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SPACE AGENCIES, PATENTS AND TECHNOLOGY TRANSFERS: PRACTICES FROM AROUND THE WORLD

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ABSTRACT

In 2019, the National Aeronautics and Space Administration ("NASA"), held the program 'Apollo 50: The role of intellectual property in space commerce'. One of the most significant developments that were noted was NASA's engagement with partners from the private sector and discussions on an intellectual property ("IP") regime that would further incentivize private sector investments and involvement. The very next year, the Union Government of India came out with an announcement stating that the space sector would be thrown open to private players as well. This was followed by reforms ensuring room for private sector participation and the sharing of the Indian Space Research Organization ("ISRO") patented technology for the growth and development of a strong domestic private space industry. The trend is clear. Space agencies are increasingly incentivizing the space sector and liberalizing the IP regime associated with it, for greater private sector involvement. This can be mainly seen by transfers of patented technology of space agencies to the private partners, who in turn commercialize the same for the development of new products and technologies that propel human advances in space exploration or develop products based on such technologies for benefitting life on Earth. In light of these advances, the authors of this work undertake the task of exploring the technology transfer programs and IP policies of major space agencies such as NASA and the European Space Agency("ESA"), and how India's policies fare in comparison. This work utilizes both primary sources of information such as legislative and executive materials, as well as secondary sources of information such as published papers, dissertations and symposiums. This analysis has consequently found that the new policies would aid in attracting private sector involvement and potential areas of improvement have also been suggested, as a result therein.

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I. INTRODUCTION

Intellectual Property is widely accepted as being one of the bedrocks that help facilitate investments in commerce, thus resulting in greater research and development and consequently, greater innovations. This importance has been recognized by space agencies as well, which not only recognize the role that IP plays in rewarding and incentivizing innovation [1], but also the significance it poses in incentivizing the private sector as well in activities leading to space commercialization.[2] That is, IP such as patents may also be used by space agencies to engage with other private enterprises.

On 26th June 2020, the Union Cabinet approved changes to the sector of space exploration in India, aiming to boost the participation of private players.[3] ISRO Chairman Dr. K. Sivan has pointed out that the reforms allowing the private sector to participate in the space sector were introduced, keeping in mind the fact that the global space economy is around $366 billion as of 2019, of which India's share was only less than 3%.[4] Tapping this enormous market would be a substantial opportunity, for which private players' involvement would be needed.[5] He further went on to say that though earlier, everything was done by ISRO, the perception of the future of space activities is changing with private players being given equal opportunities.[6] A part of this also involves the sharing of technologies by ISRO with the private players.[7] Such sharing forms the crux of the subject matter of this paper as it brings out the question of how technology transfers and the issue of intellectual property will be tackled by ISRO, in its dealing with Non-Governmental Private Entities. To give context to this analysis, the approaches of some of ISRO's counterparts from other countries are also looked into.

This paper undertakes the task of analyzing some of the major changes in the IP and technology transfer policy of the Indian Space Research Organization in light of the renewed emphasis on the private sector participation and its relevance. To chart out the same, first, the relevance of

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[1] *ESA, Industry and Intellectual Property*, THE EUROPEAN SPACE AGENCY, https://www.esa.int/About_Us/Business_with_ESA/How_to_do/ESA_Industry_and_Intellectual_Property, (last visited Mar. 20, 2021).

[2] Barbara Luxenberg, *Protecting Intellectual Property in Space*, 27 PROC. ON L. OUTER SPACE 172 (1984).

[3] *India opens space sector to private players: What it means for ISRO*, FINANCIAL EXPRESS (Jun. 26, 2020), https://www.financialexpress.com/lifestyle/science/india-opens-space-sector-to-private-players-what-it-means-for-isro/2005105/.

[4] UPES, *Future of Aerospace & Avionics in India*, YOUTUBE (Mar. 12, 2021), https://www.youtube.com/watch?v=flsPoMSm1-o.

[5] *Id.*

[6] *Id.*

[7] *Id.*

intellectual property for space agencies shall be looked into. Second, the policies from other space-faring nations who are leaders in the field of technology transfer and intellectual property, i.e., the US and the EU shall also be looked into, to acquaint ourselves with the best practices from around the world. Third, we shall come to the Indian scenario and look into the erstwhile policies of technology transfer and handling of IP that was followed by ISRO. Fourth, the new policy shall be assessed to understand some of the major changes vis -à-vis technology transfer and the handling of IP. Fifth, we shall also look into some areas which the authors believe would be worth exploring, as far as future changes to the policy are concerned.

II. RELEVANCE OF PATENTS FOR SPACE AGENCIES

Before going into an analysis of the space policies, one of the pertinent issues to be tackled is the relevance of a patent to a space agency. In fact, *Frank Cepollina*, National Inventors Hall of Fame Inductee, was asked why NASA needs patents if it encourages private players in the space industry.[8] He stated two reasons:

> *"First reason is protection. Most of the companies that you start to work with, that want to make the push, that already have some of the technology but recognize that they need to make a financial push to match up to NASA's needs, they want to be protected. So somewhere, somehow, you have to have a protection system where their investment makes sense to them economically and which protects them…The other part that never gets talked about is acceleration…when there is a patent or even a patent pending awarded, and NASA puts its list out, all of a sudden, phone calls ring off the hook. Everybody in the country that is interested in that particular technology wants to know what you're doing, wants to know if they can share in the patent, wants to know if they can get it. So, it accelerates the innovation."*[9]

A further point lies in an observation made by *Dr. Kathryn Sullivan*, an astronaut on three space shuttle missions. She opined that at times, the ideas behind a technology would normally arise in a 'NASA lab or a NASA funded University', thus making the grant of patents to NASA justified.[10] Another reason can be found in the words of the Administration itself where they say that if NASA has the authority according to the Space Act to transfer technology, then an equal responsibility lies on NASA to 'establish and protect the Government's rights in inventions to

[8] USPTOVIDEO, *Apollo 50: The role of intellectual property in space commerce (Part II)*, YOUTUBE (Aug. 2, 2019), https://www.youtube.com/watch?v=hpuJ8Fnu2QU.
[9] *Id.*
[10] *Id.*

which NASA has a title.'[11] Notwithstanding the aforementioned factors, an organization like NASA does recognize the need to provide as much flexibility as possible with regard to the handling of intellectual property rights in light of the involvement of private players.

A. The Nasa Experience

The US is well known for its strides towards the protection of IP and has one of the most robust mechanisms in place for the protection of one's invention. Thus, it is only apt that the country's IP protection regime regarding inventions in the space sector be examined first.

NASA had previously stated that due to a tightening of government budget allocation and an ever-rising number of competitors from around the world, the role of NASA was also constantly evolving. It further went on to say that the various legislations and executive materials available show that the legislative intent is to '*facilitate and support the commercialization of federally funded endeavours.*' That is, '*the support to the United States industry*' should be of utmost priority to NASA.[12]Thus, what NASA seeks to achieve with its inventions, in part, is to commercialize it, which would ultimately benefit the US industry and the society at large, by making available these technologies for daily use of the people. At this juncture, one of the questions that prop up would be why there is a need to involve the US industry in the first place when NASA could have tried to bring the device over which it had patent rights to the market by itself. The answer can be found rooted in the tilt of the US economy towards free markets during the 20th century, as such an act of commercializing the product by itself would have put NASA in a situation of direct competition with the private sector - which was unthinkable at the time of the Cold War and the ideological conflict against communism.[13]

The further emphasis on the commercialization of technology is also visible from the policies adopted by NASA for licensing out its patents. At the time when the negotiation for the terms of the licenses for the technologies are finalized, a proper plan for commercialization has to be provided by the potential licensee and a reasonable time within which the practical application of the invention can be achieved must be specified, if a license is to be obtained. Such commercialization plan must be for the '*development and the marketing of the invention.*' NASA also

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[11] *Intellectual Property Management*, NASA, https://www.nasa.gov/offices/oct/partnership/partnerships/section_ipm.html (last visited Dec. 10, 2019).

