Low Orbit Patent Protection: Cautions and Considerations for Commercialized Microgravity

"Space drugs have finished cooking baby!" tweeted Delian Asparouhov, co-founder of Varda, a start-up breaking new ground in low-orbit. This summer, Varda, working with SpaceX, successfully launched a 90 kilogram capsule with a unique payload, a platform for pharmaceutical development in space. That launch was a success; "for the first time ever, orbital drug processing happened outside of a government-run space station," a critical first step to "commercializing microgravity and building an industrial park in LEO (Low Earth Orbit)."

Why go through the trouble of manufacturing drugs in space? Pharmaceutical manufacturing in microgravity provides unexpected benefits. Terrestrial pharmaceuticals can take on new, better forms once freed from gravity's constant embrace. For example, astronaut scientists on the International Space Station have shown that, when manufactured in microgravity, known cancer treatments – like the monoclonal antibody Keytruda – can form higher order, purer, and more uniform crystals, opening the door to better, more efficient, treatments. Those results did not go unnoticed. Pharmaceutical companies have already dedicated significant funds to researching microgravity pharmaceuticals (Merck and Bristol Myers Squibb are involved) and so has our administration (Joe Biden recently announced an allocation to NASA for low orbit cancer-related research in the 2024 fiscal-year budget).

But what about other types of manufacturing? To keep up with Moore's law, an adage promising the doubling of processing speed each year, semiconductors may too have to escape our atmosphere. Just as gravity constrains our ability to grow and organize pharmaceutical crystals, it limits the quality and quantity of nano-scale materials used in semiconductor production. In orbit, free from that restraint, the potential advances in semiconductor technology are great. Space Forge, a start-up based out of Wales, aims to lead that advance and is designing an in-space semiconductor manufacturing platform. Once operational, low-orbit semiconductor production may lead to a "10 to 100 X improvement in semiconductor performance," said Andrew Parlock, Space Forge's managing director of U.S. operations.

Low earth orbit manufacturing, once science fiction, is here and is backed by significant private and public investment. As this industry grows – estimated to reach $10 billion by 2030 – the inevitable question becomes, how will the players in this new space protect their IP?

Low orbit legal disputes may appear entirely novel, but there are strong analogs in our law already, namely, extraterritorial patent protection in international waters. There, courts have rejected arguments that there is no liability "for infringement because U.S. patent laws did not apply on the high seas," reasoning that U.S. patent laws extend "to the decks of American vessels on the high seas" as "any contrary ruling would render valueless 'patents for improvements in the tackle and machinery of vessels, or in their construction.'" M-I Drilling Fluids UK Ltd. v. Dynamic Air Ltda., 890 F.3d 995, 1006 (Fed. Cir. 2018). That reasoning, as noted by the Federal Circuit, neatly applies to manufacturing machinery on spacecraft.

The need to protect inventions on the proverbial high seas is just as, if not more present, in low orbit. Indeed, that need is what motivated Congress's little known (and less litigated) 1990 Inventions in Outer Space Act. There Congress expanded patent protection to U.S. spaceships, providing a remedy "for infringing activities in outer space," and incentivizing "commercial investment in outer space research and manufacturing." 1990 U.S.C.C.A.N. 4058, 4060–62. Per the Outer Space Act, "[a]ny 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 for the purposes of" patent infringement.

Nevertheless, many open questions remain and the protection of low orbit IP should be of significant concern for this burgeoning industry. To this author, beyond the obvious need for careful demarcation of this country's "jurisdiction or control" in orbit, two considerations rise above the rest.

