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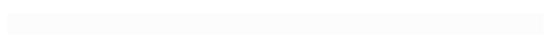
“While the psychological barrier to mining asteroids is high,” the Goldman report concludes, “the actual financial and technological barriers are far lower.” In April, NASA selected Trans Astronautica Corp., an aerospace company based in Lake View Terrace,

Calif., for \$3.25 million in technology study grants. Among TransAstra's NASA-approved projects: an asteroid-hunting telescope whose stated mission is "to start a gold rush in space."

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## THE FUTURE OF EVERYTHING: A NEW WSJ PODCAST SERIES

Law and Order in the Final Frontier



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The final frontier is starting to look a lot like the Wild West. As more companies announce ambitious

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- plans to do business beyond Earth, serious questions are emerging about the legality of off-planet activity.

Everything that happens in space falls under the purview 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. This international agreement, also known as the Outer Space Treaty, turned 50 years old in January. More than 100 countries, including the U.S., Russia and China, are parties to the treaty. "It's the Constitution and the Magna Carta of space law," says Sagi Kfir, general counsel for Deep Space Industries, an asteroid-mining company based in Mountain View, Calif. "It's so fundamental that its principles have become customary international law even for those countries that aren't signatories."

The treaty's principal drafters, the U.S. and the U.S.S.R., were primarily concerned with nuclear weapons when they met in 1967 at the United Nations; Article IV of the treaty prohibits military installations and weapons of mass destruction from being placed in orbit or on other worlds. Further stipulations guarantee freedom of access to all nations, ban territorial claims and promote scientific cooperation. Above all, the treaty was designed to ensure that space exploration occur peacefully and for the benefit of all mankind. "I think you can compress the main principles down to two," says Henry Hertzfeld, a professor of space policy and international affairs at George Washington University in Washington, D.C. "One is the Golden Rule, and the other is don't do anything stupid; more specifically, don't do anything that will cause harm or get in the way of others in space."

But the Golden Rule isn't a governing principle for competitive companies, who are certain to get in each other's way if space exploration proves as profitable as Goldman

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## Mining the Universe »

The technology behind the coming outer space gold rush



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Sachs suggests. Drafted at a time when only governments had the resources to mount space missions, the Outer Space Treaty mentions “nongovernmental entities” in only one of its 17 articles. It makes no provisions for asteroid mining or suborbital tourism or the colonization of Mars, which leaves many of today’s space-faring companies in something of a legal gray area.

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One of the biggest modern-day sticking points stems from Article VI, which states that nongovernmental entities—i.e. private businesses—must receive “authorization and continuing supervision” from their country of origin. Article VI was originally a compromise between the communist Soviets, who wanted to ban off-planet commercial activity, and the Americans, who insisted that space be open for business. “The Soviets said, ‘If you Americans are so crazy that you want those private-sector activities to be permitted, go ahead,’ ” says Frans von der Dunk, a professor of space law at the University of Nebraska-Lincoln. “ ‘But you’re responsible for their doings, and if they cause damage, you have to pay as a government.’ ”

All space-faring nations have set up their own administrative regimes to manage

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commercial players, but their jurisdictions are hazy. In the U.S., no company can launch a rocket into orbit without express permission from the Federal Aviation Administration, whose regulatory framework was developed mostly to

license rockets that launch satellites. The FAA has never had to grapple with ventures such as Jeff Bezos' Blue Origin, which is developing huge reusable rockets to enable humans to live and work in space. And the agency's rulings on less ambitious plans have already raised eyebrows. In 2015, Bigelow Aerospace asked the FAA whether its inflatable lunar commercial bases would make it through the agency's approval process. The FAA responded that it wouldn't stand in the way of business development and wouldn't permit a launch that could deploy a payload within the vicinity of a Bigelow's proposed commercial bases. But in its letter to Bigelow, the FAA acknowledged a concern from the U.S. State Department that "the national regulatory framework, in its present form, is ill-equipped to enable the U.S. government to fulfill its obligations" under the Outer Space Treaty. Whether the FAA will be able to regulate anything beyond launch, re-entry and launch/re-entry sites remains to be seen.

