India Space Congress

Conference Report

INDIA SPACE CONGRESS 2022

SIAINDIA
SatCom Industry Association

Also find us on:

MESSAGE BY PRESIDENT, SIA-INDIA

Dr. Subba Rao Pavuluri,
President, SIA-India,
Chairman & MD, Ananth Technologies Ltd.

Esteemed colleagues,

It is with great pleasure that I report the successful conclusion of India Space Congress-2022: 'Leveraging Space to Power Next-Gen Communication & Businesses' organized by the Satcom Industry Association (SIA-India) from 26-28 October 2022 in New Delhi.

ISC 2022 was supported by 6 Major Govt organizations, 21 international space associations and 60 private organisations. The three-day conference, brought together 182 speakers from 30 countries addressing over 650 delegates. During the conference two reports were released and two MOU's signed. A major milestone conference by any standards.

The three-day mega event showcased 35 thematic sessions, with international experts engaging in lively discussions on various aspects of the space industry, including key dialogues on disruptive business models, regulatory challenges, and lessons from other geographies. The conference was widely covered by both domestic and international media highlighting the growing importance of the space industry and its potential for collaboration and economic growth.

The conference featured a number of technical sessions, where experts from various fields shared their knowledge and experience. The sessions covered a wide range of topics, including satellite communication, remote sensing, space policy, and space law. In addition to the technical sessions, the ISC'22 provided an excellent platform for networking and building relationships. The delegates had the invaluable opportunity to meet and interact with industry leaders, policymakers, and researchers from around the world. This can potentially lead to many fruitful partnerships in the near future.

A vital insight gleaned from the conference was the significance of cultivating deeper collaboration among the public, private sectors, and academia to stimulate innovation and propel growth in the space industry. The conference provided a comprehensive plan for the future advancement of the industry in India.

I am pleased to inform you that SIA-India launched a Call for Papers to promote and inspire young talent and raise awareness of the space sector's potential. Over 36 original research papers were submitted, and an expert jury panel shortlisted five papers for cash prizes. Students presented their research to professionals and engaged with a distinguished audience. The initiative successfully encouraged and highlighted the potential of the space sector to a new generation of aspiring professionals.

The success of the India Space Congress-2022 is a testament to the growing interest and support for the space industry in India. It provides a platform for high-level stakeholders from space agencies, industry, and institutions around the world to exchange insights, strategies, and rising trends for the collaborative development of the space ecosystem in India, and to bring global and regional economic benefits.

The ISC'22 conference report provides a comprehensive summary of the discussions and deliberations, as well as key suggestions made to the government, regulators, and policymakers. We trust this report will prove to be a hand book for stakeholders and readers interested in the space industry in India and around the world, as it provides insights into the opportunities and challenges facing the industry, as well as strategies for growth and collaboration.

I am excited to witness the continued growth and success of the space industry in India and I keenly look forward to the next edition of the India Space Congress.

Thank you and I look forward to seeing you again at ISC'23.

Sincerely, [President of SIA-India]

MESSAGE BY CHAIRMAN, ISRO

Dr. S . Somanath
Secreatry, DOS and Chairman, ISRO

The India Space Congress 2022, organised by SIA-India is coming just at the right time. With the country poised to take off on a renewed journey into outer space and claim its rightful place as a co-traveller in the Space sector, it is important to take a overarching view of international businesses and how they have fared. It is important to take learnings from them to step ahead and to avoid pitfalls.

A few short months ago I was handed the first brochure of the ISC'22 and was informed about this upcoming conference. Now I see the agenda with a vast array of subjects being addressed during the 3 days and I feel this is an effort par excellence by the organisers. Such platforms are few where international business heads can meet with their Indian counterparts and discuss threadbare the various issues affecting businesses. The congress deliberations will undoubtedly bring forth fresh ideas, innovative solutions and a way forward to address new opportunities and the challenges.

I am looking forward to the recommendation arising out of the deliberations. I thank the organisers for their efforts in organising the event and would like India Space Congress to continue as an annual event. I wish the Congress huge success.

CONTENTS

2022 Highlights


ISRO
GSLV
MkIII-D2
ISRO
इसरो
INDIA
भारत
इसरो डिगठ
SDSC SHAR
SRIHARIKOTA







India Space Congress

2022 Highlights

The first Mega three-day Space Congress was the latest milestone in a series of conferences held by SIA-India in partnership with 6 Major Govt organisations viz., the Department of Space, Indian Space Research Organisation (ISRO), Ministry of Defence, Niti Aayog, In-Space, NewSpace India Ltd (NSIL) and the Department of Telecommunication. The congress also had wide support from 60 private Industries.

The theme for ISC 2022 was 'Leveraging Space to Power Next-Gen Communication & Businesses'. ISC will be held every year to discuss the growth opportunities in India in the space sector with the vision to bring all the high-level stakeholders together from space agencies, industry and institutions around the world under one roof to swap insights, strategies and rising trends for collaborative development of the space ecosystem in India and to bring global and regional economic benefits.

The three-day India Space Congress 2022 witnessed 600 plus delegates, 180 Speakers, 35 thematic sessions from 30 nationalities. The platform opened several key dialogues, discussed disruptive business models, talked about key regulatory challenges and possible learnings from other geographies. The congress generated huge interest for all including the new entrepreneurs - towards the goal of making 'Atmanirbhar Bharat' a reality.

180 Speakers from 30 countries indulged in intense discussions and touched upon various aspects of space segments with the aim to proliferate the age space ecosystem in the country.

Representatives of 21 organizations [international and India] were part of the congress. 8 Knowledge & Consulting Partners.

Delegates ranged from Govt Departments, Regulators, Policymakers, Defence Security Forces to Satellite Operators and Service Providers, Broadcasters/ DTH Service Providers, Satellite System Integrators and Launch vehicles, Ground and Terminal Equipment Manufacturers and Suppliers, Satellite-based IOT/M2M service providers, Law Firms, Deep Tech startups, Incubators, Venture Capital Firms, Geospatial Segments – EO & RS and the user Segments: Agriculture, Aviation & Maritime, O&G, Defence, Railways, Healthcare, Banking and Fintech also had a prominent participation

180 Speakers from 30 countries indulged in intense discussions and touched upon various aspects of space segments with the aim to proliferate the age space ecosystem in the country.

The Research and Information System for Developing Countries (RIS) has partnered with the SIA-India organization to create a cohesive roadmap for the development of the space industry in India. The two organizations have also signed a memorandum of understanding (MoU) to collaborate and work together on the ongoing development of the space industry in the country. This partnership may be beneficial for both organizations, as they can share resources and expertise to support the growth of the space industry in India. It may also help to foster collaboration and cooperation between the public and private sectors, which may be necessary to achieve the goals of the roadmap and support the long-term development of the space industry in the country.

Maiden Voyage: India Space Congress

The India Space Congress was attended by a number of notable figures, including Shri Rajeev Chandrasekhar, Union Minister of State for Entrepreneurship, Skill Development, Electronics & Information Technology, Shri Om Prakash Sakhlecha, the Honorable Minister of Science and Technology for the government of Madhya Pradesh; Dr. Somanath S, the Chairman of the Space Commission and Secretary of the Department of Space, as well as the Chairman of the Indian Space Research Organisation (ISRO); Shri K. Rajaraman, the Chairman of the Department of Communications and the Secretary of Telecom; Shri A. S. Kiran Kumar, a member of the Space Commission and former Secretary of the Department of Space; Dr. Mike Short CBE, the Chief Scientific Advisor for the UK Department of International Trade; Mr. Nathan De Ruiter, the Managing Director of Euroconsult; Mr. Deepak Mathur, the Executive Vice President of Global Sales for Video-SES; and Dr. Subba Rao Pavuluri, the President of the SIA-India and Chief Executive Officer of Ananth Technologies. These individuals likely participated in discussions on a range of topics related to space exploration, research, and development.

Shri Rajeev Chandrasekhar, Union Minister of State for Entrepreneurship, Skill Development, Electronics & Information Technology, spoke about the importance of satellites in providing internet access to all citizens in India. He emphasized that the ministry is keen to create a "India Techade," referring to the next decade that will bring tremendous opportunities driven by young Indians.

The minister also emphasized the importance of the space and satellite communications (Satcom) sectors in driving the growth of the technology ecosystem in India. He highlighted the role that satellites can play in addressing issues of connectivity, particularly in the Northeast region of the country, where some areas still lack internet access. He cited the example of Kiphire, a place in Nagaland that is eight hours from the nearest airport and has no internet connectivity at the District Magistrate's office.

By leveraging the capabilities of satellites and other technologies, the government is working to address these connectivity issues and bring the benefits of the internet to all citizens.

By 2025-26, Govt plans for 1.2 B people to have the ability to connect to their devices through the internet and the role of satellite and satcom will be an inherent part of the overall blueprint to connect the unconnected with quality internet, sighting the limitations of terrestrial technologies.

