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Recommendation Report on the Legal and Political Repercussions of Privatization of Autonomous and Augmented Systems in Space and Conflict Activities

1. Governance and Auditing Considerations over Autonomous Systems in Space Tech

The Space Sector is an ever-evolving industry and therefore it is imperative to develop an autonomous system.

- Space Law can be deemed to be regarded as the law which governs the activities of the various states in outer space. It can be deemed to be regarded as a piece of legislation which governs and determines the rights and the duties of the individuals resulting from all activities which are carried out by individuals or organizations in a particular country in the outer space and within it- and to do so, in the interest of the mankind as a whole, to offer protection to life, terrestrial and non-terrestrial, wherever it may exist. Now, Space is a sector which is emerging at a very fast pace, however, the rules and regulations with regards to autonomous systems and space tech are not developed. It is imperative to understand that autonomous systems will play a major role in shaping the mankind and shaping its ability to explore and operate in Space, “by providing greater access beyond human space-flight limitations in the harsh environment of space and by providing greater operational handling that extends the capabilities of the astronauts who are performing their experiments and duties in the outer space. Autonomous systems in the Space Sector have developed before, for instance geospatial satellites, unmanned satellites are already being sent in the Outer Space by a number of countries. Autonomous systems need to be developed, not to replace individuals or humans, however, they need to be developed in order to aid professionals. These autonomous systems can reduce human workloads by managing routine activities requiring constant monitoring over long periods of time. Space is at present undergoing transformation, however, due to the miniaturisation of electronics and the increased ease and reduced cost of access to space, for both government, commercial and research/education players. This can also pave the way for innumerable opportunities increasing in the development of space-based tasks in disruptive ways, or enable entirely new applications. There could be innumerable opportunities which could be developed with the help of autonomous formations and with the development of miniature spacecrafts having sensor capabilities, it could be proven to be a boon for carrying out spatial activities. However, a number of implications may arise with regards to the emergence of the need for managing a congested space environment, for example, through autonomous



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spacecraft collision avoidance capabilities. It is highly imperative to understand that most spacecraft operations are autonomous in nature so far as the control functions and routines are uploaded and this is done via telecommand for immediate implementation, or usually, such functions are undertaken at predefined times and in a strictly pre-decided sequence.

- Autonomous systems will allow humans to venture beyond their limitations, by providing greater operational handling that extends astronauts capabilities. An important notion for this is 'trust'. The human-machine interaction, and the safety of the human in that interaction, is critical for advancing this notion. There are two stages of governance. Firstly, precautionary approaches and secondary damage control approaches. The precautionary approach will be verification and validation approaches (V&V), that employ runtime analysis and model checking, software design architectures that enable tractable modular verification tasks. Secondly, for damage control countries will have to come together and frame guidelines for specific issues relating to conflict in space related to these systems. Model-based software can help address both of these key issues, this is the ability to reconfigure in response to global goals, and to self-model from limited observables, requires extensive reasoning about system wide interactions. To build an infrastructure and develop a "flight heritage," such developmental activities should lead to several flights of small spacecraft that incrementally advance capabilities as they add to the flight heritage and experience of the technology and the team.

Importance of Autonomous Systems and its development

- With the advancements in technology when it comes to dealing with the Space has brought about tremendous benefits to mankind and to various individuals. Taking into consideration the Indian aspect, India being one of the developing countries has certainly accounted for a development in this field, however, the laws to govern these activities are not in a good shape in India. With the advancement in satellite-based communication and Space technology, satellites which have been positioned in the Earth's orbits provide all countries with critical information, when dealing with climatic changes and other disasters, which could hamper one's existence on Earth. The revolution that Space Technology has created is certainly unprecedented and needs to be protected with laws that are well-constructed and properly drafted and such laws are clearly not present in India. Space Activities have channelled the desires of various countries for further exploration and at the same time, exploring the intricacies of the space jurisprudence. Space manufacturing, using autonomous machines to mine on the surface of other planets, taking up tourism, inculcating space solar power projects and fast suborbital transport services are some of the potential future applications which could mark a niche for India in the Global Space Sector. This would highly benefit India as a country, leading it to becoming a powerful nation. However, laws and regulations need to be in place, both domestically and globally which could govern these outer space activities. There exists a dire need for a proper piece of legislation in place when it comes to any country planning on stepping foot into the Space Sector. However, few countries such as the United States of America, Luxembourg and Japan by far have been the only countries who have been able to formulate their own national space laws. Clearly, the only legal instruments for space activities exist in international law. The first international instrument which deals with the subject of space law is the 1967 Treaty on Principles Governing the Activities of States in the Exploration and Use of Outer Space,