[12] Vernon Williams, *NASA Technical Memorandum 106731 – Intellectual Property Rights at the National Aeronautics and Space Administration, Lewis Research Center*, NASA TECHNICAL REPORTS SERVER 2-3 (Sept. 01, 1994), https://archive.org/details/nasa_techdoc_19950005453.

[13] Sylvia Kraemer, *NASA, Monopolies and the Cold War: The Origin and Consequences of the National Patent Policy, 1958 - 1996*, NASA (Oct. 1999), https://www.hq.nasa.gov/office/codez/plans/R&D/SHOTOCT99.html.

furthers its goal of supporting the US industry by giving preference to those potential licensees, who choose to manufacture substantially in the US. One of the distinguishing features of NASA is that apart from non-exclusive licenses, *exclusive or partially exclusive licenses* may also be granted by the Administration. The fact that exclusivity of licenses is allowed, is indicative of the openness of the Administration to look into various avenues to ensure commercialization. However, such exclusivity is not without riders. It must be *reasonably necessary* to the extent that it would incentivize businesses to achieve practical application of the invention. Another safeguard that ensures that the exclusivity would stay in the realm of legality would be that such exclusivity that is granted must not violate Federal anti-trust laws or result in a substantial reduction in the competition. The interests of the Federal Government or US industry in foreign commerce must also be enhanced, in case the invention for which the license is sought, is covered by a foreign patent application or patent.[14]

This goes to show the importance that NASA attaches to its *goal of commercialization of technology* and *industry support* and how NASA, through a pragmatic approach, ensures the attainment of these goals. To achieve these two goals, one of the mechanisms used by NASA would be licensing of technologies. For the purpose of this paper, licensing shall be analyzed through NASA's technology transfers and Space Act Agreements.

1. Technology Transfer and Licensing at NASA

a) The Intent and Importance of Technology Transfer as highlighted by NASA

Technology transfer is a critical step in making sure that NASA fosters Research and Development (R&D)[15] and commercializes its inventions and technologies, by transferring such rights to the industry partner, university or non-profit organization.[16] Jim Bridenstine, the 13th Administrator of NASA, had stated that licensing of the NASA technologies to private enterprises drives up the competition and further brings down the cost. He predicted a future where many of these private industries would partner with customers who are not necessarily

[14] National Aeronautics and Space Administration, NPD 2090.6A, AUTHORITY TO ENTER INTO LICENSE AGREEMENTS AND IMPLEMENTATION OF LICENSING AUTHORITY 1-2 (2018), https://nodis3.gsfc.nasa.gov/npg_img/N_PD_2090_006A_/N_PD_2090_006A__main.pdf.
[15] National Aeronautics and Space Administration, NPR 7500.2, NASATECHNOLOGY TRANSFER REQUIRE MENTS 14 (2014), https://nodis3.gsfc.nasa.gov/npg_img/N_PR_7500_0002_/N_PR_7500_0002_.pdf.
[16] *Supra* note 12, at 6.

NASA, thus making NASA one customer of many.[17] In 2018, NASA highlighted technology transfer as a strategic objective.[18] Another important outcome of technology transfer is the creation of spinoffs.

b) Affecting Technology Transfer – The T2 program and more

With over 1200 patents available for licensing[19], NASA is a goliath when it comes to technology transfer. As far as such patents are concerned, the T2 portal is a major attraction for those who aim at developing their companies through technology transfer from NASA. Through the usage of its patent licensing program and the T2 portal, the Administration seeks to license and transfer technologies to potential users, so that they may be commercialized. The T2 program aims to transfer NASA technologies developed for space, which would also help solve real life problems on Earth.[20] Inventions and technologies developed by NASA inventors, partners, grantees and contractors are disclosed to NASA through the New Technology Reports. Among such technologies, those which are patentable has commercialization potential and conforms to the rest of NASA's policy would be patented and made available on the 'patent portfolio'[21] section of the T2 program website. This section provides a catalogue of technologies over which NASA has patents. This would help potential licensees to choose from the options available and directly interact with a NASA licensing manager to obtain the licenses.[22]

Through this program, the licenses provided to startups would not be accompanied with any initial licensing fees. There will also not be a minimum fee for the first three years. However, there must be express intent from the part of the startup to commercialize the technology, and royalty fees must be paid to NASA once the product starts selling. This policy is applicable only to non-exclusive licenses[23] Moreover, there must be compliance with the requirements provided

[17] USPTOVIDEO, *Apollo 50: The role of intellectual property in space commerce (Part I)* , YOUTUBE (Aug. 2, 2019), https://www.youtube.com/watch?v=vQjY7GRI-6I.
[18] National Aeronautics and Space Administration, NASA 2018 STRATEGIC PLAN 24-25 (2018), https://www.nasa.gov/sites/default/files/atoms/files/nasa_2018_strategic_plan.pdf.
[19] Angeline Puranen, *Technology Transfer Office – Strategic Partnership at Ames*, NASA (Aug. 29, 2019), https://www.nasa.gov/ames/technologytransfer.
[20] NASA SPINOFF, *Technology Transfer Portal welcome video*, YOUTUBE (Oct. 10, 2014), https://youtu.be/FHkBAljGq5Y.
[21] *NASA Patent Portfolio*, NASA TECHNOLOGY TRANSFER PROGRAM, https://technology.nasa.gov/patents (last visited Dec. 25, 2019).
[22] *Id; See NASA's Technology Transfer Process*, NASA TECHNOLOGY TRANSFER PROGRAM, https://technology.nasa.gov/ipprocess (last visited Mar. 01, 2021); *See also How to License NASA Technology* , NASA TECHNOLOGY TRANSFER PROGRAM, https://technology.nasa.gov/license (last visited Mar. 01, 2021).
[23] (However, NASA would be open to negotiation on the grant of further exclusivity, if the startup wishes to do so.)

in federal licensing statutes and NASA policy, including the development of a commercialization plan and reporting on efforts to achieve practical application.[24]

The mechanism adopted by the Administration to transfer technologies are also quite vast. Apart from the T2 program, technology transfer may also be affected through the p rocess of an 'IP auction', which involves the utilization of the services of an intermediary to auction NASA technologies.[25] The highest bidders from this auction would end up obtaining the licenses.

c) Spinoffs

This focus on commercializing inventions and helping businesses use NASA technologies to make products for the market has resulted in nearly 2000 products that have incorporated NASA technology or experience, since 1976. Such products are called spinoffs.[26] From technologies to combat water pollution and inventions such as winglets in airplanes, to enriched baby formula and inexpensive ventilators and more, these spinoffs have impacted our daily lives for the better.[27]

2. Space Act Agreements and Licensing at NASA

The following two aspects of Space Act Agreements may be analyzed, for the purpose of the discussion at hand:

a) Handling of IP when the work of the Inventive type is not done for NASA

Apart from the T2 program, another aspect of importance, vis-à-vis the licensing of technologies between the Administration and partner entities would be through certain 'other transactions.' Such transactions have been conceived as a way for NASA to enter into agreements with any US agency or instrumentality, another State, Territory, possession, political sub-division thereof,

