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Is the Sky the Limit?

PATENT IMPLICATIONS OF DISCOVERIES MADE IN OUTER SPACE

Max Stul Oppenheimer[†]

INTRODUCTION: THE PATENT CHALLENGE OF SPACE EXPLORATION

It has been less than a century since space flight was the province of science fiction.¹ Sixty years ago, space flight was the province of a few advanced nations² and manned space exploration remained the province of science fiction³; fifty years ago, manned

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¹ In 1920, under the title “A Severe Strain on Credulity” the *New York Times* ridiculed Dr. Robert Hutching Goddard’s proposal to launch a rocket capable of reaching the moon. See *A Severe Strain on Credulity*, N.Y. TIMES: TOPICS OF THE TIMES (Jan. 13, 1920), <https://timesmachine.nytimes.com/timesmachine/1920/01/13/102738081.pdf> [<https://perma.cc/GEK7-CZWF>]. “[A]fter the rocket quits our air . . . its flight would be neither accelerated nor maintained by the explosion of the charges it then might have left. To claim that it would be is to deny a fundamental law of dynamics and only Dr. Einstein and his chosen dozen . . . are licensed to do that.” *Id.* The *New York Times* published what might be considered a retraction in 2001—nearly thirty years after a rocket, employing Dr. Goddard’s design, landed on the moon. See Tom Kuntz, *150th Anniversary: 1851–2001; The Facts That Got Away*, N.Y. TIMES (Nov. 14, 2001), <https://www.nytimes.com/2001/11/14/news/150th-anniversary-1851-2001-the-facts-that-got-away.html> [<https://perma.cc/R58U-D9QA>]. In addition, the U. S. government paid \$1 million to settle suits alleging infringement of Dr. Goddard’s U. S. patents 2,395,113 (“method for feeding combustion liquids to rocket apparatus”), and 2,397,657 and 2,397,659 (“control mechanism for a rocket apparatus”). *Frequently Asked Questions About Dr. Robert H. Goddard*, CLARK UNIVERSITY <http://www2.clarku.edu/research/archives/goddard/faq.cfm> [<https://perma.cc/9FX4-R5AV>].

² Sputnik I, the first rocket to achieve low earth orbit, was launched by the Soviet Union in 1957; the United States followed with its own low earth orbit rocket in 1958. Steven J. Dick, *50 Years of NASA History*, NASA (May 28, 2008) https://www.nasa.gov/50th/50th_magazine/historyLetter.html [<https://perma.cc/GL5Y-BRFA>].

³ The first human would not reach space until Yuri Gagarin flew the Soviet Union’s Vostok I in a single orbit around the Earth in 1961. See Paul D. Spudis, *Lunar Exploration: Past and Future*, NASA, https://www.nasa.gov/50th/50th_magazine/lunar_exploration.html [<https://perma.cc/466G-VGEW>]; *The Flight of Vostok 1*, EUROPEAN SPACE AGENCY, https://www.esa.int/About_Us/Welcome_to_ESA/ESA_history/50_years_of_humans_in_space/The_flight_of_Vostok_1 [<https://perma.cc/8KDE-SML3>]. At that time, Arthur C. Clarke’s “Sentinel of Eternity” had been published, but was still a decade away from being brought to the movie screen as Stanley Kubrick’s classic “2001: A Space Odyssey.” See Arthur C. Clarke, *Sentinel of Eternity*, TEN STORY FANTASY, Spring 1951; 2001: A SPACE ODYSSEY (Metro-Goldwyn-Mayer Studios, Inc., 1968).

lunar exploration was a stunning achievement;⁴ ten years ago, human space travel was the exclusive realm of governments,⁵ only three of which maintained any kind of sustained presence in space.⁶ Today, private companies have launched human space flights⁷ and orbital rockets that carry experiments and cargo to the International Space Station (ISS),⁸ while NASA's New Horizons mission has gone beyond the known planets and on New Year's Day 2019 reached Ultima Thule, an object 4 billion miles from our sun.⁹

In the next ten years, private companies plan to reach the moon and planets,¹⁰ while NASA is developing a plan to land

⁴ See Vic Lang'at Jr., *Which Countries Have Been on the Moon?*, WORLD ATLAS (Dec. 12, 2018) <https://www.worldatlas.com/articles/which-countries-have-been-on-the-moon.html> [https://perma.cc/AC5X-YHBE]. In 1969, the United States was the first nation to land a human (Neil Armstrong) on the moon and is still the only nation to have done so. Brian Dunbar, *The Moon*, NASA (Apr. 26, 2019), <https://www.nasa.gov/moon> [https://perma.cc/5A43-E9EL].

⁵ In all, only 12 men have walked on the moon and no one has reached another planet. For a list of lunar astronauts, see Nancy Atkinson, *How Many People Have Walked on the Moon*, UNIVERSE TODAY (Aug. 1, 2013), <https://www.universetoday.com/55512/how-many-people-have-walked-on-the-moon/> [https://perma.cc/LPD3-7T8A]. The first nongovernmental spaceflight did not occur until June 21, 2004. Tim Sharp, *SpaceShipOne: The First Private Spacecraft*, SPACE (Mar. 5, 2019), <https://www.space.com/16769-spaceshipone-first-private-spacecraft.html> [https://perma.cc/ZXG6-HZLQ].

⁶ The Soviet Union maintained the Mir space station, the U.S. maintained the Skylab space station (now maintained jointly as the International Space Station), and China maintained the Tiangong space station. See Deborah Bloom & Kate Hunt, *China Launches Tiangong-2 Space Lab*, CNN (Sept. 25, 2016, 2:25 PM), <https://www.cnn.com/2016/09/15/asia/china-launches-tiangong-2-space-lab/index.html> [https://perma.cc/ZM4D-8HTA]; Elizabeth Howell, *Skylab: First U.S. Space Station*, SPACE (July 11, 2018), <https://www.space.com/19607-skylab.html> [https://perma.cc/5BNW-LRST]; *China's Shenzhou 11 Docks at Tiangong 2 Space Station*, BBC NEWS (Oct. 19, 2016), www.bbc.com/news/world-asia-china-37700404 [https://perma.cc/YZ8A-KV9Z]; NASA, *International Cooperation*, https://www.nasa.gov/mission_pages/cooperation/index.html [https://perma.cc/7BBN-64C6].

⁷ The private company SpaceShipOne launched a suborbital flight in 2004, enabling it to win the X Prize. Dan Brekke, *SpaceShipOne Back on Course*, WIRED (July 7, 2004, 11:09 AM), <https://www.wired.com/2004/07/spaceshipone-back-on-course/> [https://perma.cc/8YWS-XSUY]; *Launching a New Space Industry*, ANSARI XPRIZE, <https://ansari.xprize.org/> [https://perma.cc/DJ6P-QWKV].

⁸ In 2012, SpaceX became the first private company to deliver cargo to the ISS and has launched 16 resupply missions to the ISS. *Dragon Resupply Mission (CRS-16)*, SPACE X (Jan. 14, 2019), <https://www.spacex.com/news/2018/12/05/dragon-resupply-mission-crs-16> [https://perma.cc/QWP8-ALKAI]; Press Release, NASA, Release 14-256 NASA Chooses American Companies to Transport U.S. Astronauts to International Space Station (Sept. 16, 2014), <https://www.nasa.gov/press/2014/september/nasa-chooses-american-companies-to-transport-us-astronauts-to-international> [https://perma.cc/8N4D-Z3HH].

⁹ Kenneth Chang, *Snowman-like Photos of Ultima Thule Sent Home by NASA's New Horizon Spacecraft*, N.Y. TIMES (Jan. 2, 2019), <https://www.nytimes.com/2019/01/02/science/ultima-thule-pictures-new-horizons.html> [https://perma.cc/8XPF-8QLV].

¹⁰ Leonard David, *Will Commercial Space Travel Blast Off in 2014?*, SPACE (Jan. 11, 2014, 10:00 AM), <https://www.space.com/24249-commercial-space-travel-blasts-off-2014.html> [https://perma.cc/3P76-A9LD]; see also Alan Boyle, *Jeff Bezos Lifts Curtain on Blue Origin Rocket Factory, Lays Out Grand Plan for Space Travel That Spans Hundreds of Years*, GEEKWIRE (Mar. 8 2016, 7:58 PM), <http://www.geekwire.com/2016/jeff-bezos-lifts-curtain-blue-origin-rocket-factory-vision-space/> [https://perma.cc/62C8-B3NW]. See generally Elizabeth Howell, *SpaceX: First Private Flights to Space Station*, SPACE (Feb. 27, 2017),

humans on Mars by the 2030s,¹¹ with the first step planned for 2020 when an unmanned craft is to be sent into deep space to retrieve an asteroid and push it into lunar orbit for study.¹²

While perhaps only a footnote in this story of incredible scientific achievement, the evolution of space travel has implications for law in general and patent law in particular.¹³ The possibility of discovering useful materials or technology in outer space was recognized early in the space era,¹⁴ but the patent law consequences of such discoveries have not been addressed completely.

In 1984, Congress recognized the private economic potential of space and set out to regulate it in the Commercial Space Launch Act, whose purposes included “promot[ing] economic growth and entrepreneurial activity through use of the space environment for peaceful purposes.”¹⁵ In the relatively brief period since space travel has become feasible,¹⁶ patent law has also been modified to solve many of the new problems posed by the possibility of economic activity and technological development in outer space.¹⁷ Other

spacex.html [https://perma.cc/H259-9SGS] (outlining SpaceX corporation’s plans for commercial space travel).

¹¹ Gary Daines, *NASA’s Journey to Mars*, NASA (Aug. 7, 2017), <https://www.nasa.gov/content/nasas-journey-to-mars> [https://perma.cc/4Q2M-97KS]; Amy Klamper, *White House Panel Spells Out Human Spaceflight Options for NASA*, SPACE (Sept. 8, 2009, 8:01 PM EDT), <http://www.space.com/7255-white-house-panel-spells-human-spaceflight-options-nasa.html> [https://perma.cc/UZD7-NVCR].

¹² Daines, *supra* note 11.

¹³ There are three types of patents issued by the United States government. “Patents issued under § 161 are referred to as ‘plant patents,’ which are distinguished from § 101 utility patents and § 171 design patents.” *J.E.M. AG Supply, Inc. v. Pioneer Hi-Bred Int’l, Inc.*, 534 U.S. 124, 133 n.5 (2001). While it is conceivable that space exploration will discover new plants that might raise issues similar to those discussed, the focus of this article is on utility patent issues; the term “patent” will refer to utility patents unless specifically stated otherwise.

¹⁴ In a 1959 article, Wolf Haber proposed a model space treaty which included a provision that “[t]he contracting States recognize that space and celestial matter are potential sources of raw materials They, therefore, undertake to develop these potentials in concert for the common good of mankind.” Wolf Haber, *A Draft Convention on International Law of Space*, 38 MICH. ST. B. J. 24, 25 (1959).

¹⁵ Commercial Space Launch Act, Pub. L. No. 98-575, 98 Stat. 3055, 3055 (1984) (codified as amended at 51 U.S.C. § 50901(b)(1) (2012 & Supp. V 2017)).

¹⁶ In comparison, English common law dates back nearly one thousand years. JOHN LANGBEIN, RENÉE LETTOW & BRUCE SMITH, *HISTORY OF THE COMMON LAW: THE DEVELOPMENT OF ANGLO-AMERICAN LEGAL INSTITUTIONS* 4 (2d ed. 2009); ROSCOE POUND, *THE SPIRIT OF THE COMMON LAW* 5 (1921); Mary Ann Glendon, Andrew D.E. Lewis, & Albert Roland Kiralfy, *Common Law*, ENCYC. BRITANNICA (July 26, 2018), <https://www.britannica.com/topic/common-law> [https://perma.cc/CR4D-385N] (dating the common law from the Norman conquest of England in 1066).

¹⁷ While the concept of outer space is probably intuitive, it is helpful to define the dividing line between the application of “terrestrial”—or traditional territorial—law and the application of “space law”. A helpful set of definitions is provided in an article from the dawn of the space age:

“Space” is that area immediately above airspace and extending outward from the surface of the earth to infinity, and which surrounds all celestial matter. . . . “Airspace” is that area immediately superjacent to the earth, which

problems remain to be resolved, new problems will arise, and even those problems that appear to have been solved have yet to face the test of practical application. This article focuses on one effect of the emergence of extraterrestrial activity from the exclusive and occasional realm of government activity to the possible realm of everyday private activity: the impact on the definition of prior art under patent law, which in turn has an impact on patentability of inventions (both those made in outer space and those made on Earth) and the extent to which the benefits of activities in space can be imported to earth. As currently written, the patent statute does not explicitly address the prior art status of inventions and discoveries made in outer space and whether future extraterrestrial discoveries might invalidate existing patents.

This article proceeds in the following Parts: Part I reviews the basics of patent law and patent theory in order to understand the problems that private entry into the field of space exploration and exploitation poses for the patent system. Part II identifies problems posed for traditional patent law by the possibility of extraterrestrial discoveries and summarizes those problems which Congress has addressed. Next, Part III identifies a category of issues—the status of extraterrestrial discoveries as prior art under patent law—that still requires attention, and presents two simple scenarios providing context for the policy considerations bearing on how patent law should treat extraterrestrial prior art. Part IV offers a precedential framework for addressing the problem. Finally, Part V suggests an approach to analyzing extraterrestrial prior art that, while contrary to a literal reading of current law, is consistent with the constitutional mandate to “promote progress”¹⁸ through the patent laws and is supported by early precedent.

I. A CRASH COURSE IN PATENT THEORY AND LAW

Monopolies are generally considered undesirable.¹⁹ According to economic theory, monopolies raise consumer prices

is subject to the sovereignty, suzerainty and control of the State above which it lies. It extends from the surface of the earth to a height where the presence of air is so negligible as to provide less than Y per cent of aerodynamic lift, at a forward speed of B miles per hour.

Haber, *supra* 14, at 24.

¹⁸ Article I Section 8 of the Constitution grants Congress the power “[t]o promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.” U.S. CONST. art. I, § 8, cl. 8.

¹⁹ See *Diamond v. Chakrabarty*, 447 U.S. 303, 319 (1980) (Brennan, J., dissenting); see also *Graham v. John Deere Co.*, 383 U.S. 1, 7–10 (1966).

and stifle innovation.²⁰ Yet, the Constitution provides authority to grant limited term exclusivity²¹ and, since the first Congress, patents (which are in effect government-sanctioned monopolies²²) have been part of U.S. law.²³ In the words of Thomas Jefferson, patents provide an incentive for “things which are worth to the public the embarrassment” of a monopoly.²⁴

Patents are thought to be “worth the embarrassment” of a monopoly because innovators often have the option of profiting from their innovations without providing the public benefit of disclosure.²⁵ Patents provide an incentive to disclose how to make and use inventions. In exchange for public disclosure (which destroys trade

²⁰ *United States v. Aluminum Co. of Am.*, 148 F.2d 416, 427 (2d Cir. 1945) (“Many people believe that possession of unchallenged economic power deadens initiative, discourages thrift and depresses energy; that immunity from competition is a narcotic, and rivalry is a stimulant, to industrial progress; that the spur of constant stress is necessary to counteract an inevitable disposition to let well enough alone.”); see *United States v. Corn Prods. Refining Co.*, 234 F. 964, 1014 (S.D.N.Y. 1916) (recognizing monopoly “power to exclude others from entering [an] industry”).

²¹ U.S. CONST. art. I, § 8, cl 8.

²² The Supreme Court has observed that “a patent is not, accurately speaking, a monopoly The term monopoly connotes the giving of an exclusive privilege for . . . a thing which the public freely enjoyed prior to the grant An inventor deprives the public of nothing which it enjoyed before his discovery.” *United States v. Dubilier Condenser Corp.*, 289 U.S. 178, 186 (1933). In the broader sense of the term, patents may be viewed as monopolies: they constrain others from competing with the owner of the patent within the scope of its claims. See 35 U.S.C. § 271 (2012).