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Including the Moon and Other Celestial Bodies (Outer Space Treaty). Subsequently, the 1968 Agreement on the Rescue of Astronauts, the Return of Astronauts and the Return of Objects Launched into Outer Space (Rescue Agreement), the 1972 Convention on International Liability for Damage Caused by Space Objects (Liability Convention), the 1976 Convention on Registration of Objects Launched into Outer Space (Registration Convention) and the 1984 Agreement Governing the Activities of States on the Moon and Other Celestial Bodies (Moon Agreement) were signed. Two significant Declarations and three important Principles also exist under international space laws that are, the 1963 Declaration of Legal Principles Governing the Activities of States in the Exploration and Uses of Outer Space (Declaration of Legal Principles), the 1982 Principles Governing the Use by States of Artificial Earth Satellites for International Direct Television Broadcasting (Broadcasting Principles), the 1986 Principles Relating to Remote Sensing of the Earth from Outer Space (Remote Sensing Principles), the 1992 Principles Relevant to the Use of Nuclear Power Sources in Outer Space (Nuclear Power Sources Principles) and the 1996 Declaration on International Cooperation in the Exploration and Use of Outer Space for the Benefit and in the Interest of All States, Taking Into Particular Account the Needs of Developing Countries (Benefits Declaration). However, it is imperative to understand that the private sector is emerging and soon it would be playing a major role in developing autonomous machines with the help of Artificial Intelligence and Machine Learning and a proper regulation is extremely necessary.

- As these concerns can halt and impede the New Space evolution, the international community should discuss the optimal way forward. There is a fair amount of proposed solutions, with three distinguishable trends. A first line of thought may be to keep the existing international framework of space law because it offers freedom for national space laws to develop. A second trend may be to amend the existing international framework of space law in order for it to support the contemporary space business. Finally, a third suggestion could be of drafting an entirely new international framework of space law that can possibly harmonize all national space laws. However, a clearer vision of the common heritage principle should be strived for.

Limitations with the autonomous system

- The International community should set binding legal instruments in order to protect space as a global common. Limits to access to space should be decided keeping in mind the interests of humankind instead of vested interests of states and private actors.
- These legal instruments should be based on broad consultations of citizens around the world and monitored by an autonomous and neutral body.
- With unlimited advantages of an autonomous system, it creates new opportunities for problems to arise. These problems are more prominent to the new space industries and start-ups who are not used to the aggressive and comprehensive testing needed to roll out problems pertaining to software and establish a balance between automation and manual control.
- An excellent example of this is the Boeing's starliner capsule which failed to make it to ISS because of a glitch in the timer. A minor error in one million lines of code could be a deciding factor and change the mission from success to a complete failure. During the Boeing's mission, it was later revealed that not only timer glitch, but there were many other software errors which were not even



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detected before the launch by the system. A former pilot was of the view that this error could have been easily detected by human crew members.

- Space is additionally getting progressively clogged. The danger of in-orbit crashing is growing and can eventually restrict our utilization of space.
- In the event that we think back there have been examples of overcoming adversity and ahead, we unquestionably have opportunities. but even after a long time after the first autonomous system was launched, appropriate administration is yet to be standardized.

2. Ethics and Strategy Concerns in Space Politics

- It is essential that non-Western countries such as India would bring their own specific perspective on ethics based on their own wisdom, philosophies, religions, and cultural perspectives. In a globalized world, it is critical to have a broad view of ethical stances.
- So far, ethical issues related to new technologies are mainly, if not uniquely, shaped by Western reflections that we can find in institutional documents or in ethics codes all around the world.
- So far, ethical thinking suffered a strong and problematic bias given its Western oriented approach while there is a valuable richness of lenses through which we could assess the ethicality of technologies such as AI or autonomous systems. While we are focusing on gender or skin color biases, we are not aware of the biases introduced by the Western perspective on ethics. The mere fact that gender biases or skin colors biases are debated in countries where these practices are widespread demonstrate that the ethical debate is under the influence of the West. There is room for countries like India to bring a breath of fresh air to the debate and open minds to new ways of thinking ethics. Otherwise we accept to submit to the Western ethical tyranny.
- Space is no exception. Non-Western countries do have a say in the ethical debate raised by the exploitation of the global commons. they must think outside the Western box. Particularly since it is clear that so far the Western perspective has not been really efficient in protecting people from technological drifts. Satellites indulging in electronic surveillance-a great threat of intrusion and misuse of data gathered. There is no legislation or regulation on the monitoring of the data gathered by these satellites, and how one can assess that intrusive measures are not taken. Ethical concerns are heightened when entities could use such data to gain a competitive advantage and in turn breach privacy and rights of Individuals
- Artificial pricing and destabilization practices must not be indulged in at all. Private entities must be regulated in this aspect when operating in space. State's have to take a step ahead to ensure such standards are met. So the states also must not intervene and promote favouring to particular entities, as such unfair trade in space could cause grave environmental damage. Framing of Competition Rules and Guidelines for private players operating in Space Private entities will also have conflicts related to unfair competition practices and a level playing field for private players. These laws will need to comply with their respective national laws.



