wide boulevard, apparently in a large city. There were no cars on the boulevard; the only vehicles present were a line of tanks. And standing in front of the lead tank was one solitary man, who looked like he was holding a grocery bag in each hand as he tried to stop the tanks from advancing.

"This picture, of course, is from the uprising in Tiananmen Square, when Western agents had misled some of our people into rising up against the Party. The People's Army had successfully cleared the Square in an overnight action, but as the tanks began moving toward the city center, this man stood in their path, a futile effort to say the least. Two of his friends quickly came and took him away, but not before we got a good enough look to identify him.

"His name is Wang Weilin. And he was your father."

Tom Liping looked at the picture. She had seen it many times before, though never openly. She had been placed in the orphanage at age three, told only that her parents had died during the "disturbance" of 1989. It was years later when an old family friend had shown her the picture while the taikonaut-in-training had been on a goodwill visit to her place of birth. The friend had pulled the picture from its hiding place in an old book and revealed to her how her father had "disappeared" soon after the photo had been taken. The friend had even given her the book so she could take the photo with her. Liping had kept the picture ever since, hidden in the book through all the intervening years, looking at it whenever she needed a reminder of her past. And now it had surfaced again. She shivered.

"As you know," continued the Director, "much false information has been spread about that uprising. Some have

even tried to make heroes of those who participated. This has been a threat to the State, so all such pictures and stories about the event have been banned. It is a crime even to be in possession of such a picture.”

Major Tom kept a straight face. “And what does this have to do with me?”

“When we started to follow Major Harris, the United States astronaut, it occurred to us that the United States might already be spying on our own space travelers. So we decided to do a security sweep of your home while your family was still in San Francisco. Not to invade your privacy,” he quickly added as she started to object. “We didn’t look at any writings or computer records. But considering the top-secret nature of our mission, it seemed prudent to make sure you weren’t being bugged. Imagine our surprise when we came across this picture in one of your books.”

Major Tom was silent. For years she had feared such a revelation. For years she had considered destroying the picture. But every time she looked at it, she did not have the heart to destroy her only link to her childhood, to her parents. And now she could think of no response. The Director did not force her to make one.

“Of course, we cannot be sure how the picture came to be in one of your books. Our experts tell me there are no fingerprints, as if the person who last handled the picture had carefully wiped them clean. But when we combine this discovery with your recent actions, we begin to wonder about your deepest motivations. I’m afraid you’ve placed yourself in a compromising position.”

The taikonaut responded slowly. “I have demonstrated both the willingness and the ability to take on the toughest assignments for the people – and the Party,” she quickly added. “Despite all you say, I remain the best qualified person to pilot the module safely to a lunar landing.”

“Perhaps. But we have growing confidence on our automated systems, and your husband is sufficiently familiar with them. We will give him specific training in the flight

controls in case he needs to take over at some point. Tom Enloi is going to be the first person to return to the Moon, the first person to begin humanity's permanent presence on another celestial body. He will be known throughout history for that. The leadership does not believe such an honor should be conveyed upon someone whose loyalty has been compromised, even if it is only the appearance of disloyalty.

"Of course, we will not reveal the details of our decision. The agent who found the picture took it immediately to his superior, who brought it to me. They have both been sworn to secrecy and are very aware of the consequences of revealing state secrets. We still want you to be a hero and example for our people, and you will still pilot the lunar shuttlecraft as soon as it is ready. But you will not be making the first flight. Our decision is final."

Tom Liping could only sit silently as the Director went on to describe the details of the modified mission. For years she had worked hard to put herself in a position where she could start to affect policy. She knew there were other people like her, people who were not convinced that the Party was the eternal answer to all their problems. Perhaps not even the short-term answer. She had been very careful not to push the boundaries too far, biding her time for a moment when even greater change was possible. But now her deeper motives had been revealed. It was only her public status that was keeping her from "disappearing" immediately. But she knew the Party would never again give her a speaking role, or any sensitive assignment. Though she was not afraid for her own safety, or her family's, she suddenly felt very, very defeated.

CHAPTER TWELVE – Deputy Director

“Have you ever regretted leaving the astronaut corps?”

Major Michael Harris had been working late with Sarah Bailey, the Deputy Director of NASA. They had spent all day in the clean room at the SpaceTech construction facility in southern California, doing the final tests on the modified capsule that would take him to the Moon. They had finally decided there was nothing more they could do. Having reinforced the base of the service module and installed racks in the capsule to hold additional supplies, they had reached their weight limit. If they tried to add anything more, the capsule would not have enough fuel for a safe landing. All day they kept going back and forth over the computations, trying to squeeze out an extra pound or two. They were finally satisfied that they had packed it as full as possible with supplies without trading away essential safety. Now they were at a nearby lounge, trying to decompress from ten weeks of nonstop activity. It was not the Deputy Director’s style to fraternize with the astronauts; among her other duties, she decided who was going to fly on what missions. But the decision for this mission had been made by higher ups, so she felt no conflict.

“Only every day,” she replied, sipping on her second vodka tonic. “But after the second Shuttle accident, Congress decided it wanted an astronaut in top management. And a woman. Even though there had been female shuttle pilots and station commanders, there were no female directors. I hadn’t expected to be selected, since I had only been a mission specialist, but none of the regular astronauts were interested.”

"Now, now, don't belittle yourself. Just because you weren't a pilot or in command doesn't diminish your accomplishments. Your work with the robotic arm was both spectacular and dramatic, helping to repair the solar panels on the space station when the folks on the ground had given up. Do you remember your response when mission control told you your plan wasn't by the book?"

She smiled. "I wrote the book."

"Yes. And you even got a presidential citation when you got back. No wonder they put you in charge of robotics development, and no wonder they picked you a few years later to run the agency."

"Well, I'm only the Deputy Director."

"Right. And the Director doesn't know solid fuel from liquid fuel. He's a political appointee who knows how to hobnob and schmooze with the elites, but everyone in the agency knows it's you who gets things done."

"Perhaps," she replied, then paused as the bartender brought them another round. Tavern talk was not forbidden, but internal politics was kept in-house, part of having the "right stuff."

"No 'perhaps' about it," continued Major Harris when they were alone again. "You earned your respect the hard way, surviving the long hours and rigorous training that every astronaut has to endure. Not to mention a dangerous mission. And you know what it's like to be up there, to look down on a planet that has no boundaries, that looks so fragile. You weren't promoted just because you're a woman; you were promoted because you're the best person to lead the agency. We were just sorry that you left the corps."

"We', Michael Harris? Or you? Are you asking if I regretted leaving the corps, or if I regretted leaving you?"

The astronaut paused before answering, took another drink. Theirs had been a secret affair, a liaison between two single astronauts in a corps where most were married and had children. Those who knew were discreet, lest the press learn and make a big deal about it. Two people with difficult jobs

had found joy and pleasure in each other's company, and the strength to persevere. Indeed, their feelings had been so intense, their lust so consuming, that they had decided to keep it separate from the rest of their lives, fearing that going public would destroy both their relationship and their careers. In some ways that had made their parting easier, but there had never been any sense of closure, only a wondering.

"I suppose I'm asking if you had any regrets about leaving me," he finally answered.

For a moment Sarah Bailey stared at her drink. Like him, she had thought about this for years, but still had trouble putting it into words. "Michael, I couldn't figure out what we were doing. The lust was certainly enjoyable; we explored every fantasy we could think of! But there seemed to be something missing. Our jobs were always a priority, and you seemed to relish the role of "playboy astronaut" that the press pinned on you. I couldn't really complain about your other involvements. I was afraid to ask for anything more, afraid you might say no and then I would lose everything. But when the opportunity came along to go to Washington, it didn't seem like I was giving up a lot to take it."

"And now?"

"Now I'm working on a mission that has a higher chance of failure than any other we've tried. And I suddenly find myself worrying about the man who's going to fly it." She had been staring at her drink while talking, but now looked straight at him. "I've been trying to remain professional while we worked on this, but I keep being reminded of the reasons I was attracted to you in the first place. You're an amazing man, Michael Harris, more so than you know. Or will admit. Beyond the swagger there is a sensitive soul, someone who cares for those around him, who will do anything for them. Will even take on the most dangerous assignment because he knows he is the best, and that his destiny is to push the envelope to the edge."

She paused and took another drink. "I know you always put on a brave face for those working with you, but I know the

dangers of this mission better than anyone else, the thousand-and-one things that could go wrong. I know you know them, too. And because of that, and despite my own reluctance, I'm developing a deep affection for you. For Major Harris, the man with whom no one can get really close. Except, perhaps, the woman who knows him best."

Michael Harris was struck dumb. For years he had enjoyed the fame of being an astronaut, had enjoyed the company of the many women who wanted to spend some time with a famous hero. Yet they had all been attracted to his image, not the person inside. He had even kept Sarah at a distance, his ego never feeling the need to share his innermost self with anyone. But now he felt a huge void.

He looked at her again, absently stirring her drink after having said her peace. He very tentatively reached over and took her hand in his.

"Perhaps," he said, "there's still time to find affection in our lives."

She looked at him, seeing for the first time a man who was vulnerable, who was not going to bluster his way through another difficult situation.

"Perhaps there is," she replied, gently squeezing his hand. "Perhaps there is. Would you care to go for a walk?"

"I would indeed," said the astronaut, feeling more alive. The bitterness that had been growing inside him was suddenly lifted. Perhaps there really was something to live for, something beyond obeying the orders of a heartless leader. They both got up and he helped her with her coat. She accepted the act of chivalry, even though she normally took care of herself. Something was different tonight. Was it the fear of death from a dangerous mission, or had two people finally found the meaning of love? Whatever the reason, she found herself taking his arm as he offered it, two space travelers walking along a busy street, in a crowded city on a planet called Earth.

CHAPTER THIRTEEN – Chief Engineer

“OK, Major, that’s as secure as I can fasten them. I don’t think they would come loose even if the whole ship exploded.”

Chief Engineer Zhang Senlor had not expected to be a taikonaut, though he had always dreamed of it. With poor eyesight and a defective heart valve, he hadn’t even applied for the corps. But his mind was as sharp as anyone’s, and he loved to tinker, so he set his mind on becoming the best aerospace engineer in the country. And he had succeeded, helping to design and build the latest generation of space vehicles. He was one of the few with the security clearance to know about the entire project. Only those outside of the loop were surprised that he had been tapped to go into orbit and make modifications to the “station”.

“Thanks, Lor,” replied Major Tom. “Having those extra oxygen tanks is a great comfort. I can make the food last by eating less, but I don’t think I can stop breathing for very long!”

The engineer smiled. “Well, now you won’t have to. I bolted the tanks to the main frame, then sealed the bolts with a polymer. No matter how rough the landing, they’re not going to come loose. And you’ll have all the comforts of home during your stay. We even upgraded the sound system with full spectrum speakers so you won’t have to wear a headset when talking to Ground Control or your family.”

Tom Enloi felt a bit of relief now that the tanks had been installed, but only a bit. He wasn’t supposed to be on orbit for another few months. A two-person crew of regular taikonauts

was supposed to be on this flight, delivering supplies and making sure the OTV was properly attached. But the Director was worried that the United States was going to launch their own lunar mission soon, so Major Tom had been sent up just in case.

But now the taikonaut was worried; if he really was being watched, then the U.S. knew that he had been sent out of rotation, and that a non-taikonaut engineer had been sent up with him, sure signs that something was going on. This would only cause them to accelerate their plans.

Suddenly the communicator started beeping, alerting him that a message was incoming from Ground Control. He turned it on: "Major Tom here."

"Hello, Major. This is the Director on a secure line from Ground Control. It appears our worries were well-founded. SpaceTech has just rolled out their heavy booster onto the launch pad at Cape Canaveral. We know they're able to fuel and launch it within 24 hours. It looks like we're going to have to send you right away. Have you transferred all the supplies from the capsule?"

"Yes, sir, and Lor has just finished securing the oxygen tanks. You were wise to have this contingency plan ready. I might lose a little weight, but I am confident I can survive for six months on the Moon. Just don't be late with the relief ship!"

The two exchanged a few more details, then signed off. Major Tom informed the Chief Engineer of what was happening. "I thought so," he replied. "It's a good thing we worked as hard as we did. Good luck to you, Major Tom. The whole country will be riding with you."

With that he prepared for the trip back to Earth. As he did, he looked through the view portal once more, getting one last look at the planet from a perspective that few had ever enjoyed. He had only spent a couple days in space, but every moment would stay with him for a lifetime.

I wonder if I'm the first gay man to have such moments, he thought to himself. Sally Ride had kept her sexual orientation private; her death notice was when the world

learned she been partners with another woman for 27 years. Other lesbians and gay men might have flown, but they had either chosen to keep their orientation private or had felt forced to do so, like he did. Yet when he looked down at the Earth, he felt only awe and wonder, and a heightened realization that humanity was all one. Even that hidden feeling of separateness from leading a secret life was diminished. If only everyone could experience this, thought the Chief Engineer. Perhaps our fears about our differences would finally start to fade.

They blew through the departure checklist, then shared a final hug before sealing the engineer in the return capsule. If all went as planned, it would be six months before the taikonaut would have such contact with another human being. Within an hour of receiving the message from the Director, the capsule separated from the module, fired its own thrusters, and began its decent back to Earth.

Major Tom turned his attention to preparing for the lunar transfer burn. He opened communications with Ground Control and began running through the checklist. The systems on the OTV were activated, and they all checked out. "All systems are go," reported the taikonaut, and Ground Control concurred. Then they all waited patiently as the module and OTV circled to the right point in orbit, when they could launch toward the Moon using the least amount of fuel. The module was so heavy that the OTV would barely be able to get it there, with just enough thrust to escape the Earth's gravity and get caught in the Moon's. The Apollo missions had gotten to the Moon in three days; this trip would take five.

"Three, two, one, ignition!" Ground Control counted it down, but the computer did the actual firing of the OTV's engines. Indeed, almost everything was automated from here on out. In theory, Major Tom could just sit back and allow the ship to land itself. How odd it seemed, to have been in so much of a hurry getting ready, and now he was just sitting there enjoying the ride. Just like any other traveler, he thought to himself with a smile.

He looked out the aft window and saw the Earth receding. The further one got from the planet, the more fragile it looked, a small ball of color in the infinite blackness of space. He was already farther away than any Earthling had travelled in almost half a century. He thought of his wife and son; by now they would have been told of his departure. Soon he would get to speak with them, but for now he missed them, and felt very lonely.

The transfer burn ended. Major Tom felt a jolt as the OTV separated from the module. It used its own thrusters to move a safe distance away, then did another short burn. This put it on a course to loop around the Moon and return to Earth orbit. The module stayed on a course that would take it to the Moon's surface, where its own thrusters would brake for a landing.

He looked again at the Earth, saw the east coast of the United States through the clouds. Somewhere, he knew, Major Michael Harris was preparing for his own mission. What, he wondered, was going through the astronaut's mind right now?

CHAPTER FOURTEEN – Astronaut

“Folks, the longer we wait, the behinder we get. Let’s light this candle before it’s too late.”

Major Harris was sitting in the capsule atop the SpaceTech booster on the launch pad at Cape Canaveral. Today was supposed to be the final dress rehearsal and systems check, but then the word came down that the Chinese “space station” had just been boosted into a lunar transfer trajectory. Now the technicians were frantically trying to determine if they could launch as soon as the rehearsal was completed.

The astronaut was willing to stay in the capsule without another break. He didn’t need to get out to stretch; the capsule had been built to hold five people, and even with the extra supplies, he had plenty of room. Nor did they need to pack anything more. The meticulous planning that he and the Deputy Director had done had allowed the capsule to be loaded before being mated to the booster. Nor would he miss saying any goodbyes. He had no family members waiting at Cape Canaveral, and the person he felt closest to was 3,000 miles away at the SpaceTech mission control center in California. A simple “Godspeed” from the capsule communicator would be a good enough sendoff.

Capcom responded. “Roger that, Major. The flight controllers have just made the decision to load the liquid oxygen. Because it must be kept cold, it’s never loaded during a rehearsal, so I guess that means we’re launching today.

We'll start sending you the new launch data as soon as it's ready."

You'll be sending it to the computer, thought Major Harris, but he let it slide. Like the early astronauts, he chafed at having a machine do all the work that a pilot should be doing. But he also knew that there were thousands of computations that would be made each second to keep him on course, and that even the slightest miscalculation during liftoff would be magnified as the trip progressed, perhaps too much to be fixed by a mid-course correction. So he forced himself to relax as the ground crew went to work.

He didn't have long to wait. "Major, this is Capcom again at Launch Control. Looks like we're go for a launch within an hour. All tracking stations are ready, all rescue ships are in position. Mission Control in California is fully up to speed and ready to take over as soon as we launch. They just want a final confirmation that the astronaut is ready to go."

Major Harris smiled to himself. That would be Sarah, doing what she could to make sure he was OK. It means a lot, he thought to himself, to have someone care so much about you. "Please inform Mission Control that the astronaut is ready to meet his destiny, more so than ever before. Make sure to thank them for me, for all their help during the past few months."

"Will do, Major. The automatic launch sequence has just been activated, and the liquid oxygen is being loaded. You'll be launching in about 39 minutes. Good luck, Major. The hopes of a nation are riding with you."

They went through the final checklist, more of a double-check to keep them busy. If any system was not a go, the computer would shut everything down before the engineers were even aware of the problem. But the checklist kept them focused, and before they knew it they were at T-minus one minute. All the chatter stopped now as the astronaut steeled himself for liftoff; despite improvements, it was still an "E-ticket ride," as Sally Ride had once said. The final seconds counted down, then the deep rumble as the main engines fired up. In

only a few seconds they reached maximum thrust, then the restraining bolts were released. Michael Harris felt himself pushed back into his seat, and knew there was no turning back.