²³ The tradition of U.S. patents reaches back to pre-Revolution England as well as to Colonial America. See *Goldstein v. California*, 412 U.S. 546, 557 n.13 (1973); *Pennock v. Dialogue*, 27 U.S. (2 Pet.) 1, 17 (1829); Edward C. Walterscheid, *To Promote the Progress of Science and Useful Arts: The Background and Origin of the Intellectual Property Clause of the United States Constitution*, 2 J. INTEL. PROP. L. 1, 12 (1994). South Carolina had a general patent statute. An Act for the Encouragement of Arts and Sciences, 1784 S.C. Pub. Laws 333-34. Ga. An Act for the Encouragement of Literature and Genius (1786) and N.H. Act for the Encouragement of Literature and Genius (1783) had intellectual property statutes broad enough to cover both copyrights and patents. Under the Articles of Confederation, the power to grant patents was not among the rights granted to the central government and was therefore reserved to the states. ARTICLES OF CONFEDERATION, art. II; Max Stul Oppenheimer, *Harmonization Through Condemnation: Is New London the Key to World Patent Harmony*, 40 VAND. J. TRANSNAT'L L. 445, 475 n.160 (2007) [hereinafter Oppenheimer, *Harmonization*]. The power was granted to the national government under the Constitution through what has variously been called the Intellectual Property Clause, the Copyright Clause, and the Patent Clause. U.S. CONST. art. I, § 8, cl. 8; Max Stul Oppenheimer, *Defending Breakthrough Innovation: The History and Future of State Patent Law*, 20 UCLA J. L. & TECH. 1, 3–7 (2016).

²⁴ Letter from Thomas Jefferson to Isaac McPherson (Aug. 13, 1813) <https://founders.archives.gov/documents/Jefferson/03-06-02-0322> [<https://perma.cc/XG3E-Z6BV>].

²⁵ They can do so by relying on trade secret protection. UNIF. TRADE SECRETS ACT § 1(4) (UNIF. LAW COMM'N 1985). The trade secret option has been made more attractive by the Leahy-Smith America Invents Act, Pub. L. No. 112–29, § 5(a), 125 Stat. 284, 297 (2011) (codified as amended at 35 U.S.C. § 273 (2012)) which made it a defense to patent infringement if the alleged infringer could show use of the patented invention—even in secret—more than a year before the patent application was filed. Thus, the Act eliminated one disadvantage of maintaining an innovation as a trade secret: the risk that someone else might independently invent the same technology, patent it, and use the patent to prevent the innovator from using it.

secrecy),²⁶ patents provide broader²⁷—but limited-term²⁸—protection for inventions.²⁹ This public disclosure is thought to be of greater benefit to society than trade secret use, because it allows others to learn from the invention and build on it.³⁰

While it is an article of constitutional faith³¹ that patents provide the public benefits of increased inventive activity and disclosure of inventions, there are those who have presented convincing arguments to the contrary. For example, in the eighteenth century, Thomas Jefferson observed that “generally speaking, other nations have thought that these monopolies produce more embarrassment than advantage to society, and it may be observed that the nations which refuse monopolies of invention, are as fruitful as England in new and useful devices.”³² Two hundred years later, Josh Lerner produced the data to support Jefferson’s intuition. Examining 177 changes in patent policy from 1852 to 1998 in sixty of the largest economies, he concluded that

²⁶ One requirement for maintaining a trade secret is that the information not be publicly known. UNIF. TRADE SECRETS ACT § 1(4) (UNIF. LAW. COMM’N 1985). Patents are published, at the latest, when issued.

²⁷ Trade secrets only grant the right to prevent “misappropriation,” which is defined as the “disclosure or use of a trade secret” acquired by “improper means.” *Id.* § 1(2)(ii)(A). Thus, independent invention is a defense to trade secret infringement, and most states recognize reverse engineering of a publicly sold product as beyond the protection of trade secret law. *See, e.g.,* *Kewanee Oil Co. v. Bicon Corp.*, 416 U.S. 470, 476 (1974). Patents grant the exclusive right to manufacture, use, sale or importation, even against reverse engineering and even against those who independently develop the same technology. 35 U.S.C. § 271 (2012).

²⁸ Trade secrets last as long as the definitional requirements are met: reasonable steps to prevent disclosure and lack of public knowledge. *See* UNIF. TRADE SECRETS ACT § 1(4) (NAT’L CONF. COMM’RS 1985). Patents typically last for twenty years from the date an application is filed. 35 U.S.C. § 154(a)(2) (2012).

²⁹ A report on the effects of patents commissioned by the Federal Trade Commission succinctly summarized the pros and cons of the system:

Awarding patent rights . . . is not costless. An innovator whose patent confers market power can raise prices or depress output (and . . . broad initial patent rights can sometimes interfere with follow-on innovation). These effects may be the price of progress, if the promise of a patent grant is necessary to elicit an invention, its disclosure, or investment in it. If invention, disclosure, or investment would have occurred even without the promise of a patent award, however, these costs hurt consumers unjustifiedly.

FED. TRADE COMM’N, TO PROMOTE INNOVATION: THE PROPER BALANCE OF COMPETITION AND PATENT LAW AND POLICY 1–2 (2003) (footnotes omitted). The report further noted “competition to win a patent right may drive a race to innovate. Indeed, firms competing to innovate may approach research problems differently, increasing the chances of successful innovation.” *Id.* at 2.

³⁰ *Motion Picture Patents Co. v. Universal Film Mfg. Co.*, 243 U.S. 502, 511 (1917) (“[T]he primary purpose of our patent laws is not the creation of private fortunes for the owners of patents, but is ‘to promote the progress of science and useful arts’” (quoting U.S. CONST. art. I, § 8)); *see also* *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 427 (2007); *Graham v. John Deere Co.*, 383 U.S. 1, 5–6 (1966).

³¹ U.S. CONST. art. I, § 8, cl. 8.

³² Letter from Thomas Jefferson to Isaac McPherson, *supra* note 24.

“[a]djusting for the change in overall patenting, the impact of patent protection-enhancing shifts on applications by residents was actually negative.”³³

Evidence to the contrary notwithstanding, Congress believes (as the Constitution commands) that “[i]f the United States is to maintain its competitive edge in the global economy, it needs a system that will support and reward all innovators with high quality patents.”³⁴ Recognizing Jefferson’s concerns, the patent statute³⁵ is at least designed to attempt to limit patent grants to inventions “worth the . . . embarrassment.”³⁶

Arguably the most important step in assuring that the public gets appropriate value for the patent monopoly is the requirement that an applicant prepare and file a written application, describing how to make and use the invention.³⁷ This assures that the fundamental bargain—a limited term monopoly in exchange for disclosure—is met. Most applications are published approximately eighteen months after filing,³⁸ and all patents are published.³⁹

The invention must fall within at least one of four statutory categories: (1) machine; (2) manufacture; (3) composition of matter;

³³ Josh Lerner, *Patent Protection and Innovation over 150 Years* 12, 27 (Nat’l Bureau of Econ. Res., Working Paper No. 8977, 2002), <https://www.nber.org/papers/w8977.pdf> [<https://perma.cc/5DB7-HDBJ>].

³⁴ H.R. REP. NO. 112-98, at 40 (2011).

³⁵ The constitutional authority to provide limited-term incentives for innovation is exercised in Title 35 of the U. S. Code, regulations governing patents are contained in Title 37 of the Code of Federal Regulations, and specific internal rules governing the handling of patent applications are contained in the Manual of Patent Examining Procedure (MPEP). It should be noted that, while many of the rules for each are similar, there are actually three types of patents issued by the United States: utility patents, design patents, and plant patents. The type which most people mean when referring to a “patent” is the utility patent, and that is the meaning of the term “patent” as used in this article.

³⁶ Letter from Thomas Jefferson to Isaac McPherson, *supra* note 24.

³⁷ 35 U.S.C. § 111; 35 U.S.C. § 112 (a) (2012). The process of obtaining a patent, referred to as “patent prosecution,” is initiated by submitting the written application to the U.S. Patent and Trademark Office (USPTO). See *Patent Prosecution Overview*, JUSTIA, <https://www.justia.com/intellectual-property/patents/patent-prosecution/> [<https://perma.cc/9BDF-HVEJ>]. The operation of the USPTO is outlined in a comprehensive guidance document for patent examiners, known as the Manual of Patent Examining Procedures (MPEP). See *generally* MPEP (9th ed., Rev. 8, Jan. 2018). Trade secrets, on the other hand, require no filing.

³⁸ 35 U.S.C. § 122(b) (2012); 17 C.F.R. § 1.211 (2018); MPEP § 1309 (9th ed. Rev. 8 Jan. 2018).

³⁹ 35 U.S.C. §§ 111, 154. The requirements of 35 U.S.C. § 112(a)—that “[t]he specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains . . . to make and use the same”—assure that the public receives adequate disclosure in exchange for the patent monopoly.

or (4) process.⁴⁰ The invention must also be useful,⁴¹ meaning, under United States Patent and Trademark Office (USPTO) guidelines, that the claimed invention has a “specific, substantial and credible” use.⁴² The threshold for utility is not high,⁴³ but the invention must be able to work. At a minimum, it must not violate the known laws of physics.⁴⁴

The statute also requires that the invention be “novel.”⁴⁵ If the public already has access⁴⁶ to the invention, there is no need to grant a monopoly with a patent in order to get disclosure.⁴⁷ Thus, beginning with the first patent statute,⁴⁸ patents have been available to novel inventions only, a requirement reflected in Sections 101 and 102 of the current statute.⁴⁹ Since patents are

⁴⁰ “Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent . . .” 35 U.S.C. § 101 (2012); *see also* *Kewanee Oil Co. v. Bicron Corp.*, 416 U.S. 470, 483 (1974) (“[N]o patent is available for a discovery, however useful, novel, and nonobvious, unless it falls within one of the express categories of patentable subject matter of 35 U.S.C. § 101 . . .”). Certain types of inventions that fall within the literal terms of the statute are not patentable because of judicially announced exceptions: “Phenomena of nature, though just discovered, mental processes, and abstract intellectual concepts are not patentable as they are the basic tools of scientific and technological work.” *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972). “[P]henomena of nature. . . are part of the storehouse of knowledge . . . free to all men and reserved exclusively to none.” *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948). Whether a given claim covers statutory subject matter is a question of law and reviewed without deference. *AT&T Corp. v. Excel Commc’ns, Inc.*, 172 F.3d 1352, 1355 (Fed. Cir. 1999). Nevertheless, “[t]he boundary between patentable and unpatentable subject matter is not always a bright line.” *In re Alappat*, 33 F.3d 1526, 1569 (Fed. Cir. 1994) (Newman, P., concurring). The Supreme Court itself noted that the “line between a patentable ‘process’ and an unpatentable ‘principle’ is not always clear.” *Parker v. Flook* 437 U.S. 584, 589 (1978).

⁴¹ 35 U.S.C. § 101 (2012).

⁴² U.S. DEP’T OF COMMERCE, PATENT AND TRADEMARK OFFICE, MANUAL OF PATENT EXAMINING PROCEDURES § 2107 (9th ed. 2015).

⁴³ *Fuller v. Berger*, 120 F. 274, 275 (7th Cir. 1903) (An invention is useful unless “it is incapable of serving any beneficial end”). *See generally* *Brenner v. Manson*, 383 U.S. 519, 532–36 (1966) (explaining the threshold for utility for patents).

⁴⁴ *Raytheon Co. v. Roper Corp.*, 724 F.2d 951, 956–57 (Fed. Cir. 1983) (A claim that requires “accomplishing an unattainable result” is invalid.).

⁴⁵ 35 U.S.C. §§ 101, 102 (2012).

⁴⁶ In the patent context, “access” does not necessarily mean that the public *realizes* what it has access to, under a doctrine known as “inherency.” This poses a particularly difficult issue for the treatment of extraterrestrial prior art. *See* discussion *infra* Part III.

⁴⁷ *See* *Miller v. Eagle Mfg. Co.*, 151 U.S. 186, 196–97 (1894) (if two identical inventions are claimed, it is proper to reject the second as not “novel”).

⁴⁸ The Patent Act of 1790, ch. 7, 1 Stat. 109, 110.

⁴⁹ 35 U.S.C. § 101 provides:

Inventions patentable—Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

35 U.S.C. § 102 provides (with exceptions related to publications by, or derived from, the patent applicant):

intended to provide an incentive to add to the public domain, a patent cannot be granted for something that is already in the public domain.⁵⁰ The definition of public domain has been modified from time to time, but fundamentally consists of information⁵¹ available to the public prior to the applicant's date of invention⁵² and information available to the public more than a year prior to the applicant's priority date. This information is collectively known as "prior art."⁵³

The statute also prevents granting patent monopolies on trivial advances, i.e., those that would have been considered "obvious" by someone of ordinary skill in the field⁵⁴ who, under the rules of the patent statute, is presumed to have complete

(a) NOVELTY; PRIOR ART.—A person shall be entitled to a patent unless—

(1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention; or

(2) the claimed invention was described in a patent

"Public use" has been defined as use by a person other than the inventor who is under no restriction by the inventor. There is an exception for experimental use of an invention by or under control of the inventor in order to perfect the invention. *Elizabeth v. Pavement Co.*, 97 U.S. 128, 135 (1877) ("[S]uch use is not a public use . . . so long as the inventor is engaged, in good faith, in testing its operation."); *see also, e.g.*, *Allied Colloids, Inc. v. Am. Cyanamid Co.*, 64 F.3d 1570, 1576–77 (Fed. Cir. 1995) (discussing the requirements of experimental use).

⁵⁰ *Bonito Boats, Inc. v. Thunder Craft Boats, Inc.*, 489 U.S. 141, 146–50 (1989) (stating that Congress cannot remove information from the public domain because removal would thwart the constitutional mandate to promote the progress of science and the useful arts.) A claimed invention which is rejected for lack of novelty is referred to as "anticipated" by the reference which shows that it is not novel. "[A] prior patent or other publication to be an anticipation must bear within its four corners adequate directions for the practice of the [invention]." *Dewey & Almy Chem. Co. v. Mimex Co.*, 124 F.2d 986, 989 (2d Cir. 1942); *see also* *Lincoln Stores, Inc. v. Nashua Mfg. Co.*, 157 F.2d 154, 159–60 (1st Cir. 1946); *Gordon Form Lathe Co. v. Walcott Mach. Co.*, 32 F.2d 55, 58 (6th Cir. 1929).

⁵¹ Under prior law, there were two categories of information which formed the public domain. Printed publications and patents anywhere in the world qualified, but other acts qualified only if they occurred in the United States. 35 U.S.C. § 102(e) (2006). The distinction was eliminated under current law. Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284, 285–86 (codified as amended at 35 U.S.C. § 102(d) (2012)).

⁵² 35 U.S.C. § 102(a) (2012). Under the pre-AIA statute, inventive activity abroad could not be used to establish a date of invention unless the activity took place in a North America Free Trade Agreement (NAFTA) or World Trade Organization (WTO) country. 35 U.S.C. § 104 (2006). Activities by individuals domiciled in the United States, a NAFTA country, or a WTO country but serving outside those countries on behalf of one of those countries could also qualify as covered inventive activity that could establish a date of invention. *Id.* § 104(2)(A)–(C).

⁵³ 35 U.S.C. § 102(b) (2012). The applicant may be able to claim a priority date, which is usually the date of the first application filed by the applicant which describes the claimed invention, provided certain technical requirements are met.

⁵⁴ 35 U.S.C. § 103 (2012).

knowledge of the prior art.⁵⁵ While recognized by judicial interpretation more than a century ago,⁵⁶ the concept of “obviousness” did not enter the patent statute until 1952.⁵⁷ Under the standard, things which would be obvious to others of ordinary skill in the relevant field are not patentable. As explained by the Supreme Court in *Graham v. John Deere*:

Under § 103, the scope and content of the prior art are to be determined; differences between the prior art and the claims at issue are to be ascertained; and the level of ordinary skill in the pertinent art resolved. Against this background, the obviousness or nonobviousness of the subject matter is determined.⁵⁸

The Supreme Court expanded its explanation of the obviousness requirement in *KSR International Co. v. Teleflex, Inc.*: “[g]ranting patent protection to advances that would occur in the ordinary course without real innovation retards progress and may, in the case of patents combining previously known elements, deprive prior inventions of their value or utility.”⁵⁹ Finally, the application must contain claims that define the invention and are sufficiently specific to apprise the public of the scope of the claimed patent rights.⁶⁰

After the patent application is filed, the application is examined by a patent examiner, who determines which, if any, of the claims satisfy all of the statutory requirements for patentability. Those which do are allowed, and form part of the issued patent.⁶¹ Following the grant of a patent, the specification and drawings are published, thereby destroying any trade secrets which might have existed in the application.⁶² In return, the patent owner is granted the right to stop others from making, using,

⁵⁵ See *In re Winslow*, 365 F.2d 1017, 1020 (C.C.P.A. 1966).

⁵⁶ See *Hotchkiss v. Greenwood*, 52 U.S. 248, 265–67 (1851).

⁵⁷ Bryson Act, ch. 950, 66 Stat. 792, 798 (1952) (codified as amended at 35 U.S.C. § 103 (2012)).

⁵⁸ *Graham v. John Deere Co.*, 383 U.S. 1, 17 (1966).

⁵⁹ *KSR Int'l. Co. v. Teleflex Inc.*, 550 U.S. 398, 419 (2007).