[24] Press Release, Joshua Buck, Public Affairs Specialist for Human Exploration and Operations and NASA Technology, *NASA Offers Licenses of Patented Technologies to Start-Up Companies* (Oct. 7, 2015), https://www.nasa.gov/press-release/nasa-offers-licenses-of-patented-technologies-to-start-up-companies.
[25] NATIONAL AERONAUTICS AND SPACE ADMINISTRATION, PLAN FOR ACCELERATING TECHNOLOGY TRANSFE R AT NASA 7-8 (2012), https://www.nasa.gov/pdf/709314main_NASA_PLAN_FINAL.pdf.
[26] *What is a spinoff and what is spinoff*, FREQUENTLY ASKED QUESTIONS, https://spinoff.nasa.gov/faq (last visited Aug. 20, 2020); *See* NASA SPINOFF, https://spinoff.nasa.gov/ (last visited Aug. 20, 2020).
[27] *40 Years of NASA Spinoff*, NASA, https://www.nasa.gov/offices/oct/40-years-of-nasa-spinoff (last visited Mar. 18, 2021); *See Spinoffs: How NASA Technologies Benefit Life on Earth*, PLANETARY (Mar. 03, 2021), https://www.planetary.org/planetary-radio/dan-lockney-nasa-spinoff21?fbclid=IwAR0i1ESZHACqWYeWeQUtn4M7rBKqGTjLFdKkxPjaH5wsL-DpS8veBk_VuqA.

person, firm, corporation, association or educational institution.[28] Such agreements are called Space Act Agreements ("SAA").[29] The importance of these agreements lie in the fact that it gives legroom for NASA to negotiate and tailor its intellectual property clause, as long as the work of the inventive type is not being performed by the partner for NASA, but for its own benefit, thus distinguishing it from procurement contracts.[30]

The flexibility in negotiations that SAAs provide has resulted in several ways in which the intellectual property that arise out of these agreements are handled.[31] In most cases, the patent rights over the inventions and technologies developed by the parties will remain with themselves. However, if some joint activities are performed and NASA's work would normally result in some sort of invention, NASA may choose to waive its rights and grant an *exclusive* or *partially exclusive commercial license*, subject to the retention of a *government purpose license* and a non-exclusive license to the contractor (where a title is acquired from a support contractor). As discussed before, this is done in the spirit of commercialization. That being said, if the commercialization is found to be inconsistent with NASA or government policy, then the licenses may be made *royalty bearing and revocable*. If the nature of the SAA is such that NASA is reimbursed by the partner entity, the nature of the license granted to the partner entity would be *exclusive, royalty-free and irrevocable*, subject to Federal Regulations.[32] It is also to be noted that in the aforesaid case, NASA would retain rights only to the extent of research, demonstration, test and evaluation processes.

b) Handling of IP when the work under an SAA is done for NASA

When the work is done by the partner *for* NASA or if NASA transfers inventions or funds to the partner[33], the vesting and licensing of intellectual property in an invention created therein, if any[34], is a bit different from the previously discussed scenario. When intellectual prop erty rights are created by an entity other than a small business organization or non-profit organization as part of the work it does under any NASA contract or subcontract, then the title to such intellectual property created as part of such invention, discovery, improvement or innovation

[28] 51 U.S.C. § 20113 (e) (2020)
[29] NASA, NAII 1050-1D, SPACE ACT AGREEMENTS GUIDE B-43 (2017), https://nodis3.gsfc.nasa.gov/NPD_attachments/N_AII_1050_001D.pdf.
[30] *Reference*, NASA, https://www.nasa.gov/offices/ogc/ip/1210_prt.htm (last visited Jan. 29, 2020); *See id.*
[31] *Id.*
[32] 37 CFR § 404 (2004).
[33] NASA, *supra* note 29.
[34] NASA, *supra* note 29 at B-45.

shall lie with the US government.[35] However, the US government may *waive* its rights[36], while reserving an *irrevocable, nonexclusive, nontransferable, royalty-free license* for the practice of such invention throughout the world by or on behalf of the United States or any foreign government pursuant to any treaty or agreement with the United States.

Small business firms and non-profit entities are treated on a separate pedestal and are given a separate provision to obtain title over their inventions on the assumption that they can commercialize the invention faster than a federal agency[37]. Therefore, when such entities perform work under the aforementioned type of contracts or sub-contracts, it may elect to retain the title to their invention.[38]

c) March-in Rights – A Safeguard

From technology transfers to licensing policies, it is evident that NASA's policies are business - friendly. Agreements such as SAAs provide a wide berth for negotiations. Ultimately, NASA policies aim at making sure that their technologies reach the market in one form or fashion. However, care must be taken to understand that such transfers and licensing would not mean that NASA's engagement with the private entity is done and dusted. To make sure that the licensees stick to the commitments given to NASA, vis-à-vis the technology transferred, NASA keeps the option open for the exercise of march-in rights. These are rights that are retained by the Federal Government agencies like NASA whereby they can require contractors or successors in title to the patents to grant licenses to responsible applicants, in certain specific circumstances. If such persons refuse to do so, the license may be granted by the Government itself.[39]

Though the Administration has never exercised march-in rights, the value of the same is respected because it gives leverage in commercializing federally funded initiatives.[40] Whether the Administration decides to waive its rights[41] or where the contractor elects to retain the title[42],

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[35] 51 U.S.C. § 20135(b)(1) (2020) (Pursuant to sub-clauses A and B. This section was formerly § 305 (a) of the National Aeronautics and Space Act of 1958); *See* Policy, 48 C.F.R. § 1827.302 (a) (2020).
[36] 51 U.S.C. § 20135(g); *See* Patents and other Intellectual Property Rights, 14 C.F.R. Part 1245 (2020) (As mentioned in 48 C.F.R. § 1827.302(b)(2)(v)).
[37] *Supra* note 12, at 9.
[38] 48 C.F.R. § 1827.302(b)(1); *See* 35 U.S.C. § 202 (2020) (Subject to the conditions in sub-section(a), (c) and other provisions of the chapter).
[39] JOHN THOMAS, CONG. RESEARCH SERV., R44597, MARCH-IN RIGHTS UNDER THE BAYH-DOLE ACT 7 (2016).
[40] U.S. GOV'T ACCOUNTABILITY OFFICE, GAO-09-742, FEDERAL RESEARCH: INFORMATION ON THE GOVERNMENT'S RIGHT TO ASSERT OWNERSHIP CONTROL OVER FEDERALLY FUNDED INVENTIONS (2009), https://www.gao.gov/assets/gao-09-742.pdf (*See* "What GAO found").
[41] Reservations, 14 CFR § 1245.107 (b) (2020); *See also* 14 CFR § 1245.117 (2020).
[42] 14 CFR § 1274.913 (j) (2020); *See also* 37 CFR § 401.6 (2020).