“Godspeed, Major Harris. Mission Control, the spaceship has cleared the tower.”

Normally he would have felt anxious about the launch, usually the most dangerous part of the mission. But this time he felt a great inner peace, the peace of someone who is following their best destiny, and who is loved by someone who admires him for doing so.

“Mission Control, this is Lunar One. Everything is A-OK. The race is on. Let’s see if we can make up some time.”

A continent away, the Deputy Director of NASA kept an even face as she watched the rocket ascend on the long-range cameras. She knew now that it was possible to feel connected to someone far away, someone who would not return for months – if ever. Somehow, instead of being distraught, the feeling gave her strength. She could only hope that it did the same for him.

CHAPTER FIFTEEN – A Walk in the Park

“Mama, where’s Papa now?”

Tom Liping and her son were walking in a park near their home. It was evening, and the waxing crescent Moon hung over the city in the western sky. The autumn air was cool and clear after a recent rain, perfect weather for sky watching.

“He’s about halfway to the Moon by now,” she said.

“And Major Harris?”

Major Tom had been keeping her son fully informed about the two missions, even speaking kindly about their so-called “competitor”. They would watch reports on television together, then search the internet for more. She had filled him in on the mission details, free to talk now that it was no longer a secret. He was as fascinated as the rest of the world.

“Major Harris is not far behind. He will probably catch Papa tomorrow and reach the Moon before him.”

“How is he able to catch him?”

“Well, our ship weighs a lot more than Major Harris’. And our booster is not as strong. So we couldn’t make our ship go as fast.”

“I understand. Papa told me that more weight needs more fuel. I guess less weight means you can go faster with the same amount of fuel.”

“Exactly,” replied his mother, feeling a bit of pride that her son was learning so much at such a youthful age.

“Are they going to get close? What if they hit?”

“Don’t worry, they won’t get close. They’re aiming for different landing spots. We’re going to land at the Moon’s

south pole, at the bottom point of the crescent,” she said while pointing to it. “It looks like Major Harris will be landing at the north pole. That’s where his current course is taking him, and we don’t think he’s going to change course.”

“Papa told me it takes more fuel to change course, and he probably doesn’t want to waste any.” He paused for a moment. “Why are they landing at the north and south poles?”

“Those are the only places that have sunlight all the time. Every place else on the Moon has two weeks of sunlight followed by two weeks of darkness. There would be no sunlight for their solar panels, and no electricity for their heaters. Their batteries aren’t strong enough to last that long, and they would freeze to death. When they land, they’ll put their panels on a high spot that gets sunlight all the time, and they’ll have free energy for as long as they need it.”

“It sounds really hard,” said the young Tom.

“It is. We had planned on having two people to move them. But your father is strong, and we practiced before he left. On the Moon they won’t weigh as much, so he’ll be able to do it.”

“Why don’t they just work together? Wouldn’t it be easier?”

The taikonaut was stunned for a moment by the insight of her son’s question. “Yes, it would. It’s always easier when people work together to do something.”

“Then why don’t they?”

She looked down at him, put her arm around his shoulder. “I don’t know, son. I really don’t know.” She looked back up at the stars, where he was still gazing, two people among the millions, perhaps billions, who were looking up that night and wondering about the fate of two of their own.

CHAPTER SIXTEEN – Astronaut Redux

“Altitude fifty thousand feet, Major. All systems are go for landing.”

Michael Harris had reached the point of no return. He still had enough speed and fuel to loop around the Moon and return to Earth. It would be a close approach, six miles, about the same as Apollo 10 when it did the dress rehearsal for the first Moon landing. But without an atmosphere to slow him down, he would swing back toward Earth for a traditional landing. The heat shield and parachutes had been left on the capsule for that possibility.

He had told himself he would do that if anything seemed wrong, not allowing his personal bravado to put a whole program at risk. A crash landing and fatality would set back U.S. space flight a lot more than aborting the mission. But the ship had performed flawlessly, almost magnificently. For most of the flight he had been able to relax and enjoy the view while Mission Control monitored the systems. Even that had worked flawlessly. NASA had decided to send its people to California to the SpaceTech control room rather than making SpaceTech's go to theirs in Texas. All the technicians who built the capsule were there, and all the telemetry for the capsule was linked to equipment there. The Deputy Director had laid the groundwork for the two teams to work together. “A common purpose will overcome any rivalries,” she had said, and she was right.

Now Major Harris was at the decision point, and they had left the final decision to him. He looked out the window at

the Earth. The capsule had already turned around in preparation for landing, and he had a good view of his home planet out the front portal. So beautiful, he thought. It seemed so small from here, too small to hold the billions of people living on it. Yet they did, and most of them were following this mission with rapt attention. In some ways, he was an extension of them; what he experienced, so would they. He took in a deep breath as he felt their excitement, their joy, even their support. He looked around again at all the instruments. Everything was still go. It was time to land on the Moon.

“Roger that, Control. Confirm all systems go. Computer is programmed for a descent and landing at Plaskett Crater. Activating program now.”

There was no immediate jolt. He had activated the program about a minute before the scheduled burn. In theory, he could still change his mind and head back to Earth, but his mind was set.

The clock in the capsule counted down, three, two, one. “The thrusters are firing. Forward velocity decreasing. On trajectory now for a landing at the crater. Altitude 40,000 feet. Thrusters continue to function nominally. Altitude 30,000. Plaskett Crater now coming into view. Decent velocity now decreasing. Altitude 20,000. Forward velocity approaching zero. Thruster still performing well. Altitude 10,000. Directly over Plaskett now, approaching maximum deceleration.” He paused and looked at the view screen. Like a car with a rearview camera, it showed the view below the capsule as it neared the surface. With the forward motion now stopped, it would give him the best view for landing the capsule.

Suddenly he felt a jolt, then a vibration as he heard the horrible sound of metal tearing. Then the sound and vibration stopped. He looked at the view screen and saw a curved piece of metal falling toward the lunar surface.

“Control, this is Major Harris. It looks like we just lost the shielding over the solar panels. The computer has already made an adjustment for the decreased mass. Still descending

toward Plaskett Crater. Too late to abort mission. Just going to have to ride it down and hope the panels aren't damaged too bad."

"Control to Lunar One. We confirm your telemetry and concur it is too late to abort. Best option is to land as quickly as possible."

The astronaut had a brief surge of anger as he thought of the risks that had been taken because some leader had insisted on being first. But he set that aside. No time for moral judgments. He still had to find a place to land.

"Continuing to descend. Below four thousand now. The plateau that we chose near the crater's rim seems pretty flat. Shouldn't be any problem with tilting. Two thousand now, rate of descent slowing. Starting to see details of the landing site. Surface looks even and unbroken. A few rocks, but no large boulders. Taking over controls now to avoid the rocks."

The plateau had been chosen because it was a flat spot at the very top of the crater's rim. It would get sun almost 90% of the time. Major Harris found a spot that was clear of rocks but still far away from the shady edges of the plateau. The thrusters were on full now as they suspended the capsule while he moved it into position.

"Thirty seconds," called out Capcom. Harris smiled, thinking of Neil Armstrong being in the same position. Everyone on Earth was holding their breath, but he knew he had plenty of fuel. With a gentle nudge on the control, he let the capsule descend the final 10 feet, felt the landing legs touch the lunar surface, then shut down the engines.

"Control, this is Major Harris. Lunar One has successfully landed. Humanity has returned to the Moon."

The applause erupted at Mission Control, and indeed throughout the world. But it was restrained by concern for the astronaut. By now everyone knew why the capsule was landing at the north pole, and how important the solar panels were.

"All systems in the capsule are green," reported the astronaut. "Switching screen to the service module." A pause,

then, “The charge controller shows no current being generated by the solar panels. I’m going to try to extend them and get more sunlight.”

He flipped the switch to extend the panels, could hear the whirring of the electric motor in the lunar stillness. But when he looked out the portal, he saw nothing. No movement at all. Instead the whining of the motor started to get higher, as if it was straining. He shut it off, then just sat there for a moment. Every test pilot knows that there might come such a time, when death became inevitable, but till now he had always managed to avoid it.

“Control, this is Lunar One. Solar array is not responding. Still zero current. From the camera on the capsule I can just see the side of the service module, and there’s extensive charring. My best guess is that the blast from the landing thrusters has melted the wiring for the array and shorted it out. Might have also destroyed the silicon cells. Right now there is no power being generated. Starting energy saving protocols. Will go outside as soon as possible for a closer inspection.”

Back at the control room, Sarah Bailey was almost sick. Their worst fear had come true. They had taken many shortcuts to make this flight as soon as possible, and one of them had failed. Never mind that they had been under orders from a determined president to do whatever it took at whatever cost. She still felt immense guilt for having been part of the effort to do so, as did everyone else in the room. But for her it was worse: she now had an empathic connection with the person in danger, and he was too far away to help.

CHAPTER SEVENTEEN – Major Tom

The Director of China's National Space Agency was feeling mixed emotions. He had been planning this day for months, a celebration of China's first taikonaut to land on the Moon, and the beginning of humanity's permanent presence there. He was at Ground Control now, along with the many Party dignitaries he had invited, plus Tom Liping and her son, who were standing near him by the Flight Controller's station. Even the Premier was there, along with his small dog. The pug-nosed sharpei had been the leader's companion for many years, and the Director had made an exception to allow the animal into the control room. Even lords of castles had to accommodate the king and his entourage.

They had all been listening to the progress of the United States mission even as they stayed in contact with their own. There had been a collective groan by the technicians when, several hours earlier, the astronaut had passed the taikonaut as they raced to the Moon. The Chinese landing would still be a great accomplishment, but would lose its historical luster if the U.S. was able to establish a permanent presence first.

Because the U.S. mission was being broadcast publicly worldwide, the Chinese had been instantly aware when trouble had developed. They had all heard Major Harris' assessment of the damage. Tom Liping and many of the engineers seemed upset, but the Director only saw an opportunity. If they could land their own craft safely, and if the U.S. astronaut died before a relief mission arrived, then China

would be recognized as having established the first permanent presence. The Middle Kingdom would once again be pre-eminent, and the world would follow their lead.

Suddenly a voice came through the ether.

“Ground Control, this is Major Tom. I’ve just checked our fuel, and I think we have enough to swing around the Moon and land at the North Pole. Our module is designed for two people, and if Major Harris and I combine our food and oxygen, we’ll have enough supplies till the next flight arrives. Request permission to change course and attempt a rescue.”

The capsule communicator turned to the Director, awaiting instructions. The Director decided to respond himself and motioned for a microphone, which was quickly provided. All eyes in the control room were on him.

“Major Tom, this is the Director. Thank you very much for your suggestion. At this time, we believe it would be more prudent for you to continue on your present course to the primary landing target. It would be too risky for you to make any last-minute changes to the mission.”

“I must disagree, Director. A North Pole landing is one of the options we considered when preparing this mission. We even have the precise landing spot loaded into the computer. It is on the same plateau where Major Harris landed. All I need to do is instruct the computer to go there and it will do so automatically.”

“Perhaps, Major Tom, but it is still too risky. The course correction would use up too much fuel. We simply can’t do it.”

“But we *must* do it. We have a duty under the Rescue Treaty to do everything we can to help an astronaut in distress. And I think we still can, if we act fast enough. Any delay will cause us to use even more fuel to change course.”

The Director thought for a moment, then spoke slowly and solemnly. “Major Tom, it is in our country’s vital interest that we establish the first permanent human presence on the Moon. Do I make myself clear?”

All too clear, thought the taikonaut. If Major Harris died before he got help, then the U.S. effort will have failed, and

China would be recognized as having established the first sustainable presence on the Moon. A knot formed in his stomach.

"With all due respect, Director, I cannot ignore the strong feeling I have to rescue a fellow space traveler, no matter what our national priorities."

The Director tried once more. "Major, there are times when we must set aside our personal feelings and do what is necessary for the greater good."

Tom Enloi looked away from his instruments, looked out the portal toward planet Earth. He saw no boundaries, only the home of several billion human beings. "But that is what I *am* doing," he replied.

The Director sighed, knowing that he would not be able to change the taikonaut's mind. He nodded to a nearby technician, who used his computer to access the lunar module's computer settings. Tom Liping could see the screen as the technician typed in a sequence of numbers: 1, 5, 6, 5, 8, then Enter.

"I'm sorry, Major Tom, this is too important for one person to make a decision based on personal whims. We have taken over control of the module. You will be landing automatically at the South Pole as originally planned. You are a hero of the Chinese people, Major, and we don't want to risk you or the mission for no good reason. Please relax now and enjoy the landing."

Major Tom stabbed at his computer screen, trying to change the flight plan to the North Pole option. He kept stabbing, and the computer kept telling him that access was denied. A wave of anger rushed through him, then subsided as he became resigned to his situation. The man who had simply willed himself through so many challenging moments suddenly found himself helpless, a puppet in someone else's play. He looked again through the portal at the big blue marble that was hanging in the sky. Here I am, sitting in a tin can, he thought with great sadness. Planet Earth is blue, and there's nothing I can do.

Suddenly he felt a vibration on his chest, and heard a very faint high-pitched sound. It took a second to realize it was coming from his medallion, then only an instant to realize it was a Morse Code message from Li, sending the computer access code.

1-5-6-5-8 (pause) 1-5-6-5-8 (pause) 1-5-6-5-8 . . .

Tom Enloi quickly called up the settings screen for the onboard computer and was asked for the password. He entered it, was granted access, and immediately changed it. The computer asked for confirmation, and he repeated it. The monitor flashed, and once again the main control screen returned.

“Ground Control, this is Major Tom. Thank you for the suggestion, but I am convinced we can save Major Harris and still complete the mission. I have switched coordinates, and I think my spaceship knows which way to go.” He paused, then, “Tell my wife I love her very much.”

One more coded message came through his medallion: *She knows*. Tom Enloi smiled, then reached up and cut off communications from the ground.

Back on Earth, the capsule communicator noticed immediately. “Ground Control to Major Tom. Your circuit’s dead, there’s something wrong. Can you hear me, Major Tom? Can you hear me, Major Tom? Can you hear me, Major Tom? Can you hear . . .” He gave up and turned to the Director. “It’s no use, sir. He’s shut off all communications from the Earth.”

“How do you know that?”

“He’s left the telemetry on. We can track him and know everything he’s doing. But we no longer have any control over the module. Somehow, he got the password and has used it to shut us out. How could that happen?”

The scene at Ground Control had been chaotic the preceding few minutes. While the Director had been debating with the taikonaut, holding the microphone in his hand, he had been looking at Tom Liping, watching her reaction as he prevailed over her family’s misguided compassion. All she

could do was stare back at him, arms folded over her chest, one hand reaching up to her neck to fidget with her medallion. But something was wrong, he thought; her look was more of defiance than defeat. Suddenly the Premier's dog began barking; it broke free and ran toward the taikonaut, tried to jump up on her.

"It's no use, sir, he's shut off all communications. . . How could that happen?" The Director looked at the capsule communicator, then back at Tom Liping. Her look was now both defiant and triumphant. He suddenly realized what had happened. He reached out and grabbed the medallion, breaking the thin chain as he tore it from her neck. He turned it over and saw that the back was detachable, opened it, and saw the battery inside.

"What is the meaning of this," he hissed at her.

She glared back at him. "If you want to get something done, Director, don't mess with Major Tom."

Her son looked up at her with admiration. The Director did his best to control his rage. "You realize this is treason," he finally said to her. "Guards . . ."

"Just a moment, Director."

At the sound of the Premier's voice, everyone in the room stopped and became silent. All eyes were on him as he walked toward the Director and the Toms to retrieve his dog, who was now playing with the taikonaut's son.

"Before we rush to judgment in this matter, perhaps we should see how it concludes. We should not make any rash decisions that we might regret later."

The Director was taken aback. He had worked for years to build his fiefdom at the space agency, and had never had his authority challenged there. Now all he could do was watch as events unfolded beyond his control. If Major Tom failed, the Director would be praised for having been the voice of reason, and would likely remain in charge of the program, probably with even more authority. But if he succeeded? The Director knew that changing circumstances could cause dramatic shifts of power in a government where much was done in secret. He

bowed slightly to the Premier, indicating his submission to authority.

“Flight, this is Retro.” The familiar voice of Chief Engineer Zhang came through the intercom; the Director had rushed him back from his landing and put him at the most crucial station. “Telemetry indicates that the thrusters have fired. Scheduled for 15 seconds to alter trajectory. Down to ten now. All systems looking good. Down to five, four, three, . . .”

Beeeeeeeeeeep.

Tom Liping froze when she heard the sound, as did every technician in the room. They knew that it was the warning alarm, indicating that the module no longer had enough fuel for a safe landing. All eyes turned to Retro for confirmation.

“The burn has ended. The module is now on course for a landing at the lunar north pole. The computer now estimates that it will run out of fuel about 1,000 meters above the surface. That is too high to survive a crash landing.”

The room fell silent. Deadly silent. It was young Tom’s voice that finally broke it.

“Maybe he could get rid of some weight. If it weighs less it won’t take as much fuel to land.”

The Director looked to the Chief Engineer. “Is our far side satellite in range to transfer a signal to the module?”

“It will be in fifteen minutes, sir.”

“Then you have fifteen minutes to figure out how much weight he needs to get rid of and what could be ditched without jeopardizing the mission. Start transmitting as soon as he’s in range. He may turn his receiver back on now that we’re committed to the new landing spot.” His plans may have been thwarted, but now that his taikonaut was in danger, the Director would do everything he could to save him. Then he waited, with the rest of the humanity, to learn what was happening a world away.