⁶⁰ 35 U.S.C. § 112 (2012) (“The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.”).

⁶¹ A patent application includes a description of the invention and how it relates to the state of the art, and a separate portion that defines what the applicant claims. MPEP § 608.01(c)-(d) (9th ed. Rev. 8, Jan. 2018). Both portions together are referred to as the patent “specification.” MPEP § 608.01(a). The only portion that may be infringed, however, is the claim section. See MPEP 2100-7 (“The claims define the property rights provided by a patent, and thus require careful scrutiny.”).

⁶² 35 U.S.C. § 154(a)(4).

importing, selling, or offering to sell⁶³ products incorporating the claimed invention⁶⁴ during the term of the patent.⁶⁵

In litigation, issued patents (and each of their claims) are presumed valid,⁶⁶ but a litigant claiming that a patent is invalid can rebut the presumption by showing that any of the conditions of patentability described above were not met.⁶⁷ An alleged infringer may also defend by showing that there is not actually infringement, by showing that the allegedly infringing activity is not covered by the patent, by showing that the alleged infringer is licensed to use the patented technology, or by showing that the patent is unenforceable.⁶⁸

Two additional points deserve mention: territoriality and exclusivity. Traditional patent law is, unsurprisingly, territorial in that it only governs activities within the United States.⁶⁹ As extraterrestrial activities became more common, the United States and several other countries reached treaty agreements governing the application of domestic patent law to activities in space.⁷⁰ Additionally, with regard to exclusivity, patents are, as provided by the Constitution, “exclusive” rights.⁷¹ The term does not mean that the patent owner is the exclusive person with the affirmative right to practice the patented invention;⁷² it means that the patent owner may “exclude” others from practicing the patented invention. Issues concerning in which territory activity must take place to

⁶³ *Id.* § 271. There are also specific provisions regulating some of the more obvious ways of avoiding a technical reading of the scope of patent protection: inducing infringement by knowingly supplying a material component especially adapted for use in infringing, *id.* § 271(c), or by supplying substantial portions of a patented invention so as to induce the combination into the patented invention, *id.* § 271(f), or carrying out a patented process outside the United States, then importing the product into the United States, *id.* § 271(g). There are also special provisions, not here relevant, relating to certain biological inventions and applications relating to FDA approval. *Id.* § 271(e).

⁶⁴ The patent statute defines “claimed invention” as “the subject matter defined by a claim in a patent or an application for a patent,” *Id.* § 100(j), and “invention” as “invention or discovery.” *Id.* § 100(a). It also defines “process” to include “a new use of a known process, machine, manufacture, composition of matter, or material.” *Id.* § 100(b).

⁶⁵ The term of a patent is ordinarily the period “beginning on the date on which the patent issues and ending 20 years from the date on which the application was first filed in the United States.” *Id.* § 154(a)(2).

⁶⁶ *Id.* § 282(a).

⁶⁷ *Id.* § 282(b)(2)–(3).

⁶⁸ *Id.* § 282(b)(1).

⁶⁹ *See id.* § 271.

⁷⁰ *See infra* Part II.

⁷¹ “Congress shall have Power . . . To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the *exclusive* Right to their respective Writings and Discoveries.” U.S. CONST. art. I, § 8, cl. 8 (emphasis added).

⁷² A moment’s thought will illustrate why this is so. Suppose that one individual invents and patents the wheel, and a second individual invents and patents an automobile that includes four wheels. If the second individual could, by virtue of the automobile patent, make and sell automobiles with four wheels without permission from the owner of the wheel patent, the patent on the wheel would be meaningless.

constitute “practicing” (and whether that includes outer space) have largely been addressed, and are discussed in Part II. That leaves, however, issues concerning what constitutes an “invention” (and whether to consider activities in outer space in resolving them)—these are addressed in Part III.

II. SOLVED PROBLEMS IN EXTRATERRESTRIAL LAW

General legal implications of space flight and extraterrestrial exploration and exploitation have been well-studied and the “big” questions of sovereignty and jurisdiction have been addressed.⁷³ In addition, several patent issues have been identified and resolved, either by domestic statute or by treaty⁷⁴: (1) which nation’s patent law applies to activities in space; (2) which activities in space qualify as “domestic” for purposes of priority; and (3) what qualifies as infringing activity.

In 1990, Congress provided by statute that, in general, inventions made, used, or sold in outer space on a spacecraft under the jurisdiction of the United States are treated as if within the United States,⁷⁵ and are also treated as if within the United States if covered by international agreement.⁷⁶ In effect, the statute equates space objects under U.S. jurisdiction with other territories and possessions under the jurisdiction of the United States. While broad for the time, this statute still leaves

⁷³ The Russian launch of Sputnik in 1957 triggered a spate of articles considering questions of ownership and sovereignty in outer space. See, e.g., John C. Cooper, *The Russian Satellite—Legal and Political Problems*, 24 J. AIR L. & COMM. 379, 379–83 (1957); D. Broward Craig, *National Sovereignty at High Altitudes*, 24 J. AIR L. & COMM. 384, 384–90 (1957); Eugène Pépin, *Legal Problems Created by the Sputnik*, 4 MCGILL L. J. 66, 67–69 (1957). Most of these questions were subsequently resolved, at least by countries having the capability of space travel, by treaty.

⁷⁴ See *infra* notes 75–80. There is one major space treaty that the United States has not acceded to: The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies, Dec. 5, 1979, 1363 U.N.T.S. 3, 22 (1979) [hereinafter Moon Treaty]. Article 11 of that agreement states that “[t]he moon and its natural resources are the common heritage of mankind,” therefore “[t]he moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means” and “[n]either the surface nor the subsurface of the moon, . . . 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.” *Id.* at 25 (emphasis added); see also *Status of Treaties ch. XXIV Outer Space*, UNITED NATIONS TREATY COLLECTION (Apr. 4, 2019), https://treaties.un.org/Pages/ViewDetails.aspx?src=TREATY&mtdsg_no=XXIV-2&chapter=24&clang=en [https://perma.cc/FW5F-LJUQ].

⁷⁵ Act of Nov. 15, 1990, Pub. L. No. 101-580, 104 Stat. 2864, 2863 (codified as amended at 35 U.S.C. § 105 (2012)) (“Any invention made, used, or sold in outer space on a space object or component thereof under the jurisdiction or control of the United States shall be considered to be made, used or sold within the United States . . .”).

⁷⁶ *Id.* (“Any invention made, used, or sold in outer space on a space object or component thereof that is carried on the registry of a foreign state . . . shall be considered to be made, used or sold within the United States . . . if specifically, so agreed in an international agreement between the United States and the state of registry.”).

unresolved the status of extraterrestrial inventions (and prior art) in general—only spacecraft under U.S. jurisdiction are covered.

Additionally, in 1994, the United States acceded to the 1994 Agreement on Trade-Related Aspects of Intellectual Property Rights, which provides that “patents shall be available and patent rights enjoyable without discrimination as to the place of invention.”⁷⁷ Then, in 1998, the United States acceded to the 1998 Agreement Concerning Cooperation on the International Space Station, which provides that “each Partner shall retain jurisdiction and control over the elements it registers . . . and over personnel in or on the Space Station who are its nationals” and recognizes the jurisdiction of the partner’s courts and application of national laws regarding criminal matters, civil liability, and protection of intellectual property rights.⁷⁸ Finally, in 2011, the America Invents Act⁷⁹ eliminated nationality requirements for non-published prior art. In doing so, it may have raised more questions than it answered regarding extraterrestrial aspects of U.S. patent law.⁸⁰

Thus, a framework for dealing with intellectual property in space has been established, at least as far as questions of jurisdiction and the scope of enforcement of domestic patent rights. Questions remain, however, and the most significant of them relate, not to enforcement of existing rights, but rather to acquisition of new rights.

III. UNSOLVED PROBLEMS: TWO PARADIGMATIC POLICY PROBLEMS

One aspect of patent law that has remained unexplored is the impact of extraterrestrial occurrences⁸¹ on patentability of earth-borne inventions. The impact might be felt in one of two ways, both resulting from the patent law requirement that, to be patentable, an invention must be new⁸² and non-obvious.⁸³

⁷⁷ TRIPS: Agreement on Trade-Related Aspects of Intellectual Property Rights art. 27, Apr. 15, 1994, Marrakesh Agreement Establishing the World Trade Organization, Annex 1C, 1869 U.N.T.S. 299, 33 I.L.M. 1197 [hereinafter TRIPS Agreement].

⁷⁸ Agreement Concerning Cooperation on the Civil International Space Station, arts. 5, 16, 21–22, Jan. 29, 1998, T.I.A.S. No. 12,927.

⁷⁹ Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 284 (2011) (codified as amended at various sections of 35 U.S.C. (2012)) [hereinafter “AIA”].

⁸⁰ See *infra* Part III.

⁸¹ Occurrences, such as publications, public use, and public dissemination of knowledge which may be used to evaluate the novelty of a claimed invention are referred to as “prior art.” As discussed in Section IV.A.1 *infra*, there are certain categories of prior art which were not available to the public prior to the invention of, or application for a patent on, the claimed invention. This has consequences, discussed in Parts IV and V, *infra*.

⁸² 35 U.S.C. §§ 101–102 (2012).

⁸³ *Id.* § 103.

In one scenario, a terrestrial inventor might make an invention, never before seen on Earth, that is subsequently discovered on another planet. Conventional patent law denies patents to anything “naturally” occurring or previously known by others. Should the terrestrial inventor be denied a patent? On the one hand, the subsequent discovery takes nothing away from the effort, ingenuity, and benefits to progress afforded by the earth-borne invention. On the other hand, the invention is not technically new—it already existed.

In a second scenario, a terrestrial inventor might make an invention, never before seen on Earth, but previously invented and known by an alien civilization and (accepting the possibility of future alien contact) subsequently introduced to Earth by that alien civilization. On the one hand, the subsequent introduction takes nothing away from the effort, ingenuity, and benefits to progress afforded by the earth-borne invention. On the other hand, the terrestrial inventor is not technically the “first inventor” under the America Invents Act (AIA).⁸⁴

A simple example will illustrate the policy problem that space exploration and exploitation poses for patent law. Assume that there is a compound that does not exist naturally on Earth, but does exist naturally somewhere in the universe.⁸⁵ Then imagine that a U.S. inventor, after years of research and millions of dollars in cost, develops this same compound on Earth, unaware that it already exists in space. The compound is useful and non-obvious, and the inventor obtains a U.S. patent. This patent gives the inventor the right to stop others from making, using, or selling the compound in the United States and to stop others from importing the compound into the United States. Subsequently, a space exploration company (after years of research and millions of dollars in cost) discovers the same

⁸⁴ See Leahy-Smith America Invents Act, Pub. L. No. 112-29, sec. 3, 125 Stat. 285–93 (2011). For a discussion of the concepts and implications of “inventorship” under “first inventor” and “first filer” systems, see Oppenheimer, *Harmonization*, *supra* note 23, at 448–54 (2007).

⁸⁵ This is a reasonable assumption given the vastly different natural conditions in space, for example near-vacuum and near absolute zero temperatures in space, thermonuclear temperatures on stars and almost infinite gravity in black holes. If, however, the assumption is incorrect, then the problem disappears and the solution is simple: if there is no prior art in space, then the current statute’s “worldwide” coverage is in effect “universal” coverage and no changes are required. See MIRIA M. FINCKENOR & KIM K. DE GROH, NAT’L AUERONAUTICS & SPACE ADMIN., A RESEARCHER’S GUIDE TO: INTERNATIONAL SPACE STATION: SPACE ENVIRONMENTAL EFFECTS 10–16 (2015), https://www.nasa.gov/sites/default/files/files/NP-2015-03-015-JSC_Space_Environment-ISS-Mini-Book-2015-508.pdf [<https://perma.cc/VK93-2Y56>]; *Space Environments and Effects Program*, NASA <https://see.msfc.nasa.gov> [<https://perma.cc/QRP8-QYBB>].

compound on an asteroid and begins mining it.⁸⁶ So far, there is no problem under patent law. The inventor can prevent others from making the compound in the United States, but the exploration company is not making the compound (and certainly not in the United States). The inventor can stop others from using the compound, but only in the United States. The inventor can stop others from selling the compound in the United States—but so far, no sale has yet taken place (and certainly not in the U.S.). The inventor can stop others from importing the compound into the United States, but so far, the compound is still on the asteroid.

A conflict will arise, though, if the exploration company tries to import the compound into the United States since importation is one of the exclusive rights of the patent owner.⁸⁷ How, then, should ownership of the invention be determined? The options are to: (1) award ownership to the terrestrial inventor, who has provided the valuable technology to the public before it was discovered elsewhere; (2) award ownership to the extraterrestrial discoverer as an incentive to make the huge expenditures and take the huge risks involved in space exploration; or (3) award it to neither and have the result dictated by the literal language of the current statute and judicial interpretation.

A second set of issues arises by virtue of improved remote sensing technology.⁸⁸ It is now possible to detect and, to some extent, characterize objects at distances so great that current technology holds no prospect of actually reaching those objects.⁸⁹ For example, spectral analysis of the light from distant stars can

⁸⁶ Although extremely scarce and parceled out for research by the microgram, samples have already been brought back by space missions—samples which may carry material that, while naturally occurring in space, only exists on Earth if artificially created. Meteorites pose the same issues but are random visitors and are therefore unlikely to present the type of economic incentive that would bring these issues to the fore. See Rob Davies, *Asteroid Mining Could Be Space's New Frontier: The Problem Is Doing It Legally*, GUARDIAN (Feb. 6, 2016 11:00 AM EST), <https://www.theguardian.com/business/2016/feb/06/asteroid-mining-space-minerals-legal-issues> [<https://perma.cc/D7NK-3AQH>]. See generally *Why Asteroids*, PLANETARY RESOURCES, <https://www.planetaryresources.com/why-asteroids/> [<https://perma.cc/RJJ9-557P>] (discussing a private company's focus on developing deep space exploration capabilities by mining water from asteroids); DEEP SPACE INDUSTRIES, <http://deep-spaceindustries.com> [<https://perma.cc/99CF-E6WW>] (discussing a private company's "ambitious venture to mine the resources of asteroids").

⁸⁷ 35 U.S.C. § 271 (2012). It would also be an infringement of the inventor's patent to sell the compound in the U.S., but that would require prior importation from the asteroid.

⁸⁸ See John F. Mustard & Jessica M. Sunshine, *Spectral Analysis for Earth Science: Investigations Using Remote Sensing Data*, in REMOTE SENSING FOR THE EARTH SCIENCES: MANUAL OF REMOTE SENSING 251, 251 (Andrew N. Rencz ed., 6th ed., 1999), http://www.geo.brown.edu/research/Milliken/GEOL1710_files/Mustard_Manual_OffRemoteSensing_Ch5.pdf [<https://perma.cc/4M8L-AEBP>]; *Remote Sensors*, NASA: EARTHDATA (Apr. 16, 2018, 8:34AM EDT) <https://earthdata.nasa.gov/user-resources/remote-sensors> [<https://perma.cc/7PRL-KX6V>].

⁸⁹ See *Remote Sensors*, *supra* note 88.

identify elements which are present on those stars.⁹⁰ If the spectral analysis of a star reveals that there are spectral lines not previously observed (and therefore indicating the presence of a previously unknown element), should this constitute prior art which would deny a patent to an earthbound inventor who subsequently synthesizes that element on Earth?

Once again, one option is to award a patent to the terrestrial inventor, who has provided the public with actual access to an element which, while theoretically identified in outer space, was in no way accessible to the public prior to the terrestrial inventor's efforts. The other option is to hold the newly identified element unpatentable⁹¹—the result dictated by the literal language of the current statute and judicial interpretation.

Ordinarily, analysis of a development not anticipated by the Founders would begin with the language of the Constitution as adopted, any prior versions of the language, and the insight that contemporary discussion might offer. In the case of patent rights, the analysis is brief: “No delegate to the Constitutional Convention has left any record concerning the interpretation or meaning placed on the intellectual property clause by the delegates themselves.”⁹²

A. *Issues Under 35 U.S.C. § 101: Is Nature Universal?*

If an earthbound inventor creates something that does not exist naturally on Earth, it is potentially patentable.⁹³ If it does exist naturally on Earth but that fact is unknown when the USPTO reviews the patent application, a patent will be granted. But if it is subsequently discovered in nature, the hypothetical patent will be held invalid.⁹⁴ Should the same result apply if the

⁹⁰ *See id.*

⁹¹ The person who deduced the existence of the element by observing the spectral lines would not be able to get a patent because the observation and deduction do not teach how to make and use the invention. 35 U.S.C. § 112 (2012); *see also infra* Section II.D. The person who synthesized the element on earth would not be able to get a patent because the element was already known under a literal reading of 35 U.S.C. § 102 (2012). *See discussion supra* notes 45–53 and accompanying text.