Supercomputing, quantum computing, AI and web 3.0 are all emerging innovations that will define future platforms that can make a magnificent impact.

in pic: Shri Om Prakash Sakhlecha, Hon'ble Minister – Science & Technology, Government of Madhya Pradesh felicitating Ms Revathi Mannepalli for being successfully elected as an ITU RRB Member from Region E.

Shri Om Prakash Sakhlecha emphasized the importance of satellite technology in driving communication and technological advancement. He also mentioned the need for self-reliance and technological advancement in order to achieve the goal of "Antodaya," or uplifting the last person in society. It seems that Sakhlecha believes that it is important for all individuals and organizations to work together towards the goal of ensuring that every person and mile is digitally covered.

Dr. Somanath S, the Chairman of the Space Commission and Secretary of the Department of Space, as well as the Chairman ISRO, spoke about the plan to expand the use of NaVIC, India's satellite-based navigation system, for civilian purposes. He also mentioned the idea of partnering with the industry on the development of a reusable rocket program, with the goal of having the entire design and manufacturing process done in collaboration with the industry, which would also be responsible for operating the rocket commercially.

In addition, Dr. Somanath mentioned that the start-up ecosystem in India is enthusiastic about the space industry, and that the government's space policy is designed to allow non-governmental public entities to operate smoothly. He also mentioned that a further liberalised FDI policy is expected to be released soon to encourage investments in India.

Recently, LVM3 successfully placed 36 satellites into orbit, marking a major milestone for the company as it enters the global market. This was the fifth flight of LVM3 and the first dedicated commercial mission for a foreign customer through NSIL. While the success of this launch is a major achievement for ISRO, the

production capacity of LVs is currently limited, with only two rockets being produced each year. Dr. Somanath emphasized the need to increase this capacity at least threefold.

India's space sector is undergoing rapid transformation and growth, with increasing government outsourcing to the private sector and new legislation empowering the private sector to play a critical role. There are significant opportunities in the domestic market for earth observation, satellite communication, and satellite navigation. Satellite broadband services are expected to drive growth in the satellite communication market, which is projected to reach $51 billion by 2031. The video broadcast market is also expected to reach $73 billion by 2031.

Satellite broadband services are the major growth driver in Satcom.

- IoT/MSS market will be $2 Bn by 2031
- Satellite Broadband is projected to be a $51 B market by 2031
- Video Broadcast is projected to be a $73 B market by 2031.

The demand for earth imagery is expected to grow by a 7% CAGR over the next decade, driven by both defence and commercial organizations, for a total market value of $7.9 billion by 2031. The focus on multi-satellite constellations is significantly changing the market landscape, and India is a key market to watch. The space ecosystem is at a turning point, driven by technological innovation and changes in demand from private and government users.

A growing focus on multi-satellite constellations is significantly changing

The demand for earth imagery is expected to grow by a 7% CAGR over the next decade, driven by both defence and commercial organizations, for a total market value of $7.9 billion by 2031. The focus on multi-satellite constellations is significantly changing the market landscape, and India is a key market to watch.

the market landscape and India will be the market to look out for. The space ecosystem is at a turning point, driven by technological innovation and changes in demand patterns from private and government users. There are extensive opportunities in the Space sector and with the private sector, participation would open up several additional avenues to build strategic capacity and capability.

India, under the visionary leadership of Prime Minister Shri Narendra Modi, India is implementing policy reforms to unleash the full potential of the satellite communication sector and take the digital transformation to the next level. These reforms will benefit all sectors, including those in the most remote parts of the country.

This reform process will unleash the true potential of the Indian satellite communication sector, benefiting all sectors, including those in the most remote parts of the country.

Pranav Roach, President at Hughes Network Systems India said Broadband

is a must for inclusive development. Broadband penetration is just over 30% in rural India against a national average of 50% in terms of 512kb definition and would be much lower if the definition is compared with global broadband speed and quality.

Deepak Mathur, SVP, SES said Satcom reforms & multi-orbit strategy will unleash true potential of satellites. GEO is more cost-effective as you need 3 sats to cover the entire globe although suffers from latency challenges. LEO constellation has the maximum investment from the Pvt sector for consumer broadband and backhaul as opposed to MEO and GEO. MEO has best of both GEO and LEO, however, the signals become weak when they reach earth from MEO compared to LEO, hence more transmit power is needed to overcome path loss.

With regards to TV, Streaming cannot replace linear TV. As that would require 200 times the investment to provide the same quality and quantity of content which would be an unproductive investment.

A 10% increase in broadband penetration would lead to a 1.3% increase in the GDP, 2.3% growth in employment and 5-10% increase in productivity and a 15% increase in the efficiency of the services.

A 10% increase in broadband penetration would lead to a 1.3% increase in the GDP, 2.3% growth in employment and 5-10% increase in productivity and a 15% increase in the efficiency of the services.

Arvind Kumar, DG, STPI said every budding space entrepreneurs & start-ups need data to leverage themselves in building innovative technology products and solutions in an indigenous manner.

- To promote the Space-Tech entrepreneurship ecosystem
- To make India a global hub for developing satellite-based services, production of space equipment, and spatial data applications both for civilian and military usage
- Scaling up of ISRO-developed space-tech or spin-off technologies for commercialization & IPR creation.
- Create integrated policies for the space sector.

R Umamaheshwaran, Director of the Human Space flight project, ISRO, said the entire environment is bubbling with so many activities and in a month's time two start-ups will launch the first pvt satellite.

The next 36 satellites by OneWeb will be launched in the next 3 months' time. The total dimension of space & electronics activities is gearing up at full pace. Atmanirbharta in electronics is a must to achieve success in space. Space-qualified resistors, inductors and capacitors are not built in India today and this is a challenge that needs to be addressed. India needs to ace in manufacturing Space components that are best in the international market in a cost-effective manner. He also announced that India will carry out two unmanned flights before the Human space flight mission is launched by 2025.

India's Space Strategy for the future: Turning vision into action

India's space industry and spectrum usage requires a clear strategy to achieve its goals in the global space economy. The space sector is diverse, comprising different domains with their own specificities that impact other sectors, policy, market, access to finance, geopolitical environment, military and boundary conditions, and environmental, social, and governance factors.

In the future, trends in the space industry may include vertical integration in earth observation, end-to-end solutions, green initiatives, capacity from mega constellation operators, the emergence of low earth orbit global navigation satellite system constellations, and strong investment in space tourism.

India needs a roadmap for the next 25 years to guide its growth in this sector. To ensure security in space, independent space surveillance and tracking capabilities may be necessary. Space communications and technology play a significant role in defence strategies, and it is critical to protect space assets. However, India should maintain its policy of non-weaponization in space. While the country conducted its first space warfare test in 2019, it is important to maintain a balanced approach to the use of space.

India's space sector is strong, with over 400 private players, 60+ start-ups, 21,000+ workforce, and 270+ patents, 45 copyrights, and 10 trademarks credited to the Indian Space Research Organisation. To continue growing, the sector require light-touch regulatory support and partnerships. India also has a responsibility to lead in the development of technologies that not

only harness space power for the nation but also sustain the space environment, addressing concerns about space debris.

As India aims for a $5 trillion economy, it must devise its own pathway and avoid western hegemony. It is important for India to set norms in order to maintain strong economic relations and actively participate in the Organization for Economic Cooperation and Development [OECD] developments. Previously, space was seen as a source of soft power, but it is now becoming a source of smart power as well. One major concern in the space industry is space debris, and unless the environment is sustainable, the sector cannot thrive for the greater good. India has the opportunity to take a leading role in developing technologies that not only harness space power for the nation, but also manage the sustainability of the space environment

Light touch Regulatory support and partnership are critical for the Indian space sector to move ahead faster.

Way forward:

- Balanced Approach to Space Initiatives keep the Defence and civil needs.
- Lead in Space Situational Awareness (SSA) and manage the sustainability of the space environment
- India's defence and deterrent capabilities need to be met. Independent space surveillance and tracking capabilities have to be developed
- India must take the initiative to collaborate with international entities, especially in the OECD group.
- Light touch Regulatory support important for the sector's growth.

Decoding the Space Economy

Measuring the size of India's Space Economy

Over time, the Indian space sector has developed a significant level of domestic manufacturing capability through the efforts of the Indian Space Research Organisation (ISRO). In order to fully understand the space economy, it is important to consider both the inputs and outputs of the sector.

While a significant portion of the space economy is supported by the private sector, the inputs are often provided by the public sector. One key aspect that should be considered in assessing the space sector is the space budget, as it drives the development of the economy. For example, in India, indigenous technologies are often developed in a cost-effective manner, with a budget that is only a quarter of what would be required to develop the same technology abroad.