CHAPTER EIGHTEEN – Plaskett Crater

Michael Harris was standing outside his capsule. He had already been wearing his space suit for the descent, so it hadn't taken long to get out after the landing. He walked to the side of the spacecraft to evaluate the damage to the solar panels. It was as bad as he had feared. The heat from the landing thrusters had been so intense that it had melted most of the wiring and charred the silicon cells themselves. There were a few cells around the edges that might still work. Perhaps he could salvage some wiring, patch together enough panels to generate a few watts per hour. If he could just get enough to operate his life support, he might be able to survive till a supply ship arrived with more panels. Since the ship was in near-perpetual sunlight, he could use the sun for heat and moderate the temperature inside using the sunshade. He had plenty of food and oxygen. He didn't need much power to survive, but he did need some.

Up to now, his adrenaline had been keeping him going as he dealt with a life-and-death situation. But suddenly the immensity of the moment caught up with him. He stopped and looked around, noticing for the first time the grand and stark beauty of Plaskett Crater. With the sun so close to the horizon, everything cast a long shadow. Every peak had one side brilliantly lit, and the other side in near-total darkness. There was no atmosphere on the Moon to diffuse the sunlight, though some did reflect off the sides of nearby peaks to bring a bit of light into the shadows, along with some Earthlight. The home planet was also hanging low on the horizon, about 90

degrees from the sun, looking like a quarter moon but larger, and of course blue.

For a moment he just stopped and took it all in. His immediate sense of danger subsided, and the magnitude of his accomplishment set in. I did it, he thought. I made it to the Moon. And it is more glorious than I ever dreamed. He reached down and scooped up some lunar soil, dry and dusty, and let it fall through his fingers. From this, he thought, we will build a new home. Well, at least someone will. He turned back to the ruined solar panels, wondering where he could start to try to salvage a little power.

“Lunar One, this is Control. Do you copy?”

“Control, this is Major Harris. Reading you loud and clear. The damage to the solar panels is extensive. They cannot be activated as presently configured. However, there may be a few silicon cells I can salvage, maybe some wiring. The odds are not good, but it’s the only plan I can think of.”

“Roger that, Major. Our engineers have not come up with any other solution. However, something odd seems to be going on with the Chinese mission.”

“What’s that?”

“Our radar shows that they did not land at the south pole as scheduled. Instead their ship changed course at the last minute and slipped into a low orbit around the far side. We’re not able to monitor their communications, so we can’t be sure, but it appears they are going to try to land at the north pole. If so, the module should be showing up very soon.”

Major Harris looked up at the “sky” toward the far side. Since there was no atmosphere, the stars were more numerous and more brilliant than even the clearest night on Earth. For a moment he was distracted by the Milky Way, so clear that it was three-dimensional, its massive dust clouds standing out against the central core. Then he noticed that one of the stars was moving slightly. It was almost overhead when suddenly it got much brighter. He could just pick out the flames from thrusters, and knew then that Major Tom was indeed coming to rescue him.

CHAPTER NINETEEN – Taikonaut

“Director, we are receiving telemetry again from the module. It is on course for an automatic landing at the Plaskett Crater site, about 70 meters from the U.S. ship. And it appears to have enough fuel to land.”

“How can that be?”

“I’m not sure, sir. We could not think of any weight to get rid of except for a few kilos of food. But the rate of descent and the rate of fuel consumption indicate that the module now weighs much less than it did before the course correction.” The Chief Engineer paused while doing a quick calculation. “About 200 kilograms less, sir. That’s about the mass of a taikonaut in a space suit.”

Tom Liping put her arm around her son and drew him closer. She knew that this had been a possibility, knew that her husband was noble enough to sacrifice himself for someone else. But she had hoped it would never come to that. A tear formed in her eye, but she tried to stay strong for her son.

Suddenly a sound came over the speakers. Just static at first. But then it started to take form, and a hint of a voice came through. It was young Tom who recognized the voice first.

“Papa!” he cried out. “Mama, it’s Papa!”

His mother was more cautious. Despite her desperate hope, she was not yet ready to accept what was physically impossible. She kept straining her ears, hoping somehow that the impossible was true.

A quarter-million miles away, Major Tom Enloi was watching his spaceship descend to the Moon, as he did likewise about fifty meters away. While swinging around the far side he had donned his spacesuit, then decelerated with the module as long as possible before throwing himself out the emergency hatch. On his back was the maneuvering unit, with

its thrusters aimed toward the surface. In his hands were the module's two fire extinguishers. He began to spray them, aiming toward the surface, trying to slow down his own descent at the same rate as the module. The extinguishers were easy to grip and control, having been designed for use by someone who was weightless or wearing a space suit. But he had no idea if they could provide enough thrust for a safe landing.

He was perhaps 200 meters from the surface when he felt the extinguishers start to sputter. He tucked one between his legs and threw the other toward the surface as hard as he could. Then he did the same with the second. This slowed his speed enough so he was still even with the module, but he was starting to go faster. He turned the maneuvering thrusters of his backpack on full power. They had been designed to work in the weightlessness of space, not to fight the gravity of a planetoid. But they were enough; his rate of deceleration continued to match that of the module.

“Ground Control, this is Major Tom. I don't know if you can hear me. I have set the module controls on automatic and am attempting to land myself on the Moon using backpack thrusters. Approximately 100 meters from the surface. Confirming that Major Harris' ship is safely outside the module's landing zone. I will be closer, but should still miss it. Altitude approaching 50 meters.”

He felt the thrusters in his backpack sputter, then stop completely as they exhausted their fuel. A quick calculation told him that a fall on the Moon from this height would be like a fall on Earth from about 10 meters. Not much worse than training for a parachute jump, he thought. As he slowly fell in the reduced gravity, he still had time to swing his arms and rotate his body so that it was leaning backwards about 30 degrees. He took a deep breath and exhaled, closed his eyes, and waited.

He landed feet first and immediately fell backwards, with most of the force being absorbed by his backpack. It crumpled but did not collapse. Instead he began bouncing and

tumbling in backward summersaults. Had there been any boulders or rocky projections in his path they probably would have ripped his suit open or caused fatal blunt force trauma. But the engineers had picked the location well; the plateau was flat and clear. After several seconds and a few more tumbles, he finally stopped, lying face down on the surface. For a moment he lay still, making sure that nothing was broken and that his suit was still airtight. Then he felt a wave of triumph wash over his psyche. He had made it. He had landed on the Moon.

He tried to lift himself up but was barely able to get on his hands and knees. Then he felt a hand grab him under one arm and help him to his feet. He looked up and saw Major Harris, with a smile on his face as bright as the sun.

The two space travelers looked at each other, astronaut and taikonaut, representatives of two nations that seemed locked in eternal conflict. And they embraced. Tears came to both their eyes, tears that could not be wiped away as they rolled down their cheeks inside their helmets. And as they embraced, the Chinese module settled down on the surface about a hundred meters away, its descent engines also sputtering as they ran out of fuel, but not too soon. The landing legs absorbed the impact, then suddenly all was still again. The two men watched, then slapped each other on the shoulder when they realized that their home away from home had landed safely.

“Ground Control, this is Major Tom. I am pleased to report that the module and I have made a safe landing at Plaskett Crater. Major Harris appears to be fine. We are going to enter the module now and begin preparations for our stay. Our thanks to everyone who made this mission possible.”

Major Harris was making a similar report. A quarter-million miles away, the people in two control rooms erupted in cheers. The jubilation was unstoppable. Amid the celebration, the Premier of China approached the Director of China's National Space Administration.

“Congratulations, Director, on a successful mission. You have demonstrated that our technology is the equal of the United States’, perhaps even better. And our country will gain great prestige on the world stage for having saved their astronaut. All in all, a glorious day for our nation, wouldn’t you agree?”

“Of course, Premier. But we still lost the race back to the Moon. And we didn’t establish the first permanent presence there. It is difficult to see how we achieved our main goal.”

“Perhaps we didn’t, Director, though it will be difficult for the United States to establish that claim since their own presence was not sustainable. But there is a new reality now, and we must move forward as best we can. There have been times in history when our people have been best served when the Middle Kingdom cooperated with those around it. Perhaps this is one of those times. A whole new direction may be opening up for our space program.”

The Director was silent. He knew that a “new direction” often meant a new director, be it here or in the United States. He looked around the control room as the celebration continued. A few technicians had returned to their stations, already assisting the two new residents of the Moon. But most of them had been involved in the flight and landing, and their jobs were finished. Many of them were gathered around Tom Liping and her son, offering congratulations and praising the efforts of their husband/father. Her star had just risen dramatically, and the Director would not be surprised if she was soon given a leadership position, perhaps even his own.

He sighed, thinking of how much he had put into the program, how much he had wanted to stay on as Director while the Moon base was built. But he could not help being caught up in the excitement. Perhaps, he thought, even his own ambition was not as important as this triumph of humanity. And with that realization, even the Director smiled.

CHAPTER TWENTY – Beginning

Tom Liping was standing in front of her new office at The Presidio in San Francisco. The old Army base had been donated to the City, which had been slowly filling it with organizations dedicated to public service. The newest was the Agency for the International Development of Outer Space. The ribbon-cutting ceremony would take place the next day, full of visiting dignitaries and speeches. But this evening was quiet, allowing her a moment for reflection.

Events had moved quickly following the Moon landings. The two nations quickly realized that neither of them could claim to have first established a permanent presence on the Moon. Though the U.S. had been first, it was China who had made the base sustainable. The Chinese government had decided to ratify the Moon Treaty and support the formation of an international agency to oversee all economic development in outer space, by governments or private enterprise, to make sure it is consistent with the treaties and would benefit all of humanity. There would be no economic exclusion zones, but there would be legal support for private activity, even property rights for space mining and settlements. This would avoid monopolies while still encouraging both exploration and commercial activities. The United States had objected at first, but when no other signatories to the treaties supported its claim and instead had agreed to create an international agency, the White House decided it had to go along or not have a seat at the table.

Of course, the devil was in the details, and regulations would need to be developed, with standards and recommended practices, to meet the changing reality. That would be the Agency's job, working with organizations around the world. There was a lot of debate over where it would be located, and who would first lead it. In the end, it was a compromise between the two nations who had led humanity back to the Moon; the agency would be in San Francisco, but it would be headed by someone from China who was acceptable to all. Tom Liping had been the obvious choice, as she had proposed such an agency at the Space Treaty conference and had been well received by all the representatives.

Now she stood on the lawn in front of the freshly painted building, looking at the Golden Gate Bridge and the vast expanse of the Pacific Ocean beyond. San Francisco was one of the newest cities in the world, the Bay Area's population among the most diverse, and it was the birthplace of the high-tech revolution. It didn't have a spaceport; the nearest launch facility was hundreds of miles to the south at Vandenberg Air Force Base. But starting tomorrow it would be the nexus of governance for humanity's expansion into outer space.

She heard a noise, and turned to see her son running toward her, with just enough time to brace herself before he slammed into her with a hug. Her husband followed behind; they had both just arrived from the airport. They greeted each other with a kiss and a hug, much shorter than the one when he had returned from the Moon, but still full of affection. Although Tom Liping had been scheduled to be on the ship that relieved him, the two taikonauts had decided that it would be better for their son to have the family together for a while. This also freed up her time and attention to get the new agency set up and running. But now her family had arrived from China for the opening, and it was time to share some time together.

"It is so good to see you again, my love," he said. "Things are so hectic in China. Everybody wants me to visit their organization and give a speech. A few days ago, I even went to our son's school for show-and-tell. I don't actually mind, but there are times when I miss our former life of obscurity!"

"I know what you mean. The Chinese community here is treating me like a goddess. And not just them. There are a lot of people who see this as a fresh start for humanity. I've even been invited to speak at a Star Trek convention! So much hope, so much idealism. And it's all because of you, dear husband."

"Because of us, dear wife. And all those who supported us."

They looked at each other, remembering all that had happened, and hugged again, joined quickly by their son. After a moment they ended their embrace, but still held each other side-by-side as they looked up at the quarter Moon, silvery white against the deep blue sky.

"By the way," she said, "What was the new access code that you used on the module after I sent you the old one?"

"0, 6, 0, 6, 8, 9." he replied with a smile.

She thought for a moment, then tears came to her eyes. "That's the date my father stood up to the tanks."

"Yes, it is. Your own act of defiance made me think of it. Let's just call it the ghost in the machine. There are some forces that cannot be stopped."

Once again they looked up at the Moon, both sensing a spirit looking down upon them, the spirit a father watching over his family with immense pride and joy. Major Tom looked down at her son, who returned her look with a smile. What adventures will he have, she thought, and what difficulties will he face? She shook her head to clear the thought, then looked up again at the sphere where four humans now resided. Her generation had faced its crisis and had triumphed. The future of the world – indeed, the solar system – was now up to his.

APPENDIX ONE – THE SPACE TREATIES

Treaty On Principles Governing The Activities Of States In The Exploration And Use Of Outer Space, Including The Moon And Other Celestial Bodies (The Outer Space Treaty, January 27, 1967)

The States Parties to this Treaty,

Inspired by the great prospects opening up before mankind as a result of man's entry into outer space,

Recognizing the common interest of all mankind in the progress of the exploration and use of outer space for peaceful purposes,

Believing that the exploration and use of outer space should be carried on for the benefit of all peoples irrespective of the degree of their economic or scientific development,

Desiring to contribute to broad international co-operation in the scientific as well as the legal aspects of the exploration and use of outer space for peaceful purposes,

Believing that such co-operation will contribute to the development of mutual understanding and to the strengthening of friendly relations between States and peoples,

Recalling resolution 1962 (XVIII), entitled "Declaration of Legal Principles Governing the Activities of States in the Exploration and Use of Outer Space", which was adopted unanimously by the United Nations General Assembly on 13 December 1963,

Recalling resolution 1884 (XVIII), calling upon States to refrain from placing in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction or from installing such weapons on celestial bodies, which was adopted unanimously by the United Nations General Assembly on 17 October 1963,

Taking account of United Nations General Assembly resolution 110 (II) of 3 November 1947, which condemned propaganda designed or likely to provoke or encourage any threat to the peace, breach of the peace or act of aggression, and considering that the aforementioned resolution is applicable to outer space,

Convinced that a Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the

moon and Other Celestial Bodies, will further the Purposes and Principles of the Charter of the United Nations,

Have agreed on the following:

Article I

The exploration and use of outer space, including the moon and other celestial bodies, shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development, and shall be the province of all mankind.

Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies.

There shall be freedom of scientific investigation in outer space, including the moon and other celestial bodies, and States shall facilitate and encourage international co-operation in such investigation.

Article II

Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means.

Article III

States Parties to the Treaty shall carry on activities in the exploration and use of outer space, including the moon and other celestial bodies, in accordance with international law, including the Charter of the United Nations, in the interest of maintaining international peace and security and promoting international co-operation and understanding.

Article IV

States Parties to the Treaty undertake not to place in orbit around the earth any objects carrying nuclear weapons or any other kinds of weapons of mass destruction, install such weapons on celestial bodies, or station such weapons in outer space in any other manner.

The moon and other celestial bodies shall be used by all States Parties to the Treaty exclusively for peaceful purposes. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military manoeuvres on celestial bodies shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or

facility necessary for peaceful exploration of the moon and other celestial bodies shall also not be prohibited.

Article V

States Parties to the Treaty shall regard astronauts as envoys of mankind in outer space and shall render to them all possible assistance in the event of accident, distress, or emergency landing on the territory of another State Party or on the high seas. When astronauts make such a landing, they shall be safely and promptly returned to the State of registry of their space vehicle.

In carrying on activities in outer space and on celestial bodies, the astronauts of one State Party shall render all possible assistance to the astronauts of other States Parties.

States Parties to the Treaty shall immediately inform the other States Parties to the Treaty or the Secretary-General of the United Nations of any phenomena they discover in outer space, including the moon and other celestial bodies, which could constitute a danger to the life or health of astronauts.

Article VI

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty. When activities are carried on in outer space, including the moon and other celestial bodies, by an international organization, responsibility for compliance with this Treaty shall be borne both by the international organization and by the States Parties to the Treaty participating in such organization.

Article VII

Each State Party to the Treaty that launches or procures the launching of an object into outer space, including the moon and other celestial bodies, and each State Party from whose territory or facility an object is launched, is internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons by such object or its component parts on the earth, in air space or in outer space, including the moon and other celestial bodies.

Article VIII

A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body. Ownership of objects launched into outer space, including objects landed or constructed on a celestial body, and of their component parts, is not affected by their presence in outer space or on a celestial body or by their return to the earth. Such objects or component parts found beyond the limits of the State Party to the Treaty on whose registry they are carried shall be returned to that State Party, which shall, upon request, furnish identifying data prior to their return.

Article IX

In the exploration and use of outer space, including the moon and other celestial bodies, States Parties to the Treaty shall be guided by the principle of co-operation and mutual assistance and shall conduct all their activities in outer space, including the moon and other celestial bodies, with due regard to the corresponding interests of all other States Parties to the Treaty. States Parties to the Treaty shall pursue studies of outer space, including the moon and other celestial bodies, and conduct exploration of them so as to avoid their harmful contamination and also adverse changes in the environment of the earth resulting from the introduction of extraterrestrial matter and, where necessary, shall adopt appropriate measures for this purpose. If a State Party to the Treaty has reason to believe that an activity or experiment planned by it or its nationals in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities of other States Parties in the peaceful exploration and use of outer space, including the moon and other celestial bodies, it shall undertake appropriate international consultations before proceeding with any such activity or experiment. A State Party to the Treaty which has reason to believe that an activity or experiment planned by another State Party in outer space, including the moon and other celestial bodies, would cause potentially harmful interference with activities in the peaceful exploration and use of outer space, including the moon and other celestial bodies, may request consultation concerning the activity or experiment.