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- Asia-Pacific Space Cooperation Organization supports satellite development by training students and academics, supporting the development of the radiometric calibration capabilities of member countries of the organization and developing small satellites through its Joint Small Multi-Mission Satellite Constellation programme. Bilateral agreements can support science and technology partnerships involving both public and private sector actors. This will help understand nations best practices, as per theory cultures and ideologies. This could lead to a future of norms that will develop for ethical practices in space globally.

3. Private Ownership and Control Issues

- Space Activities has consistently been an administrative issue, as it something which was highly required by every individual, and was never seen with a commercial point of view. However, recently, we can see a move toward commercialization and inevitably toward the privatization of space activity.
- Lately, there have been numerous developments in the augmentation of space and conflict activity, both on the national and international front. Government-led agencies have achieved amazing things since the Moon landings, but one simply does not have the in-house capacity to address the country's growing requirements.
- The space sector and its requirements have grown enormously in the last decade to include television and broadband services, space science and exploration, space-based navigation, and, of course, defence and security applications. Around 32 States and 2 international organizations (ESA and Eumetsat) have registered space objects with the United Nations.
- SpaceX became the first private enterprise, which launched its first successful launch in the year 2019. This became a landmark moment for the private space sector. Not very back, Jeff Bezos's Blue origin entered into the game of the private space sector.
- The privatization of Space is by all accounts an extraordinary thought somewhat. Public funding isn't the way to genuine advancement. Real space exploration needs a development equipped for delivering income and benefit. This will require private undertakings to venture outside the administrative agreements and assemble a space voyaging revenue industry.
- Consequence with privatisation and control issue boosted by cheaper launch prices and new microsatellite technology which has seen devices shrink to the size of a loaf of bread, companies are now launching more and more satellites into space, and that has consequences. The small area of space around our planet is becoming quite crowded, and the potential for damaging and expensive collisions has increased.
- Monopoly in the sector cannot be hidden. Now, since private companies have entered and in the coming even more will enter, there are high chances of monopoly in the business. It won't be surprising to see the powerful throwing other organizations out of business, which will eventually lead to other problems like an increase in the cost.
- It is evident that in the upcoming year there will be a lot of hustle in space activities. With a greater number of private enterprises along with government organization, entering the space,



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it becomes necessary for proper legislation which must be made by the government of the state and enact national space legislation.

- Before privatisation, there arises a dire need for a Space Legislation Policy or a robust piece of legislation, which needs to be enacted, thereby paving a way for the growth of the emerging Space Sector in India. For India to reach its leaps and bounds when dealing with the matters pertaining to Space Laws are concerned, it needs to understand the importance of having a proper piece of legislation in place.
- The laws pertaining to Cyber Crimes and Intellectual Property Rights have reached great heights and are still constantly developing. Similarly, a thorough contribution is required towards national development of Space Laws in India. Space Law in India is still in its nascent stages and an advancement in this aspect is extremely crucial and needs the attention of the law-makers. There exists a desperate need of a proper piece of legislation in place when it comes to India diving into the outer space sector. On 1st February, 2011, the Indian Space Research Organization (ISRO) successfully launched a record 104 satellites in a single flight, on board its Polar Satellite Launch Vehicle from the Satish Dhawan Space Center and ever since ISRO has undertaken a number of projects and has never disappointed its country and its people and has always received accolades for the work it has done so far.
- However, ISRO is not provided enough capital, skilled workmen and opportunities to venture into outer space and create more and more miracles. ISRO, despite never disappointing the country or its people, has failed to reach the position it should have, however, if there were proper domestic laws in place and regulations which could regulate the space activities, then ISRO could have perhaps done wonders. In fact, allowing private players to enter into the market with the blessings and mentorship provided by ISRO, private players could certainly do wonders. It is imperative to understand that the Global Space Market, at present is valued at USD \$350 Billion and if one looks at India's share in this huge market, it only constitutes a meagre 2% of this enormous Space Market, which is an extremely small share if one takes into consideration the amount at which it is presently valued. It is therefore time that the Government and the legislative bodies come out of their lethargy and implement a proper set of rules and regulations in the form of a policy, taking into consideration the roles and the guidelines which the businesses would adhere to who wish to set their foot in this industry.
- It is imperative for the government to back up its statements with actions and these actions cannot be regulated in the form of guidelines or regulations, however, it needs to take the form of a policy. India needs a robust policy. It is highly recommended that an independent regulatory agency be set up, which would enable the ISRO to focus more on research and innovation and not get embroiled in anything else. The roles of different agencies need to be clearly demarcated in order to avoid confusions.
- The Swedish National Space Agency allows the companies in Sweden complete autonomy while dealing with their business. Similarly, the Naro Space Center in Korea also aids the businesses in its space sector by providing them complete autonomy while dealing with their business activities and this helps in the promotion of Foreign Direct Investments. It is necessary for India to have a separate regulatory authority or a separate regulatory agency