One way to better understand the size and importance of the space sector is to introduce a "Satellite Account" or "National Accounts Statistics" for the national account. Having a "Satellite Account" or "National Accounts Statistics" would allow for a better understanding of the size and importance of the space sector in the overall economy. Currently, there are terms like "digital economy," "blue economy," and "white economy," but there is no clear way to measure the size of specific space sectors. Certain International frameworks are there; to understand, dissect & measure the size of the space economy:

The OECD Framework allows us to dissect & decompose the contours of the space economy. It measures the output, input, and impact of the economy. The FW doesn't really give the actual size of the space economy as it does not depict the space economy as a percentage of the GDP. Moreover, the inputs [space

budget, in orbit and ground space assets, and Human capital] & outputs [space manufacturing, Satcom, EO, Insurance, int Trade, and Innovation] of the space economy, plus the direct and indirect impact would lead to overestimation estimation and double counting.

IDA Science and Technology Policy Institute has therefore factored in the issue of double counting where the size of the global space economy is $166 Bn [2016].

Secondly, **the UK Space Agency** Framework divides the whole economy into 4 parts: space manufacturing, space operations, space applications, and ancillary services. The diversification of the space economy into 4 parts; allows us to view the comprehensive picture of the nation's space economy. The revenue from each sector can be added up to estimate the percentage of the GDP.

Additionally, the framework differentiates between stock & flow variables. All the components are flow variables that are computed annually.

Third, the **US Bureau of Economic** Analysis [BEA], is considered to be the most scientific & systematic study among all the other studies. However, it requires a lot of funding for the study or analysis to be conducted, along with this pre-condition; they also require detailed supply & use cables for arriving at the National Accounts Characteristics of the Space Economy.

The US Bureau of Economic Analysis framework is the only official statistical agency in the world to attempt to produce a satellite account of the national account statistics of the country.

Having a "Satellite Account" or "National Accounts Statistics" would allow for a better understanding of the size and importance of the space sector in the overall economy.

Measuring India's Space Economy: Based on UK Space Framework

The budget of ISRO (2020-21)is the driving force of the Indian Space Economy. Unfortunately, the private space sector does not have a high level of involvement in the space sector. The purpose was to replicate the estimates or revenue; which is 0.2% of the GDP ($6.1b). The size is expected to reduce; in future, based on the budget the Government provides it has been less in economic terms as well; unless the private sector comes into action & overcomes that particular barrier in the space economy.

The current size of the Indian Space Economy ranges from $6-$7b.

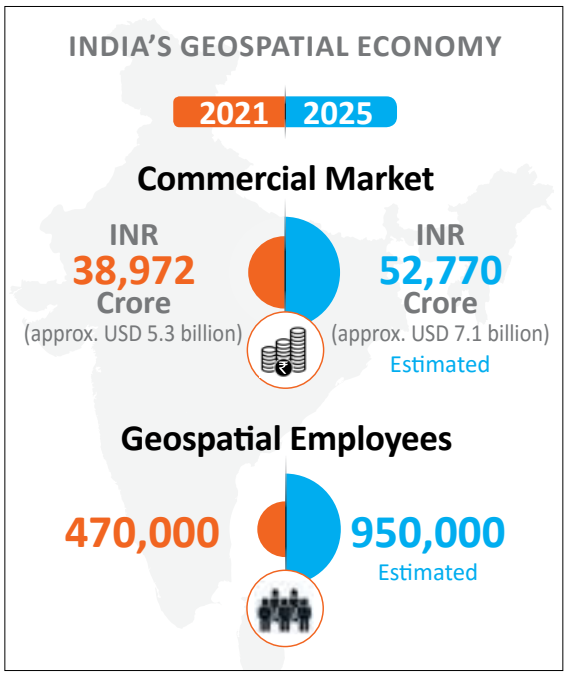
In 2020, PwC conducted a study; which estimated the size of the Indian Space Economy to be close to $7b, which is close to the estimated value. However, the methodology followed has not been explained in their study.

With adherence to 2020, EY conducted a study with regards to the size of the Indian Space Economy to be $9.7b. Unfortunately, their methodology of the figure is unclear as well; but they do focus on a few sub-sectors of the economy like "Upstream & Downstream" to arrive at the size.

To measure the entire size of the Indian Space Economy, there is a need for a detailed analysis of the value-added sub-sectors to arrive at the correct figure for the Indian Space Economy. However, the increase in the size of the Indian Space Economy largely depends on the Public Sector Budgets for Space Research & further investments of the State for Space Activities for the space economy, which has been going down; in recent times.

Earth Observation: Use, Impact on the Indian Space Economy

The use of earth observation data has had a significant impact on the Indian space economy and has helped to drive innovation and economic growth in the sector. It has allowed for the development of various applications and services that rely on this data. For example, earth observation data has been used to improve the accuracy of weather forecasts, monitor natural disasters, and track environmental changes. In addition, the use of earth observation data has also helped to drive innovation and economic growth in the Indian space sector. Companies and organizations that provide earth observation data and services have emerged as major players in the space economy, and the demand for these services has continued to grow over time.



India's idea of development revolved around three major elements: communication, education & monsoon prediction for farmers.

ISRO conducted two landmark experiments in the 1970s to educate villages through satellite communication: the SITE (Satellite Instructional Television Experiment) and the STEP (Satellite Telecommunication Experiment Project). These experiments were among the largest mass communication experiments ever conducted and had significant economic and social impacts.

Between 1980 and 2005, ISRO's earth observation (EO) segment, particularly the operational missions, spent approximately INR 1008 crore (approximately USD 140 million) on EO activities, while the National Remote Sensing Centre (NRSC) and the Space Applications Centre (SAC) spent INR 554 crore (approximately USD 75 million). During this time, the direct returns from data sales within India were INR 220 crore (approximately USD 30 million), and outside India were INR 60 crore (approximately USD 8 million).

One of the economic impacts of the shift from ground survey to remote sensing was the estimated saving of INR 1100 crore (approximately USD 150 million). This saving was due in part to the use of satellite remote sensing in waste-land mapping, which reduced the area of wastelands by 70 million hectares, including 62 million

hectares through three World Bank-aided projects: the Uttar Pradesh State Sodic Land Reclamation Project, the Integrated Mission for Sustainable Development (IMST), and the Rajiv Gandhi National Drinking Water Mission.

Another economic impact was the creation of a forest mapping plan using satellite remote sensing, which helped to divide 200 forests, saving time and resources and contributing to the estimated saving of INR 1100 crore (approximately USD 150 million). According to a 2012 report by the Comptroller and Auditor General of India (CAG), the actual internal rate of return on data sales was only 6%. Hence, it is important to also consider the induced economic impacts on the economy, as the use of satellite data and services can lead to further economic growth and development.

One of the economic impacts of the shift from ground survey to remote sensing was the estimated saving of INR 1100 crore (approximately USD 150 million). This saving was due in part to the use of satellite remote sensing in waste-land mapping, which reduced the area of wastelands by 70 million hectares, including 62 million hectares.

The geospatial economy, which includes industries that use geospatial data and technology, is a significant contributor to employment and expenditure in India. In 2021, India's geospatial economy was valued at INR 38,972 crore (approximately USD 5.3 billion) and employed approximately 4,70,000 people across the country. It is estimated that by 2025, the geospatial economy will be valued at INR 52,770 crore

In 2021, India's geospatial economy was valued at approximately USD 5.3 billion and employed approximately 4,70,000 people across the country. By 2025 It is estimated to be approximately USD 7.1 billion and will employ over 950,000 people

(approximately USD 7.1 billion) and will employ over 950,000 people.

In 2020, the National Council of Economic Research (NCAER) focused on two missions: the National Monsoon Mission and High-Power Computing. The Government of India granted over INR 500 crore (approximately USD 67 million) globally for the National Monsoon Mission to improve the predictability of monsoons beyond 5 days. The mission had an impact on 12,000 fishermen and farmers, who estimated an additional income of INR 50,000 crore (approximately USD 6.7 billion). These examples illustrate the significant economic impact that the geospatial economy can have in India.

However, it can be challenging to accurately estimate the proportion of the geospatial economy that can be attributed to earth observation and satellite technologies, as the geospatial economy encompasses a wide range of industries and sectors that use geospatial data and technology. These sectors may use a variety of data sources, including earth observation and satellite data, as well as ground-based data and other sources.

To better understand the contribution of earth observation and satellite technologies to the geospatial economy, it may be necessary to conduct a detailed analysis of the various industries and sectors that make up the geospatial economy and the data sources they use. This could involve collecting and analyzing data on the amount and types of geospatial data and technology used by these industries and sectors, as well as the economic value and employment generated by these activities. Such an analysis could provide a clearer understanding of the role that earth observation and satellite technologies play in the geospatial economy.

In conclusion it is important for India to carefully consider the upstream and downstream sectors of the space economy and to study the induced impacts of these sectors in terms of economic, environmental, regulatory, entrepreneurship, science and technology, and societal factors. This will allow for a more comprehensive understanding of the space economy and its various impacts. In order to accurately assess the impact of the space economy, it is important to consider both direct and indirect impacts and to take care to avoid double counting. It is also important to account for any negative impacts and to consider the net value of the space economy. This will help to provide a completer and more accurate picture of the space sector and its importance to India's economy and society.