Article X

In order to promote international co-operation in the exploration and use of outer space, including the moon and other celestial bodies, in conformity with the purposes of this Treaty, the States

Parties to the Treaty shall consider on a basis of equality any requests by other States Parties to the Treaty to be afforded an opportunity to observe the flight of space objects launched by those States.

The nature of such an opportunity for observation and the conditions under which it could be afforded shall be determined by agreement between the States concerned.

Article XI

In order to promote international co-operation in the peaceful exploration and use of outer space, States Parties to the Treaty conducting activities in outer space, including the moon and other celestial bodies, agree to inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of the nature, conduct, locations and results of such activities. On receiving the said information, the Secretary-General of the United Nations should be prepared to disseminate it immediately and effectively.

Article XII

All stations, installations, equipment and space vehicles on the moon and other celestial bodies shall be open to representatives of other States Parties to the Treaty on a basis of reciprocity. Such representatives shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited.

Article XIII

The provisions of this Treaty shall apply to the activities of States Parties to the Treaty in the exploration and use of outer space, including the moon and other celestial bodies, whether such activities are carried on by a single State Party to the Treaty or jointly with other States, including cases where they are carried on within the framework of international inter-governmental organizations.

Any practical questions arising in connection with activities carried on by international inter-governmental organizations in the exploration and use of outer space, including the moon and other celestial bodies, shall be resolved by the States Parties to the Treaty either with the appropriate international organization or with one or more States members of that international organization, which are Parties to this Treaty.

Article XIV

1. This Treaty shall be open to all States for signature. Any State which does not sign this Treaty before its entry into force in accordance with paragraph 3 of this Article may accede to it at any time.

2. This Treaty shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United Kingdom of Great Britain and Northern Ireland, the Union of Soviet Socialist Republics and the United States of America, which are hereby designated the Depositary Governments.

3. This Treaty shall enter into force upon the deposit of instruments of ratification by five Governments including the Governments designated as Depositary Governments under this Treaty.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Treaty, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification of and accession to this Treaty, the date of its entry into force and other notices.

6. This Treaty shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

Article XV

Any State Party to the Treaty may propose amendments to this Treaty. Amendments shall enter into force for each State Party to the Treaty accepting the amendments upon their acceptance by a majority of the States Parties to the Treaty and thereafter for each remaining State Party to the Treaty on the date of acceptance by it.

Article XVI

Any State Party to the Treaty may give notice of its withdrawal from the Treaty one year after its entry into force by written notification to the Depositary Governments. Such withdrawal shall take effect one year from the date of receipt of this notification.

Article XVII

This Treaty, of which the English, Russian, French, Spanish and Chinese texts are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of

this Treaty shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

IN WITNESS WHEREOF the undersigned, duly authorised, have signed this Treaty.

DONE in triplicate, at the cities of London, Moscow and Washington, the twenty-seventh day of January, one thousand nine hundred and sixty-seven.

Agreement On The Rescue Of Astronauts, The Return Of Astronauts And The Return Of Objects Launched Into Outer Space (April 22, 1968)

The Contracting Parties,

Noting the great importance of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, which calls for the rendering of all possible assistance to astronauts in the event of accident, distress or emergency landing, the prompt and safe return of astronauts, and the return of objects launched into outer space,

Desiring to develop and give further concrete expression to these duties,

Wishing to promote international co-operation in the peaceful exploration and use of outer space,

Prompted by sentiments of humanity,

Have agreed on the following:

Article 1

Each Contracting Party which receives information or discovers that the personnel of a spacecraft have suffered accident or are experiencing conditions of distress or have made an emergency or unintended landing in territory under its jurisdiction or on the high seas or in any other place not under the jurisdiction of any State shall immediately:

(a) notify the launching authority or, if it cannot identify and immediately communicate with the launching authority, immediately make a public announcement by all appropriate means of communication at its disposal;

(b) notify the Secretary-General of the United Nations, who should disseminate the information without delay by all appropriate means of communication at his disposal.

Article 2

If, owing to accident, distress, emergency or unintended landing, the personnel of a spacecraft land in territory under the jurisdiction of a Contracting Party, it shall immediately take all possible steps to rescue them and render them all necessary assistance. It shall inform the launching authority and also the Secretary-General of the United Nations of the steps it is taking and of their progress. If assistance by the launching authority would help to effect a prompt rescue or would contribute substantially to the effectiveness of search and rescue operations, the launching authority shall cooperate with the Contracting Party with a view to the effective conduct of search and rescue operations. Such operations shall be subject to the direction and control of the Contracting Party, which shall act in close and continuing consultation with the launching authority.

Article 3

If information is received or it is discovered that the personnel of a spacecraft have alighted on the high seas or in any other place not under the jurisdiction of any State, those Contracting Parties which are in a position to do so shall, if necessary, extend assistance in search and rescue operations for such personnel to assure their speedy rescue. They shall inform the launching authority and the Secretary-General of the United Nations of the steps they are taking and of their progress.

Article 4

If, owing to accident, distress, emergency or unintended landing, the personnel of a spacecraft land in territory under the jurisdiction of a Contracting Party or have been found on the high seas or in any other place not under the jurisdiction of any State, they shall be safely and promptly returned to representatives of the launching authority.

Article 5

1. Each Contracting Party which receives information or discovers that a space object or its component parts has returned to Earth in territory under its jurisdiction or on the high seas or in any other place not under the jurisdiction of any State, shall notify the launching authority and the Secretary-General of the United Nations.

2. Each Contracting Party having jurisdiction over the territory on which a space object or its component parts has been discovered shall, upon the request of the launching authority and with

assistance from that authority if requested, take such steps as it finds practicable to recover the object or component parts.

3. Upon request of the launching authority, objects launched into outer space or their component parts found beyond the territorial limits of the launching authority shall be returned to or held at the disposal of representatives of the launching authority, which shall, upon request, furnish identifying data prior to their return.

4. Notwithstanding paragraphs 2 and 3 of this Article, a Contracting Party which has reason to believe that a space object or its component parts discovered in territory under its jurisdiction, or recovered by it elsewhere, is of a hazardous or deleterious nature may so notify the launching authority, which shall immediately take effective steps, under the direction and control of the said Contracting Party, to eliminate possible danger of harm.

5. Expenses incurred in fulfilling obligations to recover and return a space object or its component parts under paragraphs 2 and 3 of this Article shall be borne by the launching authority.

Article 6

For the purposes of this Agreement, the term "launching authority" shall refer to the State responsible for launching, or, where an international intergovernmental organization is responsible for launching, that organization, provided that that organization declares its acceptance of the rights and obligations provided for in this Agreement and a majority of the States members of that organization are Contracting Parties to this Agreement and to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

Article 7

1. This Agreement shall be open to all States for signature. Any State which does not sign this Agreement before its entry into force in accordance with paragraph 3 of this Article may accede to it at any time.

2. This Agreement shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United Kingdom of Great Britain and Northern Ireland, the Union of Soviet Socialist Republics and the United States of America, which are hereby designated the Depositary Governments.

3. This Agreement shall enter into force upon the deposit of instruments of ratification by five Governments including the

Governments designated as Depositary Governments under this Agreement.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Agreement, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification of and accession to this Agreement, the date of its entry into force and other notices.

6. This Agreement shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

Article 8

Any State Party to the Agreement may propose amendments to this Agreement. Amendments shall enter into force for each State Party to the Agreement accepting the amendments upon their acceptance by a majority of the States Parties to the Agreement and thereafter for each remaining State Party to the Agreement on the date of acceptance by it.

Article 9

Any State Party to the Agreement may give notice of its withdrawal from the Agreement one year after its entry into force by written notification to the Depositary Governments. Such withdrawal shall take effect one year from the date of receipt of this notification.

Article 10

This Agreement, of which the English, Russian, French, Spanish and Chinese texts are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Agreement shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

In witness whereof the undersigned, duly authorised, have signed this Agreement.

Done in triplicate, at the cities of London, Moscow and Washington, the twenty-second day of April, one thousand nine hundred and sixty-eight.

Convention On International Liability For Damage Caused By Space Objects (September 1, 1972)

The States Parties to this Convention,
Recognizing the common interest of all mankind in furthering the exploration and use of outer space for peaceful purposes,

Recalling the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies,

Taking into consideration that, notwithstanding the precautionary measures to be taken by States and international intergovernmental organizations involved in the launching of space objects, damage may on occasion be caused by such objects,

Recognizing the need to elaborate effective international rules and procedures concerning liability for damage caused by space objects and to ensure, in particular, the prompt payment under the terms of this Convention of a full and equitable measure of compensation to victims of such damage,

Believing that the establishment of such rules and procedures will contribute to the strengthening of international co-operation in the field of the exploration and use of outer space for peaceful purposes,

Have agreed on the following:

Article I

For the purposes of this Convention:

(a) The term "damage" means loss of life, personal injury or other impairment of health; or loss of or damage to property of States or of persons, natural or juridical, or property of international intergovernmental organizations;

(b) The term "launching" includes attempted launching;

(c) The term "launching State" means:

(i) A State which launches or procures the launching of a space object;

(ii) A State from whose territory or facility a space object is launched;

(d) The term "space object" includes component parts of a space object as well as its launch vehicle and parts thereof.

Article II

A launching State shall be absolutely liable to pay compensation for damage caused by its space object on the surface of the earth or to aircraft flight.

Article III

In the event of damage being caused elsewhere than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, the latter shall be liable only if the damage is due to its fault or the fault of persons for whom it is responsible.

Article IV

1. In the event of damage being caused elsewhere than on the surface of the earth to a space object of one launching State or to persons or property on board such a space object by a space object of another launching State, and of damage thereby being caused to a third State or to its natural or juridical persons, the first two States shall be jointly and severally liable to the third State, to the extent indicated by the following:

(a) If the damage has been caused to the third State on the surface of the earth or to aircraft in flight, their liability to the third State shall be absolute;

(b) If the damage has been caused to a space object of the third State or to persons or property on board that space object elsewhere than on the surface of the earth, their liability to the third State shall be based on the fault of either of the first two States or on the fault of persons for whom either is responsible.

2. In all cases of joint and several liability referred to in paragraph 1 of this article, the burden of compensation for the damage shall be apportioned between the first two States in accordance with the extent to which they were at fault; if the extent of the fault of each of these States cannot be established, the burden of compensation shall be apportioned equally between them. Such apportionment shall be without prejudice to the right of the third State to seek the entire compensation due under this Convention from any or all of the launching States which are jointly and severally liable.

Article V

1. Whenever two or more States jointly launch a space object, they shall be jointly and severally liable for any damage caused.

2. A launching State which has paid compensation for damage shall have the right to present a claim for indemnification to other participants in the joint launching. The participants in a joint

launching may conclude agreements regarding the apportioning among themselves of the financial obligation in respect of which they are jointly and severally liable. Such agreements shall be without prejudice to the right of a State sustaining damage to seek the entire compensation due under this Convention from any or all of the launching States which are jointly and severally liable.

3. A State from whose territory or facility a space object is launched shall be regarded as a participant in a joint launching.

Article VI

1. Subject to the provisions of paragraph 2 of this Article, exoneration from absolute liability shall be granted to the extent that a launching State establishes that the damage has resulted either wholly or partially from gross negligence or from an act or omission done with intent to cause damage on the part of a claimant State or of natural or juridical persons it represents.

2. No exoneration whatever shall be granted in cases where the damage has resulted from activities conducted by a launching State which are not in conformity with international law including, in particular, the Charter of the United Nations and the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

Article VII

The provisions of this Convention shall not apply to damage caused by a space object of a launching State to:

(a) nationals of that launching State;

(b) foreign nationals during such time as they are participating in the operation of that space object from the time of its launching or at any stage thereafter until its descent, or during such time as they are in the immediate vicinity of a planned launching or recovery area as the result of an invitation by that launching State.

Article VIII

1. A State which suffers damage, or whose natural or juridical persons suffer damage, may present to a launching State a claim for compensation for such damage.

2. If the State of nationality has not presented a claim, another State may, in respect of damage sustained in its territory by any natural or juridical person, present a claim to a launching State.

3. If neither the State of nationality nor the State in whose territory the damage was sustained has presented a claim or notified its intention of presenting a claim, another State may, in

respect of damage sustained by its permanent residents, present a claim to a launching State.

Article IX

A claim for compensation for damage shall be presented to a launching State through diplomatic channels. If a State does not maintain diplomatic relations with the launching State concerned, it may request another State to present its claim to that launching State or otherwise represent its interests under this Convention. It may also present its claim through the Secretary-General of the United Nations, provided the claimant State and the launching State are both Members of the United Nations.

Article X

1. A claim for compensation for damage may be presented to a launching State not later than one year following the date of the occurrence of the damage or the identification of the launching State which is liable.

2. If, however, a State does not know of the occurrence of the damage or has not been able to identify the launching State which is liable, it may present a claim within one year following the date on which it learned of the aforementioned facts; however, this period shall in no event exceed one year following the date on which the State could reasonably be expected to have learned of the facts through the exercise of due diligence.

3. The time-limits specified in paragraphs 1 and 2 of this Article shall apply even if the full extent of the damage may not be known. In this event, however, the claimant State shall be entitled to revise the claim and submit additional documentation after the expiration of such time-limits until one year after the full extent of the damage is known.

Article XI

1. Presentation of a claim to a launching State for compensation for damage under this Convention shall not require the prior exhaustion of any local remedies which may be available to a claimant State or to natural or juridical persons it represents.

2. Nothing in this Convention shall prevent a State, or natural or juridical persons it might represent, from pursuing a claim in the courts or administrative tribunals or agencies of a launching State. A State shall not, however, be entitled to present a claim under this Convention in respect of the same damage for which a claim is being pursued in the courts or administrative tribunals or agencies

of a launching State or under another international agreement which is binding on the States concerned.

Article XII

The compensation which the launching State shall be liable to pay for damage under this Convention shall be determined in accordance with international law and the principles of justice and equity, in order to provide such reparation in respect of the damage as will restore the person, natural or juridical, State or international organization on whose behalf the claim is presented to the condition which would have existed if the damage had not occurred.

Article XIII

Unless the claimant State and the State from which compensation is due under this Convention agree on another form of compensation, the compensation shall be paid in the currency of the claimant State or, if that State so requests, in the currency of the State from which compensation is due.

Article XIV

If no settlement of a claim is arrived at through diplomatic negotiations as provided for in Article IX, within one year from the date on which the claimant State notifies the launching State that it has submitted the documentation of its claim, the parties concerned shall establish a Claims Commission at the request of either party.

Article XV

1. The Claims Commission shall be composed of three members: one appointed by the claimant State, one appointed by the launching State and the third member, the Chairman, to be chosen by both parties jointly. Each party shall make its appointment within two months of the request for the establishment of the Claims Commission.

2. If no agreement is reached on the choice of the Chairman within four months of the request for the establishment of the Commission, either party may request the Secretary-General of the United Nations to appoint the Chairman within a further period of two months.

Article XVI

1. If one of the parties does not make its appointment within the stipulated period, the Chairman shall, at the request of the other party, constitute a single-member Claims Commission.

2. Any vacancy which may arise in the Commission for whatever reason shall be filled by the same procedure adopted for the original appointment.

3. The Commission shall determine its own procedure.

4. The Commission shall determine the place or places where it shall sit and all other administrative matters.

5. Except in the case of decisions and awards by a single-member Commission, all decisions and awards of the Commission shall be by majority vote.

Article XVII

No increase in the membership of the Claims Commission shall take place by reason of two or more claimant States or launching States being joined in any one proceeding before the Commission. The claimant States so joined shall collectively appoint one member of the Commission in the same manner and subject to the same conditions as would be the case for a single claimant State. When two or more launching States are so joined, they shall collectively appoint one member of the Commission in the same way. If the claimant States or the launching States do not make the appointment within the stipulated period, the Chairman shall constitute a single-member Commission.

Article XVIII

The Claims Commission shall decide the merits of the claim for compensation and determine the amount of compensation payable, if any.

Article XIX

1. The Claims Commission shall act in accordance with the provisions of Article XII.

2. The decision of the Commission shall be final and binding if the parties have so agreed; otherwise the Commission shall render a final and recommendatory award, which the parties shall consider in good faith. The Commission shall state the reasons for its decision or award.

3. The Commission shall give its decision or award as promptly as possible and no later than one year from the date of its establishment, unless an extension of this period is found necessary by the Commission.

4. The Commission shall make its decision or award public. It shall deliver a certified copy of its decision or award to each of the parties and to the Secretary-General of the United Nations.

Article XX

The expenses in regard to the Claims Commission shall be borne equally by the parties, unless otherwise decided by the Commission.

Article XXI

If the damage caused by a space object presents a large-scale danger to human life or seriously interferes with the living conditions of the population or the functioning of vital centres, the States Parties, and in particular the launching State, shall examine the possibility of rendering appropriate and rapid assistance to the State which has suffered the damage, when it so requests. However, nothing in this article shall affect the rights or obligations of the States Parties under this Convention.

Article XXII

1. In this Convention, with the exception of Articles XXIV to XXVII, references to States shall be deemed to apply to any international intergovernmental organization which conducts space activities if the organization declares its acceptance of the rights and obligations provided for in this Convention and if a majority of the States members of the organization are States Parties to this Convention and to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

2. States members of any such organization which are States Parties to this Convention shall take all appropriate steps to ensure that the organization makes a declaration in accordance with the preceding paragraph.