NASA reserves march-in rights. NASA is empowered to require the contractor or the patent assignee to grant *nonexclusive, partially exclusive, or exclusive license to a responsible applicant or applicants.*

B. The ESA Example

The ESA, consisting of 22 Member States, was set up by the Convention for the establishment of a European Space Agency, 1975.[43] At the outset, it is pertinent to note that ESA does not have ownership and exploitation of intellectual property as one of its primary objectives. Rather, it aims to '*shape the development of Europe's space capability and ensure that investment in space continues to deliver benefits to the citizens of Europe and the world.*'[44] This is further evident from the fact that Article III.1 of the ESA Convention provides that ESA and the Member States should facilitate the 'the exchange of scientific and technical information pertaining to the fields of space research and technology and their space applications'.[45]

The ESA has well-defined rules that outline the way in which intellectual property resulting from ESA's activities are dealt with.[46] Primarily, ESA concerns itself with two ways in which intellectual property is created – by ESA staff in the course of their duties and by a Contractor of ESA, during the performance of a contract. In its genesis in 1989, the rules were more focused on providing free access to ESA-funded information and data to its Member States. This did not have the intended effects and was revised in 2001[47], whereby Contractors of ESA funded programmes were allowed to protect their creations. Subsequently, intellectual property developed by ESA's staff is owned by the ESA[48] and intellectual property developed by a Contractor is owned by the Contractor, barring certain exceptions.[49]

1. Technology Transfer

[43] Convention for the Establishment of a European Space Agency, *opened for signature* May 30, 1975, 14 I.L.M 2 (entered into force Oct. 30, 1980) [hereinafter ESA Convention].
[44] *About the European Space Agency*, EUROPEAN SPACE AGENCY, https://www.esa.int/Newsroom/About_the_European_Space_Agency (last visited May. 1, 2020).
[45] *Supra* note 43, art. III.1.
[46] European Space Agency [ESA], *Rules on Information, Data and Intellectual Property*, ESA/REG/008 (Apr. 23, 2014), https://esamultimedia.esa.int/docs/LEX-L/Contracts/ESA-REG-008-EN.pdf; These are based on Article III of the ESA Convention.
[47] Karl Eisermann & Christian Grafe, *The New Intellectual Property Rights Regime in ESA Contracts*, 3 CONVERGENCE 38, 39 (2007).
[48] ESA Staff Regulations, Reg. 4.2.
[49] *Infra* notes 63-68 and accompanying text.

With nearly 530 patents and patent applications,[50] ESA has a diverse patent portfolio on matters ranging from production technologies to biotechnology. ESA offers most of its patents on technology transfer, mainly to European Industries, with over 340 space technologies transferred.[51] This has resulted in space technologies being used in non-space areas such as healthcare, waste management and water recovery.[52] ESA's Technology Transfer and Patent Office identifies space technologies arising out of ESA R&D contracts and ESA inventions viable for transfer and conducts studies before offering them for transfer.[53]

On behalf of ESA, the Technology Transfer Programme Office ("TTPO") markets and facilitates the transfer of ESA technologies.[54] ESA's website lists out the technologies it has on offer to transfer. Applicants are to contact the TTPO through a network of brokers known as the ESA Technology Transfer Network ("TTN"), spread across Europe who works to identify novel uses for ESA technology and identify technologies in other sectors that could benefit ESA.[55] The ESA Space Solutions Belgium, managed by Verhaert, conducts feasibility studies,[56] technology scouting,[57] etc. and accepts proof of concepts from applicants to apply ESA technologies in terrestrial applications. Funding may also be provided for approved projects.[58]

One of the most entrepreneurial activities of the ESA can be seen in its approach towards startups. ESA's Business Incubation Centres ("BIC") aid in the turning of the Space-connected

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[50] *Patents*, EUROPEAN SPACE AGENCY, http://www.esa.int/Enabling_Support/Space_Engineering_Technology/Patents (last visited May. 1, 2020).
[51] *Technology Transfer Programme Office*, EUROPEAN SPACE AGENCY,https://www.esa.int/Applications/Telecommunications_Integrated_Applications/Technology_Transfer/Technology_Transfer_Programme_Office2 (last visited May. 1, 2020).
[52] *Benefits of Technology Transfer*, EUROPEAN SPACE AGENCY,https://www.esa.int/Applications/Telecommunications_Integrated_Applications/Technology_Transfer/Benefits2 (last visited May. 1, 2020).
[53] *ESA's Technology Transfer and Patent Office*, EUROPEAN SPACE AGENCY, https://www.esa.int/Enabling_Support/Space_Engineering_Technology/ESA_s_Technology_Transfer_and_Patent_Office(last visited May. 1, 2020).
[54] *IP for commercialisation*, EUROPEAN SPACE AGENCY, http://www.esa.int/Enabling_Support/Space_Engineering_Technology/IP_for_commercialisation(last visited May. 1, 2020).
[55] *Technology Transfer Network*, EUROPEAN SPACE AGENCY, http://www.esa.int/Applications/Telecommunications_Integrated_Applications/Technology_Transfer/Technology_Transfer_Network3 (last visited May 1, 2020).
[56] *Feasibility Studies*, SPACE SOLUTIONS BELGIUM, https://spacesolutions.be/technology-transfer/feasibility-studies/ (last visited Sep. 1, 2020).
[57] *Technology scouting*, SPACE SOLUTIONS BELGIUM, https://spacesolutions.be/technology-transfer/technology-scouting/ (last visited Sep. 1, 2020).
[58] *Proof of Concept*, SPACE SOLUTIONS BELGIUM, https://spacesolutions.be/technology-transfer/proof-of-concept/ (last visited Sep. 1, 2020).

business ideas into commercial start-up companies.[59] This has had a profound impact on the start-up culture and has resulted in 20 ESA BICs in 17 European countries, incubating more than 300 start-ups.[60] The programme accepts applications from qualified applicants, whose products or services should have a relevant space technology relationship, which can be an upstream development, downstream application of space technologies, technology transfer between space and non-space sector, or licensing a patent from the ESA patent portfolio.[61] Businesses under incubation may be eligible to receive funding, access to laboratories and other facilities, networking and business development support. One such example is the Open Sky Technology Fund, a €100 million fund which invests in start-ups and companies using space-related technologies or satellite applications in non-space applications.[62]

It is pertinent to note the importance of space agencies incubating space-based businesses under their wing. While it may look like the program resembles every other start-up incubation, space-based industries require specific support that may not be available elsewhere. Access to laboratories and testing facilities, support from scientific, managerial and business sectors, networking and marketing opportunities will be different for start-ups that use space technology. Therefore, a specific start-up incubation programme is beneficial to such start-ups than a generic one, and such benefits are greatened when they are provided by an established space agency.

2. IP Created by ESA Contractors

The General Clauses and Conditions of ESA ["GCC"][63], unless provided for otherwise, is a *sine qua non* for all contracts entered into by the ESA, and it provides that the Contractor shall own the intellectual property rights arising out of the work performed under the Contract.[64] Such

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[59] *ESA Business Incubation Centres*, EUROPEAN SPACE AGENCY, https://www.esa.int/Applications/Telecommunications_Integrated_Applications/Business_Incubation/ESA_Business_Incubation_Centres12 (last visited May. 1, 2020).

[60] *Id.*

[61] *ESA BIC Frequently Asked Questions*, SCIENCE AND TECHNOLOGY FACILITIES COUNCIL, https://stfc.ukri.org/files/esa-bic-uk-q-a/ (last visited Sep. 1, 2020).

[62] *ESA Open Sky Technologies Fund*, EUROPEAN SPACE AGENCY, http://www.esa.int/Applications/Telecommunications_Integrated_Applications/Technology_Transfer/Open_Sky_Technologies_Fund; *See also Dr. Bernd Geiger, Funding Mechanisms for Technology Transfer: OSTF – Open Sky Technologies Fund*, TRIANGLE VENTURE CAPITAL GROUP, https://iea.blob.core.windows.net/assets/imports/events/320/geiger.pdf (last visited Jun. 7, 2020).