Turning the spotlight on Mission DefSpace – Defence India Start-up Challenge

Hon'ble Prime Minister of India, Shri Narendra Modi's resolve for Aatma Nirbharta has led to India's significant stride towards, Defence Self-Sufficiency & created a technology-enabled innovative system for Defence Manufacturing. He is set to launch Mission DefSpace with Defence Space Challenges. On the occasion of Azadi ka Amrit Mahotsav; 75 challenges in the Defence Sector.

Mission DefSpace – Defence India Start-up Challenge is a program initiated to encourage the development of innovative technologies and solutions for the defence sector. This program is aimed at fostering entrepreneurship and innovation in the defence sector, with a particular focus on the space domain.

Through the Mission DefSpace program, start-ups are provided with support and resources to develop technologies and solutions that can address challenges facing the defence sector, including those related to space. This support may include funding, mentorship, and access to research and development facilities.

The goal of the Mission DefSpace program is to promote the development of technologies and solutions that can enhance the capabilities and effectiveness of the defence sector, particularly in the space domain. By supporting start-ups and fostering innovation in the defence sector, the program aims to strengthen India's defence capabilities and contribute to the overall growth and development of the country's economy.

Space is a critical frontier for warfare in India and is an important component of the country's next-generation national defence strategy. The Mission DefSpace program aims to launch defence space

applications and support start-ups that are working on solutions to in-space challenges.

In 2018, the Indian government launched the iDEX (Innovation for Defence Excellence) program to bring together micro, small, and medium enterprises (MSMEs) and start-ups to develop solutions to problems related to defence services. The goal of the iDEX program is to support sustainable models that can be used by MSMEs and start-ups to solve defence-related challenges.

The iDEX program is now a part of the Defence Exhibition procedure, which is a key reference for defence acquisition in India. The Defence Innovation Organisation (DIO)/iDEX program has made INR 300 crore (approximately USD 40 million) available for registered start-ups and MSMEs to innovate for defence space applications. A list of eligible start-ups and MSMEs can be found on the iDEX website.

The two fundamental objectives of (iDEX); one was to create a Defence Industrial Base for India & to have a co-creational model where the users can share their problem statements, can share their challenges; which can be developed with start-ups.

Defence India: Start-up Challenges

The Indian government has announced plans to disperse a fund of INR 100-300 crore (approximately USD 13.5-40 million) over the next two years to support the development of the Indian space sector. This funding will be provided through the Defence India Start-up Challenge grant program, which is designed to support the development of prototypes and innovative technologies for the defence sector.

The Indian government has announced plans to disperse a fund of INR 100-300 crore (approximately USD 13.5-40 million) over the next two years to support the development of the Indian space sector.

Under the grant program, start-ups and other organizations can apply for funding to develop prototypes and technologies that have the potential to be used by the defence sector. The grant funding can be used to support the development of these prototypes and technologies, but the procurement, size, and memorandums of understanding (MoUs) for these products are typically separate transactions.

In some cases, the grant program may support the development of very early-stage technologies in applied science. In these cases, the grant may be de-risked through the development process to help ensure the success of the technology. Engineers and young technologists may then build a business around the grant and work to navigate the procurement system to bring their technology to market.

To support start-ups and other organizations in understanding the procurement process, the government may provide talks, lectures, and knowledge-sharing sessions to help them navigate the system and develop their businesses over the longer term. This support can help to ensure that the system evolves to better meet the needs of start-ups and other organizations working in the space sector.

Demystifying U.S. Export Control Regulations ITAR and EAR for the Indian Space Sector

The United States has two main sets of export control regulations: the International Traffic in Arms Regulations (ITAR) and the Export Administration Regulations (EAR). These regulations are designed to ensure that defence articles and services, as well as other items that may have military applications, are not exported to prohibited destinations or used for unauthorized purposes. The ITAR is administered by the Directorate of Defence Trade Controls (DDTC) within the Department of State and regulates the export and temporary import of defence articles and services listed on the United States Munitions List (USML).

The ITAR implement the Arms Export Control Act (AECA). The DDTC is responsible for implementing the ITAR and ensuring compliance with the AECA and ITAR. The DDTC is made up of three offices: the Office of Defence Trade Controls Policy (DTCP), the Office of Defence Trade Controls Compliance (DTCC), and the Office of Defence Trade Controls Licensing (DTCL). The DTCP is responsible for maintaining and interpreting the ITAR and its United States Munitions List (USML), which identifies defence articles and services that are subject to the ITAR.

The ITAR applies to items that are specifically designed, developed, produced, or modified for military use and to related technical data and services. The EAR is administered by the Bureau

of Industry and Security (BIS) within the Department of Commerce and regulates the export and reexport of items that are primarily for commercial use, but may also have military applications. These items are listed on the Commerce Control List (CCL).

Both the ITAR and EAR require companies to obtain a license or other written approval from the relevant government agency before exporting or reexporting controlled items. The licensing process involves submitting an application with supporting documentation and undergoing an administrative review to ensure compliance with the regulations. Understanding and complying with these export control regulations is important for companies in the Indian space sector that wish to do business with the United States or that may export or reexport items that are subject to these regulations.

The DTCC is responsible for ensuring compliance with the AECA and ITAR through civil enforcement and coordination with law enforcement personnel. The DTCL is responsible for reviewing and adjudicating requests to export, reexport, retransfer, and temporarily import defence articles and services and engage in brokering activities. This office also issues licenses and other approvals for these activities as needed. Together, these offices work to regulate defence trade and ensure that it aligns with U.S. national security and foreign policy objectives.

Under ITAR, a licence from DDTC is required for the export or import of defence articles or defence services. In order to apply for a licence, an applicant must provide all relevant documentation related to the proposed transaction, including information about the type of articles involved, the end user, and the purpose of the transaction.

The DDTC conducts an administrative review of the application and supporting

documentation before issuing a licence. During this review, the DDTC may collaborate with other agencies and departments of the U.S. government, including the National Security Council, the Office of Homeland Security, the State Department, the Defense Department, the Energy Department, the Intelligence Community, and NASA, as needed to gather more information or to consider the national security implications of the transaction.

In cases that involve additional scrutiny for national security and economic considerations, the DDTC may consult with its oversight committees and other appropriate members of Congress and congressional staff on matters of mutual interest on a case-by-case basis. The process of issuing a licence typically takes 48 days for normal cases. However, for cases involving coordination with multiple agencies and departments and security considerations, the process may take 3-6 months depending on the specific case.

Once all relevant information has been gathered and the case has been adjudicated, the DDTC will issue a licence. Any re-export, re-transfer, other disposition, or change in end-user or destination of defence articles or services that were initially exported or transferred pursuant to a license or other written approval requires further scrutiny and a new licence.

Under ITAR, exports are legally required to state that the goods being exported are destined for the country indicated on all shipping documents and this statement is called the Destination Control Statement (DSC). The recipients of defence articles, services, or technical data are to obtain written consent from the Department of State prior to transfer, disposal, or change of end-use of these items.

Understanding and complying with the export control regulations is important for companies in the Indian space sector that wish to do business with the United States or that may export or reexport items that are subject to these regulations.

All third-party transfer requests are reviewed, undergo interagency review and are guided by arms transfer laws, general criteria and specific third-party transfer of arms law, regulations, and policies. To ease the regulations of commercial exports and imports of defence articles and services, some of the articles from ITAR were moved to EAR, which is maintained and implemented by BIS. BIS regulatory jurisdiction has predominantly commercial uses but also may have military applications.

If an Indian space sector company wishes to do business with the United States or export or reexport items that are subject to ITAR or EAR, it is important to understand and comply with these export control regulations. It is important for Indian space sector companies to be aware of the requirements of ITAR and EAR and to ensure that they are in compliance with these regulations. Failure to comply with these regulations can result in penalties and other consequences. Companies may wish to seek legal counsel or guidance from trade experts to ensure compliance with these regulations.

Power Session: Space Investment Outlook and Funding for New Ventures

The establishment of an International Financial Services Centre (IFSC) in India could potentially provide a solution to the capital convertibility challenges faced by start-ups, small and medium-sized enterprises (MSMEs), and large organizations in the space sector. By creating an international zone for foreign currency and regulatory oversight, the IFSC could facilitate the conduct of business in foreign currency and help attract investment in the space sector.

In addition, the inclusion of the space sector in the FinTech Entity Framework could provide opportunities for alternative investment funds and other financial innovations to support the growth of start-ups, MSMEs, and the overall ecosystem in the space sector. This could potentially have a transformative impact on the investment and funding landscape for the space sector in India, helping to drive innovation and growth in the industry.

Overall, the involvement of the IFSC and the development of a supportive regulatory framework for the space sector could help to create a more conducive environment for the growth and development of the space industry in India.

Fin-Tech in Indian Space Sector

IFSC is a gateway for Indian SpaceTechs to raise significant capital thereby allowing global space tech to invest via foreign

capital. Therefore, IFSC is considered to be of global jurisdiction.