⁹² Edward C. Walterscheid, *Inherent or Created Rights: Early Views on the Intellectual Property Clause*, 19 *HAMLIN L. REV.* 81, 92 (1995). For a summary of available research and thinking on the genesis of the IP clause, see Max Stul Oppenheimer, *The Time and Place for “Technology-Shifting” Rights*, 14 *MARQ. INTELL. PROP. L. REV.* 269, 273–81 (2010).

⁹³ Invention itself, of course, is not enough for patentability: the other requirements, discussed in Part I, *supra*, must be met.

⁹⁴ Patents are presumed valid. 35 U.S.C. § 282(a) (2012). That presumption may, however, be overcome by showing that the decision to issue the patent was flawed, for example, because there was prior art that the USPTO had not considered before issuing the patent. *Canron, Inc. v. Plasser Am. Corp.*, 609 F.2d 1075, 1075 (4th Cir. 1979) (*per curiam*).

invention does not, in fact, exist naturally on Earth but does exist elsewhere in the universe?

The answer turns on interpretation of Section 101. That section of the patent statute has been described as a gatekeeper,⁹⁵ defining the only categories of invention which are eligible for patent consideration: “new and useful process[es], machine[s], manufacture[s], or compositions of matter, or any new and useful improvement thereof.”⁹⁶ The Supreme Court, however, has engrafted three exceptions to the categories enumerated as patentable: “laws of nature, physical phenomena, and abstract ideas.”⁹⁷ The Court further explained that “[t]he concepts covered by these exceptions are ‘part of the storehouse of knowledge of all men . . . free to all men and reserved exclusively to none.’”⁹⁸

A literal reading of Supreme Court precedent might lead to the conclusion that the hypothetical patent should be invalidated. The cases place no geographic limits on the location in which the laws of nature apply, or the physical phenomena exist. To date, however, the Court has only had to deal with earthly inventions, laws of nature, and physical phenomena. Should the Court’s language extend to either: (1) inventions made in space; (2) laws of nature which do not apply on Earth but do apply in space;⁹⁹ or (3)

⁹⁵ See *In re Comiskey*, 499 F.3d 1365, 1371 (Fed. Cir. 2007); *State St. Bank & Trust Co. v. Signature Fin. Grp.*, 149 F.3d 1368, 1372 n.2 (Fed. Cir. 1998) (noting that § 101 is a threshold issue that must be addressed before other questions of patentability); *In re Bergy*, 596 F.2d 952, 960 (C.C.P.A. 1979) (“The first door which must be opened on the difficult path to patentability is § 101.”). This view, however, finds no support in the patent statute and is contrary to the stated practice of the USPTO. Patent examiners are instructed that their review of a patent application is to be “complete as to all matters.” 37 C.F.R. § 1.104(b) (2018); see also MPEP § 707.07(g) (9th ed. Rev. 8, Jan. 2018) (“[p]iecemeal examination should be avoided as much as possible.”).

⁹⁶ 35 U. S. C. § 101 (2012).

⁹⁷ *Bilski v. Kappos*, 561 U.S. 593, 601 (2010) (quoting *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980)).

⁹⁸ *Id.* at 602 (quoting *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948)).

⁹⁹ It was once an article of scientific faith that the universe is governed by a single set of laws of physics which apply everywhere. See, e.g., Neil deGrasse Tyson, *On Earth as in the Heavens*, NAT. HIST. MAG., Nov. 2000, at 90–92 (“The universality of physical laws drives scientific discovery like nothing else.”); Neil de Grasse Tyson, *Telling the Story*, NAT. HIST. MAG., Feb. 2000, at 48 (“All parts of the known universe reflect the same basic laws of nature we observe and test here on Earth.”). Some now question that assumption. See Swinburne Univ. of Tech., *Laws of Physics Vary Throughout the Universe, New Study Suggests*, SCIENCE DAILY (Sept. 9, 2010) <https://www.sciencedaily.com/releases/2010/09/100909004112.htm> [https://perma.cc/SF42-LFTP] (According to Dr. Michael Murphy from Swinburne University, “It’s one of the biggest questions of modern science—are the laws of physics the same everywhere in the universe and throughout its entire history?” (internal quotation marks omitted)). Dr. Murphy is one of the authors of a 2011 article which reported detecting minute variations in what were thought to be cosmological constants, raising the possibility that the laws of physics are not constant throughout the universe. J. K. Webb et al., *Indications of a Spatial Variation of the Fine Structure Constant*, 107 PHYS. REV. LETT. 191101 (2011). If that is the case, then extraterrestrial discoveries would not necessarily constitute prior

physical phenomena (including “natural” compounds) which are natural in space, but not on Earth? Would the rationale that these are “part of the storehouse of knowledge of all men” apply even though very few have access to them?¹⁰⁰ Any of these issues would be questions of first impression.

There is, however, a clue in the issuance of U.S. Patent 3,161,462.¹⁰¹ That patent, which claimed a new transuranium compound, “Element 96 and compositions thereof,” was issued to Glen T. Seaborg, assignor to the U.S. Atomic Energy Commission in 1964.¹⁰² While Dr. Seaborg was the first person to isolate Element 96 (curium) on Earth, the element clearly exists in other parts of the universe¹⁰³ (and, in fact, exists on Earth in minute quantities).¹⁰⁴ The fact that the patent office issued the patent suggests that isolation of a natural element, although technically a physical phenomenon (and therefore unpatentable under the literal reading of the Supreme Court’s language), might still be patentable if the newly isolated element were not otherwise obtainable on Earth.¹⁰⁵ The Seaborg patent was never challenged in court, so there is no definitive judicial guidance on the issue. In the absence of judicial guidance, the views (and actions in determining to issue the patent) of the USPTO would be illuminating. It is possible that the USPTO raised objections to the application since the application was pending before the USPTO for fifteen years.¹⁰⁶ It

art, as they would exist under different conditions than those on Earth. However, even assuming that physical laws are, in fact, universal, there are still certainly manifestations of those laws which do not exist on Earth but do exist in space. An example would be a black hole.

¹⁰⁰ Of course, if space travel becomes commonplace, the analysis would need to change.

¹⁰¹ U.S. Patent No. 3,161,462 (filed Feb. 7, 1949) (issued Dec. 15, 1964).

¹⁰² *Id.*

¹⁰³ It was speculated that curium was produced in stars, and its natural existence in other parts of the universe was confirmed when it was detected in a meteorite. Francois L.H. Tissot, Nicholas Dauphas, & Lawrence Grossman, *Origin of Uranium Isotope Variations in Early Solar Nebula Condensates*, 2 SCI. ADVANCES *1, *2 (2016).

¹⁰⁴ It is thought that “[m]inute amounts [of curium] may exist in natural deposits of uranium.” *Periodic Table: Curium*, ROYAL SOC’Y OF CHEMISTRY, <http://www.rsc.org/periodic-table/element/96/curium> [<https://perma.cc/USX8-JJD4>].

¹⁰⁵ The process of isolating curium for the first time on Earth was extraordinary. It began by placing 100 mg. of plutonium, itself extraordinarily hard to come by at the time, in a cyclotron (a rare scientific tool at the time) and bombarding it with helium ions, dissolving it in sulfuric acid, evaporating the sulfuric acid solution, then dissolving what remained in dilute nitric acid. What had not dissolved in the dilute nitric acid was then dissolved by heating with a nitric acid/hydrofluoric acid mixture and oxidized. Finally, lanthanum fluoride was precipitated from the solution carrying with it insoluble curium trifluoride, from which curium was isolated. *See* ‘462 Patent.

¹⁰⁶ Currently, the average time to disposition—the time from filing a patent application until it is either issued or abandoned—is roughly two years. *See* U.S. PATENT & TRADEMARK OFFICE, PERFORMANCE & ACCOUNTABILITY REPORT 2 (2018).

was filed February 7, 1949 and issued December 15, 1964.¹⁰⁷ Such USPTO objections would be reflected in the application file, which is a public document,¹⁰⁸ yet the file for this application is “missing.”¹⁰⁹ Therefore, all that can be said for certain is that the courts have not addressed the issue and, if the USPTO had concerns about patentability under such circumstances, those concerns were overcome and the patent was issued.¹¹⁰

B. Issues Under 35 U.S.C. § 102: Is Novelty Restricted to Earth?

There has been an evolution in the view of what constitutes prior art, beginning with what might be termed “insular prior art” (limited to materials that are actually available to the public within the jurisdiction),¹¹¹ evolving to what might be termed “feasibly available prior art” (consisting of materials that are actually available to the public within the jurisdiction plus materials that have a high probability of becoming available to that public),¹¹² and

¹⁰⁷ ‘462 Patent.

¹⁰⁸ 37 C.F.R. § 1.11 (2018); *see also* MPEP § 103 (9th ed. Rev. 7., Jan. 2018).

¹⁰⁹ Correspondence on file with the author.

¹¹⁰ In a similar case, dealing with claims to the invention of Element 95 (Americium), the USPTO had rejected claims to the element, because in its view the same element would have been produced—although not recognized—by earlier experiments using a Fermi reactor. *In re Seaborg*, 328 F.2d 996, 999 (C.C.P.A. 1964). In that case, the court reversed the rejection, concluding that there was “no positive evidence that americium was produced . . . by the operation of the [Fermi] reactor” in light of an affidavit that concluded that the earlier production of Americium by a Fermi reactor was purely theoretical, and that the theoretical calculations showed that

the maximum amount of americium-241 that could have been produced in the reactor . . . can be calculated to be 6.15×10^{-9} gram. Thus, the reactor could have produced no more than one billionth of a gram of americium-241, and this one billionth of a gram would have been distributed throughout forty tons of intensely radioactive uranium reactor fuel. This amount of an unknown, unconcentrated isotope, if present, would have been undetectable.

Id. at 997. Because the decision rested on a failure of proof, it did not resolve the issue of patentability of a newly isolated element. It is possible, though, that this case, decided in March of 1964, may have persuaded the USPTO to abandon any challenge to the claims to Element 96 and issue the patent—after fifteen years of review—in December 1964. *See* ‘462 Patent. While the file itself is missing, the typical time taken to complete the mechanical step of issuing the patent once the decision has been made that the invention is patentable and the applicant has paid the issue fee is about two months, which suggests that the USPTO’s decision that the invention was patentable must have occurred very shortly after the decision in *In re Seaborg*.

¹¹¹ The Venetian and early British systems of patents of importation are examples. *See infra* Section IV.A.4.

¹¹² The U.S. system from 1836 to 2012 is an example. During that period, prior art consisted of things known or used in the U.S. plus printed publications anywhere. *See* 35 U.S.C. § 102(a) (2006) (pre-AIA). An explanation of this distinction is provided in *In re Tenney*: A printed publication is more likely to become available to the public than is personal knowledge held abroad. Printing implies a number of copies, and books travel

culminating in what might be termed “unrestricted prior art” (consisting of materials known or used anywhere).¹¹³

When Congress overhauled the patent statute in 1952, the committee reports from both chambers stated that patentable subject matter was intended to “include anything under the sun that is made by man.”¹¹⁴ The related questions of whether prior art as well encompassed everything under the sun and whether “under the sun” meant “on Earth” were not considered by the pre-space age Congress. Therefore, the novelty requirement, set out in Section 102, was written in terms of activities in this country, and activities in this or a foreign country, without mention of activities beyond Earth.

The 1952 version of Section 102 set out the requirement (which remained in force until the America Invents Act¹¹⁵ was enacted in 2011) that, to be patentable, an invention must be novel¹¹⁶

Thus, under the 1952 patent statute, a patent application would be rejected as anticipated if the claimed invention had been disclosed in a prior publication anywhere, but in order to reject it based on unpublished knowledge, use or offer for sale, such activity would have had to have taken place within the United States.

1. Impact of AIA amendments

The post-space age amendments to the patent statute enacted in the America Invents Act eliminated these geographic distinctions.¹¹⁷ The language chosen, however, was not written with the possibility of extraterritorial prior art in mind, and therefore raise (probably inadvertently) the first novelty issue posed by extraterrestrial activity.

As amended by the AIA, Section 102 now provides (with exceptions related to publications by, or derived from, the patent applicant):

across national boundaries more easily than people do. *See In re Tenney*, 254 F.2d 619, 625–26 (C.C.P.A. 1958).

¹¹³ The current, post-AIA U. S. system is an example. Prior art consists of things published, known or used or “otherwise available to the public”, without reference to geography. 35 U.S.C. § 102 (2012 & Supp. V 2018).

¹¹⁴ S. REP. NO. 82-1979, at 5 (1952); H.R. REP. NO. 82-1923, at 6 (1952). The language from the committee reports was quoted as support for the holding in *Diamond v. Chakrabarty* that genetically engineered organisms were, although alive, patentable. *Diamond v. Chakrabarty*, 447 U.S. 303, 309 (1980).

¹¹⁵ Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284 (2011).

¹¹⁶ 35 U.S.C. § 102 (2006 & Supp. V 2012)) (pre-AIA). If a prior art reference discloses what is claimed in a patent claim, the reference makes the claim unpatentable because the claim does not cover a novel invention and is said to “anticipate” the claim. *See supra* note 49–53 and accompanying text.

¹¹⁷ Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284, 285 (2011).

(a) NOVELTY; PRIOR ART.—A person shall be entitled to a patent unless—

(1) the claimed invention was patented, described in a printed publication, or in public use, on sale, or otherwise available to the public before the effective filing date of the claimed invention.¹¹⁸

Eliminating the “in this country” language from the statute has the consequence of broadening the scope of prior art considered in evaluating the novelty, and therefore patentability, of a claimed invention. The question that remains is whether the language change was intended to remove all spatial limitations on the location of prior art (and therefore include extraterrestrial prior art) or simply to remove the distinction between domestic and foreign (earthly) prior art.¹¹⁹ It is certainly possible that, by removing not only the language “in this country” but also the language “in this or a foreign country” the intent was to remove location as a factor in enumerating prior art—i.e., anything in the universe could qualify. If this was the intent, the new language introduces a new ambiguity: the meaning of “public.” It is hard to support the argument that the twelve people who have walked on the moon¹²⁰ constitute “the public.”¹²¹ Thus, if a lunar astronaut had observed something on the moon and had written a publication describing it or filed a patent application based on it, it would clearly constitute prior art under Section 102(a);¹²² the observation itself would not (unless “public” is read to cover such a small and constrained group) constitute prior art.¹²³

¹¹⁸ 35 U.S.C. § 102(a)(1) (2012). The statute also permits certain patent applications to be considered prior art that can invalidate claims even though the applications were not available to the public at the time the claims were filed. 35 U.S.C. § 102(a)(2) (2012). This provision was not changed by the AIA amendments.

¹¹⁹ The question is not addressed in the legislative history.

¹²⁰ For a list of people who have walked on the moon, see Atkinson, *supra* note 5.

¹²¹ Some support for the proposition might be found in the treatment of classified information as prior art. While it is not considered a publication until it is declassified, once declassified it may be used as evidence of prior knowledge as of the date of its (classified) dissemination. MPEP 707.05(f) (8th ed. Rev. 9., Aug. 2012). There is still an issue whether the classified dissemination was sufficiently broad to constitute “public” knowledge, but the fact that it was not available to the “general public” does not disqualify it. Of course, it cannot be prior art at all until it is declassified, because until then neither the USPTO nor a potential infringement defendant would have access to it.

¹²² Information which is disseminated to a small group under an obligation of confidentiality is not prior art. MPEP 2128.01(III). However, published information is clearly covered by Section 102(a).

¹²³ This interpretation would also help explain the decision to issue the Seaborg patent: even accepting that curium existed naturally in “minute quantities” or was unintentionally created in earlier nuclear experiments, the number of people who would have had access to it was small and selected (and under obligations of confidentiality). See *In re Seaborg*, 328 F.2d 996, 999 (C.C.P.A. 1964).