3. If an international intergovernmental organization is liable for damage by virtue of the provisions of this Convention, that organization and those of its members which are States Parties to this Convention shall be jointly and severally liable; provided, however, that:

(a) any claim for compensation in respect of such damage shall be first presented to the organization;

(b) only where the organization has not paid, within a period of six months, any sum agreed or determined to be due as compensation for such damage, may the claimant State invoke the liability of the members which are States Parties to this Convention for the payment of that sum.

4. Any claim, pursuant to the provisions of this Convention, for compensation in respect of damage caused to an organization which has made a declaration in accordance with paragraph 1 of this Article shall be presented by a State member of the organization which is a State Party to this Convention.

Article XXIII

1. The provisions of this Convention shall not affect other international agreements in force in so far as relations between the States Parties to such agreements are concerned.

2. No provision of this Convention shall prevent States from concluding international agreements reaffirming, supplementing or extending its provisions.

Article XXIV

1. This Convention shall be open to all States for signature. Any State which does not sign this Convention before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.

2. This Convention shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Governments of the United Kingdom of Great Britain and Northern Ireland, the Union of Soviet Socialist Republics and the United States of America, which are hereby designated the Depositary Governments.

3. This Convention shall enter into force on the deposit of the fifth instrument of ratification.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Convention, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Depositary Governments shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification of and accession to this Convention, the date of its entry into force and other notices.

6. This Convention shall be registered by the Depositary Governments pursuant to Article 102 of the Charter of the United Nations.

Article XXV

Any State Party to this Convention may propose amendments to this Convention. Amendments shall enter into force for each State Party to the Convention accepting the amendments upon their acceptance by a majority of the States Parties to the Convention and thereafter for each remaining State Party to the Convention on the date of acceptance by it.

Article XXVI

Ten years after the entry into force of this Convention, the question of the review of this Convention shall be included in the provisional agenda of the United Nations General Assembly in order

to consider, in the light of past application of the Convention, whether it requires revision. However, at any time after the Convention has been in force for five years, and at the request of one third of the States Parties to the Convention, and with the concurrence of the majority of the States Parties, a conference of the States Parties shall be convened to review this Convention.

Article XXVII

Any State Party to this Convention may give notice of its withdrawal from the Convention one year after its entry into force by written notification to the Depositary Governments. Such withdrawal shall take effect one year from the date of receipt of this notification.

Article XXVIII

This Convention, of which the English, Russian, French, Spanish and Chinese texts are equally authentic, shall be deposited in the archives of the Depositary Governments. Duly certified copies of this Convention shall be transmitted by the Depositary Governments to the Governments of the signatory and acceding States.

IN WITNESS WHEREOF the undersigned, duly authorized thereto, have signed this Convention.

DONE in triplicate, at the cities of London, Moscow and Washington, this twenty-ninth day of March, one thousand nine hundred and seventy-two.

Convention On Registration Of Objects Launched Into Outer Space (September 15, 1976)

The States Parties to this Convention,

Recognizing the common interest of all mankind in furthering the exploration and use of outer space for peaceful purposes,

Recalling that the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies of 27 January 1967 affirms that States shall bear international responsibility for their national activities in outer space and refers to the State on whose registry an object launched into outer space is carried,

Recalling also that the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space of 22 April 1968 provides that a launching authority shall, upon request, furnish identifying data prior to the return of an object it has launched into outer space found beyond the territorial limits of the launching authority,

Recalling further that the Convention on International Liability for Damage Caused by Space Objects of 29 March 1972 establishes international rules and procedures concerning the liability of launching States for damage caused by their space objects,

Desiring, in the light of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, to make provision for the national registration by launching States of space objects launched into outer space,

Desiring further that a central register of objects launched into outer space be established and maintained, on a mandatory basis, by the Secretary-General of the United Nations,

Desiring also to provide for States Parties additional means and procedures to assist in the identification of space objects,

Believing that a mandatory system of registering objects launched into outer space would, in particular, assist in their identification and would contribute to the application and development of international law governing the exploration and use of outer space,

Have agreed on the following:

Article I

For the purposes of this Convention:

(a) The term "launching State" means:

(i) A State which launches or procures the launching of a space object;

(ii) A State from whose territory or facility a space object is launched;

(b) The term "space object" includes component parts of a space object as well as its launch vehicle and parts thereof;

(c) The term "State of registry" means a launching State on whose registry a space object is carried in accordance with article II.

Article II

1. When a space object is launched into earth orbit or beyond, the launching State shall register the space object by means of an entry in an appropriate registry which it shall maintain. Each launching State shall inform the Secretary-General of the United Nations of the establishment of such a registry.

2. Where there are two or more launching States in respect of any such space object, they shall jointly determine which one of them shall register the object in accordance with paragraph 1 of this article, bearing in mind the provisions of article VIII of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, and without prejudice to appropriate agreements concluded or to be concluded among the launching States on jurisdiction and control over the space object and over any personnel thereof.

3. The contents of each registry and the conditions under which it is maintained shall be determined by the State of registry concerned.

Article III

1. The Secretary-General of the United Nations shall maintain a Register in which the information furnished in accordance with article IV shall be recorded.

2. There shall be full and open access to the information in this Register.

Article IV

1. Each State of registry shall furnish to the Secretary-General of the United Nations, as soon as practicable, the following information concerning each space object carried on its registry:

(a) name of launching State or States;

(b) an appropriate designator of the space object or its registration number;

(c) date and territory or location of launch;

- (d) basic orbital parameters, including:
 - (i) nodal period;
 - (ii) inclination;
 - (iii) apogee;
 - (iv) perigee;
- (e) general function of the space object.

2. Each State of registry may, from time to time, provide the Secretary-General of the United Nations with additional information concerning a space object carried on its registry.

3. Each State of registry shall notify the Secretary-General of the United Nations, to the greatest extent feasible and as soon as practicable, of space objects concerning which it has previously transmitted information, and which have been but no longer are in earth orbit.

Article V

Whenever a space object launched into earth orbit or beyond is marked with the designator or registration number referred to in article IV, paragraph 1 (b), or both, the State of registry shall notify the Secretary-General of this fact when submitting the information regarding the space object in accordance with article IV. In such case, the Secretary-General of the United Nations shall record this notification in the Register.

Article VI

Where the application of the provisions of this Convention has not enabled a State Party to identify a space object which has caused damage to it or to any of its natural or juridical persons, or which may be of a hazardous or deleterious nature, other States Parties, including in particular States possessing space monitoring and tracking facilities, shall respond to the greatest extent feasible to a request by that State Party, or transmitted through the Secretary-General on its behalf, for assistance under equitable and reasonable conditions in the identification of the object. A State Party making such a request shall, to the greatest extent feasible, submit information as to the time, nature and circumstances of the events giving rise to the request. Arrangements under which such assistance shall be rendered shall be the subject of agreement between the parties concerned.

Article VII

1. In this Convention, with the exception of articles VIII to XII inclusive, references to States shall be deemed to apply to any international intergovernmental organization which conducts space

activities if the organization declares its acceptance of the rights and obligations provided for in this Convention and if a majority of the States members of the organization are States Parties to this Convention and to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

2. States members of any such organization which are States Parties to this Convention shall take all appropriate steps to ensure that the organization makes a declaration in accordance with paragraph 1 of this article.

Article VIII

1. This Convention shall be open for signature by all States at United Nations Headquarters in New York. Any State which does not sign this Convention before its entry into force in accordance with paragraph 3 of this article may accede to it at any time.

2. This Convention shall be subject to ratification by signatory States. Instruments of ratification and instruments of accession shall be deposited with the Secretary-General of the United Nations.

3. This Convention shall enter into force among the States which have deposited instruments of ratification on the deposit of the fifth such instrument with the Secretary-General of the United Nations.

4. For States whose instruments of ratification or accession are deposited subsequent to the entry into force of this Convention, it shall enter into force on the date of the deposit of their instruments of ratification or accession.

5. The Secretary-General shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification of and accession to this Convention, the date of its entry into force and other notices.

Article IX

Any State Party to this Convention may propose amendments to the Convention. Amendments shall enter into force for each State Party to the Convention accepting the amendments upon their acceptance by a majority of the States Parties to the Convention and thereafter for each remaining State Party to the Convention on the date of acceptance by it.

Article X

Ten years after the entry into force of this Convention, the question of the review of the Convention shall be included in the provisional agenda of the United Nations General Assembly in order to consider, in the light of past application of the Convention,

whether it requires revision. However, at any time after the Convention has been in force for five years, at the request of one third of the States Parties to the Convention and with the concurrence of the majority of the States Parties, a conference of the States Parties shall be convened to review this Convention. Such review shall take into account in particular any relevant technological developments, including those relating to the identification of space objects.

Article XI

Any State Party to this Convention may give notice of its withdrawal from the Convention one year after its entry into force by written notification to the Secretary-General of the United Nations. Such withdrawal shall take effect one year from the date of receipt of this notification.

Article XII

The original of this Convention, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations, who shall send certified copies thereof to all signatory and acceding States.

IN WITNESS WHEREOF the undersigned, being duly authorized thereto by their respective Governments, have signed this Convention, opened for signature at New York on the fourteenth day of January, one thousand nine hundred and seventy-five.

Agreement Governing The Activities Of States On The Moon And Other Celestial Bodies (July 11, 1984)

The States Parties to this Agreement,

Noting the achievements of States in the exploration and use of the moon and other celestial bodies,

Recognizing that the moon, as a natural satellite of the earth, has an important role to play in the exploration of outer space,

Determined to promote on the basis of equality the further development of co-operation among States in the exploration and use of the moon and other celestial bodies,

Desiring to prevent the moon from becoming an area of international conflict,

Bearing in mind the benefits which may be derived from the exploitation of the natural resources of the moon and other celestial bodies,

Recalling the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies, the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space, the Convention on International Liability for Damage Caused by Space Objects, and the Convention on Registration of Objects Launched into Outer Space,

Taking into account the need to define and develop the provisions of these international instruments in relation to the moon and other celestial bodies, having regard to further progress in the exploration and use of outer space,

Have agreed on the following:

Article 1

1. The provisions of this Agreement relating to the moon shall also apply to other celestial bodies within the solar system, other than the earth, except in so far as specific legal norms enter into force with respect to any of these celestial bodies.

2. For the purposes of this Agreement reference to the moon shall include orbits around or other trajectories to or around it.

3. This Agreement does not apply to extraterrestrial materials which reach the surface of the earth by natural means.

Article 2

All activities on the moon, including its exploration and use, shall be carried out in accordance with international law, in particular the

Charter of the United Nations, and taking into account the Declaration on Principles of International Law concerning Friendly Relations and Co-operation among States in accordance with the Charter of the United Nations, adopted by the General Assembly on 24 October 1970, in the interest of maintaining international peace and security and promoting international co-operation and mutual understanding, and with due regard to the corresponding interests of all other States Parties.

Article 3

1. The moon shall be used by all States Parties exclusively for peaceful purposes.

2. Any threat or use of force or any other hostile act or threat of hostile act on the moon is prohibited. It is likewise prohibited to use the moon in order to commit any such act or to engage in any such threat in relation to the earth, the moon, spacecraft, the personnel of spacecraft or man-made space objects.

3. States Parties shall not place in orbit around or other trajectory to or around the moon objects carrying nuclear weapons or any other kinds of weapons of mass destruction or place or use such weapons on or in the moon.

4. The establishment of military bases, installations and fortifications, the testing of any type of weapons and the conduct of military maneuvers on the moon shall be forbidden. The use of military personnel for scientific research or for any other peaceful purposes shall not be prohibited. The use of any equipment or facility necessary for peaceful exploration and use of the moon shall also not be prohibited.

Article 4

1. The exploration and use of the moon shall be the province of all mankind and shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development. Due regard shall be paid to the interests of present and future generations as well as to the need to promote higher standards of living and conditions of economic and social progress and development in accordance with the Charter of the United Nations.

2. States Parties shall be guided by the principle of co-operation and mutual assistance in all their activities concerning the exploration and use of the moon. International co-operation in pursuance of this Agreement should be as wide as possible and

may take place on a multilateral basis, on a bilateral basis or through international intergovernmental organizations.

Article 5

1. States Parties shall inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of their activities concerned with the exploration and use of the moon. Information on the time, purposes, locations, orbital parameters and duration shall be given in respect of each mission to the moon as soon as possible after launching, while information on the results of each mission, including scientific results, shall be furnished upon completion of the mission. In the case of a mission lasting more than sixty days, information on conduct of the mission, including any scientific results, shall be given periodically, at thirty-day intervals. For missions lasting more than six months, only significant additions to such information need be reported thereafter.

2. If a State Party becomes aware that another State Party plans to operate simultaneously in the same area of or in the same orbit around or trajectory to or around the moon, it shall promptly inform the other State of the timing of and plans for its own operations.

3. In carrying out activities under this Agreement, States Parties shall promptly inform the Secretary-General, as well as the public and the international scientific community, of any phenomena they discover in outer space, including the moon, which could endanger human life or health, as well as of any indication of organic life.

Article 6

1. There shall be freedom of scientific investigation on the moon by all States Parties without discrimination of any kind, on the basis of equality and in accordance with international law.

2. In carrying out scientific investigations and in furtherance of the provisions of this Agreement, the States Parties shall have the right to collect on and remove from the moon samples of its mineral and other substances. Such samples shall remain at the disposal of those States Parties which caused them to be collected and may be used by them for scientific purposes. States Parties shall have regard to the desirability of making a portion of such samples available to other interested States Parties and the international scientific community for scientific investigation. States Parties may in the course of scientific investigations also use mineral and other substances of the moon in quantities appropriate for the support of their missions.

3. States Parties agree on the desirability of exchanging scientific and other personnel on expeditions to or installations on the moon to the greatest extent feasible and practicable.

Article 7

1. In exploring and using the moon, States Parties shall take measures to prevent the disruption of the existing balance of its environment, whether by introducing adverse changes in that environment, by its harmful contamination through the introduction of extra-environmental matter or otherwise. States Parties shall also take measures to avoid harmfully affecting the environment of the earth through the introduction of extraterrestrial matter or otherwise.

2. States Parties shall inform the Secretary-General of the United Nations of the measures being adopted by them in accordance with paragraph 1 of this article and shall also, to the maximum extent feasible, notify him in advance of all placements by them of radioactive materials on the moon and of the purposes of such placements.

3. States Parties shall report to other States Parties and to the Secretary-General concerning areas of the moon having special scientific interest in order that, without prejudice to the rights of other States Parties, consideration may be given to the designation of such areas as international scientific preserves for which special protective arrangements are to be agreed upon in consultation with the competent bodies of the United Nations.

Article 8

1. States Parties may pursue their activities in the exploration and use of the moon anywhere on or below its surface, subject to the provisions of this Agreement.

2. For these purposes States Parties may, in particular:

(a) Land their space objects on the moon and launch them from the moon;

(b) Place their personnel, space vehicles, equipment, facilities, stations and installations anywhere on or below the surface of the moon.

Personnel, space vehicles, equipment, facilities, stations and installations may move or be moved freely over or below the surface of the moon.

3. Activities of States Parties in accordance with paragraphs 1 and 2 of this article shall not interfere with the activities of other States Parties on the moon. Where such interference may occur,

the States Parties concerned shall undertake consultations in accordance with article 15, paragraphs 2 and 3, of this Agreement.

Article 9

1. States Parties may establish manned and unmanned stations on the moon. A State Party establishing a station shall use only that area which is required for the needs of the station and shall immediately inform the Secretary-General of the United Nations of the location and purposes of that station. Subsequently, at annual intervals that State shall likewise inform the Secretary-General whether the station continues in use and whether its purposes have changed.

2. Stations shall be installed in such a manner that they do not impede the free access to all areas of the moon of personnel, vehicles and equipment of other States Parties conducting activities on the moon in accordance with the provisions of this Agreement or of Article I of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies.

Article 10

1. States Parties shall adopt all practicable measures to safeguard the life and health of persons on the moon. For this purpose they shall regard any person on the moon as an astronaut within the meaning of article V of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies and as part of the personnel of a spacecraft within the meaning of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space.

2. States Parties shall offer shelter in their stations, installations, vehicles and other facilities to persons in distress on the moon.

Article 11

1. The moon and its natural resources are the common heritage of mankind, which finds its expression in the provisions of this Agreement, in particular in paragraph 5 of this article.

2. The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means.

3. Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of

any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof. The foregoing provisions are without prejudice to the international regime referred to in paragraph 5 of this article.

4. States Parties have the right to exploration and use of the moon without discrimination of any kind, on the basis of equality and in accordance with international law and the terms of this Agreement.

5. States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. This provision shall be implemented in accordance with Article 18 of this Agreement.

6. In order to facilitate the establishment of the international regime referred to in paragraph 5 of this article, States Parties shall inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of any natural resources they may discover on the moon.

7. The main purposes of the international regime to be established shall include:

(a) The orderly and safe development of the natural resources of the moon;

(b) The rational management of those resources;

(c) The expansion of opportunities in the use of those resources;

(d) An equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of those countries which have contributed either directly or indirectly to the exploration of the moon, shall be given special consideration.

8. All the activities with respect to the natural resources of the moon shall be carried out in a manner compatible with the purposes specified in paragraph 7 of this article and the provisions of Article 6, paragraph 2, of this Agreement.

Article 12

1. States Parties shall retain jurisdiction and control over their personnel, vehicles, equipment, facilities, stations and installations on the moon. The ownership of space vehicles, equipment, facilities,

stations and installations shall not be affected by their presence on the moon.

2. Vehicles, installations and equipment or their component parts found in places other than their intended location shall be dealt with in accordance with Article 5 of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space.