With the emergence of space tourism as a new industry, spacecraft leasing is also becoming a possibility. Other exciting areas of development in the space industry include the lunar economy and asteroid mining, which require significant capital investment. In India, a new financial incentive called the "IFSCA Fin-Tech Incentive Scheme 2022" has been introduced to support start-ups in the space tech sector. This program provides grants of up to 75 lakhs to small, innovative companies that are working to get off the ground. This is a welcome change for bootstrapped start-ups in the space tech industry.

Space Investments & Outlooks in India & at Global level

Space Capital, a venture capital firm that focuses on investing in early-stage space companies, released a quarterly report in 2022 showing that $3.4 billion was raised by space-faring countries, contributing to the overall increase in equity of around $268 billion across 1,700 companies over the past decade. In the early days of the space industry, Skybox became the first start-up in Silicon Valley to raise private capital, securing $90 million in funding for their demo satellites. However, the company struggled to find the necessary talent to bring their technology to fruition.

In Europe, space start-ups may face challenges in obtaining grants due to their heavy reliance on government funding. The H2020 program provides around $70-80 billion euros in funding every year, but many start-ups still struggle to secure even $3-4 million in grants. In the US, the Small Business Innovation Research (SBIR) and Small Business Technology Transfer (STTR) programs provide grants of $100,000-

$150,000 for companies to prove the commercial viability of their technology, and $50,000-$75,000 for companies to further develop their technology for commercial use. While these grants have been successful in supporting the development of new space technologies, they have also been criticized for being dominated by a small group of companies that consistently receive the grants.

The Indian space economy may be able to benefit from the US grant framework, as it has a similar structure to the programs offered by NASA. However, it will be important for the Indian sector to address the issue of grant funding being dominated by a small group of companies, as this has been a problem in the US as well.

India has seen a significant increase in investment in space activities, particularly in the venture capital arena, with more space start-ups receiving funding. Four Indian space start-ups, in particular, Pixxel, Bellatrix Aerospace, Agnikul, and Skyroot, have raised significant amounts of funding through their venture capital rounds.

According to the most recent investment round, these companies have raised $33 million, $11 million, $15 million, and $68 million, respectively. In 2020-2021, the number of new Indian space start-ups entering the space sector increased significantly, with 47 new companies entering the market in 2021 alone. The cross-sectoral applications of these technologies have created a disruptive and attractive environment for Indian space start-ups to invest in.

In 2020-2021, the number of new Indian space start-ups entering the space sector increased significantly, with 47 new companies entering the market. The cross-sectoral applications of these technologies have created a disruptive and attractive environment for Indian space start-ups to invest in.

In 2020-21, 11 new Indian Space start-ups ventured into the space sector (2020), however in 2021; 47 new space start-ups were added to the list of space start-ups. Cross-sectoral applications of these technologies created a disruptive and attractive environment for Indian Space start-ups to invest.

At the forefront of investment and funding in India; IFSC revenue transferred to Indian revenue stands to directly impact the FDI scenario in India. However, the appetite for capital-intensive investments is currently low in India. Additionally, the Indian Laws regarding “Tokenization” have to further be modified. However, within the jurisdiction of IFSC, Tokenization is allowed.

In India, regulation policies are the main hindrance for foreign companies to invest in the Indian Space market. However, Space businesses have the potential & metrics to have growth which is similar to start-ups.

Building an Innovation Ecosystem through Space Clusters

Space clusters are geographic concentrations of space-related companies, organizations, and research institutions that collaborate and share resources. They can be an effective way to drive innovation and facilitate the exchange of talent in the space industry. By co-locating resources such as supply chain management, transportation, and academic facilities, space clusters can help scale up technology research and implementation.

Space clusters can also create a network of economic relationships in a region that can provide a competitive advantage and increase efficiency. The growth of space clusters may be important for economic growth and can also influence foreign investment. Foreign direct investment (FDI) can stimulate clustering activity and have positive spillover effects on the wider economy. This model can encourage collaboration between organizations and create a managed ecosystem for the space industry.

It is important for organizations in the space industry to be able to move from an innovative idea to a business proposition and scale it up on the international stage. To achieve this, it can be helpful to establish a supportive ecosystem that promotes collaboration and the exchange of ideas. Start-up clusters and education clusters, such as the ones located in Bangalore and Kota, are good examples of this type of ecosystem.

These clusters bring together a variety of organizations and institutions, fostering an environment that encourages innovation and helps companies grow and succeed. By providing resources and support to help organizations navigate the challenges of scaling up and entering the international market, these clusters can be a valuable resource for start-ups and other companies in the space industry.

The policy changes that have been implemented in India are likely to have a positive impact on the space start-up ecosystem in the country. These changes, along with the engagement of the Indian Space Research Organisation (ISRO) with industry and state-level policy initiatives, are driving opportunities for start-ups in the space industry.

To foster the growth of space start-ups, it is important for state governments, in addition to the central government, to provide support in the form of skilled manpower, enabling policies and incentives, market access, and capital. This can help create a supportive environment for start-ups, entrepreneurs, and small and medium-sized enterprises (SMEs) to thrive and contribute to the overall growth of the space industry in India. Similar to Bangalore, other states in India can also encourage the development of space start-ups and create clusters of space-related organizations and institutions to foster innovation and collaboration.

In addition to favorable policies and regulations, academic linkages, and strong technical manpower, access to capital is critical for the development and sustainability of space clusters. Currently, most of the capital flow for space clusters in India comes from venture capitalists, rather than foreign direct investment (FDI) or large industrial houses. However, investors may be hesitant to invest due to a lack of clarity in the regulatory environment.

Key factors for the growth of space clusters include supportive policies, academic partnerships, skilled technical personnel, and access to funding. In India, most financing for space clusters is from venture capitalists, not FDI or big corporations, due to regulatory barriers.

To address this issue, ISRO and the Software Technology Parks of India (STPI) have plans to incubate start-ups in collaboration with technology institutes in various parts of the country. This, combined with the overall supportive policy environment, has the potential to boost the emergence of new space clusters in cities where space activity has not traditionally thrived, such as Bangalore and Hyderabad. By providing the necessary resources and support to start-ups and other space-related organizations, these clusters can help foster innovation and drive the growth of the space industry in India.

Leveraging Industry Base for National Space Capabilities

It is suggested that India needs a dedicated national strategy for space technologies and manufacturing to fully realize its potential in the space industry. This strategy should focus on research and development (R&D) and manufacturing of space-grade electronics, new-age satellite constellations, and user terminals. A supportive regulatory framework is also necessary to promote competition and provide legal certainty for space sector manufacturing in India.

As one of the top six space-faring nations, India has a lot of capabilities in the upstream sector of the space industry. By developing a comprehensive national strategy and supporting regulatory framework, India can further enhance its position in the global space market and contribute to the growth and development of the space industry.

NSIL is the commercial arm of ISRO with the primary responsibility of enabling Indian industries, especially manufacturing industries to take up high-technology space-related activities. By facilitating the transfer of the assets, NSIL will be able to further provide the desired financial autonomy to the company to realise capital-intensive programmes/ projects.

NSIL was created to meet the increasing demands of the Indian space programme and to commercially utilise the emerging global space market. NSIL is keen on facilitating key collaborations with foreign players and Indian manufacturers to exchange technology know-how and bring in FDIs.

PSLV and GSLV are India's low-cost launch vehicles. In another historic milestone,

The next 25 years will be centered on space in India, as the country aims to increase its share of the global space market from 2% to 10% in the next 10 years. To achieve this growth, India needs to increase its space industry at a rate of 23% annually, which is an achievable pace considering the capabilities and potential of the Indian space industry.

NSIL signed two launch service contracts with OneWeb where 36 satellites were placed into orbit by LVM3, ISRO's heaviest launch vehicle, from Satish Dhawan Space Centre.

India is witnessing a heavy demand for satellites for earth observation and communication applications, building and launching satellites, building launch vehicles, and providing launch services. India has cost-effective options for launching satellites where developmental costs and launch costs of satellites, especially in the Small Satellite segment, are low.

The next 25 years will be centered on space in India, as the country aims to increase its share of the global space market from 2% to 10% in the next 10 years. To achieve this growth, India needs to increase its space industry at a rate of 23% annually, which is an achievable pace considering the capabilities and potential of the Indian space industry. To support this growth, it will be important for the government to implement favourable policies and regulations, provide access to capital and skilled manpower, and foster collaboration and innovation within the industry. By focusing on these key areas, India can successfully increase its share of the global space market and contribute to the growth and development of the space industry.

The government needs to form a dedicated strategy to exploit India's Small Satellite capability. Driving this effort, the government must ensure greater budgetary allocation. Continued involvement of Govt through ISRO and the private sector with their agility should build up capabilities for overseas markets in building satellites, launches, and ground segment equipment, which will help to raise the Year-on-Year growth rate significantly.

It is interesting to note that the private sector in India plays a significant role in the work of ISRO, with 80% of ISRO's work being contributed by the private industry. The private sector is involved in end-to-end activities in the space industry, and this highlights the need for the industry to strengthen itself in areas such as system design and integration efficiency.