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which aids businesses in the private sector and provides them complete transparency while dealing with various issues concerning the activities which a particular organization aims to carry out abroad. It is imperative that an independent authority be set up and this separate regulatory agency needs to have a single window clearance as it would be feasible as the regulatory authority would itself have the necessary powers conferred in it to allow the private firms to undertake activities.

- The Government of India needs to take a holistic approach while dealing with this industry on all fronts, for instance, it needs to consider the GST and the various taxation regimes. A lot of private companies aspiring to enter into the space sector hesitate because of the high tax rates that the government levies upon them, this is why, a number of companies which are of an Indian origin are looking to establish themselves in other countries and carry out space activities from other countries as the taxation regimes in a number of other countries are comparatively liberal as compared to India. Private enterprises want something more as private enterprises in India are suffering from the non-availability of resources and it needs to outsource if it simply wants to conduct a launch and this can be deemed to be regarded as quite expensive and therefore a lot of companies then set themselves up in countries wherein the government-run space organizations provide them with complete autonomy and enable them to develop and carry out a number of space activities.
- This trend will significantly change the role of public agencies in the development of space technologies and of private low-cost space operators, and open possible new configurations of public-private partnerships and collaboration. ISRO has recently opened its door to private entities, allowing sharing of data and facilities. The states must formulate certain guidelines of use of such facilities, and what are the limitations. So, the private entities can be promoted as well as regulated.
- Adopting a Joint-Liability Framework When entering into agreements with private sectors for Augmented systems to be used in Space, the state will require a well-framed Liability clause. This clause would prevent private operators from escaping liability. Augmented and Autonomous systems are developed at various stages by different tools and human resources. Hence, private operators might escape liability by blaming outsourcing parties or other involved parties. This situation is when a joint-liability framework would prevent that situation and incentivize third parties to operate or develop such systems to maintain point level accuracy.
- Uniform Export Guidelines for Space Objects These systems that need to be built for Space require high-end technology and infrastructure, because of which it is highly dependent on international trade and export. Private companies indulging in trade with the extra-territorial application must have a certain quality and security guidelines. The USA is a significant exporter of 'space objects,' already has guidelines relating to space objects' export.
- Transparency of government and private entities showcases to states with clear intentions about their space project and use. Also, it will keep the public informed, and in turn legitimize space use and prevent any wrongs. A public dialogue will be important to maintain this balance between states and private entities.



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- The idea supporting privatization was that the person who owns the property would better care for it. However, this does not seem to be happening at the commercial level. For a company, the ownership and control of the resources can be traded, that too at shorter intervals, profit remains the sole motive. It also results in a concentration of ownership in the hands of a few big corporates. Once rights get concentrated, it's all too easy for the new owners to hijack the regulatory and legislative process. As a result, the rights don't get scaled back when they need to be. A system of limits that was designed to protect a resource ends up ensuring its slow destruction. A corporate owner that seeks only a financial return will have a much shorter time horizon when making decisions. It may simply not be worth it to preserve the future productivity of a natural resource if that means forgoing a much greater profit today. The incentive to chase a quick buck may outweigh the financial and social rewards of long-term stewardship.