3. In the event of an emergency involving a threat to human life, States Parties may use the equipment, vehicles, installations, facilities or supplies of other States Parties on the moon. Prompt notification of such use shall be made to the Secretary-General of the United Nations or the State Party concerned.

Article 13

A State Party which learns of the crash landing, forced landing or other unintended landing on the moon of a space object, or its component parts, that were not launched by it, shall promptly inform the launching State Party and the Secretary-General of the United Nations.

Article 14

1. States Parties to this Agreement shall bear international responsibility for national activities on the moon, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in this Agreement. States Parties shall ensure that non-governmental entities under their jurisdiction shall engage in activities on the moon only under the authority and continuing supervision of the appropriate State Party.

2. States Parties recognize that detailed arrangements concerning liability for damage caused on the moon, in addition to the provisions of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies and the Convention on International Liability for Damage Caused by Space Objects, may become necessary as a result of more extensive activities on the moon. Any such arrangements shall be elaborated in accordance with the procedure provided for in article 18 of this Agreement.

Article 15

1. Each State Party may assure itself that the activities of other States Parties in the exploration and use of the moon are

compatible with the provisions of this Agreement. To this end, all space vehicles, equipment, facilities, stations and installations on the moon shall be open to other States Parties. Such States Parties shall give reasonable advance notice of a projected visit, in order that appropriate consultations may be held and that maximum precautions may be taken to assure safety and to avoid interference with normal operations in the facility to be visited. In pursuance of this article, any State Party may act on its own behalf or with the full or partial assistance of any other State Party or through appropriate international procedures within the framework of the United Nations and in accordance with the Charter.

2. A State Party which has reason to believe that another State Party is not fulfilling the obligations incumbent upon it pursuant to this Agreement or that another State Party is interfering with the rights which the former State has under this Agreement may request consultations with that State Party. A State Party receiving such a request shall enter into such consultations without delay. Any other State Party which requests to do so shall be entitled to take part in the consultations. Each State Party participating in such consultations shall seek a mutually acceptable resolution of any controversy and shall bear in mind the rights and interests of all States Parties. The Secretary-General of the United Nations shall be informed of the results of the consultations and shall transmit the information received to all States Parties concerned.

3. If the consultations do not lead to a mutually acceptable settlement which has due regard for the rights and interests of all States Parties, the parties concerned shall take all measures to settle the dispute by other peaceful means of their choice appropriate to the circumstances and the nature of the dispute. If difficulties arise in connection with the opening of consultations or if consultations do not lead to a mutually acceptable settlement, any State Party may seek the assistance of the Secretary-General, without seeking the consent of any other State Party concerned, in order to resolve the controversy. A State Party which does not maintain diplomatic relations with another State Party concerned shall participate in such consultations, at its choice, either itself or through another State Party or the Secretary-General as intermediary.

Article 16

With the exception of articles 17 to 21, references in this Agreement to States shall be deemed to apply to any international

intergovernmental organization which conducts space activities if the organization declares its acceptance of the rights and obligations provided for in this Agreement and if a majority of the States members of the organization are States Parties to this Agreement and to the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies. States members of any such organization which are States Parties to this Agreement shall take all appropriate steps to ensure that the organization makes a declaration in accordance with the foregoing.

Article 17

Any State Party to this Agreement may propose amendments to the Agreement. Amendments shall enter into force for each State Party to the Agreement accepting the amendments upon their acceptance by a majority of the States Parties to the Agreement and thereafter for each remaining State Party to the Agreement on the date of acceptance by it.

Article 18

Ten years after the entry into force of this Agreement, the question of the review of the Agreement shall be included in the provisional agenda of the General Assembly of the United Nations in order to consider, in the light of past application of the Agreement, whether it requires revision. However, at any time after the Agreement has been in force for five years, the Secretary-General of the United Nations, as depository, shall, at the request of one third of the States Parties to the Agreement and with the concurrence of the majority of the States Parties, convene a conference of the States Parties to review this Agreement. A review conference shall also consider the question of the implementation of the provisions of Article 11, paragraph 5, on the basis of the principle referred to in paragraph 1 of that article and taking into account in particular any relevant technological developments.

Article 19

1. This Agreement shall be open for signature by all States at United Nations Headquarters in New York.

2. This Agreement shall be subject to ratification by signatory States. Any State which does not sign this Agreement before its entry into force in accordance with paragraph 3 of this article may accede to it at any time. Instruments of ratification or accession shall be deposited with the Secretary-General of the United Nations.

3. This Agreement shall enter into force on the thirtieth day following the date of deposit of the fifth instrument of ratification.

4. For each State depositing its instrument of ratification or accession after the entry into force of this Agreement, it shall enter into force on the thirtieth day following the date of deposit of any such instrument.

5. The Secretary-General shall promptly inform all signatory and acceding States of the date of each signature, the date of deposit of each instrument of ratification or accession to this Agreement, the date of its entry into force and other notices.

Article 20

Any State Party to this Agreement may give notice of its withdrawal from the Agreement one year after its entry into force by written notification to the Secretary-General of the United Nations. Such withdrawal shall take effect one year from the date of receipt of this notification.

Article 21

The original of this Agreement, of which the Arabic, Chinese, English, French, Russian and Spanish texts are equally authentic, shall be deposited with the Secretary-General of the United Nations, who shall send certified copies thereof to all signatory and acceding States.

IN WITNESS WHEREOF the undersigned, being duly authorized thereto by their respective Governments, have signed this Agreement, opened for signature at New York on 18 December 1979.

APPENDIX TWO

The Way Forward:

An Implementation Agreement for the Moon Treaty

By Dennis O'Brien

8th CSA-IAA Conference on Advanced Space Technology
Shanghai, China, Sept. 2019

Abstract

The United Nations' Committee on the Peaceful Uses of Outer Space has accomplished much over the decades, most notably the five space treaties and related guiding principles. But it has failed to produce the international framework of laws needed to support humanity's departure from our home planet. The Moon Treaty, with the proper Implementation Agreement, now offers the best hope for doing so. Such an agreement would need to address many issues, most involving private enterprise and settlements. Although some argue that the Moon Treaty would hinder private space activities, with the proper IA it would in fact support them.

The Space Treaty Project has proposed a ten-paragraph Implementation Agreement that is based on **four organizational principles**:

- 1) The Agreement must be **comprehensive** and support **all private activity**;
- 2) **Trade** private property rights for public policy obligations (The Grand Bargain);
- 3) **Defer** issues currently at impasse (e.g., monetary sharing of benefits) by creating a governance process for making future decisions;
- 4) **Build** upon and integrate current institutions and processes.

Why is this proposal necessary? As of July 2019, there is no internationally recognized mechanism for granting property rights to anyone for any location or natural object in outer space. The current controlling international law is the Outer Space Treaty of 1967, which prohibits any one country from appropriating anything in outer space:

"Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means."

Most countries agree that the prohibition against appropriation

prevents any country from granting property rights on its own authority. A small minority disagree, enough so that the potential for conflict has grown. Since one of the goals of law to avoid conflicts, it is imperative to create the international framework before they occur.

The Moon Treaty provides the international authority to grant property rights. Article 11 does not prohibit ownership; it just prohibits any one country from granting it. The proposed Implementation Agreement provides the minimum framework of international law that is necessary at this time for public and private activity on the Moon and beyond.

At this moment in time, it is space law itself that needs capacity building. The current framework is inadequate, resulting in endless arguments over the meaning of outdated agreements.

The hopes and dreams of individuals and groups to create new societies in outer space are just as important as the entrepreneurship of those seeking to engage in space commerce. Both must be recognized, honored, and nurtured if humanity is to leave our home planet in a sustainable manner.

The mission of space law must be nothing less than to restore hope, to inspire humanity by giving the people of our planet a future they can believe in. To counter the despair of war and violence and neglect. To build that shining city on a hill that will light the way for all.

There will be only one time when humanity leaves our home world, only one chance to create a new pattern that will lead each person, and all people, to their best destiny. That time is now.

1. Introduction

The United Nations' Committee on the Peaceful Uses of Outer Space (COPUOS), through its consensus process, has accomplished much over the decades, most notably helping to produce the five space treaties and related guiding principles. But it has failed to produce an international framework of laws to facilitate humanity's departure from our home planet. At the April 2019 meeting of its Legal Subcommittee, a proposal by Greece and Belgium to use COPUOS to draft such a framework failed to achieve consensus. [1] At the same meeting, Austria, one of the 18 current States Parties of the Moon Treaty, called on other nations to adopt it. [2] The Moon Treaty, with the proper Implementation Agreement (IA), now offers the best hope for creating the

international framework of laws. Such an agreement would need to address many issues, most involving private enterprise and settlements. Although some argue that the Moon Treaty would hinder private space activities, with the proper IA it would in fact support them.

At its full committee meeting in June, COPUOS adopted 21 “Guidelines for the Long-term Sustainability of Outer Space Activities”. The Guidelines encourage national governments to adopt policies and regulations that will ensure the peaceful and sustainable use and exploration of outer space on behalf of all people, including future generations. But they do not provide enough specifics or a legal foundation for private activity in outer space, only the hope that countries will work together and somehow adopt identical regulations. [3]

The Space Treaty Project (see end comments) has proposed a ten-paragraph Implementation Agreement that is based on **four organizational principles**:

- 1) The Agreement must be **comprehensive** and support **all private activity**;
- 2) **Trade** private property rights for public policy obligations (The Grand Bargain);
- 3) **Defer** issues currently at impasse (e.g., monetary sharing of benefits) by creating a governance process for making future decisions;
- 4) **Build upon and integrate** current institutions and processes.

2. Proposed Implementation Agreement for Article 11 of the Moon Treaty

Preamble: The provisions of this Agreement and the Treaty shall be interpreted and applied together as a single instrument. In the event of any inconsistency between this Agreement and the Treaty, the provisions of this Agreement shall prevail. After the adoption of this Agreement, any instrument of ratification or formal confirmation of or accession to the Treaty shall also represent consent to be bound by this Agreement. No State or entity may establish its consent to be bound by this Agreement unless it has previously established or establishes at the same time its consent to be bound by the Treaty.

2.1. Creation of Agency

The States Parties agree to create as soon as is practicable an agency ("Agency") to administer the provisions of the Agreement Governing The Activities Of States On The Moon And Other Celestial Bodies ("Treaty") and this Implementation Agreement ("Agreement").

2.2. Licenses for Private Activity

The Agency shall be authorized to issue licenses to non-governmental entities ("NGE") for the priority exploitation of resources. Exploitation of resources shall include but is not limited to: (a) the extraction of materials, (b) the use of a location for any other commercial activity (such as tourism), and (c) the use of a location for noncommercial private activity (such as settlements). Licenses shall describe the extent, duration, and nature of the activity and shall maximize access for all in accordance with Treaty Article 8. Use by governments is authorized under Treaty Articles 8 and 9.

2.3. Requirements for License

The Agency shall issue a license upon the proper application by any NGE that is authorized and supervised by a State Party to this agreement. The States Parties agree to require that their nationals (a) accept the public policy obligations of the Treaty as mandated by Treaty Article 14, and (b) share technology as described in Paragraph 5 of this Agreement. The license shall be revoked if, at any time, a licensed NGE fails to comply with its obligations.

2.4. Public Policy Obligations

The public policy obligations of the Treaty include the following:

1. Using outer space exclusively for peaceful purposes (Article 3.1);
2. Providing co-operation and mutual assistance (4.2);
3. Informing the public of activities, any scientific discoveries, any phenomena which could endanger human life or health, or any indication of organic life (5.1-5.3), along with full compliance with the Registration Convention;
4. Protecting the environment and preserving areas of "special scientific interest" such as historic landing sites (7.1-7.3);
5. Allowing free access to all areas by other parties (9.2);
6. Honoring the Rescue Treaty (10.1)
7. Informing the public of the discovery of resources (11.6).

2.5. Sharing Technology

In accordance with Treaty Article 4, the States Parties agree to develop a process for sharing technology on a mutually acceptable basis. Until or in the absence of such a process, the States Parties agree to require their nationals to license technology at no more than fair market value. Technology that is subject to export controls shall be excluded from these requirements.

2.6. Standards and Recommended Practices; Registry

The States Parties, in consultation with private enterprise and international organizations, agree to develop technology standards and recommended practices for the safe use and development of space resources. Such standards or practices shall not require technology that is subject to export controls. The Agency and/or other designated entities shall maintain the registry of such information that is not included in the registry for the Registration Convention maintained by the United Nations

2.7. Heritage Sites

The States Parties agree to prohibit the use or disturbance of any location on the Moon or other celestial body that is the site of a historical mission that occurred prior to the year 2000 pending a final determination of the site's status as a Cultural Heritage Site. This prohibition applies to the location of any equipment and any evidence of presence (e.g., footprints, tracks). The States Parties agree to develop standards and recommended practices for making such determinations or to designate another entity/process for making such determinations that will be binding on the States Parties.

2.8. Collection of Fees; Governance

The States Parties are ultimately responsible for the Agency, which shall be operated in a cost-effective manner. By adoption of this agreement, the States Parties authorize the Agency to collect fees to pay for its administrative costs. The collection and use of fees for any other purpose must be authorized by the States Parties. The States Parties agree to create a process of governance for making this and other substantive decisions as authorized under Article 18 of the Treaty.

2.9. Dispute Resolution

Any dispute concerning this Agreement or the Treaty shall be addressed using the consultation process detailed in Treaty Article 15. As an alternative, the States Parties hereby authorize the voluntary use of binding arbitration in accordance with the 2011 Permanent Court of Arbitration Optional Rules for Arbitration of Disputes Relating to Outer Space Activities. The results of such arbitration shall be enforceable within the judicial system of the States Parties who are parties, or whose nationals are parties, to the arbitration. The Agency shall facilitate and inform the arbitration.

2.10. Controlling Law; Rights of Individuals, Settlements

In accordance with Treaty Article 12, the States Parties agree that the controlling law at any location shall be the law of the country that authorized/supervises the licensees using that location, subject to this Agreement and Treaty. Relations between locations of different nationalities will be governed by current international law, including the Liability Convention, until such time as new substantive rules are created under the governance process in Paragraph 8, as authorized by Treaty Article 18. Nothing in this Agreement or in the Treaty shall be interpreted as denying or limiting the rights guaranteed to individuals by the Universal Declaration of Human Rights, or the right of settlements to seek autonomy and/or recognition as sovereign nations.

3. The Need for an International Framework of Laws to Create Property Rights

Why is this proposal necessary? As of July 2019, there is no internationally recognized mechanism for granting property rights to anyone for any location or natural object in outer space. The current controlling international law is the Outer Space Treaty of 1967, which prohibits any one country from appropriating anything:

Outer space, including the moon and other celestial bodies, is not subject to national appropriation by claim of sovereignty, by means of use or occupation, or by any other means. [4]

Most countries agree that the prohibition against appropriation prevents any country from granting property rights on its own authority. A small minority disagree, enough so that the potential for conflict has grown. Since one of the goals of law to avoid conflicts, it

is imperative to create the international framework before they occur.

The Moon Treaty provides the international authority to grant property rights. Article 11 does not prohibit ownership; it just prohibits any one country from granting it:

11.2. The moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means.

11.3. Neither the surface nor the subsurface of the moon, nor any part thereof or natural resources in place, shall become property of any State, international intergovernmental or non-governmental organization, national organization or non-governmental entity or of any natural person. The placement of personnel, space vehicles, equipment, facilities, stations and installations on or below the surface of the moon, including structures connected with its surface or subsurface, shall not create a right of ownership over the surface or the subsurface of the moon or any areas thereof. *The foregoing provisions are without prejudice to the international regime referred to in paragraph 5 of this article. . . .*

11.5. States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible.”
[5] (emphasis added)

The States Parties are thus authorized to create an international framework of laws that grants property rights, so long as they do it together. Once the framework is established and the obligations are accepted, then any entity authorized/supervised by a State Party would be granted such rights as they are needed.

The Hague International Space Resources Governance Working Group (“Hague Group”), a consortium of NGE’s, supports the creation of an international framework for space resource activity, with states authorizing private activity, in its proposed Building Blocks:

5. International responsibility for space resource activities and jurisdiction over space products

5.1 The international framework should provide that States

and intergovernmental organizations shall be responsible for space resource activities authorized by them in accordance with their international obligations. [6]

It is the international framework of laws that will create private property rights. Without it, private entities will have difficulty moving forward. The uncertainty over the legitimacy of their "ownership" and their ability to engage in commerce would make long-range financial planning, including attracting investors, almost impossible.

4. The Use of Priority Rights

The Hague Group has also proposed the use of "priority rights" to establish property rights:

6. Access to space resources

6.1 The international framework should enable the unrestricted search for space resources.

6.2 The international framework should enable the attribution of priority rights to an operator to search and/or recover space resources *in situ* for a maximum period of time and a maximum area upon registration in an international registry, and provide for the international recognition of such priority rights. The attribution, duration and the area of the priority right should be determined on the basis of the specific circumstances of a proposed space resource activity. [6]

The current prohibition on the ownership of materials applies only to materials "in place", sometimes called *in situ*. [7] The license issued by the Agency would allow a licensee to remove materials from in place. At that point the materials would become the personal property of the licensee and marketable in accordance with any other applicable laws.

What about commerce that is not engaged in mining, such as space tourism? If an NGE wanted to establish a facility and/or engage in activities on the Moon, it would apply for a license for priority use of a location for that purpose. In this example, the licensee would need to honor the prohibition against disturbing cultural/historical sites as a condition for its license; the penalty for not doing so would be revocation of the license.