2. Application of the “Inherency” Doctrine

A second novelty-related problem implicates the doctrine of “inherency.” The inherency doctrine is described by the USPTO as follows:

The express, implicit, and inherent disclosures of a prior art reference may be relied upon in the rejection of claims The discovery of a previously unappreciated property of a prior art composition, or of a scientific explanation for the prior art’s functioning, does not render the old composition patentably new to the discoverer [and] just as the discovery of properties of a known material does not make it novel, the identification and characterization of a prior art material also does not make it novel.¹²⁴

The policy behind the inherency doctrine is that, if the public already has access to the technology, there is no need to purchase it with a patent monopoly—even if the public does not know that it has access to the technology. The policy is constitutionally required: Congress cannot remove information from the public domain because removal would thwart the constitutional mandate to promote the progress of science and the useful arts.¹²⁵

The United States Court of Appeals for the Federal Circuit in *EMI v. Cypress Semiconductor* offers this illustration of the policy:

A hypothetical example clarifies this principle. Humans lit fires for thousands of years before realizing that oxygen is necessary to create and maintain a flame. The first person to discover the necessity of oxygen certainly could not have obtained a valid patent claim for “a method of making a fire by lighting a flame in the presence of oxygen.” Even if prior art on lighting fires did not disclose the importance of oxygen and one of ordinary skill in the art did not know about the importance of oxygen, understanding this law of nature would not give the discoverer a right to exclude others from practicing the prior art of making fires.¹²⁶

Thus, a prior art reference may anticipate a claim even if it does not explicitly disclose every feature of the claimed invention if each “missing [feature] is necessarily present, or inherent, in the single anticipating reference.”¹²⁷ In that case, the public had access to the

¹²⁴ MPEP § 2112 (9th ed. Rev. 7, Jan. 2018) (internal citations and quotation marks omitted). A single prior art reference that discloses, either expressly or inherently, each limitation of a claim invalidates that claim by anticipation. *Minn. Mining & Mfg. Co. v. Johnson & Johnson Orthopaedics, Inc.*, 976 F.2d 1559, 1565 (Fed. Cir. 1992).

¹²⁵ See *Bonito Boats, Inc. v. Thunder Craft Boats*, 489 U.S. 141, 146, 150 (1989).

¹²⁶ See *EMI Grp. N. Am., Inc. v. Cypress Semiconductor Corp.*, 268 F.3d 1342, 1351 (Fed. Cir. 2001).

¹²⁷ See *Schering Corp. v. Geneva Pharm., Inc.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003); see also Dan L. Burk & Mark A. Lemley, *Inherency*, 47 WM. & MARY L. REV. 371, 379 (2005) (Where courts “actually find inherent anticipation the determining factor

inherent feature—even if the public was not specifically aware that the feature was present. Similarly, “[n]ewly discovered results of known processes” are “not patentable”—those results are inherent in the known processes.¹²⁸

In other words, contrary to the intuitive meaning of “prior” art, there are certain “later” activities that are still considered “prior” art.¹²⁹ An example is presented in the *Myriad* case.¹³⁰ In that case, the patent applicant had discovered a gene sequence that had significant therapeutic value. Prior to the discovery by the applicant (and recognition of the significance of the gene sequence), no human knew of its existence or function. Prior to the discovery by the applicant, however, the gene sequence (obviously) existed. The Court held the discovery unpatentable as a mere discovery of a natural substance.¹³¹ Thus, it was the applicant’s own discovery that defeated the patent—but for that discovery, no one would have known that the gene sequence existed (and therefore constituted prior art, which denied the applicant’s right to the patent).

In another example, *In re Cruciferous Sprout Litigation*, researchers at Johns Hopkins had determined that, at an early stage of development, broccoli sprouts were high in a compound that had cancer-fighting properties, and claimed “a method of preparing food products rich in glucosinolates . . . [by] harvesting sprouts prior to the 2-leaf stage, to form a food product comprising

appears to be that the public has already benefitted from the presence of the claimed invention in the prior art, even though it may not have been aware of the invention itself.”).

¹²⁸ See *Bristol-Myers Squibb Co. v. Ben Venue Labs., Inc.*, 246 F.3d 1368, 1376 (Fed. Cir. 2001).

¹²⁹ Patents are presumed valid. 35 U.S.C. § 282(a) (2012). That presumption may, however, be overcome by showing that the patent should not have been issued, for example because there was prior art that the USPTO had not considered during the prosecution of the patent, i.e., later discovered prior art. 35 U.S.C. § 282(b)(2) (2012). It is also possible for information that was unknown to the public at the time of the invention may still constitute “prior” art. For example, classified material is considered published when declassified, but may be considered “known” at an earlier date. See *supra* note 121. Thus, there might be information to which the general public gained access only *after* the invention was made (or after a patent application is filed), but which might be treated as prior art because of developments subsequent to the invention (and possibly even subsequent to the filing of the patent application). Interestingly, this logic is not applied to the seemingly similar situation of magazine articles. As to those, the USPTO takes the position that the effective date of a magazine is the date it reaches an addressee, not the date it is mailed. MPEP § 2128.08 (9th ed., Rev. 8, Jan. 2018). This position is supported by caselaw. See *Canron, Inc. v. Plasser Am. Corp.*, 609 F.2d 1075, 1075 (4th Cir. 1979) (per curiam); *Bergstrom v. Sears, Roebuck & Co.*, 599 F.2d 62, 64–65 (8th Cir. 1979) (per curiam). Neither the USPTO nor the cases have taken the second step of acknowledging that by the time a magazine is placed in the mail, its contents must be “known by others” (the authors, editors, production staff, etc.).

¹³⁰ See *Ass’n for Molecular Pathology v. Myriad Genetics, Inc.*, 569 U.S. 576 (2013).

¹³¹ *Id.* at 591, 596.

a plurality of sprouts.”¹³² No one else had recognized the high concentrations of glucosinolates in sprouts at this early stage, but the court held the claims invalid because the inventors merely discovered an inherent, although previously unappreciated, property of the sprouts.¹³³

In the USPTO’s view, “[t]here is no requirement that a person of ordinary skill in the art would have recognized the inherent disclosure *at the time of invention*, but only that the subject matter is in fact inherent in the prior art reference.”¹³⁴

C. *Issues Under 35 U.S.C. § 103: What Is the Person of Ordinary Skill Presumed to Know?*

In addition to requiring novelty, the patent statute requires that, in order to be patentable, the claimed invention must not be obvious to people of ordinary skill in the relevant art.¹³⁵

The underlying reason for denying patents based on obviousness is to limit the grant of patent monopolies to situations in which the public receives in exchange technology which it would not otherwise receive,¹³⁶ and inventions which are

¹³² See *In re Cruciferous Sprout Litig.*, 301 F.3d 1343, 1345, 1352 (Fed. Cir. 2002).

¹³³ *Id.* at 1350–52.

¹³⁴ MPEP § 2112 (9th ed., Rev. 8, Jan. 2018) (citing *Schering Corp. v. Geneva Pharm. Inc.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003); see also *Schering Corp. v. Geneva Pharm. Inc.*, 339 F.3d 1373 (Fed. Cir. 2003). Schering Corp. owned a patent (4,282,233) covering loratadine, the active component of Claritin, a blockbuster antihistamine marketed by Schering, and a method of using the compound to treat allergies. *Id.* at 1374–75. When the patent was about to expire, Schering applied for a patent covering descarboethoxyloratadine (DCL), the compound created in a user’s body when loratadine is metabolized. *Id.* at 1375. The court held that, although DCL was unknown until disclosed in the new patent, the method of treatment disclosed in the original patent necessarily produced DCL when a patient took Claritin and therefore the 4,282,233 patents anticipated the later application. *Id.* at 1380–81. The court rejected the contention that inherent anticipation requires that a person of ordinary skill in the art would have recognized the existence of the inherent property. *Id.* at 1377. There is at least one case holding, to the contrary, that not only must the missing element be inherently present, but in addition it must have been recognizable by a person of ordinary skill. See *Continental Can Co. USA v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991). These positions seem inconsistent. The Federal Circuit has stated, however, “[o]ur cases have consistently held that a reference may anticipate even when the relevant properties of the thing disclosed were not appreciated at the time.” *Abbott Labs. v. Baxter Pharm. Prods. Inc.*, 471 F.3d 1363, 1367 (Fed. Cir. 2006). For detailed analysis and attempts to rationalize the positions, see Janice M. Mueller & Donald S. Chisum, *Enabling Patent Law’s Inherent Anticipation Doctrine*, 45 HOUS. L. REV. 1101, 1102–03, 1106–07, 1116–17, 1150 (2008). See generally Cynthia Chen, Note, *Schering Corp. v. Geneva Pharmaceuticals, Inc.: Clarification of the Inherent Anticipation Doctrine and Its Implications*, 20 BERKELEY TECH. L.J. 95 (2005).

¹³⁵ 35 U.S.C. § 103 (2012).

¹³⁶ The obviousness standard was codified as 35 U.S.C. § 103 in 1952, but the principle that inventions which were technically new, but encompassed only minor variations on known technology was recognized judicially as an extension of the

obvious variations of what already is available would, in the ordinary course, become available as well. This goal justifies the judicially created fiction that the hypothetical person of ordinary skill knows everything that is available to the public. In *In re Winslow*, the Court of Customs and Patent Appeals (predecessor of the Federal Circuit) held that the obviousness of a claimed invention was to be determined with reference to a hypothetical person of ordinary skill in the field who was presumed to have complete knowledge of all relevant prior art.¹³⁷

The goal of denying patents for ideas that would likely become available to the public without intervening invention justifies the fiction that the hypothetical person of ordinary skill knows everything that is available to the public. The question remains: how far should the fiction extend? The notion of ignoring the cost of assembling the knowledge appears implicit in the *Winslow* rationale, so that the knowledge available to the hypothetical person of ordinary skill should include knowledge brought back to Earth from space, even at great cost.

The harder question is whether the fiction should extend to every natural phenomenon, whether previously observed or not, and whether existing on Earth or not, or should it only apply to natural phenomena that had been reported back to the hypothetical earthbound person of ordinary skill? This question implicates the inherency doctrine discussed above,¹³⁸ but with a complication. The application of the doctrine of inherency in a determination of obviousness is more complicated than in a determination of novelty because “[t]hat which may be inherent is not necessarily known and that which is unknown cannot be obvious.”¹³⁹ Inherency can defeat novelty because what is claimed is not really new—it was just not recognized. Obviousness, however, requires a determination that someone of ordinary skill would likely have been able to achieve the claimed invention knowing all that was known. If an inherent property was not previously known, it would not have been available to the hypothetical person of ordinary skill to use in achieving the claimed invention.

An even harder extension of the *Winslow* fiction to justify would be knowledge of as-yet unappreciated properties of things that exist in the universe but not as yet on Earth. Such an extension would appear to require that the hypothetical person of

statutory novelty standard in 1850 in *Hotchkiss v. Greenwood*. *Hotchkiss v. Greenwood*, 52 U.S. (11 How.) 248, 265–67 (1850).

¹³⁷ *In re Winslow*, 365 F.2d 1017, 1020 (C.C.P.A. 1965).

¹³⁸ See *supra* Section III.B.2.

¹³⁹ See *Honeywell Int’l Inc. v. Mexichem Amanco Holding S.A. DE C.V.*, 865 F.3d 1348, 1354 (Fed. Cir. 2017) (quoting *In re Rijckaert*, 9 F.3d 1531, 1534 (Fed. Cir. 1993)).

ordinary skill, in addition to having complete knowledge of everything known about the field, including as-yet unappreciated properties of known materials, can also predict the future and foresee information that exists in the universe but has not yet been introduced to the earthbound “public.”

D. Issues Under 35 U.S.C. § 112: Enablement and Claiming

Section 112 of the patent statute requires that an applicant for a patent describe how to make and use the claimed invention¹⁴⁰ (the “enablement” requirement) and provide claims which define the invention¹⁴¹ (the “claiming” requirement).¹⁴² Both requirements are typically met with earthbound applications in mind.¹⁴³ The two requirements are related. The degree of enablement required (and the scope of available prior art) is defined by the scope of the claims. The applicant need only enable what is claimed, and only material which is relevant to the claims is relevant prior art.¹⁴⁴ If the claims are not fully supported by the enabling description, they are referred to as overbroad and will not be allowed¹⁴⁵; on the other hand, an applicant wants to claim as much as possible and does not want the claims to fail to include everything that has been enabled and is not precluded by prior art. Therefore, both requirements will require reevaluation as extraterrestrial activity becomes more common.

It would be unusual for a patent application to recite that the invention is to be made or used “under standard conditions on earth” in order to make the invention operative,¹⁴⁶ because most inventions are intended to be made and used on Earth¹⁴⁷ and therefore those conditions are implicit. Conditions would not normally be recited unless non-standard conditions were required to describe how the invention would be made or used. In addition, it would be unusual to need to recite “standard” conditions in order to distinguish the claimed invention from

¹⁴⁰ 35 U.S.C. § 112(a).

¹⁴¹ *Id.* § 112(b).

¹⁴² *Id.* § 112(a)–(b) (2012).

¹⁴³ There are exceptions, typically patents directed to inventions intended to be used in space. *See, e.g.*, U. S. Patent No. 4,815,279 (filed Apr. 13, 1987) (issued Mar. 28, 1989) (issued to Franklin R. Chang for “Hybrid plume plasma rocket”). Claim 1 is illustrative: “A space vehicle having a selectable vehicle velocity and a selectively adjustable thrust . . .” *Id.* col. 6.

¹⁴⁴ *See supra* Section III.B.2.

¹⁴⁵ MPEP § 706.03(c) (9th ed., Rev. 8 Jan. 2018).

¹⁴⁶ 35 U.S.C. § 112.

¹⁴⁷ In addition, if the invention happened to work in some extraterrestrial environments, it would inherently satisfy the requirements of 35 U.S.C. § 112 (2012).

prior art: most prior art is earthbound and therefore also operates under “standard” conditions.¹⁴⁸

As extraterrestrial activity increases, however, the conditions under which an invention is intended to operate will become relevant. If an invention requires oxygen to operate, enablement for earthbound operations would not require explicitly stating so, while enablement for operation in space would require an explanation of how the required oxygen will be supplied.

Related to the question of whether it is necessary to be explicit regarding conditions which are implicit on Earth is the question of whether it is necessary to be explicit in defining the scope of the invention. As discussed above, claims in a patent application are rejected under Section 102 if they have already been disclosed in the prior art or under Section 103 if they have not been disclosed in the prior art, but would have been obvious given what is in the prior art.¹⁴⁹ If a claim is specifically limited to particular conditions, then it cannot be rejected unless the prior art discloses, or renders obvious, those conditions. Careful applicants may therefore begin drafting claims to inventions which are intended to operate on Earth to include explicit terms that limit the operation and definition of the invention to earthly conditions. In addition to satisfying enablement requirements, this will also have the effect of reducing the scope of extraterrestrial prior art that might otherwise be used to reject claims.

IV. DESIGNING A SOLUTION

A comprehensive approach to the application of patent law to extraterrestrial activity is currently missing two elements. It should include rules governing the protection of extraterrestrial innovation: and should address the questions of whether new compounds discovered in space and new technologies invented in space should be protectable under U.S. patent law and, if so whether they should be protectable even if they represent “principles of nature” in the location where discovered or invented, but not on Earth. It should also include rules governing the use of extraterrestrial discoveries to deny patents for innovations made on Earth: if an invention is made on Earth (meaning that human intervention was required in order to make it possible) but the same “invention” occurs

¹⁴⁸ If there were extraterrestrial prior art that needed to be distinguished, the applicant would have the option of limiting the claims either spatially (to Earth) or of specifying conditions that exist on Earth but not at the location where the extraterrestrial prior art was found.

¹⁴⁹ See *supra* Section III.B–C.

naturally in some extraterrestrial environment, should that deny the earthbound inventor of a patent? If so, should it matter whether the extraterrestrial phenomenon was unknown at the time the earthbound inventions was made?

Any solution must either be consistent with the Constitution and treaties, or must be sufficiently compelling to justify changing them. The solution must, of course, also be consistent with federal law, but presumably the selected solution will either be lawful or sufficiently compelling to persuade Congress to adopt the necessary legislation, and “the powers of Congress to legislate upon the subject of patents is plenary by the terms of the Constitution, and as there are no restraints on its exercise, there can be no limitation of their right to modify them at their pleasure.”¹⁵⁰

There is, surprisingly, a question as to whether the Constitution is the supreme law of the land, or whether treaties are co-equal with the Constitution. The Constitution grants the president the power “by and with the Advice and Consent of the Senate, to make Treaties, provided two thirds of the Senators present concur”¹⁵¹ and also provides that “[t]his Constitution, and the Laws of the United States which shall be made in Pursuance thereof; and all Treaties made, or which shall be made, under the Authority of the United States, shall be the supreme Law of the Land.”¹⁵²

As Professor Tribe notes, a treaty “may effectively repeal preceding congressional legislation and preempt conflicting state law,”¹⁵³ but this leaves open the question whether a treaty can override the Constitution. In 1870, the Supreme Court held that “a treaty cannot change the Constitution or be held valid if it be in violation of that instrument.”¹⁵⁴ In 1957, the Court held an executive agreement, which gave U.S. military courts exclusive jurisdiction over U.S. servicemen and their families stationed in Great Britain, unconstitutional.¹⁵⁵

The uncertainty regarding the hierarchy of treaties and the Constitution arise because, as Nowak and Rotunda observe: “Justice Holmes suggested once . . . that treaties were equal to the Constitution, even if they were not made in pursuance of it. As a consequence, the theory developed that treaties were not

¹⁵⁰ See *McClurg v. Kingsland*, 42 U.S. (1 How.) 202, 206 (1843).