4. Sustainable Development and Economic Rejuvenation considerations via AI

- All the 17 Sustainable Goals of the United Nations can be achieved in a better way with the help of AI. This ranges from reducing poverty and hunger to providing gender justice and equitable education opportunity.
- AI can be used to focus the policies in a more effective and efficient manner. Sending a robot mission will definitely be much cheaper than sending a human mission to other planets or satellites.
- The huge amount of data available through the internet or from satellites is beyond the comprehension of human beings. This can be converted to meaningful data with the help of AI. An Indian example could be the data of COVID patients through Arogya Setu Application. It was useful in detecting the clusters which needed to be isolated, thus restricting the pandemic to a great extent.
- There is a need to meet the balanced requirement between general interest of public at large and specific interests of private players involved in business.
- Sharing of information in a manner that environmental and fundamental research in space activity can be contributed. However, not commercial info that is to be shared only in circumstances if required. The sharing of rest is in best interest of private entities and states
- Different players to be treated differently, i.e. policies that favour developing countries to integrate them with the developed countries.
- In 2018, data from National Aeronautics and Space Administration (NASA) satellites were used for cholera forecasting in Yemen, with a 92 per cent accuracy rate. Hence, to achieve such goals better for the public at large there needs to be cooperation of states on a large scale.
- Article IX of the Outer Space Treaty, for its part, mainly focuses on damage to the earth environment. Now, the problem nowadays is exploitation of space also and not only



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protection of earth. These treaties must be read and implanted according to the modern age and its growing needs.

- Space science and space tech play a major role in fulfilling a number of objectives pertaining to sustainable development. Space science is something which can be deemed to be regarded as a discipline which under its ambit, takes into consideration the various activities pertaining to space exploration and also deals majorly with the analysis pertaining to the natural occurrences and how the physical man-made bodies in the outer space function. Space science also includes under its scope, innumerable disciplines such as astronomy, aeronautics, avionics, space medicine and astrobiology amongst others.
- Space tech is something which can be understood by making reference to the various Earth Satellite observation systems and how satellite communication works. Technology has reached its zenith and the technological advancements which help weather forecasters understand the weather, thereby involving innumerable aspects pertaining to remote sensing data, global positioning systems and satellite television, along with the incorporation of the communication system, all of these rely on how space science works.
- Now, Space tech can be deemed to be regarded as an important innovation in a number of fields. It can be said that Space Tech plays a major role in modern agricultural innovation and how it develops. The use of space technology can be deemed to be regarded as an effective method when it comes to farming and the management that is solely limited to developed countries as now. This is because of the high costs that are involved in setting up such a huge space infrastructure which could aid the farmers and it is a well-known fact that in developing nations, the farmers live in utmost adversity, therefore the implementation of this technology in developing nations for sustainable development can prove to be something which they could perhaps achieve in the future. However, in recent years, open access to geospatial data, data products and services and the lower costs of geospatial information technology has certainly reached its zenith worldwide.
- Apart from this, satellite Earth observation and satellite communication in outer space is something which can aid in managing natural resources and the environment. It is highly imperative to understand that Earth observation and satellites can be developed in order to support fisheries, freshwater and forestry management and at the same time it can help in analysing illnesses and providing the treatments to such illnesses. Earth observation data from satellites can also be used to overcome various challenges related to air pollution and in areas such as water management and forest preservation. For example, the observation of precipitation is useful in addressing water-related diseases such as floods, typhoons and landslides. Earth observation is also a tool for monitoring illegal mining activities. Remote sensing can be used at the same time to monitor variations.

5. IP Recognition and Safety Policies

- The first type or range of problems relates to the applicability of the patentability criteria of novelty, non-obviousness and usefulness or functionality to 'space' inventions. For example,



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when microgravity is the most important element based on which an invention is made, it is extremely difficult to prove novelty. Hence, creating a grey area for regulation of such patents

- National laws should be strengthened to include an extra-territorial structure. They need to be in accordance with Article VIII of the Outer Space Treaty that prescribes the states to retain jurisdiction and control over the objects they launch into outer space. The entry of private entities will only aggravate the challenges. Therefore, a strong patent system nationally will help development and growth of states.
- Nations should also focus on catering to interests of private entities, as well as maintaining public interest. Hence, an approach of incentivising private entities that are working towards matters that further public interest. This will create a solid foundation for public-private partnerships.
- Most of the times, the accidents are not intended, but beyond human comprehension. This could be checked through global collaboration.
- Risk management in an unfamiliar environment and high-risk activities becomes even more important. There has to be Health standards, Fitness for duty and limiting Hazard and exposure. For this, liability needs to be fixed (unlike the Bhopal Gas tragedy) and strict liability need to be there for errors which could have been avoided.