[63] European Space Agency [ESA], *General Clauses and Conditions for ESA Contracts*, ESA/REG/002, REV.3 (Jul. 5, 2019), https://esamultimedia.esa.int/docs/LEX-L/Contracts/ESA-REG-002_rev3_EN.pdf [hereinafter GCC].

[64] Part II of the GCC deals with Intellectual Property Rights and it is in consonance with Article III of the ESA Convention; *See* European Space Agency, *General Clauses and Conditions for ESA Contracts*, cls. 36.3 a), 50.3 a), ESA/REG/002, REV.11 (7th Feb., 2013), https://download.esa.int/docs/LEX-L/Contracts/20130207.REG002,REV.1_EN_GCC.pdf.

contracts may either be fully or partly funded by ESA, and the resultant rights depend on the extent of funding. In either case, the contractor owns the intellectual property, with certain rights reserved by ESA. This shows a stark difference from the method adopted by NASA.

Where contracts are fully funded by the ESA, all intellectual property rights arising from work performed under the Contract shall be available to entities including ESA, Participating States and bodies, Academic and Research institutions, and third parties, in different capacities.[65] Additionally, ESA has certain rights, akin to march-in rights reserved over the invention. For example, if the contractor fails to register the product arising out of a fully funded project, or abandons it, and they are not able to find a suitable third party to protect and exploit those rights, ESA can require the Contractor to assign those rights to it free of charge.[66] This can be attributed to the fact that more public money is spent for such contracts. Where contracts are not fully funded by the ESA, and there is an element of funding from the contractor, all IPR arising from work performed under the Contract shall be available to ESA, Participating States, Persons and Bodies, and third parties on a more limited capacity.[67] ESA does not have march-in rights over the invention in this case. In this regard, it should also be noted that the contractor can transfer technologies developed under such contracts, even to parties outside of Member States, complying with applicable laws and regulations.[68]

C. The Case of ISRO

The Indian Space Research Organization has increasingly taken a proactive role in the handling of its patents or licensing the same. It has taken adequate steps with regard to important factors such as safeguarding innovations, increasing patent productivity among scientists, monitoring patent applications and patent alerts, identifying and processing various technologies developed in-house for their intellectual property registration and licensing intellectual property through licensing agreements.[69]

1. *The Approach of ISRO to Technology Transfer till the Draft 2020 Policy*

[65] *Id.* at 41.
[66] *Id.* at 40.5.
[67] *Id.* at 55.
[68] *Id.* at 49, 63.
[69] RAM JAKHU & RANJANA KAUL, *Regulation of Space Activities in India*, NATIONAL REGULATION OF SPACE ACTIVITIES 153, 194 (2010).

Similar to the other two space behemoths mentioned before, ISRO also emphasizes technology transfer and licensing. ISRO has defined technology transfer to be a process by which the knowledge, intellectual property and capabilities developed utilizing ISRO's resources are transferred to external entities.[70] ISRO's *mindset* towards licensing and technology transfer can be said to be mirroring that of NASA. This is because the topic of technology transfer has been viewed through the prism of commercialization, greater industry participation and focus on *spinoffs*.[71] Like the US, there is an added emphasis on commercialization in India. This is evident from the fact that ISRO has focused on the maximum commercial exploitation of ISRO's technologies, through technology transfers or licensing schemes.[72] ISRO's IP portfolio is confirmed to have 270 patents[73] and till date, 300 technologies have been confirmed to have been transferred.[74] Some of these ISRO technologies have already been used to develop spinoffs that have helped to better life on Earth.[75] Moreover, ISRO also seeks plans for implementation among other requirements from the potential licensees.[76]

The main arena for the transfer of technologies from ISRO has been for commercial and societal applications. Wherever it is 'feasible and necessary', ISRO also keeps buy-back options.[77] The transfer of the NavIC messaging receiver for the ultimate benefit of the fishermen community is an example of a technology transferred for societal application. It is also noteworthy that ISRO had not collected licensing fees or royalty loading for the aforementioned societal application.[78]

An important factor that can be observed is that the licenses to the technologies transferred usually shy away from the realm of exclusivity, unlike the US approach. Technology transfers are effected through the grant of *non-exclusive, revocable licenses* to third parties and the rights over the intellectual property is kept with ISRO.[79] ISRO may enter into buyback contracts in case the

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[70] *SAC Industry Portal*, SAC, https://www.sac.gov.in/SAC_Industry_Portal/technology.html (last visited Aug. 26, 2020).
[71] *Id.; See, Space Applications Centre (SAC), Ahmedabad executed 100th Technology Transfer Agreement*, ISRO (Nov. 24, 2015 11:17 AM), https://www.isro.gov.in/space-applications-centre-sac-ahmedabad-executed-100th-technology-transfer-agreement.
[72] *Patent*, ISRO, https://www.isro.gov.in/isro-technology-transfer/patent (last visited Mar. 19, 2020).
[73] *Id.*
[74] *Technologies Transferred*, ISRO, https://www.isro.gov.in/isro-technology-transfer/technologies-transferred.
[75] *Supra* note 71.
[76] *FAQs*, ISRO, https://www.isro.gov.in/isro-technology-transfer/faqs (last visited Mar. 19, 2020).
[77] ISRO, *supra* note 71; *See also Industry Interface: Technology Transfer*, U. R. RAO SATELLITE CENTRE, https://www.ursc.gov.in/industry/technology-transfer.jsp (last visited Mar. 20, 2020).
[78] DEPT. OF SPACE, ANNUAL REPORT 2018-2019, 85 (2019), https://www.isro.gov.in/sites/default/files/annualreport2018-19.pdf.
[79] *Technology Transfer*, VIKRAM SARABHAI SPACE CENTRE, https://www.vssc.gov.in/VSSC/index.php/2-uncategorised/7-technology-transfer (last visited Jan. 20, 2020).

technology is transferred and the industry sets up facilities for productionization, but ISRO ends up being the only market for the product.[80] In such cases, the pricing of the product would be important for ISRO and as a means of extending support to the industry, it may also underwrite the risks of the licensee by means of 'full investment or investment-sharing, guaranteed buy-back with firm off-take schedule'.[81] ISRO may charge royalties if the product is sold to third parties. However, down payment and royalties are avoided or kept low in case of buy-backs. It can also be seen that when there is limited competition, ISRO has resorted to limits on the product price and has also advocated for multiple licensing.[82] One of the desirable results of the same would be that there would be a safeguard against the formation of monopolies.