¹⁵¹ U.S. CONST. art. II, § 2, cl. 2.

¹⁵² U.S. CONST. art. VI, cl. 2.

¹⁵³ LAWRENCE H. TRIBE, *AMERICAN CONSTITUTIONAL LAW* 645 (3d ed. 2000).

¹⁵⁴ *The Cherokee Tobacco Case*, 78 U.S. (11 Wall.) 616, 620–21 (1870).

¹⁵⁵ *Reid v. Covert*, 354 U.S. 1, 5, 15–19, 40–41 (1957) (holding that the executive agreement violated the Fifth and Sixth Amendments).

subject to any constitutional limitations.”¹⁵⁶ Nowak and Rotunda go on, however, to conclude “[t]his view is incorrect. As Justice Field stated, in often quoted dictum in *De Geofroy v. Riggs*, the treaty power, like all other powers that the Constitution grants, is subject to constitutional limitations.”¹⁵⁷

The hierarchy of the Constitution, statutes, and treaties continues to provide fuel for debate,¹⁵⁸ and three commentators have analyzed the possibility of using the Treaty Power to overcome perceived constitutional problems in the specific context of intellectual property rights.¹⁵⁹ Since there appear to be no conflicts between the Constitution and current treaties, however, the analysis will proceed on the assumption that any solution should be consistent with those treaties.¹⁶⁰

The United States is a signatory to three major treaties which could constrain extraterrestrial patent principles.¹⁶¹ The first, the 1994 Agreement on Trade-Related Aspects of Intellectual Property Rights (TRIPS Agreement),¹⁶² is not by its terms directed to activities in space. It does not appear that the negotiators were focused on questions of extraterrestrial activity, but rather were attempting to harmonize patent laws among nations. The treaty does, however, contain language which appears broad enough to cover activities in space: “patents shall be available and patent rights enjoyable without discrimination

¹⁵⁶ JOHN E. NOWAK & RONALD D. ROTUNDA, CONSTITUTIONAL LAW 242 (6th ed. 2000) (footnote omitted) (citing *Missouri v. Holland*, 252 U.S. 416, 433 (1920)).

¹⁵⁷ *Id.* (citing *De Geofroy v. Riggs*, 133 U.S. 258, 266–67 (1890)).

¹⁵⁸ *See, e.g.*, Audrey I. Benison, *International Criminal Tribunals: Is There a Substantive Limitation on the Treaty Power?*, 37 STAN. J. INT’L L. 75, 75 (2001); David M. Golove, *Treaty-Making and the Nation: The Historical Foundations of the Nationalist Conception of the Treaty Power*, 98 MICH. L. REV. 1075, 1077–79 (2000); Timothy R. Holbrook, *The Treaty Power and the Patent Clause: Are There Limits on the United States’ Ability to Harmonize?*, 22 CARDOZO ARTS & ENT. L.J. 1, 2–4 (2004).

¹⁵⁹ *See* Holbrook, *supra* note 158, at 4; Caroline T. Nguyen, Note, *Expansive Copyright Protection for All Time? Avoiding Article I Horizontal Limitations Through the Treaty Power*, 106 COLUM. L. REV. 1079, 1079–84 (2005); Oppenheimer, *Harmonization*, *supra* note 23, at 483–87.

¹⁶⁰ Of course, if a desired solution conflicted with a treaty, there would be the option to withdraw from the treaty. *See, e.g.*, Curtis A. Bradley & Mitu Gulati, *Withdrawing from International Custom*, 120 YALE L.J. 202, 204 (2010). *But see* Lea Brilmayer & Isaias Yemane Tesfaldet, *Treaty Denunciation and “Withdrawal” from Customary International Law: An Erroneous Analogy with Dangerous Consequences*, 120 YALE L.J. ONLINE 217 (2011), <https://www.yalelawjournal.org/forum/treaty-denunciation-and-qwithdrawalq-from-customary-international-law-an-erroneous-analogy-with-dangerous-consequences> [<https://perma.cc/5CRX-RGW5>].

¹⁶¹ *See* Agreement Concerning Cooperation on the Civil International Space Station, *supra* note 78; TRIPS Agreement, *supra* note 77; Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space, Including the Moon and Other Celestial Bodies, *opened for signature* Jan. 27, 1967, 18 U.S.T. 2410, 610 U.N.T.S. 205 (entered into force Oct. 10, 1967) [hereinafter Outer Space Treaty].

¹⁶² TRIPS Agreement, *supra* note 77, 1869 U.N.T.S. at 299.

as to the place of invention. . . .”¹⁶³ Arguably, by using the phrase “place of invention” rather than, for example, “country of invention,” the treaty applies to extraterrestrial activity.¹⁶⁴ Assuming that the treaty does apply to extraterrestrial activity, it would require granting patents on inventions without discrimination simply because they were “invented” in space, but would place no other constraints on the proposed solutions.¹⁶⁵

The second major treaty that the United States is a signatory to is 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 prohibited colonization of the moon and other celestial bodies “by claim of sovereignty, by means of use or occupation, or by any other means.”¹⁶⁶ Article VI requires signatories to assure that activities by their nationals, whether by governmental agencies or by non-governmental entities are carried out in conformity with the treaty.¹⁶⁷ Article VIII provides that signatories retain jurisdiction over objects launched into space including objects constructed on a celestial body.¹⁶⁸ Article VII makes each signatory “internationally liable for damage to another State Party to the Treaty or to its natural or juridical persons.”¹⁶⁹ Although there are no cases on patent infringement under this treaty,¹⁷⁰ these provisions read together appear to authorize actions for infringement of patents in space on the same basis as if the infringing activity had occurred within the signatory’s territory on Earth.

The third major treaty signed by the United States is the 1998 Agreement Concerning Cooperation on the International Space Station, which provides that “each Partner shall retain jurisdiction and control over the elements it registers . . . and over personnel in or on the Space Station who are its nationals” and recognizes the jurisdiction of the partner’s courts and

¹⁶³ *Id.* at 311.

¹⁶⁴ *Id.*

¹⁶⁵ If the TRIPS treaty is determined not to apply to space, then it imposes no constraints whatsoever on the solutions.

¹⁶⁶ Outer Space Treaty, *supra* note 161, 18 U.S.T. 2413, 610 U.N.T.S. 208.

¹⁶⁷ *Id.* at 18 U.S.T. 2415, 610 U.N.T.S. 209.

¹⁶⁸ *Id.* at 18 U.S.T. 2416, 610 U.N.T.S. 209.

¹⁶⁹ *Id.* at 18 U.S.T. 2415, 610 U.N.T.S. 209.

¹⁷⁰ One case asserting private property rights to an extraterrestrial object was dismissed for failure to state a cause of action. *Nemitz v. United States*, No. CV-N030599-HDM (RAM), 2004 WL 3167042, at *1–2 (D. Nev. Apr. 26, 2004) (alleging trespass against the National Aeronautics and Space Administration for landing on an asteroid claimed by the plaintiff).

application of national laws regarding criminal matters, civil liability, and protection of intellectual property rights.¹⁷¹

One additional treaty should be mentioned, although the United States has not acceded to it. The Agreement Governing the Activities of States on the Moon and Other Celestial Bodies states that “[t]he moon is not subject to national appropriation by any claim of sovereignty, by means of use or occupation, or by any other means” and “natural resources in place, shall [not] become property of any State . . . *non-governmental organization, . . . or of any natural person.*”¹⁷² The specific language (“natural resources in place”) would not appear to implicate patent rights. The more general language (appropriation . . . by any other means), however, is arguably broad enough to cover patent rights if a patent claim covered activity on the moon. As the United States is not currently a signatory, this treaty is not considered further in the analysis that follows.

Andrew Brehm analyzes the application of current treaties to property rights in space and concludes that such rights are not available to private parties.¹⁷³ If that were generally true, it would severely constrain the development of intellectual property rights in space or arising from activities in space. His analysis focuses, however, on tangible property, and there are distinctions between tangible and intangible property which might allow a contrary conclusion with respect to intangible property rights, such as patents. Tangible property is exclusive in the sense that possession by one individual precludes simultaneous possession by anyone else; intangible property is non-exclusive—more than one person can hold the same trade secret, for example. As Thomas Jefferson observed, the “peculiar character [of an idea] . . . is that no one possesses the less, because every other possesses the whole of it. He who receives an idea from me, receives instructions himself without lessening mine; as he who lights his taper at mine receives light without darkening me.”¹⁷⁴ In addition, tangible property is, by

¹⁷¹ Agreement Concerning Cooperation on the Civil International Space Station, *supra* note 78, at 5.

¹⁷² Moon Treaty, *supra* note 74, 1363 U.N.T.S. at 25 (emphasis added).

¹⁷³ Andrew R. Brehm, Note, *Private Property in Outer Space: Establishing a Foundation for Future Exploration*, 33 WIS. INT'L L.J. 353, 359–62 (2015). Leslie Tennen likewise argues that national recognition of private property rights in space “would constitute a *de facto* exclusion of other states and their nationals, and thereby constitute a form of national appropriation” in violation of treaties, for example Article II of the Outer Space Treaty. Leslie I. Tennen, *Towards a New Regime for Exploitation of Outer Space Mineral Resources*, 88 NEB. L. REV. 794, 805 (2010).

¹⁷⁴ Letter from Thomas Jefferson to Isaac McPherson, *supra* note 24. As I have previously argued, “this observation was clearly a lapse of economic judgment for the sake of rhetoric. The basis of trade secret law is that there is economic value in keeping

definition, local—it exists at one particular place and, under traditional rules, is subject to the jurisdiction of that place—while intangible property has no physical location and therefore may be subject to multiple, remote, jurisdictions.¹⁷⁵

Moreover, unlike tangible property claims in outer space, intangible property rights embodied in intellectual property could have effect only within terrestrial territories (at least until a court system is established in outer space). Claims would only be binding on individuals subject to the jurisdiction of the nation which granted those rights. This sort of jurisdiction is classically within the power of nations¹⁷⁶ and not inconsistent with treaty obligations not to “claim” space.¹⁷⁷ Therefore, if the treaty concerns relate to the threat of occupation of space and national control of space,¹⁷⁸ those concerns do not apply to intangible property and thus would not be pose the types of legal concerns identified by Brehm.

In addition to satisfying any constraints imposed by treaty obligations, any solution must, of course, also be consistent with the Constitution. The principal constitutional constraint on patent laws in general is found in Article I of the Constitution. Any patent enactment must “promote the progress of [s]cience and useful [a]rts.”¹⁷⁹ To date, no provision of the current patent statute has been found unconstitutional,¹⁸⁰ so the extension of existing provisions to space should pose no special constitutional issues.

competitors in the dark.” Max Stul Oppenheimer, *In Vento Scribere: The Intersection of Cyberspace and Patent Law*, 51 FLA. L. REV. 229, 236 n.20 (1999). The point regarding the non-exclusivity of intangible property is, however, valid.

¹⁷⁵ See, for example, 35 U.S.C. § 105(a) (2012), which extends U.S. patent rights to cover manufacture, use or sale “in outer space on a space object or component thereof under the jurisdiction or control of the United States.”

¹⁷⁶ In a sense, this is comparable to the patents of importation discussed *infra* Section IV.A.4. Both can be viewed as rewarding the importation of technology from abroad by imposing restrictions on the importing country’s citizens within the importing country’s borders.

¹⁷⁷ See, e.g., *Nemitz v. United States* No. CV–N030599–HDM (RAM), 2004 WL 3167042, at *1–2 (D. Nev. Apr. 26, 2004), (in which the plaintiff had claimed an asteroid on which a U. S. spacecraft had landed. The U.S. federal district court held that there was no cognizable cause of action against the United States—and, of course, there was no court on the asteroid in which the claim could be brought).

¹⁷⁸ These do appear to be the principal concerns. For example, the Outer Space Treaty states “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.” Outer Space Treaty, *supra* note 161, 18 U.S.T. at 2413, 610 U.N.T.S. at 208.

¹⁷⁹ U.S. CONST. art. I, § 8, cl. 8, see also *KSR Int’l. Co. v. Teleflex Inc.*, 550 U.S. 398, 427 (2007).

¹⁸⁰ The most recent provision of the patent statute to survive constitutional challenge is the process known as “*inter partes* review” (introduced in the AIA) whereby any member of the public may challenge an issued patent in an administrative proceeding within the USPTO. See 35 U.S.C. § 311 (2012); *Oil States Energy Servs., LLC v. Greene’s Energy Grp.*, 138 S. Ct. 1365, 1371, 1379 (2018). In addition, many commentators questioned whether changing the “first inventor” provisions of the patent statute to “first to file” provisions is constitutional. See, e.g., Michael A. Glenn & Peter J. Nagle, *Article I and the First Inventor to File: Patent Reform or Doublepeak?*, 50

One existing constitutional constraint with potential application to options for dealing with extraterrestrial patent rights is the principle that only one patent may be issued for any invention.¹⁸¹ If two applicants claimed the same invention under the pre-AIA statute, ownership was resolved through an interference proceeding.¹⁸² Under the AIA, the interference proceeding was considered unnecessary and was replaced by a derivation proceeding to determine if the first applicant had obtained knowledge of the invention from the “true” inventor.¹⁸³ This “one invention/one patent” principle precludes solutions which allow two inventors.

A. Available Models

It is tempting to conclude that the impact of extraterrestrial activity on patent law is *sui generis* and that no precedent exists, leaving to Congress, writing on a blank slate, the task of figuring out which rules should apply. Surprisingly, however, these issues are not new. They were faced four hundred years ago and, in the interim, patent theory has developed different solutions to the tension between the desire to provide an incentive to innovate and the desire to limit monopolization of innovation. It turns out that, in addition to solutions that approach this as a wholly new problem, there have been earlier situations when new “worlds” opened up and they provide models that could be useful for determining the impact of the opening of this most recent “new world” on patent law.

IDEA: INTELL. PROP. L. REV. 441, 457–61 (2010); Holdbrook, *supra* note 158, at 6; Brad Pedersen & Vadim Braginsky, *The Rush to a First-to-File Patent System in the United States: Is a Globally Standardized Patent Reward System Really Beneficial to Patent Quality and Administrative Efficiency?*, 7 MINN. J.L. SCI. & TECH. 757, 762–63 (2006); Karen E. Simon, Comment, *The Patent Reform Act's Proposed First-to-File Standard: Needed Reform or Constitutional Blunder?*, 6 J. MARSHALL REV. INTELL. PROP. L. 129, 139–43 (2006). So far, no judicial challenge to the AIA's change to a first-to-file patent system has reached the appellate court level.

¹⁸¹ See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186, 198 (1894).

¹⁸² 35 U.S.C. § 135(a) (2006 & Supp. V 2012)) (pre-AIA statute). Under the interference system, in the rare case when two applicants claimed the same invention and had the identical filing date and the identical date of invention, the internal USPTO appeals board held that neither was entitled to the patent. *Lassman v. Brossi, Gerecke, & Kyburz*, 159 U.S.P.Q. 182, 1967 WL 7458, at *1–3 (B.P.A.I. 1967).

¹⁸³ See Leahy-Smith America Invents Act, Pub. L. No. 112-29, 125 Stat. 289 (2011) (codified as amended at 35 U.S.C. § 135 (2012 & Supp. V 2018)). The revisions were designed to ensure that the first person to file a patent application is actually an inventor. S. REP. No. 111-18, at 6 (2009).

1. Status Quo

One possibility, of course, is to do nothing and await developments. Even given the pace of private activity directed to space exploration and exploitation, there is probably time to think and debate, or to simply wait until there is an undesirable result under current law and then attempt to fix it.¹⁸⁴ This approach has the advantage of deferring action until there is more information about what problems might need to be addressed. One thing that is predictable about innovation, though, is that its timing is not predictable. Doing nothing until a specific problem arises has its own risks.