The use of a location on the Moon for a settlement is also

defined in the proposed Implementation Agreement as an exploitation of resources. Settlers would likewise obtain a license for priority use of their chosen location that would provide the same or similar property rights that homeowners have on Earth. As with commercial activities, their license would be revoked if they did not comply with the Treaty's public policy obligations.

Expanding the definition of "exploitation of space resources" to include the use of any location for any private activity allows the creation of a comprehensive framework of laws that supports all private activity on the Moon and beyond. It is the only way to fulfill the mission of the Moon Treaty - to facilitate humanity's departure from our home planet.

5. The Creation of an Agency

Once the States Parties, through the Implementation Agreement, establish the requirements for a license, they will need to create an agency to administer the process. The Agency in the proposed IA will be ministerial, not discretionary. It will not pass judgement on the merits of any use, nor try to impose some universal "common law". "The Agency shall issue a license upon the proper application by an NGE that is authorized and supervised by a State Party to this agreement." (IA paragraph 3) The Agency will thus function like a Department of Motor Vehicles, focusing on licensing and registration, revoking a license if a licensee fails to follow the "rules of the road", but not making substantive decisions.

The Hague Group has called for "The designation or establishment of an international body or bodies" responsible for the identification of best practices, governance of an international registry, and other functions:

17. Institutional arrangements

The international framework should provide for:

- a) The establishment and maintenance of a publicly available international registry for registering priority rights of an operator to search and recover space resources *in situ*;
- b) The establishment and maintenance of an international repository, in addition to the international registry, for making publicly available:
 - i. Information and best practices;

- ii. The list of designated and internationally endorsed outer space natural and cultural heritage sites; and
- iii. The list of designated and internationally endorsed sites of scientific interest;
- c) *The designation or establishment of an international body or bodies* responsible for:
 - i. The identification of best practices;
 - ii. The listing of designated and internationally endorsed outer space natural and cultural heritage sites, and sites of scientific interest;
 - iii. The monitoring and review of the implementation of the international framework as well as its modification or amendment; and
 - iv. The governance of the international registry, the international repository and any other mechanism that may be established for the implementation of the international framework. [6] (emphasis added)

The proposed Agency would be such a body, with the licensing of NGE's added to the above portfolio. It is the granting and revocation of such licenses that allows the enforcement of all other provisions of any international framework of laws for private activity in outer space.

6. Assessing a Fee

Perhaps the most contentious issue in space law is the proposal to use the profits of space commerce for income distribution to non-spacefaring countries. Article 11 of the Moon Treaty requires some sort of sharing of the benefits of resource development:

- 11.7. The main purposes of the international regime to be established shall include:
- (a) The orderly and safe development of the natural resources of the moon;
 - (b) The rational management of those resources;
 - (c) The expansion of opportunities in the use of those resources;
 - (d) An equitable sharing by all States Parties in the benefits derived from those resources, whereby the interests and needs of the developing countries, as well as the efforts of

those countries which have contributed either directly or indirectly to the exploration of the moon, shall be given special consideration.[5]

The Hague Group Building Blocks state that “The international framework should not require compulsory monetary benefit-sharing” (12.2), though it also proposes that “Operators should be encouraged to provide for benefit-sharing.” (12.3) [4] The same section lists other ways in which the benefits of space exploration and development can be shared:

12. Sharing of benefits arising out of the utilization of space resources

12.1 Bearing in mind that the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries and humankind, the international framework should provide that States and intergovernmental organizations authorizing space resource activities shall provide for benefit-sharing through the promotion of the participation in space resource activities by all countries, in particular developing countries. Benefits may include, but not be limited to enabling, facilitating, promoting and fostering:

- a) Development of space science and technology and of its applications;
- b) Development of relevant and appropriate capabilities in interested States;
- c) Cooperation and contribution in education and training;
- d) Access to and exchange of information;
- e) Incentivization of joint ventures;
- f) Exchange of expertise and technology among States on a mutually acceptable basis;
- g) Establishment of an international fund. [6]

Some fear that the statement “The moon and its natural resources are the common heritage of mankind” in the Moon Treaty (Art. 11.2) [4] requires the literal sharing of all mined materials or the proceeds of their sale. It does not. The very same sentence in the Treaty continues “which finds its expression in the provisions of this Agreement, in particular in paragraph 5 of this article.” Paragraph 5 then explicitly empowers the development of resources:

States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. (Art. 11.5) [5]

Article 11.7, as quoted above, defines the “equitable sharing” of benefits. Compulsory monetary sharing is not explicitly required, nor is it prohibited. It is an option to be considered by the States Parties.

The proposed Implementation Agreement defers a decision on this most controversial issue. It instructs the States Parties to create a governance process that can make such a decision in the future, along with any other substantive decision. The Agency’s authority will be limited to ministerial actions. By the terms of the IA, the Agency will only have the authority to collect fees to cover its own administrative costs. That provision is consistent with the Hague Group’s recommendation, as the fees will be used only for administration, not benefit-sharing.

How would such fees be structured? The implementation agreement for the Convention for the Law of the Seas (CLOS) allows NGE’s to pay the fee either as a standard amount up front or as a percentage of profit at a later date. [8] The fee for a settlement, if any, would likely be less than for an income-producing use. The Agency should allow the greatest flexibility for payment of fees in the name of encouraging activity, not restricting it. The Agency would follow any directive concerning fees given to it by the States Parties through their ongoing governance process (see below).

Ultimately, the States Parties are responsible for the cost of administration. If a State Party does not want its NGE’s to pay the fee and instead wants its national government to bear the cost of administration, it can grant a tax credit for the amount of the fee to any NGE required to pay it. This process would guarantee funding for administration while giving individual State Parties control over who pays it.

In short, it is not necessary to resolve the issue of monetary benefit sharing at this time in order to empower space commerce and settlements. Other types of benefit sharing will be implemented while a framework for collecting fees is established. Doing so will help build capacity while building confidence among all interested parties for substantive decisions that must be made later.

7. Governance for Substantive Decisions

If the Agency is ministerial, how will substantive decisions be made? Since the Moon Treaty and its Implementation Agreement are functions of international law, the States Parties can, by consensus (unanimous consent) make any such decision; they are the ultimate legislature. But obtaining the consensus of all parties to a treaty can be cumbersome, so international organizations such as the United Nations and the European Union have created structures of ongoing governance for making such decisions. The Moon Treaty itself envisions such ongoing governance, even requiring a review of any implementation agreement every 10 years (Article 18). [5]

The governance structure most relevant to space law is the one created by the Convention on the Law of the Seas (“CLOS”). The CLOS established a governing entity separate from the United Nations, composed of an Assembly made up of all Member States and an executive Council made up of 36 states who are chosen by the Assembly. Membership on the Council consists of five sub-groups to assure that all interests and interested parties are served. For example, four members are from countries who each consume more than 2% of the world’s consumables of potentially developable sea resources; 18 members are chosen to assure geographic diversity. (Agreement on Part XI, Annex 3) [8]

Since the Moon Treaty (Art.4) and even the Outer Space Treaty (Art. 1) require that “the exploration and use of outer space shall be carried out for the benefit and in the interests of all countries, irrespective of their degree of economic or scientific development” [4][3], the sub-groups for governance will help insure that the “interests of all countries” are represented.

Although consensus is preferred, it is possible under the CLOS to make decisions in both the Assembly and the Council by a simple majority for procedural matters and by two-thirds majority for substantive matters. All decisions on financial matters, including the charging of any fees, the administrative budget, and the use of any income “shall be based on the recommendations of the Finance Committee” that is chosen by the Executive Council. Decisions of the Finance Committee on substantive matters must be by consensus. (Agreement on Part XI, Annexes 3, 9) [8] This is still a high bar, but not as difficult as consensus by all States Parties for all substantive decisions.

The proposed Implementation Agreement requires the States

Parties to create a form of governance to make such substantive decisions. By deferring the decision on direct monetary transfers till then, the proposed IA can focus on the other ways by which the benefits of space exploration and development can be shared with all of humanity. Just as the Moon Treaty calls for governance of activities as they become technologically possible, the Implementation Agreement envisions adaptive governance to make decisions as they become politically possible.

8. Sharing Information

One of the ways to share the benefits is to share information. The proposed Implementation Agreement confirms that NGE's will have the same obligations as the States Parties concerning the sharing of information. This begins with their obligation to share information under the Registration Treaty:

Article IV

1. Each State of registry shall furnish to the Secretary-General of the United Nations, as soon as practicable, the following information concerning each space object carried on its registry:

- (a) name of launching State or States;
- (b) an appropriate designator of the space object or its registration number;
- (c) date and territory or location of launch;
- (d) basic orbital parameters, including:
 - (i) nodal period;
 - (ii) inclination;
 - (iii) apogee;
 - (iv) perigee;
- (e) general function of the space object. [9]

Article 5.1 of the Moon Treaty requires more detailed information:

States Parties shall inform the Secretary-General of the United Nations as well as the public and the international scientific community, to the greatest extent feasible and practicable, of their activities concerned with the exploration and use of the moon. Information on the time, purposes, locations, orbital parameters and duration shall be given in

respect of each mission to the moon as soon as possible after launching, while information on the results of each mission, including scientific results, shall be furnished upon completion of the mission. In the case of a mission lasting more than sixty days, information on conduct of the mission, including any scientific results, shall be given periodically, at thirty-day intervals. For missions lasting more than six months, only significant additions to such information need be reported thereafter. [5]

Article 5.3 of the Moon Treaty would also require NGE's to promptly report "any phenomena they discover in outer space, including the moon, which could endanger human life or health, as well as of any indication of organic life." [5]

Finally, Article 11.6 of the Treaty would require NGE's to disclose the discovery of any natural resources. [5] Such discoveries would *not* be considered proprietary information. This interpretation is consistent with the Hague Group's Building Blocks, depending on their definition of sharing "the results of space resource activity." Section 13(e) lists the type of information that should be shared:

13. Registration and sharing of information

(e) Provide . . . information and best practices on . . . space resource activities . . . including:

- i. The purposes, locations, orbital parameters and duration of space resource activities;
- ii. The nature, conduct, and locations of space resource activities and associated logistic activities, for example deployment of stations, installations, equipment and vehicles;
- iii. The results of space resource activities;
- iv. Any phenomena discovered in outer space which could endanger human life or health, as well as of any indication of life;
- v. Any harmful impacts resulting from space resource activities authorized by them and the measures planned or implemented to redress such impacts. [6]

The COPUOS Legal Sub-Committee has recently released a draft guidance document that summarizes the intent of the five space treaties, indicating a similar scope of what information should be shared:

48. The registration regime contained in the outer space treaties aims at the exchange of information on the nature, conduct, locations and results of space activities, in particular by submitting registration data to the Secretary-General of the United Nations and establishing national registries. States shall set up a national registry and additionally submit information to the United Nations Register maintained by the Office for Outer Space Affairs. [10]

Although the Moon Treaty itself describes the above as obligations of the States Parties, the Implementation Agreement would clarify that all such obligations also apply to NGE's (see 1.4 above). If the procedures detailed in the Registration Treaty are used, the NGE's would report to a national registry maintained by a State Party, then the State Party would report to an international registry maintained by the United Nations.

The proposed Implementation Agreement would expand the information contained in the current international registry but would still be easily manageable. If the types of information (e.g., results of a space activity) are beyond the scope of the United Nations registry, they would be included in registries maintained by the Agency or another nongovernmental organization(s) selected by the States Parties.

9. Sharing Technology

Although the proposed Implementation Agreement defers the issue of direct monetary transfers, it specifically addresses the issue of sharing technology.

The Moon Treaty's reference to the Common Heritage of Mankind ("CHM") has raised concerns about the status of intellectual property rights. One commentator has suggested that:

"They [developed countries] would also be required to surrender technology developed by private industries under their jurisdiction for extracting extraterrestrial resources so that developing nations could participate in the activity of acquiring those resources as well." [11]

The conflict over the meaning of the CHM is central to the debate

over Moon Treaty. More than anything else, it is keeping Treaty from being adopted, as some claim that the concept grants sweeping powers to international organizations while others fear precisely that. [12]

The middle way is to define what the CHM means for particular circumstances. The Moon Treaty itself tells us that the CHM is what we choose to make it:

Article 11

1. The moon and its natural resources are the common heritage of mankind, *which finds its expression in the provisions of this Agreement*, in particular in paragraph 5 of this article. . . .

5. States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon as such exploitation is about to become feasible. [5] (emphasis added)

Consider how the IA for the Convention for the Law of the Seas, which also uses the CHM concept, describes the sharing of technology:

Section 5: Transfer of Technology

(a) The Enterprise, and developing States wishing to obtain deep seabed mining technology, shall seek to obtain such technology on fair and reasonable commercial terms and conditions on the open market, or through joint-venture arrangements;

(b) . . . States Parties undertake to cooperate fully and effectively with the Authority for this purpose and to ensure that contractors sponsored by them also cooperate fully with the Authority;

(c) As a general rule, States Parties shall promote international technical and scientific cooperation with regard to activities in the Area either between the parties concerned or by developing training, technical assistance and scientific cooperation programmes . . . [8]

Article 12 of the Hague Group's Building Blocks also calls for an "exchange of expertise and technology among States on a mutually

acceptable basis” as part of sharing the benefits of space development with all countries (see Assessing a Fee, above.) [6]

The proposed Implementation Agreement for the Moon Treaty calls upon the States Parties to engage in such a cooperative process. As a backup, it requires the licensing of technology for fair market value, as in the CLOS. Although such a provision would require private companies to share technology, it would also mandate that they are paid a fair and reasonable amount for its use. (Note: The Hague Group has proposed an “international fund” to help developing countries pay for needed technology.) An exception is made for technologies that have been barred from export for national security reasons. The proposed IA would thus protect private economic interests and national security interests while ensuring that less-developed nations have the technical capacity to share in the development of space resources.

10. Developing Standards and Practices

The Implementation Agreement requires the States Parties to develop standards and recommended practices (SARP's) for the development of outer space resources. This does not diminish the efforts of private enterprise and international organizations who are already doing so. It is not meant to create a super-agency that will override efforts that have been developing organically. Rather, it requires the States Parties work with NGE's, providing them a seat at the table and a legal foundation for their work. The International Organization for Standards (ISO) [13], the Committee on Space Research (COSPAR) [14], the Hague Space Resources Group [6], the Moon Village Association [15], and For All Moonkind [16] are examples of such organizations.

These organizations use extensive outreach and inclusive working groups to harness the knowledge and expertise of interested parties, particularly commerce, academia, and civil society. The Moon Village Association, for example, currently has active workgroups in the areas of Coordination & Cooperation and Cultural Considerations. [15]

Article 11.5 of the Moon Treaty instructs us to establish the international framework of laws concerning the exploitation of resources “as such exploitation is about to become feasible.” Article 18 establishes a process for ongoing review. [5] The Treaty thus anticipates that there will be ongoing advances in technology that

will require a constant updating of the best standards and practices. It is essential for the States Parties to integrate the work of the NGE's into this process. Otherwise a vast pool of talent and innumerable hours of work will be wasted. The Treaty and Implementation Agreement will lack organizational support and may well fail.

11. Protecting Historical/Scientific Sites

Article 7.3 of the Moon Treaty authorizes the preservation of sites of scientific interest:

States Parties shall report to other States Parties and to the Secretary-General concerning areas of the moon having special scientific interest in order that, without prejudice to the rights of other States Parties, consideration may be given to the designation of such areas as international scientific preserves for which special protective arrangements are to be agreed upon in consultation with the competent bodies of the United Nations. [5]

The organization For All Moonkind has declared as its primary mission the preservation of all historic landing sites on the Moon, including the boot prints and tracks left by explorers and rovers, not just as cultural/historical sites but also for scientific research, e.g., to study the effects of solar radiation and micrometeor strikes on surfaces newly exposed by such activity:

Declaration of Objectives and Agreements Regarding Cultural Heritage in Outer Space

This Declaration has as its primary objective the collaboration and participation of all Parties to ensure that Cultural Heritage Sites in Space are recognized for their outstanding value to humanity and consequently preserved and protected for posterity as part of our common human heritage. . . .

The Parties do hereby agree to:

1. Work together and with For All Moonkind to address the uncertainties with respect to current space law in relation to human heritage in space by developing, adopting and amending from time to time as may be necessary, progressive standards and recommended practices and procedures

("SARPs) dealing with the protection and preservation of Cultural Heritage Sites in Space on a general and a site-by-site basis, as the case may be. SARPs are intended to promote and facilitate the exploration and use of space, while balancing development and preservation. SARPs may take into consideration any national recommendations and guidelines implemented by national governments in respect of their own space objects.

2. Work with For All Moonkind to assure that each of their space activities, including any activities implemented before the development of relevant SARPs, whether on the Moon or elsewhere, will avoid disturbance and damage to any protected Cultural Heritage Sites in Space.

3. Work together and with For All Moonkind to assure that any entity seeking access to space through or with their services also agrees to assure that each of their space activities, whether on the Moon or elsewhere, will observe the SARPs, and in any event, avoid disturbance or damage to any protected Cultural Heritage Sites in Space.