This procedure of taking care to provide non-exclusive licenses can also be observed in previous policies of ISRO concerning technology transfer and licensing. Though the pricing of technology transfer has been emphasized by ISRO, the primary considerations would be market acceptance and maximum exploitation of market know-how. To achieve these considerations, ISRO has looked into several factors that focus on the conditions of the potential market for the technology and the merits of the licensee.[83] The speed at which technology is transferred at ISRO has also been commendable as ISRO provides that the Technology Transfer Documentation (through which Technology Transfer has been effected) usually takes 1-2 months from the date of signing the agreement.[84] Along with the impressive speed at which technologies are transferred, ISRO's policies that aim at the selection of licensees can also be said to be meticulous. The technical capabilities, its resources and skill have been the primary determinants in the competitive process for choosing the potential licensee industry, rather than its size.[85] ISRO further has gone on to state that the identification of licensees is based on "*competency, resources, facilities available and their business networks, production and marketing capabilities.*"[86]

Through the aforementioned process of technology transfer and buy-backs, what ISRO has achieved is that while "mission design, assembly and testing, quality assurance, integration, and launch" was performed by the Organization, the companies to which the technology was

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[80] DEPT. OF SPACE, DOS Purchase Manual 63, (2015), https://www.isro.gov.in/sites/default/files/article-files/node/8696/DOSPURCHASEMANUAL2015.pdf.
[81] *Id.*
[82] *Id.*; *See* KR. Sridhara Murthi & T. S. Shobha, *Technology transfer trends in Indian space programme*, ACTA ASTRONAUT 67, 943-944 (2010).
[83] TECHNOLOGY TRANSFER GROUP – ISRO, TECHNOLOGY TRANSFER POLICY OF ISRO 12-14.
[84] *FAQs*, ISRO, https://www.isro.gov.in/isro-technology-transfer/faqs (last visited Jan. 20, 2020).
[85] *Supra* note 82, at 943.
[86] VIKRAM SARABHAI SPACE CENTRE, https://www.vssc.gov.in/VSSC/index.php/13-technology-transfer?start=5 (last visited Aug. 24, 2020).

transferred undertook the development of several sub-systems such as propellant tanks, liquid engines, etc.[87] In short, this has resulted in the creation of an "SME base, for the offloading of activities at the tier-2 and tier-3 level."[88]

2. SAAs and GCCs – How Does India Fare?

It is to be noted that there is no equivalent for standardized agreements like the SAAs, or a GCC in India. Unlike SAAs, where there are provisions that deal with the intellectual property that arises out of joint development or when work is performed for the Administration; and the GCC, where the IP rights are more or less given to the contractors, not many Indian equivalents are observed. Mainly, it has been due to the difference in the role of the industry. It is observed that the role of the private space sector in India is more or less that of a sub-contractor, vendor or component supplier.[89] It has been found in recent times that ISRO has been encouraging public-private partnerships to encourage the private entities to expand beyond being part/component manufacturers, and get involved in the production activities.[90] At the same time, it is also observed that the industry continues to lack end to end manufacturing capabilities.[91] This mechanism has also been criticized as one that lacks incentives to create IP and thus, causing a negative slump on IP-based product exports.[92] As an example, the Expression of Interest for Development, Qualification and Supply of DC Contactor for VSSC from 2018 stipulates that intellectual property rights will be sought jointly by ISRO and the party concerned. However, a party has to get consent from the other party before assigning any rights or liabilities arising out of such IPRs and the right to transfer such technology is reserved by ISRO to meet its requirements. Not only is such a right not available to the contracting party, but they also have to procure the technology through a separate technology transfer agreement if they wish to

[87] Narayan Nagendra, *Industry Participation in India's Space Program: Current Trends and Perspectives for the Future*, 14 (2-3) ASTROPOLITICS, 237, 238 (2016).
[88] *Id.* at 248.
[89] Pallava Bagla, *ISRO's love-hate relationship with private sector – A look back at history*, FINANCIAL EXPRESS (MAY. 26, 2020 5:50 AM), https://www.financialexpress.com/opinion/isros-love-hate-relationship-with-private-sector-a-look-back-at-history/1970400/.
[90] *Preparing to scale new heights: Enhancing private participation in India's commercial space sector*, 11 PRICE WATERHOUSE COOPERS (Jan. 2020), https://www.pwc.in/assets/pdfs/research-insights/2020/preparing-to-scale-new-heights.pdf?utm_source=dlvr.it&utm_medium=facebook.
[91] *Id.*
[92] Narayan Prasad, *Modi govt wants private sector in global space race, but it's up to ISRO to make it happen*, THE PRINT (June 4, 2020 8:00 AM), https://theprint.in/tech/modi-govt-wants-private-sector-in-global-space-race-but-its-up-to-is ro-to-make-it-happen/434469/.

commercialize it.[93] Moreover, it can be seen from procurement tenders put out by ISRO centres that for works done for ISRO, IP rights, including any patents that are developed in the course of the work shall go to the respective centre or ISRO.[94] This shows a stark departure from the likes of NASA and ESA.

3. Looking Forward: Draft 2020 Policy

With the new proposal to open up the space sector for private players [95], comes a new outlook in terms of sharing IP and a new policy for technology transfer. On the 2nd of December, 2020, the Department of Space ("DOS") released the latest guidelines for technology transfer for public comments.[96] The guidelines stress on the transfer of technology and consequently, the benefits therein to be transferred to both private and public sector industries in India. The end goal would be self-reliance, industrial growth and national development. This support to the Indian industry is also crucial because ISRO plans to offload most of the space-related activities to the industry, which would in turn enhance its focus on advanced research. The same was conveyed by Director K. Sivan, who further went on to say that technology transfers would help to improve the potential of Indian industries.[97] ISRO also believes that in light of the long-term investments made in the sector, technology transfer would help in generating additional returns from spinoffs, which could have a multiplier effect on such direct long-term investments. Failure to disseminate information would result in only limited returns for the country as a whole.

Like the US, it is essential that before technology transfers are affected, the technologies that have a potential for commercialization must be identified. For this purpose, commercial viability

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[93] DEPT. OF SPACE, Expression of Interest for Development, Qualification and Supply of DC Contactor for VSSC (May. 23, 2018), https://www.vssc.gov.in/VSSC/images/2018TENDERS/PT252.pdf.

[94] Space Applications Centre, Ahmedabad, *Work Contract for FM RF & DC Harness Fabrication*, Indent no 2016002291 at p. 5, https://sac.eprocure.isro.gov.in/tnduploads/sac/tndheader/IDT00393900000000000isro05401.pdf; *See* ISRO Satellite Center, *Charging Analysis on Solar Panel Coupon*, ISAC/DO/2018E0590401 at p.5. https://isac.eprocure.isro.gov.in/tnduploads/isac/tndheader/IDT01061600000000000isro08501.pdf; LEOS Sensors Production Division - ISRO, *Fabrication, Assembly and. Testing of. Electro-Optic Sensors (EOS). Type- A, E and K* , at p. 8, https://isac.eprocure.isro.gov.in/tnduploads/isac/tndheader/IDT00249000000000000isro08501.pdf; Space Applications Centre, *Request for Proposal (RFP) for Outsourcing of ECAD based PCB Layout Design and Simulation Works for PCB Fabrication Division*, SAC/PFD/ECAD/JUL18 at p. 14, https://sac.eprocure.isro.gov.in/tnduploads/sac/tndheader/IDT00930100000000000isro05401.pdf.

[95] *Government opens space sector, ISRO facilities for private players*, THE PRINT (May. 16, 2020 6:17 PM), https://theprint.in/science/government-opens-space-sector-isro-facilities-for-private-players/423171/.

[96] DEPT. OF SPACE, Revised Technology Transfer Policy Guidelines 2020, C.19013/131/2015-Sec.3 (Proposed Draft Dec. 2 2020), https://www.isro.gov.in/sites/default/files/tt_approved_policy_2020-with_cover_for_public_feedback_1.pdf [hereinafter Draft 2020 Policy].