By definition, maintaining the status quo maintains the problems identified in Section III.A.: uncertainty regarding the application of the Supreme Court's doctrine of exclusion of natural phenomena from the definition of statutory subject matter under Section 101 (itself subject to considerable uncertainty) to extraterrestrial phenomena.¹⁸⁵

Likewise, by definition, maintaining the status quo also maintains the problems regarding the definition of prior art under Section 102, identified in Section III.B., (i.e., whether technology only observed by a few in space should preclude patentability of technology developed on Earth, and whether properties that are only inherent in space should preclude patentability of technology developed on Earth that uses such properties). Literal application of the inherency doctrine would limit the impact of extraterrestrial inherent prior art on earthbound inventions. The doctrine requires that for a prior art reference to anticipate a claim when a feature is not explicitly disclosed, the missing feature must be "necessarily present, or inherent, in the single anticipating reference."¹⁸⁶ Thus, if the missing feature only occurs in space, it is not "necessarily present" and should not anticipate a claim under the doctrine of inherency.

Likewise, by definition, maintaining the status quo maintains the problems regarding the application of the obviousness standard under Section 103, identified in Section III.C, *supra*. In addition to the problems of geographic scope and inherency, the question of whether to assume that an earthbound

¹⁸⁴ This approach may assume that there is more time before solutions are needed than is actually the case. See *supra* notes 7–12.

¹⁸⁵ See generally Max Stul Oppenheimer, *Patents 101: Patentable Subject Matter and Separation of Powers*, 15 VAND. J. ENT. & TECH. L. 1, 44–47 (2012) [hereinafter Oppenheimer, *Patents 101*].

¹⁸⁶ *Schering Corp. v. Geneva Pharm., Inc.*, 339 F.3d 1373, 1377 (Fed. Cir. 2003) (citing *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1268 (Fed. Cir. 1991); see Burk & Lemley, *supra* note 127, at 379.

person of ordinary skill has complete knowledge of information only available in space. At some point, space travel and communication may become so common as to make this a reasonable assumption, but at the moment (and for the foreseeable future) the assumption stretches legal fiction to an extreme that is difficult to justify. *Winslow* adopted the legal fiction that the person determining obviousness knew all that people in the field could know about the subject; it did not require that person to know things that were generally unknown or unavailable.¹⁸⁷

2. Everyone Wins?: Why Granting Patents to Both Inventors Is Against Current Precedent

Rather than choose between an earthbound inventor and an extraterrestrial inventor, a tempting solution is to award patents to both. While intuitively “fair,” awarding the patent to both would be contrary to current law¹⁸⁸ and long-established precedent.¹⁸⁹ The statute could be amended to eliminate the novelty impediment posed by Sections 101 and 102. However, the precedent set by *Miller v. Eagle*¹⁹⁰ and the constitutional requirement that patents promote progress would certainly raise issues regarding the grant of more than one patent on the same innovation. In addition, there would be difficult administrative issues to solve: for example, each patentee would have the power to grant licenses, making it difficult to exercise the market control which is the hallmark of patent rights.

While the specific problem that Section 101 poses regarding novelty can be addressed by amending the statute, this solution does not address the issue of patentable subject matter under Section 101, which implicates not only the statute, but the exceptions announced by the Supreme Court as a matter of constitutional command.¹⁹¹

This solution would, however, eliminate the problems relating to Section 102 (and therefore, because the obviousness analysis under Section 103 is limited to materials available under Section 102) those relating to Section 103 as well.

¹⁸⁷ *In re Winslow*, 365 F.2d 1017, 1020 (C.C.P.A. 1965).

¹⁸⁸ See 35 U.S.C. §§ 101–102 (requiring that the invention be “new.”).

¹⁸⁹ See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186, 198 (1894).

¹⁹⁰ *Id.*

¹⁹¹ See discussion *supra* Section III.A.

3. Universal Overhaul

An ambitious approach would be the creation of an “extraterrestrial patent,” issued by an international organization, and governing manufacture, use, or sale in, and importation into, space.¹⁹² Putting aside the difficulty of negotiating such a treaty, it would have the advantages of eliminating potentially overlapping extraterrestrial jurisdictions with potentially inconsistent rules, and of providing a central repository of prior art so as to reduce the risk of inconsistent grants of patents.

It would, however, have the potential to impact constitutional rights of nationals when in space, a step that would be difficult to distinguish from the attempt to restrict Fifth and Sixth Amendment rights of U. S. military families living abroad found unconstitutional in *Reid v. Covert*.¹⁹³ In addition, setting up a regime that provided different rights for earthbound and extraterrestrial innovations would be challenging under the TRIPS treaty, which requires that patent rights not vary based on location.¹⁹⁴ Finally, this approach would pose administrative issues similar to those presented by the “everyone wins” approach.

While the specific problem that Section 101 poses regarding novelty could be addressed by a treaty and conforming amendments to the statute, the issue of patentable subject matter under Section 101 poses constitutional issues.¹⁹⁵ The Supreme Court’s patentable subject matter jurisprudence is based on the principles that “[p]henomena of nature . . . are not patentable, as they are the basic tools of scientific and technological work”¹⁹⁶ and “[l]aws of nature [are] free to all men and reserved exclusively to none” because they are “part of the storehouse of knowledge of all.”¹⁹⁷ While, in the view of some,

¹⁹² One model that might be considered is the creation of a European Patent Office (created by the Convention on the Grant of European Patents), that conducts centralized review of patent applications and allows patents that may be enforced in all of its member countries. See generally *EPO—Home*, EUROPEAN PATENT OFFICE (Apr. 4, 2019), <https://www.epo.org/index.html> [<http://perma.cc/2YXU-FSB6>], and for a list of member countries, see *Member States of the European Patent Organisation, European Patent Office* (Mar. 19, 2019), <https://www.epo.org/about-us/foundation/member-states.html> [<https://perma.cc/T3DH-46BM>].

¹⁹³ *Reid v. Covert*, 354 U.S. 1, 5, 15–19, 40–41 (1957) (holding an executive agreement giving military courts exclusive jurisdiction over servicemen and their families stationed abroad a violation of the Fifth and Sixth Amendments).

¹⁹⁴ TRIPS Agreement, *supra* note 77, 1869 U.N.T.S. at 311. The TRIPS Agreement could, of course, be amended to accommodate special rules for extraterrestrial innovation and enforcement of patent rights.

¹⁹⁵ See discussion *supra* Section III.A.

¹⁹⁶ See *Gottschalk v. Benson*, 409 U.S. 63, 67 (1972).

¹⁹⁷ See *Funk Bros. Seed Co. v. Kalo Inoculant Co.*, 333 U.S. 127, 130 (1948).

Congress stretched the Constitution in adopting the first-to-file patent system under the AIA,¹⁹⁸ the constitutional stretch required to permit patenting technology which is innovative on Earth but natural in space would require distinguishing (or limiting the broad language of) Supreme Court precedent.

Furthermore, a carefully drafted treaty and statutory changes to implement the treaty provisions could resolve the novelty issues under Section 102 (and therefore, because the obviousness analysis under Section 103 is limited to materials available under Section 102) those relating to Section 103 as well. Care would need to be taken, however, to avoid adopting provisions that would result in withdrawing anything from the public domain.

4. Forward to the Past

The United States, from its inception, only granted patents to the “first inventor.”¹⁹⁹ The first patent statute, enacted in 1790, provided for a petition for patent by “any person or persons . . . setting forth, that he, she, or they, hath or have invented or discovered any useful art, manufacture, engine, machine, or device, or any improvement therein not before known or used.”²⁰⁰ The second patent statute, enacted in 1793, provided for patents to be issued on petition by

any person . . . being a citizen . . . of the United States, . . . [who has] invented any new and useful art, machine, manufacture or composition of matter, or any new and useful improvement of any art, machine, manufacture or composition of matter, not known or used before the application.²⁰¹

¹⁹⁸ See *supra* Section IV.A.2.

¹⁹⁹ It is arguable that the U. S. abandoned the “first inventor” principle in adopting the America Invents Act. See, e.g., Oppenheimer, *Harmonization*, *supra* note 23, at 449–55. Even under the AIA, however, patents are only granted to “an” inventor and a showing that someone else invented the technology first will defeat an application. See Leahy-Smith America Invents Act, Pub. L. No. 112–29, 125 Stat. 284, 289 (2011) (codified as amended at 35 U.S.C. § 135 (2012 & Supp. V 2018)). The U.S. has never recognized “patents of importation.” As early as 1804, courts considered and rejected the notion. See *Reutgen v. Kanowrs*, 20 F. Cas. 555, 556 (C.C.D. Pa. 1804) (No. 11,710) (charging a jury that “if the invention was brought over [from Europe], that is, if it appears that the plaintiff was not the original inventor, in reference to other parts of the world as well as America, he is not entitled to a patent.”). Justice Story also rejected patents of importation in several cases. See *Reed v. Cutter*, 20 F. Cas. 435, 437–38 (C.C.D. Mass. 1841) (No. 11,645); *Bedford v. Hunt*, 3 F. Cas. 37, 37–38 (C.C.D. Mass. 1817) (No. 1,217); *Woodcock v. Parker*, 30 F. Cas. 491, 492 (C.C.D. Mass 1813) (No. 17,971) (“[A] subsequent inventor cannot, by obtaining a patent therefor, oust the first inventor of his right . . . notwithstanding he may have been a subsequent inventor, without any knowledge of the prior existence of the machine . . .”).

²⁰⁰ Act of Apr. 10, 1790, ch. 7, 1 Stat. 109–10. An earlier version of the statute would have authorized patents of importation. See *infra* notes 218–220.

²⁰¹ Act of Feb. 21, 1793, ch. 11, 1 Stat. 318, 318–19.

Subsequent amendments to the patent statute retained the invention requirement.²⁰² That is not, however, the only basis on which patentability might be determined. Putting aside the practice of granting royal monopolies to reward friends of (or contributors to) the monarch,²⁰³ there was a long history of granting patents not only to independent inventors but also to individuals who observed the technology abroad (and therefore were not independent inventors) but were the first to introduce it to the jurisdiction—“patents of importation.”²⁰⁴ The U.S. patent system was, in fact, the outlier when adopted. While several early U.S. cases rejected patents of importation,²⁰⁵ most European systems of the day allowed for a broader conception of invention than embraced by the first U. S. patent statute. For sound policy reasons, discussed below, they included within their systems grants for introduction of new technologies from abroad as well as for independent invention.²⁰⁶

While there are earlier records of incentives offered for innovation,²⁰⁷ the first law providing a government-sanctioned monopoly in return for innovation is generally thought to be the Venetian Republic statute of March 19, 1474. The statute provided that:

every person who shall build any new and ingenious device in this City, *not previously made in our Commonwealth*, shall give notice . . . when it has been reduced to perfection so that it can be used and operated. It being forbidden to every other person in any of our territories and towns to make any further device conforming with and

²⁰² 35 USC § 101 (2012).

²⁰³ A classic example is given in the English case of *Darcy v. Allein*, 77 Eng. Rep. 1260 (1602), in which a monopoly was granted over the manufacture of playing cards.

²⁰⁴ Sean Carnathan argues that even the U.S. statutory term “first and true inventor” as used in contemporary England “included a person who introduced . . . an invention previously used in another country.” Sean T. Carnathan, *Patent Priority Disputes—A Proposed Re-Definition of “First-to-Invent,”* 49 ALA. L. REV. 755, 773 (1998).

²⁰⁵ See cases cited *supra* note 199.

²⁰⁶ Although by then the U.S. had rejected patents of importation, there are elements of the patent statutes which seem to have reflected similar policies. *In re Tenney*, 254 F.2d 619, 626 (C.C.P.A. 1958) (noting that § 102’s distinction between domestic and foreign knowledge and use showed that it was “readily evident that what Congress was concerned with, both in 1836 and 1952, was the probability that the subject matter would be made known to the American public. Knowledge and use in the United States would probably (or so Congress must have reasoned) become generally known, while the same assumption could not be made with respect to such knowledge and use abroad.”).

²⁰⁷ Sybaris apparently awarded exclusive rights for one year to creators of new recipes. M. Frumkin, *The Origin of Patents*, 27 J. PAT. OFF. SOC’Y 143, 143 (1945). There are records of a patent awarded by the Republic of Florence as early as 1421 (issued to Filippo Brunelleschi—the architect of the cathedral of Florence—for a barge with hoisting gear). See *id.* at 144; see also CHRISTINE MACLEOD, *INVENTING THE INDUSTRIAL REVOLUTION: THE ENGLISH PATENT SYSTEM, 1660–1800*, at 11 (2002).

similar to said one, without the consent and license of the author, for the term of [ten] years.²⁰⁸

The statute did not require “invention” in the modern sense, but only that the claimant “build” a new device; it was intended to motivate not only invention, but introduction of inventions from abroad.²⁰⁹

English practice before the Statute of Monopolies²¹⁰ likewise offered a limited term monopoly for inventors and for those who were the first to introduce a foreign invention into the country.²¹¹ Writing in the 19th century, E. Wyndham Hulme attempted to catalog the grants of monopolies in the U.K. prior to the Statute of Monopolies.²¹² Among the grants he identifies, the May 26, 1562 grant to Cobham for a dredging machine is based, not on any evidence that Cobham had invented the machine, but rather that “[t]he patentee represent[ed] that ‘by diligent travel’ he had discovered a machine to scour the entrances to harbours.”²¹³ The patentee was therefore not an inventor in the modern statutory sense of the word, but rather was rewarded for having observed someone else’s invention

²⁰⁸ Giulio Mandich, *Venetian Patents (1450–1550)*, 30 J. PAT. OFF. SOC’Y 166, 177 (1948) (emphasis added).

²⁰⁹ “Now, if provision were made for the works and devices discovered by such persons, so that others who may see them could not build them and take the inventor’s honor away, more men would then apply their genius, would discover, and would build devices of great utility and benefit to our commonwealth.” *Id.* at 176. Note that the monopoly was available not only to the actual inventor, but also to the first to bring the invention to the territory.

²¹⁰ Statute of Monopolies of 1623, 21 Jac., c. 3, § 6 (Eng.) <http://www.legislation.gov.uk/aep/Ja1/21/3>.

²¹¹ “[I]f a man hath brought in a new invention and a new trade within the kingdom . . . or if a man hath made a new discovery of any thing . . . the King . . . may grant by charter unto him, that he only shall use such . . . for a certain time.” The Clothworkers of Ipswich Case [1615] 78 Eng. Rep. 147, 148 (KB) (emphasis added). As Lord Coke explained the rationale and its limits: “[A]t first the people of the kingdom are ignorant and have not the knowledge or skill to use it: but when that patent is expired, the King cannot make a new grant thereof: for when the trade is become common . . . there is no reason that such should be forbidden to use it.” *Id.* Thus, it was held that the Crown might lawfully grant exclusive privileges in a new invention, a new discovery, or a new trade within the realm, for a limited time. *See id.* Modeled on the United Kingdom Patent Law of 1852, Jamaica likewise permitted patents of importation. *See Pfizer, Ltd. v. Medimpex Jam., Ltd.* [2014] UKPC 20. Section 3 of the statute provides that “[w]hensoever any person . . . alleg[es] that he hath invented or discovered some new and useful art, machine, manufacture, or composition of matter, not heretofore known or used within this Island . . . it shall be lawful for the Governor-General, in the name of and on behalf of Her Majesty, to direct Letters Patent, under the Broad Seal of this Island, to be issued.” *Id.* (emphasis added) (quoting Jamaica’s Patent Act of 1857) Portugal also adopted, by decree in 1892, a law authorizing the grant of patent monopolies “for the manufacture of any new industrial products . . . [with] ‘new industry’ . . . defined as one not actually in process of working in the country at the date of application.” E. Wyndham Hulme, *History of the Patent System Under the Prerogative and at Common Law*, 12 L. Q. REV. 141, 154 (1896).

²¹² *See* Hulme, *supra* note 211, at 141–54.

²¹³ *Id.* at 145.

abroad and having been the first to bring it into the country. Hulme also reports on a 1571 grant to Richard Dyer “for the manufacture of earthen fire-pots, an art which he had learned in exile [in Portugal].”²¹⁴ Again, the patentee did not invent the technology, he learned it from others (and was therefore not an inventor in the modern statutory sense)—but he introduced it into the country. Hulme argues that, even under the Statute of Monopolies, which “confined the legitimate exercise of the prerogative to the true and first inventor,” the term “inventor” as understood at the time was not confined to the mental act of invention but was broad enough to cover the first importer of technology²¹⁵ and explains:

[T]he Crown and Courts alike recognized two classes of individuals . . . as the proper recipients of royal favour, (1) the bringer-in or importer, (2) the first finder or inventor—the latter grounding his title to favourable consideration on the fact that he possessed in common with the importer the qualification of introducing a new industry within the realm.²¹⁶

Support for this rationale for patents of importation is offered by *The Clothworkers of Ipswich Case*:

[T]he King . . . cannot make a monopoly for that is to take away free-trade, which is the birthright of every subject. . . . But if a man hath brought in a new invention . . . within the kingdom, in peril of his life, and consumption of his estate or stock, &c. or if a man hath made a new discovery . . . in such cases the King of his grace and favour, in recompence . . . may grant . . . that he only shall use such . . . for a certain time because at first the people of the kingdom are ignorant. and have not the knowledge or skill to use it.²¹⁷

The United States itself considered authorizing patents of importation,²¹⁸ an approach that appears to have had the

²¹⁴ *Id.* at 150.