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The push for clearer regulations is a rare point of bipartisan consensus among U.S. lawmakers. In March, the House of Representatives held a hearing to discuss how new business will comply with Article VI of the treaty. Rep. James Bridenstine, a Republican from Oklahoma, spoke in favor of giving the FAA authority to regulate all activity not currently covered under existing laws. Sen. Ted Cruz of Texas went further at a Senate hearing in April, calling for a review and update of the original Outer Space Treaty. "Congress needs to continue to work to ensure that investment in innovation within the commercial space sector isn't chilled by obsolete regulations or overly burdensome requirements that may not naturally apply to new business models," he said. A series of hearings to discuss updating the document is scheduled for later this month.

Private space companies have generally supported new space regulations, citing a need for clarity. The private sector cheered in 2015 when President Barack Obama signed the U.S. Commercial Space Launch Competitiveness Act, which stated that commercial

entities could extract resources from an asteroid and sell them for a profit. But the decision has also proved controversial. Several countries have expressed concern that asteroid or moon mining will be open to only a few wealthy nations and corporations, leaving many on Earth behind. “The widening gap of poverty is a weapon of mass destruction,” said José Monserrat Filho of the Brazilian Association of Air and Space Law. Filho echoed the language of the Outer Space Treaty when he voiced his concerns at the March meeting of the U.N.’s Committee on the Peaceful Uses of Outer Space. “More than ever our planet needs for outer space activities to be carried out for the benefit of all mankind,” he said. Delegates from Russia and several European countries voiced similar concerns at the meeting and requested an international regulatory regime to govern space resource extraction. Article II expressly forbids any national appropriation or claim of sovereignty. The question the world now faces is whether you can mine an asteroid without owning it.

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The treaty declares the moon and other celestial bodies to be *res communis*, meaning they exist for the common good and belong to no one. Michael J. Listner, an East Rochester, N.H., lawyer with a specialty in space policy, says the *res communis* designation means resources found in outer space aren’t for the taking. “Everybody can use the resource of a local park,” Listner says, “but they can’t just chop down a tree and walk away with it to build their house.”

Not everyone agrees. “It’s like on the high seas,” another *res communis* area, says von der Dunk. “Everyone is allowed to fish as long as they follow the international rules.”

The U.S. has adopted the latter interpretation of the treaty, along with Luxembourg, which hopes to become a hub of space commerce, and the United Arab Emirates, which is currently completing its own domestic space laws to allow asteroid mining. If enough countries take a similar stance, this reading could become customary international law. All eyes are now on China, which took a more equivocal stance during the U.N. meeting in March, saying that space-faring nations “should strike a balance between the freedom of utilization and the equitable sharing of benefits.” At the conclusion of the meeting, the U.N. committee elected to hold off on any decisions and revisit the issue in 2018.

There are more urgent questions to answer before the era of commercial space travel

and settlement can commence, questions that the Outer Space Treaty's drafters couldn't have anticipated. How will a population on another planet be governed? Under the current treaty, individuals are subject to the laws of their country of origin, though what that might look like in a large and diverse settlement remains to be seen. And what if a private company owns the infrastructure necessary for humans to survive? "We will have to find a way to apply civil rights in an environment that is hostile to life-forms," says Joanne Gabrynowicz, a director of the International Institute of Space Law. "Is there a right to breathing, or do you have the responsibility to buy your own air?"

Elon Musk, CEO and founder of Space Exploration Technologies Corporation, or SpaceX, has spoken frequently and publicly about his desire to shuttle millions to Mars. At last year's International Astronautical Congress in Mexico, he unveiled a rocket transport system that he likened to the 19th-century transcontinental railroad. "Our goal is just to make sure you can get there," Musk said during a question-and-answer session after the unveiling. SpaceX declined to comment further. How potential settlers will live and breathe on Mars is anybody's guess.

The limitless expanse around us has been a peaceful arena for the past 50 years, but the complex relationships between major space-faring powers like Russia, China and the U.S. are unlikely to remain Earthbound. A lunar land grab could make the dispute over man-made islands in the South China Sea look simple. "Nobody's going to behave better in outer space than they do here," says Laura Montgomery, a former FAA attorney who now has her own private practice in space law and policy. "But it's easier to have lawyers argue about it than to have a shootout at the O.K. Corral."

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