[97] *Isro to offload most activities to industry, enhance focus on advanced research, says K. Sivan*, TIMES OF INDIA (Mar. 15, 2021, 05:24 PM), http://timesofindia.indiatimes.com/articleshow/81512137.cms.

and other strategic considerations are taken into account. The Draft 2020 Policy provides for the setting up of a new internal framework for finding, reviewing, approving and offering technologies for transfer, whereby each ISRO centre shall assess its technologies and propose them to the Technology Transfer Group at the Capacity Building Office of ISRO for their review. Approved technologies are announced for transfer by New Space India Limited ["NSIL"],[98] who fixes the fees and signs MoUs with industries. An MoU will be signed between DOS and NSIL in this regard.[99]

The Draft 2020 Policy provides that IP rights over works developed by a contractor, initiated and funded by ISRO shall be decided mutually by the DOS or ISRO and the industry partner, with a choice of a right of first refusal for technology transfer being offered to the industry partner.[100] When it comes to research programs conducted between ISRO and academic institutions, the Draft 2020 Policy carries over the pre-existing practice of deciding how the IP rights are shared before the program commences.[101]

As a first, ISRO has opened up technology transfer to foreign industries, which shall be dealt with on a case-to-case basis.[102] The policy also provides for the incubation of space-based startups on a case-to-case basis, with a first right of refusal for technology transfer given to the industrial partner.[103] For technology transfer with societal applications, the Draft 2020 Policy waives technology transfer costs as a matter of policy.[104]

The new measures are a positive step in contrast to the more restrictive and conservative methods followed by ISRO previously. This will further simplify the process of technology transfer and would incentivize more industries to engage in developmental activities with ISRO.

III. RECOMMENDATIONS – AN OPPORTUNITY FOR THE PROFOUND DEVELOPMENT OF THE INDIAN SPACE INDUSTRY

NASA and ESA have a plethora of industry-oriented policies in place that promotes and facilitates private participation in the space sector. ISRO on the other hand has taken a restrictive and protective approach when it comes to private participation, and the same can be observed

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[98] Press release, Press Information Bureau, New Space India Limited (July. 24, 2019), https://pib.gov.in/PressReleasePage.aspx?PRID=1580096.
[99] Draft 2020 Policy at 5-6.
[100] *Id.* at 3.
[101] *Id.* at 3-4.
[102] *Id.* at 9-10.
[103] *Id.* at 8.
[104] *Id.* at 9.

from its policies as well. While there have been strides in the right direction recently, the authors are of the opinion that more could be done by ISRO to make India a significant player in the private space and space-based industry as well. To achieve this, the authors believe that institutional and policy changes to the technology transfer programme will ensure industry participation. Considering norms of exclusivity for technology transfers wherever required can incentivize productionization. Additional methods to aid and assist technology transfer, such as creating a unified portal for customers to study technologies available with ISRO, and bringing in technology transfer auctions can help in commercializing technologies. Industry friendly measures such as fair discussions on sharing of IP and start-up incubation programmes are also necessary in the Indian scenario, to stimulate innovation. These recommendations are primarily borrowed from NASA, as they have a wide range of policies in place to promote the domestic space industry, especially when compared to ESA, which can be applied to the Indian scenario. Relevant suggestions from ESA are also included wherever feasible

I. It has been observed that the licenses given by ISRO as a result of the transfer of technology occupy the realm of non-exclusivity. It is suggested that exclusive or partially exclusive licenses be also looked into in appropriate circumstances. While the authors suggest such an industry-friendly approach, it is truly imperative to protect ISRO's legitimate interests over the intellectual property created and to make sure that the technologies achieve practical application. Therefore, we suggest that even if exclusive or partially exclusive licenses are granted, there must be scrutiny regarding the same. Like the American policy, the exclusivity may be granted by ISRO only to the extent that it is reasonable, would incentivize businesses, would help in greater utilization, help achieve practical application, does not result in violations of Competition Act, 2002[105], and any other reasonable safeguards. There must be a reservation of a government purpose license for ISRO. Moreover, it is suggested that ISRO explore the option of exercise of march-in rights as well in appropriate circumstances. The usage of march-in rights does not have to be arbitrary and a clear process regarding the same may be laid out by ISRO. In the US, for instance, these circumstances can be classified into:

a) If practical application of the invention has not taken place within a reasonable time;
b) When the health and safety needs are not reasonably satisfied by the contractor, assignee or licensee;

[105] *Supra* note 14.

c) If the contractor, assignee or licensee does not reasonably satisfy the requirements of public use specified by the Federal regulations;

d) The agreement required by the 'Preference for United States industry' has not been obtained or waived or because a licensee of the exclusive right to use or sell any invention in the United States is in breach of such agreement.[106]

Moreover, NASA will notify the waiver recipient the reason as to why the Administration has to exercise march-in rights and would provide such recipient 30 days to respond to the notice. In case there is no reply within the said period, the Administration is empowered to go ahead with the exercise of such rights. If a reply is given within 30 days, or later if no march-in rights have been exercised, then within 60 days of such receipt, NASA must either:

- Exercise march-in rights OR
- Drop plans to exercise march-in rights and notify the recipient regarding the same in writing.[107]

Needless to say, national security considerations if any, should also triumph all other factors. Such steps not only result in greater transparency to the aims, objectives, and policy of ISRO but also encourage the mushrooming of newer players whilst at the same time, give attractive benefits to existing players. This will also be in consonance with the Union Government's proposal to allow private players to play a greater role in the space sector.[108]

While an adoption of such policies need not necessarily guarantee a boom in the involvement of private players in the Indian space sector overnight, it would be a step in the right direction to consider the best practices from around the world. The US has the highest number of private space companies in the world, pegged at around 5500. India has the fifth ranking, with around 350 private firms.[109] Considering such a difference, it would be prud ent to use the US template as and when *possible and feasible,* to help tweak India's own policies.

II. While it is important to have a technology transfer program that broadly lays the framework for effecting such transfers, we must also constantly strive to think of new steps to promote the transfer of technologies. This is especially true in certain cases where there are technologies that do not have a lot of takers. This is one area which the authors believe

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[106] *Supra* note 42; *See supra* note 41.
[107] March-in and Waiver Revocation Procedures, *supra* note 41; *See* Exercise of march-in rights, *supra* note 42.
[108] *Supra* note 95.
[109] Chethan Kumar, *With over 350 private space companies, India in fifth place globally*, TIMES OF INDIA (Jun. 3, 2021), https://timesofindia.indiatimes.com/home/science/with-over-350-private-space-companies-india-in-fifth-place-globally/articleshow/83186207.cms.

needs more focus. In this context, NASA's example can be considered. NASA's intellectual property auction is an innovative mechanism for technology transfer and licensing, which can be illustrated with the help of the IP auction conducted with 'Ocean Tomo Federal Services', a subsidiary of the company, 'Ocean Tomo.'[110] NASA gave the subsidiary, an exclusive license to more than 40 of NASA's patents or patent pending technologies. Ocean Tomo was to handle all aspects of the auction and its intellectual property transaction platforms, including marketing and promotion at no up-front cost to NASA. The royalty structure and the reserve price would be based on the market data that is shared by Ocean Tomo with NASA. In the case that the reserve price is not met but there are interested bidders, Ocean Tomo would work with them post the auction to arrive at a deal. Moreover, the following three factors can be considered to be of utmost importance in the license with Ocean Tomo:

a) A specified timeframe for commercialization.
b) Annual reporting of commercialization progress and
c) March in rights, if it is found that there has been no legitimate attempt at commercialization.[111]

An intermediary may be granted the exclusive license to auction certain technologies and grant the highest bidder exclusive rights to the particular technology. The NSIL can act as such an intermediary. While making this proposition, the authors recognize certain apprehensions that may arise. This may particularly pertain to questions regarding exclusivity when the technologies have been partly/wholly developed by ISRO, using public funds. Keeping this in mind, the authors suggest that this process be used in India in appropriate cases, especially ones where there are certain technologies that have *not yet been commercialized*. The main objective of technology transfer is to ensure the quick pace of growth of industries and the consequent national development.[112] If the Government fails to ensure the commercialization of a technology through traditional mechanisms, the aforementioned objective will not be achieved. In such a scenario, an auction can help commercialize the technology, resulting in spinoffs. Spinoffs can have a multiplier effect on the economy as

[110] *NASA Intellectual Property Auction with Ocean Tomo*, NASA (Oct. 2008), https://www.nasa.gov/pdf/330861main_ocean_tomo_fact_sheet.pdf.
[111] *Id.*
[112] Draft Policy at 2.

well.[113] Adhering to the safeguards mentioned in the previous recommendation as well as adopting clauses similar to the contractual stipulations in the Ocean Tomo case would also be necessary in achieving the desired end results.