²¹⁵ *Id.* at 151; *see also id.* at 151 n.1 (“The connotation of the term ‘inventor’ has been unduly restricted. It is used indifferently in these grants with such phrases as ‘the first finder out,’ ‘discoverer . . .’ [etc.]. The word ‘invenio,’ I come upon, denotes primarily a physical act rather than a mental process. The Act sought to vest these privileges in those who had actually contributed to the introduction of the new art . . .”).

²¹⁶ *Id.* at 152.

²¹⁷ *The Clothworkers of Ipswich Case* [1615], 78 Eng. Rep. 147, 148 (KB); *Accord In re Edgeberry & Stephens* [1691], 91 Eng. Rep. 387, 387 (KB) (holding that the term “inventor” in the Statute of Monopolies encompasses the first importer).

²¹⁸ H.R. 41, as originally introduced treated as an inventor the first to import an invention “not before known or used within the United States.” H.R. 41, 1st Cong. (1790), *reprinted in* 6 THE FIRST FEDERAL CONGRESS PROJECT, THE DOCUMENTARY HISTORY OF THE FIRST FEDERAL CONGRESS OF THE UNITED STATES OF AMERICA, MARCH 4, 1789–MARCH 3, 1791 at 1626–32 (Linda Grant DePauw et al. eds, Johns Hopkins Univ. Press 1972) [hereinafter DOCUMENTARY HISTORY]. This section was deleted before passage of H. R. 41 as the Patent Statute of 1790. *Id.* at 1632–37. As originally introduced, H.R. 41 (the successor to the prior session’s H.R. 10) added a section

support of George Washington,²¹⁹ but language explicitly deeming the first importer as an inventor was deleted from the final version of the bill which became the first patent statute.²²⁰

The Patent Act of 1836 was the first to include an explicit provision denying a patent if the invention had been described in a pre-existing printed publication.²²¹ It distinguished between denial based on printed publications and denial based on knowledge or use. The statute provided that

if . . . it shall not appear . . . that the same had been . . . described in any printed publication *in this or any foreign country*, or had been in public use or on sale . . . prior to the application, . . . it shall be [the Commissioner's] duty to issue a patent therefor.²²²

The underlying rationale for granting patents of importation adopted by Queen Elizabeth I was “to stimulate domestic production of both raw materials and a wide variety of manufactured goods previously imported from abroad.”²²³ Faced with the goal of motivating innovation in order to generate revenue, plus the recognition that new worlds were opening and those new worlds had domestically unavailable technology, these countries adopted the view that importers of such technology deserved rewards on a par with those who independently developed innovations—the economic benefits to the national economy were similar.

expressly providing that the first importer of an invention be treated as if the original inventor. That provision was deleted and (as with many early actions related to patent law) there is no formal legislative history explaining why. Walterscheid, however, offers the possibility that concerns were raised concerning the constitutionality of patents of importation. Edward C. Walterscheid, *Charting a Novel Course: The Creation of the Patent Act of 1790*, 25 AIPLA Q. J. 445, 506–09 (1997) [hereinafter Walterscheid, *Charting a Novel Course*].

²¹⁹ “The advancement of agriculture, commerce and manufactures, by all proper means, will not, I trust, need recommendation. But I cannot forbear intimating to you, the expediency of giving effectual encouragement as well to the introduction of new and useful inventions from abroad, as to the exertions of skill and genius in producing them at home” George Washington “State of the Union” Address (Jan. 8, 1790), *reprinted in* 3 DOCUMENTARY HISTORY 251, 253.

²²⁰ “No copy specifically identified as H.R. 10 has been found, and what is known about it comes from indirect sources.” Walterscheid, *Charting a Novel Course*, *supra* note 218, at 462–63. “Nonetheless, an unidentified typescript of a combined copyright and patent bill unearthed at the Library of Congress in 1955 is now considered to be H.R. 10, because H.R. 10 is the only known combined bill attempted by the Congress.” *Id.* at 466.

²²¹ Act of July 4, 1836, ch. 357, 5 Stat. 117.

²²² § 7, 5 Stat. at 119 (emphasis added).

²²³ Edward C. Walterscheid, *The Early Evolution of the United States Patent Law: Antecedents (Part 2)*, 76 J. PAT. & TRADEMARK OFF. SOC'Y 849, 855 (1994).

A similar rationale could apply to extraterrestrial technology today.²²⁴ The risks and costs of space exploration are enormous, in many cases greater than the risks and costs of independent development.²²⁵ The impacts on the economy are potentially the same—the origin of the technology has no effect on its value, except with respect to the decision whether to invest in developing the technology, and that decision is heavily influenced by the likelihood of recovering the costs of development. The availability of patents is a major component in evaluating that likelihood.

The Constitution only authorizes grants of limited term monopolies to authors and inventors.²²⁶ The question may be raised whether patents of importation could fit within that authorization. It is tempting to respond that the constitutional line has already been crossed with the passage of the AIA, awarding patents to the first filer rather than the first inventor. Although many commentators argued that this ran afoul of the “authors and inventors” requirement,²²⁷ Congress thought the AIA constitutional. Support can be found in the common understanding of the word “invention,” during the formative years of the antecedents of U. S. patent law, as including both invention and discovery²²⁸ (and even the current U.S. patent statute defines “invention” as “invention *or* discovery”).²²⁹ The proper inquiry is whether the concept furthers national policy, under the conditions that prevail at the time. The conditions that prevail today regarding space exploration are quite similar to the conditions that prevailed in seventeenth and eighteenth century England—there are potential resources in locations that will be visited by few and only at great risk and expense.²³⁰ For the moment, this is an appropriate approach to patents, even for “naturally occurring”

²²⁴ For example, Queen Elizabeth’s position vis-a-vis contemporary continental Europe can be seen as similar to the current state of terrestrial vis-a-vis extraterrestrial technology: there may be technologies in space that would be useful on earth, but significant barriers separate the two. Rewards are appropriate for those who surmount those barriers.

²²⁵ As long as costs were borne by governments, this factor would not matter. Now that private entities are venturing into the field and making economic decisions, economic motivation does matter. *See supra* notes 7–12.

²²⁶ U.S. CONST. art. I, § 8.

²²⁷ *See* discussion *supra* note 180.

²²⁸ The standard dictionary of the day would have been Johnson’s Dictionary of the English Language, which defined “inventor” as “a [finder] of something not known before.” A DICTIONARY OF THE ENGLISH LANGUAGE 1122 (1st ed., 1755), <https://johnsonsdictionaryonline.com/page-view/?i=1122> [<https://perma.cc/2SQ6-P2WV>].

²²⁹ 35 U.S.C. § 100 (2012 & Supp. V 2018) (emphasis added).

²³⁰ If conditions change, it would certainly be appropriate to change the rules, as Congress and the courts have done regarding the definition of prior art in the past. *See* Oppenheimer, *In Vento Scribere*, *supra* note 174, at 249–58 (describing the evolution of the definition of “printed publication” in response to technological change); *see also* Section III.B., *supra*.

materials discovered in space but previously unknown on earth. Like Dyer and his fire-pot, the first party to bring such a substance “*not heretofore known or used within this Island.*”²³¹ Earth should be rewarded for the risk and expense of introducing the new material to Earth’s storehouse of knowledge.

As with the other models, there would be a constitutional issue regarding patentability of principles of nature—the Supreme Court has never been asked to clarify whether only natural phenomena that occur on Earth are included.²³² This model would, however, offer a solution to the novelty issue presented under Section 101.²³³ By allowing “the first to introduce” to apply for a patent on a par with “the first inventor to file,” and (as required by the AIA) awarding the patent to the first to file an application with the USPTO, the model limits the technology to one patent. This would, of course, be the result under the current system. What the patent of importation model adds, however, is the assurance that one of the two applicants will receive a patent; under the current system, there is the possibility that neither would receive a patent. Instead of inhibiting innovation by introducing this risk, it introduces a new element of competition—between research and exploration—which should lead to greater innovation. In addition, the administrative issues discussed in Part IV would be eliminated.²³⁴ Because only one patent is granted, the patentee would have the power to grant exclusive licenses and thereby maintain market control.

As discussed, there are unresolved issues as to the application of Section 102 to prior art from space, particularly the date upon which it becomes prior art.²³⁵ Giving the “first importer” the right to seek a patent would encourage introducing the new technology into the prior art at the earliest possible date. Because only one patent is to be issued, both an explorer and a researcher have an incentive to file an application as soon as possible. Therefore, the first to the patent office will presumably be acting before anyone else has the invention, and nothing will be withdrawn from the public domain.

As to the inherency issue, the current interpretation should adequately protect earthbound innovators. As currently

²³¹ See Hulme, *supra* note 211, at 150. Discoveries in space which were already known on Earth should not be patentable for the policy reasons discussed *supra* Section III and expressed, for example, in the quoted Jamaican statute cited *supra* note 211.

²³² See discussion *supra* Section III.A.

²³³ See *Miller v. Eagle Mfg. Co.*, 151 U.S. 186, 198 (1984); see also discussion *supra* notes 189–190.

²³⁴ See *supra* Section III.C.2.

²³⁵ See *supra* Section III.B.

interpreted, “[i]nherency . . . may not be established by probabilities or possibilities. The mere fact that a certain thing *may* result from a given set of circumstances is not sufficient.”²³⁶ Thus, if a phenomenon only exists under certain conditions—for example, only in the vacuum and extreme temperature of outer space—it cannot qualify as inherent.

By dealing with the issues under 35 U.S.C. § 102, the model also deals with those relating to Section 103.²³⁷ It also helps resolve—or, more accurately, avoid—the questions relating to how much the *Winslow* person of ordinary skill knows.²³⁸ By encouraging prompt disclosure of information learned in space, the problem of whether to include information only known in space is reduced—once the information is brought to Earth, the problem disappears.

V. CHOOSING A SOLUTION: PROMOTING INNOVATION BY PROTECTING INNOVATORS

The choice of solution depends on the choice of goals. If patents are viewed as anti-competitive in the aggregate, then the ideal solution would be one that limited patents to the extent possible. Extraterrestrial discoveries, under this view, should be available as invalidating prior art to the maximum degree.²³⁹ On the other hand, if patents are viewed as pro-growth, then the ideal solution would be one that gave inventors certainty as to expectations should they receive a patent on the theory that the patent incentive encourages innovation and that innovation is of benefit to society.²⁴⁰ Both views have their adherents.²⁴¹

Accepting the constitutional goal of promoting progress (as opposed, say, to reducing prices in the short term) by providing limited term exclusivity to innovators, a solution should provide a sufficient degree of certainty that successful innovation will be rewarded. The theory of patent grants as promoters of progress is that the marketplace (not the government) will finance innovation

²³⁶ See *In re Robertson*, 169 F.3d 743, 745 (Fed. Cir. 1999) (emphasis added) (quoting *Continental Can Co. v. Monsanto Co.*, 948 F.2d 1264, 1269 (Fed. Cir. 1991).

²³⁷ See *supra* Section III.C.3.

²³⁸ See *In re Winslow*, 365 F.2d 1017, 1020 (C.C.P.A. 1965) (in which the court assumed that in determining whether an invention was patentable or not, all relevant information was completely known).

²³⁹ If that is the goal, an even better solution would be to repeal the patent statute entirely.

²⁴⁰ See Max Stul Oppenheimer, *The Innovator's Dilemma*, 4 AM. U. BUS. L. REV. 371, 375 (2015) [hereinafter Oppenheimer, *The Innovator's Dilemma*].

²⁴¹ Any individual patent, viewed in isolation, is clearly anti-competitive—preventing others from using the claimed technology to compete is the purpose of the patent. Viewed in the aggregate, however, it is necessary to also consider the incentive to innovate and recall that, absent the innovation represented by the patent, society would not have the advance in the first place.

by assuring monopoly profits for innovation. To the extent that there is doubt regarding the availability of this reward, the incentive to innovate is reduced.²⁴² Any solution that introduces new uncertainty as to patentability of an invention will reduce the incentive to innovate, the ability to finance innovation²⁴³ and therefore the amount of innovation.

Any modification of the rules, whether by treaty or by statute, introduces uncertainty—new interpretations are required, or reaffirmation of existing interpretations to the new rule.²⁴⁴ While that is unavoidable, some modifications change uncertainty by design, changing the rules to favor or disfavor innovators.

A resolution must deal with two broad categories of issues: treatment of extraterrestrial activity for the purpose of establishing the right to a patent, and treatment of extraterrestrial activity for the purpose of defeating an existing patent. Viewed another way, the resolution must deal with pre-patent activity differently than post-patent activity.

Both discoveries and inventions made in space should be eligible for patent protection—they, like any other invention or discovery, further progress. Even discoveries—as opposed to inventions—in space should be eligible for patent protection if they introduce technology not previously available on Earth. Discoveries in space should not, however, be allowed to displace previously-applied for patents—the progress has already been made at the point of patent application and if the public did not have access to the technology at that point, the applicant has fulfilled the inventor’s part of the patent bargain.

This approach is consistent with the early “patents of importation” approach to the opening of new worlds with new technology bases. To the extent that it is inconsistent with current law, the inconsistency arises, not from constitutional requirement or the words of the patent statute, but from judicial interpretation.²⁴⁵

²⁴² See Oppenheimer, *The Innovator’s Dilemma*, *supra* note 240, at 387.

²⁴³ An investor in research and development is taking the risk that the research will actually produce the desired innovation and the risk that the innovation will be successful in the marketplace. These are typically large risks—minor innovations are generally unpatentable because of the non-obviousness requirement. 35 U.S.C. § 103 (2012 & Supp. V 2018). In order to compensate for these risks, there must be a comparably large potential for profit and that profit typically can only be protected by patents.

²⁴⁴ When the patent statute was amended in 1952 to introduce an explicit prohibition on patenting “obvious” inventions—a rule that had been in place through judicial interpretation since the 1851 case of *Hotchkiss v. Greenwood*, 52 U.S. 248, 269 (1851)—it took a Supreme Court decision to confirm that there was still a prohibition on patenting “obvious” inventions, *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966), and the contours of “obviousness” remained contentious as recently as 2007. See *KSR Int’l Co. v. Teleflex Inc.*, 550 U.S. 398, 407 (2007).

²⁴⁵ This judicial interpretation has been inconsistent, and has drawn criticism from lower courts and the patent office, which argue such interpretation is inconsistent and lacking

The approach is also consistent with the path followed by the courts in the evolution of the interpretation of the term “printed publication” in response to developments in the technology of disseminating information. Printed publications were initially treated differently from other sources of prior art (knowledge and use), on the theory that books traveled more easily and more invariably than word of mouth, and initially were limited to ink on paper. As communications technology advanced, the meaning of “printed publication” expanded to include other forms of permanently recorded information and eventually to internet publications.²⁴⁶ Similarly, as space travel becomes common, the concept of prior art from space can likewise evolve—and if Congress believes the evolution is too slow or proceeding in the wrong direction, it can amend the statute as it has done with respect to the definition of prior art from other countries.

CONCLUSION

Current patent law is ill-equipped to deal with an influx of technology from outer space. That influx may still be decades in the future, so some may argue that it is well to delay changing the patent law until there is more information on the challenges actually posed by extraterrestrial discoveries. Often it is better to defer statutory changes until the impact of a catalyst is well-understood; this reduces the risk of overreaction or of reaction to the wrong challenge.

In this case, however, it is unlikely that the impetus to commercialize space exploration will abate, and several problems have already been identified (and are unlikely to change). Acting now to clarify the potential patent rewards that space exploration will offer may, in fact, provide a needed incentive to make the enormous investments that such exploration will require.

Each of the potential solutions analyzed above has its advantages and disadvantages—what is an advantage and what is a disadvantage depends, of course, on what policy is being pursued, but that too is unlikely to change. It is therefore time to begin the discussion of how to use the patent system for the purpose it was designed for—to encourage progress—by motivating the expenditures necessary to search for and exploit what new technology might await in outer space.

in theoretical foundation. For a detailed review of the criticism of the Supreme Court's approach to statutory subject matter and an argument that the Court has usurped the legislature's authority, see Oppenheimer, *Patents 101*, *supra* note 185, at 44–47.

²⁴⁶ For a detailed description of the evolution of the concept of printed publication, and a proposal for an approach to handling emerging technologies under patent law, see Oppenheimer, *In Vento Scribere*, *supra* note 174, at 243–58.