To further advance the space industry in India, it is important for the country to focus on developing the capability to manufacture space-grade products of the highest quality. This requires a national effort to develop and produce advanced materials that will drive future space programs. By investing in these areas and fostering collaboration between the public and private sectors, India can continue to make progress in the space industry and contribute to the growth and development of the global space market.

Dialogue on Satellite role in Disaster management and resilient infrastructures

Satellite imagery and GIS services aid in emergency and disaster response, assessment, and analysis of natural disasters. The use of satellite-enabled technology allows for the enhancement of relief services, which save lives and reduce costs during emergencies, particularly where cellular networks cannot reach. Next-generation satellite-enabled connectivity will facilitate the digital thrust required to save millions of lives.

Multinational Communications Interoperability Program (MCIP) is a civilian-military collaboration during large-scale natural disasters in Asia, focusing on improved communications and information-sharing platforms, applications and institutional relationships. Since APAC regions are most vulnerable to disaster, this exercise has been continuing since 2004 to make an effective communication system.

The need for complementary satellite-enabled connectivity is imperative for even highly connected telecommunications markets, which continue to have underserved zones. Out of all the current communication systems analysed, Satellite phones score better across most areas.

- Satellite phones have high spectral efficiency and wide coverage that allow communication links to be established even in sparsely populated areas and areas with outdated or damaged infrastructure.
- Easily deployed, user-friendly, and have low network disruption risk as they do not rely on land-based towers and networks to operate.

Benefits of Satellites over Terrestrial tech: Space infrastructure can provide more coverage, resilience to disasters, easy deployment (excluding launching), and other advantages.

Network Redundancy in Critical Facilities: Satellites in Space are unaffected by disasters on Earth, so they provide resilience unmatched by terrestrial services. Managing traffic and congestion under emergency situations Satellites can offer wide, ubiquitous, instant coverage, complementary to terrestrial networks. Providing backhaul connectivity to mobile cellular networks.

Disaster management in India needs improved regulatory framework. The wider use of satellite technology and global connectivity, considering both human and economic needs in the long-term, is vital for a robust disaster response system.

Rules for use of Satellite Phones in India: India has stringent rules on the use of satellite phones. Satellite phones are permitted with specific permission from the Government of India. Regulatory clearance takes time in India for the equipment use during disaster management for security purposes.

Regulatory frameworks need to be developed to improve disaster management in India. Wider use of satellite connectivity and integration of global connectivity considering the long-term human and economic needs is critical to maintaining an adequate level of DRM system in India. India being a signatory to ITU must adhere to multilateral organizations such as ITU which has guided Governments to promote regulatory measures that permit a better satellite communication offering during emergencies.

'Crisis Connectivity Charter' is developed to improve communication in cases of disaster management by setting out solutions that enable satellite-based communications respond readily to disaster situations. The charter ensures satellite-based technology is leveraged to provide life- saving connectivity for humanitarian aids and affected populations whenever a disaster strikes. The Crisis Connectivity Charter is composed of the satellite industry and the wider humanitarian community, such as members of the EMEA Satellite Operator's Association (ESOA) and the Global VSAT Forum (GVF), in coordination with the UN Office for the Coordination of Humanitarian Affairs (OCHA).

The Charter prioritizes access to bandwidth during disaster responses and by allocating pre-positioned satellite equipment and transmission capacity in high-risk countries. It also provides training and capacity-building to communities around the world.

The European Space Agency, together with other organisations, is contributing its space infrastructure towards enabling a more effective response to emergencies. ESA co-funds the technological development agencies and forms Public-private partnerships to help funding of projects that comes partly from the private sector.

India should allow Industry and NGOs to come forward and collaborate and have quick access to resources.

Infrastructure resilience is an ongoing challenge. A partnership between government programmes, multilateral agencies, banks and financing institutions, the private sector, and knowledge institutions is a must to promote the resilience of new and existing infrastructure.

SIA-India will be signing an MOU with CDRI to promote the rapid development of resilient infrastructure to respond to the Sustainable Development Goals.

Power session: Space: The Fourth Frontier of Warfare

It is a general observation that investments in the security sector, such as the development of weapons and other military technologies, do not necessarily generate significant revenue or profits. In fact, many defence-related industries are heavily reliant on government contracts and funding, rather than commercial sales.

However, investing in the equipment and capabilities of the armed forces and security sector can provide a sense of security and assurance for governments and societies. These investments can help protect against threats and ensure the readiness and effectiveness of military and security forces. While they may not generate significant profits in and of themselves, they can help support and defend critical national interests and provide a measure of economic and social stability.

After India gained independence from Pakistan, the country faced several challenges, including military threats from its neighbors. One significant event was the attack on Kashmir in the early days of independence, when a large, irregular army known as the “Laksars” invaded the region, taking advantage of inadequate communication and defense systems. India’s military equipment at the time, which included outdated equipment dating back to World War II, was inadequate to meet the situation.

Similarly, China’s attack on India 60 years ago was aided by the fact that China had built road infrastructure near the border that was not known to Indian leadership. The Indian 5th Battalion lost the Galwan post in this conflict.

If modern satellite technology had been available at the time, it is possible that

ISRO and private players have advanced significantly in building the necessary infrastructure and capabilities needed to become a space power, including the advancement of satellite technology and other space systems that provide valuable intelligence, communication, and other national security benefits.

the situation could have been different, as satellites could have provided valuable intelligence and communication capabilities that could have helped India respond more effectively to these threats.

The situation in India today is much different when it comes to national security and the ability to respond to threats, in large part due to the development of the space industry in the country. ISRO and other private participants have made significant progress in building the infrastructure and capabilities needed to become a space power. This includes the development of satellite technology and other space-based systems that can provide valuable intelligence, communication, and other capabilities that can enhance national security.

One example of how satellite technology can improve national security is through the use of precise maps and other geospatial data. Previously, maps were often created using different criteria and technologies, which could lead to discrepancies and make it difficult to accurately interpret different grids. However, maps created using satellite imagery and other data sources can provide much higher levels of precision, making it easier to identify and assess potential threats, as well as to plan and execute responses.

Sufficient payload is available in the Space sector and the country needs to have the shooter and sensor combination to win wars. The precision battle is only possible with GPS technology/equipment. ISRO's IRNSS makes the PNT (Positioning, Navigation and Timing) services available regionally. ISRO's successful space programmes and DRDO's robust missile programmes/technology combinedly provide a good pedestal for the country.

The concept of "dual-use," which refers to the use of space-based systems for both civil and defense applications, has been considered essential for promoting the effective use of space situational awareness (SSA) and other capabilities. With the increasing number of low earth orbit (LEO) and medium earth orbit (MEO) constellations being launched, there is significant potential for augmenting military applications through the use of satellite technology. However, adequate budget allocations are critical for the sector to continue to grow and develop.

The United States, for example, has recognized the importance of space power in defense sectors and has allocated a budget of around $35 billion to the military for space-related activities. India, too, has recognized the importance of technology deterrence associated with space power for its national security. In order to tap the potential of dual-use for military applications, it is important for India to invest in research and development in the sector and to prioritize the hardening

of hardware space applications through the use of quantum technology to ensure security. Special forces in India also need to urgently address the role of space in warfare, which will require significant investment and research in the sector.

The Army has used the space domain significantly since 2000 but in the '70s the sector was sporadically chosen using ISRO services. The defence sector in the country is completely dependent on space power. As a user, the army faces a lot of challenges in terms of surveillance of the vast country, especially approximately 7500 km of the coastal area and the western and northern borders due to high mountains and difficult terrain and weather conditions. Terrestrial communication is very difficult and signals are frequently weak, this becomes critical particularly for Line of Sight, due to extreme weather and terrain conditions and dependency on terrestrial optical fibre-based communication. The need is to optimise space-based communication. The defence forces in the country need a robust and vibrant ground segment ecosystem not only for effective surveillance but also for getting intelligence/information including analyzing the huge amount of data, besides vulnerability for cypher attack.

The defence sector is looking forward to space-based platforms/solutions to achieve instantaneous communication to communicate freely, irrespective of location/terrain constraints, particularly in the island territories of Andaman and Nicobar Island and even for welfare communication with military personnel/ home, especially during a disaster [natural or man-made]. The army is working closely with ISRO to have a dedicated military satellite. The space industry and academia must take advantage of the opportunities available to them and help the defence sector overcome the current challenges.

Defense technology that does not provide accurate targeting information is of limited value in military operations. To be effective, technology must be able to accurately place a cursor over a target and provide the necessary information for attack or engagement.

One area where accurate targeting is particularly important is in the realm of anti-access/area denial (A2/AD) operations. A2/AD refers to actions taken by an adversary to slow the deployment of friendly forces into a theatre of operation or to cause those forces to operate from distances farther from the locus of conflict than they would otherwise prefer. A2 affects movement to a theatre, while area denial (AD) affects manoeuvre within a theatre.