III. The Draft 2020 Policy provides for a mutual decision to be taken over the IP generated in cases of works initiated by ISRO with an industry partner.[114] This is a welcome step, as compared to the observed ISRO practice of claiming any and all IP rights arising out of any work done.[115] This method is preferred over the system in place at ESA where the industry partner by default gets most of the IP rights, as the financial and technical capabilities of Indian industries are not at par with its European counterparts which would justify IP rights being vested with the industry partner in all cases. Therefore, a mutual decision is apt in the Indian scenario. However, the authors recommend that considering the fact that ISRO is the dominant player in the market, a procedural safeguard must be inserted to ensure a fair discussion regarding the sharing of IP rights.

IV. As provided for in the Draft 2020 Policy, NSIL announces opportunities through Interest Exploratory Notes and publicizes the technologies identified by ISRO/DOS for transfer.[116] Capable industries may e-mail NSIL for obtaining a license, in accordance with the requirements prescribed.[117] At this juncture, the authors would like to recommend the setting up of an interface on ISRO's website modelled on NASA's T2 program webpage and the associated ATLAS User Interface.

The NASA T2 program enlists the NASA patent portfolio in different sectors, ranging from 'Aeronautics' to 'Sensors.'[118] This platform helps one to browse NASA's patent portfolios, software catalogues, spinoffs etc. Therefore, those who seek to obtain the license to the technologies that are patented by NASA would use the T2 platform to select the technology for which, they would like to obtain a license. To supplement this, NASA has also launched the Automated Technology License Application System ("ATLAS"). This interactive user interface aids applicants in applying for licenses online,[119] through the T2 portal, thus

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[113] Draft Policy at 1.
[114] *Supra* note 100.
[115] *Supra* note 94.
[116] Draft 2020 Policy at 26-27.
[117] THE TECHNOLOGY TRANSFER BOOK 123 (2020), https://www.nsilindia.co.in/sites/default/files/technology_transfer_book_-_updated_file_29.09.2020.pdf., (*See* 'Technology Transfer from ISRO').
[118] *Supra* note 21.
[119] Dan Lockney, *NASA Technology Transfer Overview*, NASA TECHNOLOGY TRANSFER PROGRAM 13 (May 15, 2018), https://ipo.lbl.gov/wp-content/uploads/sites/8/2018/03/NASA-T2-Overview_DOE.pdf.

providing a streamlined experience.[120] Once the technology is selected, ATLAS would help to guide the applicant through the rest of the licensing process. ATLAS would guide the applicant through the different steps of the application process, once they choose the technology that they are interested in, from the T2 portal. Information about the company, its business goals and potential target markets would be gathered. ATLAS also sends email notifications to the applicants regarding the status of the application and the required actions would also be intimated. It also helps in unifying and streamlining a center application process into a single agency process.[121] This one stop shop approach would help in simplifying the interaction between the Administration and potential licensees.

V. In facilitating the incubation of startups, ISRO should look into providing financial, networking, and marketing support, similar to what ESA offers, over the scientific and technical support, provided for in the Draft 2020 Policy. Such niche support can only be offered by a state space agency. Setting up a specific fund for startups that transfer technology from ISRO for non-space application, like what ESA does can also better utilize ISRO's inventions by incentivizing such applications. Additionally, ISRO should also consider discounts or waivers of technology transfer licensing fees for startups, as a matter of policy, like that followed by the 'Startup NASA' scheme.[122] This would help put more money in the pockets of these budding companies and would mean less capital required to be spent by them. One of the merits of this proposal is that it would allow for more technologies to be spun-off, thus resulting in greater utilization and commercialization of ISRO technologies. Other policies which have been recommended by experts in the field, like a startup incubation programme that caters specifically to the needs of different kinds of startups – the ones that attempt to spin-off ISRO technology, and ones that create new technologies, from ideation phase to a Minimum Viable Product (MVP) and even provide post-incubation support, may be considered by ISRO.[123]

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[120] NASA TECHNOLOGY TRANSFER PROGRAM, *ATLAS - Automated Technology Licensing Application System*, YOUTUBE (Jun. 20, 2017), https://www.youtube.com/watch?v=gwLMiVMj1M8.

[121] *Supra* note 21. *Also see* Gina Anderson, *NASA Debuts Automated System to Streamline Technology Patent Licensing*, NASA-SPACE TECH (Jun. 20, 2017), https://www.nasa.gov/press-release/nasa-debuts-automated-system-to-streamline-technology-patent-licensing.

[122] *Supra* notes 23-24.

[123] Narayan Prasad, *Developing a Space Start-up Incubator to Build a NewSpace Ecosystem in India*, *in* SPACE INDIA 2.0, https://www.orfonline.org/wp-content/uploads/2017/02/Space2.0_Final_23Feb.pdf.

IV. CONCLUSION

The global space economy is a fast-expanding field. Touted to be the next frontier presenting an opportunity for commercial exploitation, the sector has been aided by an increased funding from both the private and the public sector, coupled with advances in technology. Morgan Stanley estimates that by the year 2040, the space industry could generate revenues of more than $1 trillion.[124] However, having only 3% of the global share of the space economy[125], it is necessary for the private industry to step up. As was stated by Chairman K. Sivan, the private players in India have not reached the same capability as that of ISRO[126] and that the Organization was willing to 'hand hold' such prospective partners.[127] This is where the recently announced reform s come into play, specifically, the new technology transfer draft policy. Transfer of those technologies over which ISRO has patents will help in commercializing the same. This will aid in the creation of *spinoffs*, which would have applications on Earth and would help improve our day to day lives. The move to further support and encourage private entities to develop new technologies will incentivize the setting up of space-based startups in India and would help foster the existing space-based industry in the country. ISRO is faced with a unique opportunity and an unusual challenge as there are no major private players in the domestic space sector, akin to SpaceX or Blue Origin. It is up to the DOS and ISRO to pave a way for such industries to grow. Not only would they provide employment opportunities to the intellectual capital our country has, but it will also bring greater investment to these sectors, which can one day compete with other players in the global space market. The steps taken by NASA and ESA at the nascent stages of private space-based industries in space should be given adequate consideration and policies that incentivize industries to invest more time, effort and resources must be adopted.

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[124] *Space: Investing in the final frontier*, MORGAN STANLEY (Jul. 24, 2020), https://www.morganstanley.com/ideas/investing-in-space.
[125] *Supra* note 4.
[126] *Id.*
[127] *Id.*