4. Comply with any SARPs promulgated and agreed pursuant to Section 2(1) above. [16]

It is unclear whether a new organization will be established to meet these goals or if the task will be given to an existing organization. [16] Until such decisions are made and procedures in place, the proposed Implementation Agreement prohibits "the use or disturbance of any location on the Moon or other celestial body that is the site of a historical mission that occurred prior to the year 2000." (Paragraph 9)

12. Cooperation, Assistance, and Rescue

Article 4 of the Moon Treaty requires cooperation among all States Parties:

4.2 States Parties shall be guided by the principle of co-operation and mutual assistance in all their activities concerning the exploration and use of the moon. International co-operation in pursuance of this Agreement should be as wide as possible and may take place on a multilateral basis, on a bilateral basis or through international intergovernmental

organizations. [5]

Article 10 requires assistance and rescue:

1. States Parties shall adopt all practicable measures to safeguard the life and health of persons on the moon. For this purpose they shall regard any person on the moon as an astronaut within the meaning of Article V of the Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, including the Moon and Other Celestial Bodies [Outer Space Treaty] and as part of the personnel of a spacecraft within the meaning of the Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space [Rescue Treaty].
2. States Parties shall offer shelter in their stations, installations, vehicles and other facilities to persons in distress on the moon. [5]

The proposed Implementation Agreement would confirm that NGE's also have the same obligations. It integrates the Rescue Treaty [18] into the international framework of laws concerning private activity in space, just as it integrates the Registration Treaty into the sharing of information.

What about sharing essential but scarce resources, such as water? Article 4.2 of the Moon Treaty, above, includes a mandate to cooperate. This is consistent with Article I of the Outer Space Treaty:

Outer space, including the moon and other celestial bodies, shall be free for exploration and use by all States without discrimination of any kind, on a basis of equality and in accordance with international law, and there shall be free access to all areas of celestial bodies. [4]

The COPUOS guidelines agree. "Outer space should remain . . . open for exploration, use, and international cooperation." (Sec. 1.4)

The proposed Implementation Agreement confirms that NGE's also have the obligation to cooperate, to provide free and open access to all areas, so long as there is no threat to safety or "harmful interference" with established operations. (See also Hague

Building Blocks 10.3. [6]) As with other activities, if a dispute arises, then the dispute resolution process described in Paragraph 5 of the Agreement (consultation, arbitration) will be used. As with technology, if a resource is developed by a licensed NGE, the default process requires the resource to be shared via the marketplace at a price that assures a return of investment but is not monopolistic.

Currently private organizations such as the Hague Group, the Moon Village Association, and For All Moonkind are supplementing the work of COPUOS and national governments in sorting out what it means to cooperate and assist. The Moon Treaty and the proposed IA call for incorporating the work of such organizations in developing the international framework of governance.

13. Controlling Law

The Outer Space Treaty requires all space activities to be approved and supervised by a national government.

States Parties to the Treaty shall bear international responsibility for national activities in outer space, including the moon and other celestial bodies, whether such activities are carried on by governmental agencies or by non-governmental entities, and for assuring that national activities are carried out in conformity with the provisions set forth in the present Treaty. The activities of non-governmental entities in outer space, including the moon and other celestial bodies, shall require authorization and continuing supervision by the appropriate State Party to the Treaty.

- Outer Space Treaty, Article VI [4]

Both the Outer Space Treaty and the Moon Treaty extend a country's laws to cover their nationals and objects.

A State Party to the Treaty on whose registry an object launched into outer space is carried shall retain jurisdiction and control over such object, and over any personnel thereof, while in outer space or on a celestial body.

- Outer Space Treaty, Article VIII [4]

States Parties shall retain jurisdiction and control over their

personnel, vehicles, equipment, facilities, stations and installations on the moon. The ownership of space vehicles, equipment, facilities, stations and installations shall not be affected by their presence on the moon.

- Moon Treaty, Article 12 [5]

Thus, the controlling law for any location will be the law of the country that authorized and supervises activity at that location. There will also be extra-territoriality, i.e., a country's laws will apply to its nationals if nationals travel beyond the geographic limits of the registered area of activity, even if they enter the area of activity of another country. Since all countries are bound by the treaties they have adopted, their national laws would be subject to the five space treaties, including the Moon Treaty and its Implementation Agreement.

14. Resolution of Disputes

Article 15 of the Moon Treaty details a process for resolving disputes. It begins with a process for avoiding them – mutual inspection:

Each State Party may assure itself that the activities of other States Parties in the exploration and use of the moon are compatible with the provisions of this Agreement. To this end, all space vehicles, equipment, facilities, stations and installations on the moon shall be open to other States Parties.

- Moon Treaty, Art. 15.1 [5]

The proposed Implementation Agreement confirms that this obligation also applies to NGE's, part of their public policy obligation to share information as a way of sharing the benefits of space exploration and development with all of humanity.

Article 15 goes on to describe levels of dispute resolution, beginning with consultations between the States Parties. Any other State Party can join in the consultations, and any State Party can request the assistance of the Secretary-General of the United Nations. If consultations fail to resolve the dispute, the States Parties are instructed to "take all measures to settle the dispute by other peaceful means of their choice appropriate to the

circumstances and the nature of the dispute.” (Art. 15.3)

The Hague Space Resources Governance Working Group has recommended the use of arbitration as a “peaceful means” for resolving disputes, especially between NGE’s:

The international framework should encourage recourse by States, intergovernmental organizations and operators to the amicable resolution of disputes, for example by developing procedures for consultation or promoting the use of the 2011 Permanent Court of Arbitration Optional Rules for Arbitration of Disputes Relating to Outer Space Activities. [5] [19]

The proposed Implementation Agreement allows parties to voluntarily choose binding arbitration. It guarantees that any decision/award will be enforceable. [20] The Rules referenced above allow the parties to choose the arbitrators. The proposed IA includes the Agency itself in the process as informer/facilitator, to aid with institutional continuity and precedents. Establishing the protocols for dispute resolution may be the most difficult task in creating the Implementation Agreement, but they are essential.

15. Settlements

Including settlements in the definition of “exploitation of resources” is essential for creating an international framework of laws that is sufficiently comprehensive to support all private activity in space. It is also the only way to negate the prohibitions against ownership in both the Outer Space Treaty and the Moon Treaty (see above). This is done by interpreting “the exploitation of the natural resources of the moon” in Article 11.5 to include the use of any location on the Moon for any purpose.

This interpretation is consistent with the other provisions of Article 11, such as 11.4, which asserts a universal “right to exploration and use of the moon” and 11.7, which states that “the main purposes of the international regime to be established shall include: (a) The orderly and safe development of the natural resources of the moon, (b) The rational management of those resources.” [5] “Use” and “development” are terms common to the management of real estate. Including all private activity within the scope of the Moon Treaty provides the authority, support, and protection that those activities require. If the purpose of 11.5 is to

permit use and development of the Moon, then it must have the same scope as the prohibition against ownership in 11.3.

When the Moon Treaty was first proposed, some individuals and NGE's, led by the L5 Society (now merged with the National Space Society), opposed it because there were no provisions for establishing private settlements with their own governance. [21] They pointed again to Articles 11.2, which states that "the moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means" and 11.3's prohibition against ownership (above) [5] As explained above, the international framework of laws authorized by Article 11.5 overrides those prohibitions. The proposed Implementation Agreement specifically authorizes the establishment of private settlements.

For those who wish to establish independent nations on the Moon or elsewhere in space, the Treaty's prohibitions are actually helpful. First, the ban on sovereignty stops the States Parties from establishing permanent colonies. Second, the proposed Implementation Agreement will provide settlements the protection of legal recognition and support. Third, the Implementation Agreement confirms that a settlement can seek autonomy and/or independence through established international protocols. [22]

16. Individual Rights

Applying international law to outer space activities can be challenging. What if an inhabitant of a settlement sought asylum in another country's facility? The Moon Treaty and the Outer Space Treaty contain certain provisions that seem to say that their country of origin retains jurisdiction, and can have them returned (see Controlling Law, above).

Do the treaties require the person to be returned? This would conflict with the Universal Declaration of Human Rights ("UDHR"), which states in Article 14.1 that "Everyone has the right to seek and enjoy in other countries asylum from persecution." [23] The proposed Implementation Agreement incorporates the protections of the UDHR. As explained above, this would override national law and allow individuals to remove themselves from the legal authority of one country and enter the authority of another.

The hopes and dreams of individuals and groups to create new societies in outer space are just as important as the entrepreneurship of those seeking to engage in space commerce.

Both must be recognized, honored, and nurtured if humanity is to leave our home planet in a sustainable manner. The proposed Implementation Agreement states that “nothing in this Agreement or in the Treaty shall be interpreted as denying or limiting the rights guaranteed to individuals by the Universal Declaration of Human Rights, or the right of settlements to seek autonomy and/or recognition as sovereign nations.” (Paragraph 10) Any international framework of laws must acknowledge and incorporate these protections, or it will fail. Indeed, it will never be adopted.

17. Adaptive Governance

The proposed Implementation Agreement is not meant to resolve every issue in space governance. Rather, it provides the minimum framework of international law that is necessary at this time for public and private activity on the Moon and beyond. It builds upon current institutions and processes while creating new governance for issues that are not yet ripe for resolution. It links private property rights with public policy obligations, recognizing the importance of both in the grandest of public-private partnerships.

The Moon Treaty itself acknowledges that such adaptive governance is necessary:

Article 11.5. States Parties to this Agreement hereby undertake to establish an international regime, including appropriate procedures, to govern the exploitation of the natural resources of the moon *as such exploitation is about to become feasible*. (emphasis added) [5]

In addition, Article 18 requires a review of any implementation agreement ten years after it goes into effect. [5] It is not necessary, or even desirable, to create comprehensive rules for governing the entire solar system at this time. But it is necessary to create a basic framework so that both technology and governance itself can evolve to the next level.

The Hague Group's Building Blocks endorse this approach:

Introduction

Guided by the principle of adaptive governance, the Working Group considered it neither necessary nor feasible to attempt to comprehensively address space resource activities in the

building blocks: space resource activities should be incrementally addressed at the appropriate time on the basis of contemporary technology and practices.

4. Principles

4.2 The international framework should be designed so as to
a) incrementally regulate space resource activities at the appropriate time (principle of adaptive governance). [6]

Adaptive/evolving governance is also part of the United Nations' Thematic Priorities for outer space:

2. Legal regime of outer space and global space governance: current and future perspectives. (c) Studying legal mechanisms to foster an international regime of responsibility and liability to cope with present and future challenges to the safety, security and sustainability of outer space activities . . .

7. Capacity-building for the twenty-first century: Define new innovative and effective approaches to overall capacity-building and development needs as a fundamental pillar of global space governance. [24]

The recent COPUOS guidelines also envision an ongoing evolution ("Review of implementation and updating of guidelines", Section I, Paragraphs 21-24). [3]

At this moment in time, it is space law itself that needs capacity building. The current framework is inadequate, resulting in endless arguments over the meaning of outdated agreements. The new COPUOS guidelines, though helpful, are not sufficiently specific and are voluntary; the resulting patchwork of national laws will be far from uniform and perhaps even conflicting. The time has come to craft a new agreement that will facilitate the sustainable exploration and development of outer space. In the Summer of 2019, it is the Moon Treaty, with a proper Implementation Agreement, that can provide the international framework of laws that humanity needs to become a space-faring species.

18. The Challenge of Nationalism

But such international efforts are now being threatened. The United States has already passed a law that would unilaterally grant

property rights to a space resource to any U.S. entity that gets to it first. [25] The Trump administration intends to use the U.S. military to protect such economic interests. In August 2018, U.S. Vice-President Mike Pence announced a new Space Policy Directive, calling for the creation of a "Space Force". "Space is a warfighting domain", said Pence, quoting President Trump. The United States must "prepare for the next battlefield", to "defeat a new generation of threats."

"It is not enough to merely have an American presence in space," said Pence. "We must have American dominance in space." [26] Such militant nationalism has been common throughout history. But as humanity prepares to leave its home planet, it raises new concerns. As one commentator stated:

The fear is that such rhetoric will lead to a new arms race and possible war in outer space. It may also lead to the economic colonization of space around claims for resource exploitation, including the establishment of economic exclusion zones. [27]

This concern was also raised at last year's UNCOPUOS Legal Subcommittee conference:

29. The view was expressed that space resources were accessible to only a very limited number of States and to a handful of enterprises within those States. In that connection, the delegation expressing that view was also of the view that it would be important to assess the impact of a "first-come, first-served" doctrine on the global economy, which could create a de facto monopoly in complete contradiction to the letter and the spirit of the United Nations treaties and resolutions. [28]

These are the two futures facing humanity, a choice between international cooperation and nationalistic competition. In order to make that choice, every policymaker and interested party must now pause and ask themselves, on the deepest level, "What is our mission?"

19. The Overview Through Time

The early 21st century is an extraordinary time. Humanity has been presented with an historic opportunity as it prepares to leave its home planet. Like those who went forward during the Age of Exploration some 500 years ago, the decisions made today will

affect humanity for centuries, perhaps millennia. If ever there has been a time to determine how to implement humanity's collective vision for the future, it is now.

This paper has so far been written in legal and economic terms. It has tried to demonstrate that a comprehensive international framework of laws for the development of space resources will actually help private enterprise flourish, and that the certainty and support of the rule of law will allow countries, businesses, non-profits and even individuals to dare to make their dreams come true. It is now time to speak of those dreams.

In October 1957, just six decades ago, people all over the world stood outside their homes as the sun set, looking to the sky as a blinking light passed overhead, the tumbling upper stage booster of the world's first satellite, Sputnik. Because of the Cold War there was some fear, but for most the overwhelming emotions were excitement, inspiration, and hope. Despite all its imperfections, all its follies, and all its deadly conflicts, humanity had managed to throw off the shackles of gravity and reach the stars. All the stuff of science fiction suddenly seemed possible. And not just the stuff about technological advances; the writers, the poets, those who dared to dream of a better future saw a day when humanity could resolve its differences by peaceful means and move forward together.

This dream was enhanced a decade later, in December 1968, when our view of the world literally changed. As Apollo 8 rounded the Moon, the astronauts on board were suddenly overwhelmed as humans saw the Earth rising above the lunar horizon for the first time. The picture taken at that moment showed our home planet, beautiful and fragile, hanging in the vastness of space. Humanity as a species began to realize that we are all one, living together on a small planet hurtling through the cosmos.

But even though no borders were visible, war and suffering continued to wrack the home world. In the half-century since, people have begun to lose faith in their governments, their private institutions, even in humanity itself. Every day people wake up to the news of yet another mass killing, more terrorist attacks, the disastrous effects of climate change, and an increased threat of nuclear war. To that has now been added the threat of war in outer space. The people of Earth are beginning to despair, wondering if there is anything they can really believe in. They are losing hope, and the resulting cynicism is poisoning our politics, our

relationships, even our thinking.

The mission of space law must be nothing less than to restore that hope, to inspire humanity by giving the people of our planet a future they can believe in. To counter the despair of war and violence and neglect. To build that shining city on a hill that will light the way for all.

Imagine looking up at the Moon in the future, knowing that humans are there, living and working under a common framework of international law. Every person on Earth will have that same experience, just as we did in 1957. Just imagine the inspiration and hope that looking at that Moon will give to a whole new generation of humanity, one that is not bound by the mistakes of the past.

20. Conclusion: The Time to Act

It is time to voice support for adopting the Moon Treaty with an Implementation Agreement and to make every effort to persuade national governments to do so. The current States Parties should immediately begin the process of creating an Implementation Agreement. All other nations with an interest in outer space should adopt the Treaty and help create the international framework of laws that will facilitate humanity's departure from the home planet.

It has been 500 years since the world has had such an opportunity to start anew. At that time, European countries used their advanced technology to perpetuate military conquest and economic exploitation, causing widespread misery and countless wars. And when the Industrial Revolution came along, governments placed profits ahead of people, resulting in economic and environmental catastrophe. Much of humanity stopped believing in its ability to control its own destiny.

We can change that. We can avoid making the same mistakes. But doing so requires immediate action. There will be only one time when humanity leaves our home world, only one chance to create a new pattern that will lead each person, and all people, to their best destiny. That time is now. Please join in this effort to inspire humanity, restore hope, and create a better world – a better universe – for everyone.

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Dennis O'Brien is an attorney and former member of the NASA-Hastings Research Project. After a few years practicing business law in San Francisco, he dedicated himself to the public interest, helping low-income families and local nonprofits. He is currently president of The Space Treaty Project, a California nonprofit that is dedicated to bringing inspiration and hope to humanity by helping the nations of the world to build a common future. The Project is an organizational member of the Moon Village Association; Mr. O'Brien is part of their Coordination & Cooperation Project. For more information, including a petition in support of the Moon Treaty, please go to www.spacetreaty.org.

The author began college as an engineering major but ended up with a history degree, due in large part to Isaac Asimov's *Foundation* series and the concept of psychohistory. He spent a year as a graduate teaching assistant in the history of science at Virginia Tech before illness suspended his studies. His 1985 law school treatise, *OTV: An Argument for the Independent Trader* (<http://spacetreaty.org/otv.pdf>) advocated for more involvement of private enterprise at a time when NASA was committed to using the Space Shuttle for almost all U.S. activity in space. Although rejected at the time because it limited NASA to public policy missions, the treatise predicted the current public-private model for the exploration and development of outer space.

Proceeds from the sale of *Major Tom* will be dedicated to The Space Treaty Project. The Project is fiscally sponsored by Cloud Forest Institute, an educational and scientific 501c3 tax exempt non-profit corporation. Tax deductible donations on behalf of the Space Treaty Project can be mailed to Cloud Forest Institute, PO Box 1435, Ukiah, CA 95482 or made online at www.cloudforest.org. Please note Space Treaty

Project in the memo line of your donation. We thank you for your support.

The author is an avid sports fan. In 1987 he helped found The Beat, a softball team in the San Francisco city league. His first book, *The Best Seat In The House*, is about the team's early years, culminating in their first division championship. (<http://www.sonic.net/~headroom/bestseat/index.htm>.)

The author currently lives in a small cabin in the country, partially powered by his DIY solar power system (see Home Power Magazine, June 2017).



The author (center) on the night his team won the San Francisco C-League city championship