To effectively counter A2/AD operations, it is essential to have advanced technology that can provide accurate targeting information and enable friendly forces to operate effectively in complex environments. This may include the use of satellite technology and other space-based systems, as well as advanced weapons systems and other technologies.

The A2/AD projection is not limited to a single weapon system or tactics, but instead is "a series of overlapping capabilities across multiple domains like Air, Land, Sea, Cyber and Space, with the sole aim of imposing maximum attrition on the adversaries" warfighting capability in all spectrums.

Explaining A2/AD: If the threat is from various weapons of long-range capabilities. The access will be denied using long-range missiles or long-range air power. Anti-Access to Area Denial will move from tier-1 to tier-4. The influence of conventional air is 20 KM approximately. So, it is not possible to have only air power or to sustain satellite capabilities. Therefore, the requirement is both air and space.

Balloons are an option to deploy air-defence missiles up to 100 Km or so and the cost will be much cheaper. This air-defence missile can get separated and ignite after the balloon reaches the desired height. Guiding the missile is not a problem and the drift can be controlled with the help of thrusters. The use of a low-cost balloon A2/AD option may be need-based. Specific counter A2/AD capability gaps need to be clearly identified and filled by robust and appropriate means to maintain an acceptable level of conventional deterrence.

The requirement now is to explore the higher air space for credible air defence and work on optical stealth.

Simplifying space & explaining limitations in terms of high budget allocation for R&D: It is difficult to convince the common man why huge allocation for space including the moon and mars mission is important when shortages for essential goods continue to be faced by many. There is a need to create general awareness for the public at large to understand space and the R&D requirements, where big business houses are required to play a major role.

The space needs to be simplified by creating space awareness for which space education should be introduced at an early stage in the curriculum.

Space Security in defence context: Air and space cannot be fenced or mined and is different from terrestrial applications. The foray into space from a military angle began with World War II and progressed through the Cold War era. The nature of 'Space' changed at the end of the Cold War from military aspects to civilian use. The civilian presence in space is set to grow leading to space commerce and trade. Many space applications, banking, finance, DTH, transportation etc. have penetrated into the common man's life. Any disruption to

space would mean disruption to normal lives. Therefore, civil-military cooperation is very crucial.

Going forward, earth-centric zones will fall behind and in the next 2 to 3 decades humankind will potentially move to space-centric zones with more space stations, asteroid mining, moon mining, and space colonies starting with robots and ending with man colonies. The economy will revolve around space which will be superior to the present-day economy on earth.

In this scenario, the nature of military space applications could be very different and the warfare will cover three broad areas- warfare through space, warfare in space and warfare from space. Space applications enable things to happen from the ground principally through technology, communication, navigation, positioning and information dominance. Normally threats are plenty and come from space itself i.e anti-satellite. Already four countries including India have tested the anti-satellite technologies. These are direct earth ascent technologies known as kinetic threats. There are non-kinetic threats, which could be a cypher, direct energized weapons or laser sensor attack. Resilience to acquire security and resilience to space systems become very important

The DSA's role in the country is to secure the space from these threats through adequate capabilities to deter them. So, DSA is initially concentrating to develop capabilities and hoping to acquire space command in the future. The first priority is to create an asset profile for which help from industry and academia is necessary. There is a need is to develop indigenous capabilities by creating of human resource pool through training and coherent HR policies, concentrating on avoiding brain drain and overcoming technology denial. In this direction, DSA is actively engaging the industry and academia in R&D so that the path is aligned to achieve the long-term goal of DSA in acquiring space security for the country and space development in the country as a whole.

With the entry of the private sector, the country will be able to tap the larger pool of talent (both trained and trainable manpower) available in the country.

Navigating the Laws for Space Business in India

The regulatory framework helps to establish clear guidelines and rules for businesses to follow, which can provide a level of predictability and stability for businesses to operate within. This can help businesses to plan and make informed decisions, and can also create a more fair and competitive business environment.

In addition, the regulatory framework can help to protect the interests of consumers, employees, and other stakeholders, and can also promote ethical and responsible business practices. By following the regulatory framework, businesses can operate legally and effectively, which can contribute to their overall success.

For space businesses, in particular, it is important to be aware of the specific regulations and requirements that apply to the sector. This may include regulations related to the launch and operation of satellites, the use of space-based assets for commercial purposes, and other issues.

Large organizations and start-ups alike need to be mindful of these regulations when developing business plans, running their businesses, and exploring new business models. This may involve seeking guidance from legal and regulatory experts, as well as working with relevant government agencies and other stakeholders to ensure compliance

with all applicable laws and regulations. By understanding and properly navigating the regulatory environment, businesses can position themselves for success in the space industry.

The commercial space industry requires a clear and supportive ecosystem that addresses technical, business, policy, and regulatory aspects. The announcement by the Prime Minister in 2020 regarding the space sector's focus on self-reliance, advanced capabilities, and private sector involvement marked the beginning of this effort.

To decongest the space sector, the issues concerning the ground segment (R&D and Science/Technology for developing products) and the space segment (launch vehicles/satellites delivering the payload and international laws governing airspace/outer space) are critical. In this context, the trajectory over the last two years and plus on the draft space policy and requirements of space-enabled communication remain unclear.

In the absence of clarity and confusion over the precise objective of the Government of India, the direction in which the space industry in India was moving down the line for the last 25 years is unclear.

The private space industry in India has a well-established ecosystem and is capable of undertaking end-to-end space activities. It's also important to note that the industry is governed by existing normative laws, including contract law and finance laws, which help to regulate and guide the industry.

Private space players in India are planning to launch a PSLV in the near future. It is important for businesses operating in the private space industry, or any industry, to understand and comply with the relevant laws and regulations that apply to their operations. This can help to ensure that they stay up-to-date with any changes or updates to the regulatory environment, as this can help them to adapt and remain compliant.

The growth of satellite constellations and the deployment of high-altitude platforms, spurred by ITU Radio Regulations in 2019 and the rise of 5G wireless communication, have enabled the expansion of space-based broadband services. The deployment of these platforms has also contributed to the penetration of 5G in India. However, due to a lack of experience in the private space industry and related space policy, India has limited capacity to roll out 5G on its own. As a result, the Indian government has enabled collaborations between foreign companies, such as OneWeb (incorporated in the UK), and Indian companies like Reliance-Jio and Nelco, to facilitate the roll out of 5G in the country.

The commercial space industry requires a clear and supportive ecosystem that addresses technical, business, policy, and regulatory aspects. The announcement by the Prime Minister in 2020 regarding the space sector's focus on self-reliance, advanced capabilities, and private sector involvement marked the beginning of this effort.

It is important for the government to have a clear policy framework in place for the promotion and authorization of space services in India. This framework should be based on a robust consultation process, similar to the process followed by TRAI. This will help ensure that new space activities are able to thrive and contribute to the growth of the Indian space sector. It is also important for private companies to be able to launch and operate their own satellites with their own intellectual property rights (IPR) and provide end-to-end space services.

The establishment of the Indian National Space Promotion and Authorization Centre (IN-SPACe) has already allowed for the promotion and authorization of space services and the use of ISRO facilities by various organizations. However, more needs to be done to ensure a clear and supportive policy environment for the growth of the space sector in India.

One of the main objectives of the Indian government should be to achieve technological self-reliance in the space sector and to bring capital investment into the industry. In terms of economic policy, the country can draw on its past experiences with issues such as the Antrix scandal, the cancellation of 2G spectrum licenses, and the implications of retrospective taxation. These experiences can provide valuable lessons in understanding international trade laws on taxation and can help inform decisions on what actions to take and what to avoid. By focusing on self-reliance and attracting

capital investment, the government can help support the growth and development of the space sector in India.

Currently, the absence of a law on space activities in India is a double-edged sword. While the country is bound by international obligations such as the Outer Space Treaty, Liability Convention, and Registration Convention, Indian law does not enable these obligations and hence domestic law should go through a process of local rulemaking before assuming international character. For example, the Remote Sensing Data Policy stipulates dos and don'ts, but there are no clear provisions on consequences for violations. The absence of a law on space activities leaves a gap in the legal framework for regulating and enforcing compliance in the space sector.

In a similar instance with the National Map Policy case, the Madras High Court pointed out that though the policy has been violated the penalties for consequences were not explicitly defined and hence could not be enforced.

It is important for the state to recognize that the lack of an unambiguous law on space activities can be detrimental because it leaves no means to address international obligations for domestic players. For example, in the recent Russia-Ukraine conflict, there was a cyberattack on a satellite providing military assistance to Ukraine by a private player. While international humanitarian law prohibits the attack on civilian assets or dual-use satellites in military conflicts, international space law does not address such issues. This creates confusion for the private sector on the legal provisions to be followed and whether indemnity clauses in contracts or insurance policies will cover risks. When it comes to rulemaking for space activities, it is important to consider the convergence of political, economic, business, and military interests.