First, while a bit whimsical sounding, there is a real, cognizable fear of Space Trolls. In patent law, a troll, unlike an innovator, is an entity that accumulates patents, not for the protection of new useful products (the purpose of patents), but as offensive legal artillery. A patent troll secures patents in growing technical industries, threatens or files broad infringement claims, and aims to secure quick payment by relying on the looming specter of hefty legal defense costs. Because of this, many legal scholars argue that patent trolls stifle and quash innovation. For example, after the dotcom boom and the rise of internet applications and technology, courts were awash with infringement actions from trolls who secured patents recycling known methods and processes with a trivial addition, implementing those known processes on a then-new technology, computers. This type of litigation was problematic, and foundational Supreme Court opinions have helped curtail this anticompetitive behavior, i.e., *Alice Corp. v. CLS Bank Int'l.* Unfortunately, that curtailment did not account for the oncoming wave of space trolls, armed with 'new' inventions where known compounds, methods or processes (on Earth) are transposed to low-orbit.

While innovative pharmaceutical and semiconductor firms possess large patent portfolios covering many forms of drugs or semi-conductors and the various means to make them; what is absent from most, if not all, of those portfolios, are claims to improvements from low orbit or microgravity manufacturing products and processes. While some may argue that existing law (like *Alice Corp.*) protects innovators against this type of space-trolling, that is far from clear. It is true that companies have successfully defeated trolls by invalidating patents without meaningfully new functionality or improved performance, but that defense is a poor fit here. These new patents will be directed to more potent drugs or faster semiconductors, and, unlike the generic computer implementation in *Alice*, are tangible, functionable improvements. What is stopping trolls from leveraging this opening and filing applications to improved blockbuster drugs or semiconductors relying on the inherent benefits of microgravity manufacturing? Seemingly nothing. The Patent Office does not require an applicant to actually build its invention, or go into orbit, filing the application itself is the inventive act. The logical safeguard for industry players is proactive claim drafting to capture the inherent benefits associated with microgravity manufacturing.

Second, there is a growing, sprawling uncertainty in enforcing patent rights in space. We know that direct infringement on a U.S. spaceship has a remedy through the Outer Space Inventions Act, but what makes a U.S. space station or ship? As recently stated by the Federal Circuit, a "ship's flag does not transform a ship into terra firma of the country whose flag she flies." Based on analogy to the precedent dictating patent protections on the high seas, and the strong signal from Congress, it appears likely that for international space stations, jointly owned satellites, ships or lunar bases, Courts will not rely on a categorical rule but rather a wholistic analysis, considering "[i]n addition to the law of the flag, … six other factors for a court to consider in determining what law applies aboard a ship: (1) place of the wrongful act; (2) allegiance or domicile of the injured; (3) allegiance of the ship owner; (4) place of contract; (5) inaccessibility of foreign forum; and (6) the law of the forum." In short, if the spaceship, station or satellite is flying an American flag and an American patent is infringed, it appears likely that our patent law and its protections will follow; otherwise, little is clear other than the fact that location and ownership – domestic, foreign or joint – are paramount.

Unlike direct infringement where the offending behavior occurs in orbit, indirect infringement concerns terrestrial conduct abetting low orbit infringement. Will a company be liable for knowingly producing a machine used in orbit by a third party to produce an infringing good? Some federal law already suggests yes, *M-I Drilling Fluids UK Ltd. v. Dynamic Air Ltda.*, 890 F.3d 995, 1001 (Fed. Cir. 2018).

In all, faced with these ambiguities in low orbit patent protection, innovators may consider trade secret protection. But the implications for trade secret law are even less clear. Unlike patent law, trade secrets are not the exclusive ambit of the federal government and thus vary state to state (not only country to country). If

trade secret methods or products can only be developed in space, what law applies? If the only available laboratories are aboard public or international space stations, how can measures be taken to keep the trade secrets secret? These and similar questions abound.

The take-away? While the ability to enforce patent rights against potential space-infringers is nebulous at best, proactive patent prosecution to encompass improvements in microgravity manufacturing appears a prudent safeguard against the rise of the Space Troll.

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If you have any questions about the issues addressed in this memorandum, or if you would like a copy of any of the materials mentioned in it, please do not hesitate to reach out to:

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