In India, the Department of Space (DoS) and the Department of Telecommunications (DoT) share regulatory responsibilities for space-based functions. The DoS is responsible for making space segment allocation, while the DoT issues licenses and WPC spectrum licenses. According to a consultation paper by TRAI, the entire process takes 7 to 8 months, but this deadline is not included in the law itself. This lack of transparency can be a problem for foreign investors, who may not be aware of such delays or extended deadlines, leading to uncertainties

The bureaucracy is reluctant to take concrete decisions in view of the consequences of alleged corruption or wrong interpretations following the 2G spectrum assignment issue. Legislation is required to clearly define the delegation of power and fairness in decisions.

Apart from space-related regulations, non-space-related matters such as ease of enforcement of contracts, freedom of commerce, international trade and investment obligations translated into domestic laws are the other benchmark subjects which will help to attract international investments. To ensure a seamless flow of investment in the space sector, the applicable space law should not be a hindrance, rather it should be enabling factor for ease of doing business in India.

There have been positive developments in the regulation of the space sector in India recently. Retrospective taxation

has been eliminated, and it has been announced that in cases of high-value investment, the advisory role of Supreme Court jurisdiction will be invoked for telecom licenses to avoid situations like the 2G allocations scandal. However, it is important to codify these measures into legislation to provide clarity and certainty for investors. In addition, demarcating the delegation of powers and setting clear parameters for space activities will help to achieve technological self-reliance and attract investment in the sector.

For any business, five important considerations are: 1) what can be done, 2) when it can be done, 3) how it can be done, 4) who is the authorizing agency, and 5) the cost of action. To access technology or product and services in any particular jurisdiction, it is important to understand the laws and regulations in that country.

In India, while there is a general direction in the space sector in the form of satcom reforms, the Space Act has yet to come into effect. The approval process takes 6 to 7 months, and for non-geostationary orbit (NGSO) satellite operators, this means that 30% of the satellite's life is wasted in getting licenses, as the mission life is only 3 years. These challenges can impact the attractiveness of satellite-based services in the developing market. Additionally, spectrum is scarce and sharing and coordination are crucial, which can be a time-consuming process as more and more satellites will occupy the same orbital slots in the future.

Harmonization is the key to addressing these challenges. When satellite constellations are launched from India, it is important that players have easy access to the global market and can provide services at the same technical parameters and cost. If Indian players

are not allowed to access global markets, or if other players are not able to access the Indian market, it will have cost implications. Reduced commercialization globally will increase costs, which will have to be passed on to end customers. The Space Act alone will not be sufficient to address all the issues faced by start-ups. Other laws and regulations, such as telecom regulations, FDI process, export control regulations, limitations in public procurement, and defence acquisition, will also need to be considered.

It is the responsibility of the government to create a framework that is attractive to investors. There should not be any uncertainty that everything could be cancelled after 10-15 years, leading to the loss of investment. Therefore, it is crucial to build investor confidence. The government should allow free investment in the space sector or related areas like defence.

The space industry will become an infrastructure layer for many services, particularly telecom services. In India, there is no split license for infrastructure alone, unlike in other countries where a separate infrastructure license is available. Presently, investment in the space sector is highly regulated and hinders investment.

There is a perception that private sectors are medium and small enterprises, which creates special classes that hinder capital flow. To attract a large amount of foreign investment, large businesses often need to collaborate with foreign players.

To encourage investment, the government should change its perception and allow Indian investors more flexible contract terms. This will help to attract foreign investment and support the growth of the space industry in India.

The Space Act alone will not be sufficient to address all the issues faced by start-ups. Other laws and regulations, such as telecom regulations, FDI process, export control regulations, limitations in public procurement, and defence acquisition, will also need to be considered.

The Space business needs clarity and certainty on the political and legislative framework and any delay will cost the economy, businesses, start-ups etc. The revolution in the telecom sector since 1998 was due to the reforms and the distinct role played in the settlement of disputes. In the telecom sector, the great phase of evolution started with the creation of TRAI and TDSAT by DOT, which helped enforce the separation of power. DOT is playing the role of licensor whereas TRAI and TDASAT are regulators and adjudicators respectively. It is important to have a clearcut policy to bring certainty in the investment as the country cannot afford long litigation leading to loss of time and potential for business.

Challenges on tax regime with regard to taxation in regards to the space sector

The Income Tax department amended the laws to cover assets below seas and above space and as such are subject to income tax. However, the tax policy should be in alignment with the existing regulatory

framework, and business nuances of the space economy and of course provide ease of doing business in the country.

The tax policy should be a financial enabler that helps, facilitates, and promotes businesses, bringing investment and Capex flow. It should be clear, consistent, and agile, and understand the nuances of the space business. In the last 75 years, many industrial sectors have benefited from a liberalized tax policy, such as textiles, infrastructure, e-commerce, etc., in the form of tax holidays in the corporate income tax. A similar approach in the space sector towards a progressive tax policy is fair and would promote business and investment, giving a boost to the space economy, which is expected to be a $600 billion economy by 2025.

With regard to the sub-segments of the space economy, R&D for defence and commerce get a weighted average tax deduction for the expenditure made by the corporates. The government should further reduce taxation and promote indigenous manufacturing under 'Make in India' or 'Atmanirbharat'.

Recently, production-linked incentives (PLI) have been implemented through various ministries of the Government of India and the PLI scheme has also been extended to many telecom and networking equipment. A similar concession to the space sector in terms of tax holidays will help to promote indigenous manufacturing of satellites, satellite bus etc which will push toward exports. Similarly, lower corporate income tax for setting up a manufacturing facility, as in the case of IT and ITES services will give impetus to the space economy.

Space Tech Park will bring in the entire space ecosystem of manufacturers, application developers, vendors, suppliers and service e providers under a single umbrella to synergise and reduce costs and benefit the consumers. Start-ups and MSMEs operating in the space sector are 100 plus (worth 70 to 75 million dollars by 2025) and tax benefits/ holidays to these units will accelerate to tap the space economy. Similar tax holidays/incentives are required for private players who are interested in satellite launch services and set-up testing facilities will do good for the space economy.

A robust, agile, vibrant, and progressive tax policy is necessary to keep pace with developments in the space economy. One important issue is the applicability of GST/corporate tax in cases where a satellite owner/operator is in country A, the satellite orbit lies in country B, and the services are received in country C. There are also issues with withholding tax and customs that hinder the import of equipment. These issues need to be addressed in order to support the growth of the space industry

Therefore, consistency and clarity in policy/legislation are necessary to allow foreign players to make huge investments in the space sector and uplift the space economy.

Insurance and liability coverage for space business

The global space ecosystem is currently experiencing a second space race, with low Earth orbit (LEO) constellations gaining dominance in the space economy. From an insurance liability perspective, LeoLabs has identified two key issues with LEO satellites: a 95% catastrophic risk of

Start-ups and MSMEs operating in the space sector are 100 plus (worth 70 to 75 million dollars by 2025) and tax benefits/holidays to these units will accelerate to tap the space economy.

collision with asteroids, space debris, or other satellites, and a lack of data on LEO constellations.

To mitigate these risks, LeoLabs has implemented a radar network to prevent physical and economic damages, which also impact the global space economy. Mapping high-risk conjunctions in LEO allows for the creation of insights into space safety, and statistical collision risk analysis in LEO provides real-time data on LEO constellations and facilitates policy-making for the future.

Space Insurance: New Tools in Space Market & Space Debris:

Insurance liability expenses for space-based operations can vary based on the intensity of a collision, including nominal, moderate, and worst-case scenarios. These expenses may also take into account the mass and altitude of catalogued debris. Tools that allow users to analyze data and provide real-time information and statistical insights on a bi-weekly basis can be helpful in understanding insurance coverage expenses and making accurate predictions about known and unknown space objects.

The global space race has highlighted the issue of data deficiency, which can impact space companies around the world and contribute to the problem of space debris. Space debris management is a critical issue for the space industry, as it can pose significant risks to space-based operations.

Space Missions: Modelling and Risk Mitigation

Space missions involve the planning and execution of activities related to exploration and research in outer space. These missions may involve the use of satellites, spacecraft, and other space-based assets, and they can be complex and technically challenging endeavors. In order to successfully carry out space missions, it is important to carefully plan and coordinate all aspects of the mission, including the design and development of the necessary technology and equipment, the logistics of launching and operating in space, and the management of any associated risks. This may involve the use of modeling and simulation tools to test and refine mission plans and to identify and mitigate potential risks. Effective risk mitigation strategies can help to ensure the safety and success of space missions, and may include measures such as redundant systems and backup plans, monitoring and detection systems, and contingency plans for unexpected events. By carefully planning and executing space missions with a focus on risk management, organizations can maximize the chances of success and minimize the potential for setbacks or failures.

In an ever-growing space industry ecosystem, security is critical for space assets. Thereby, much demand is in the market for security with the advent of bigger satellite constellations in space.

Security concerns are at large for the LEO constellations in space; due to their proximity to space debris in comparison to GEO constellations.

Currently, the high-accuracy TLE & HAC information (US-developed); are there for the analysis. In India, there are certain traditional limitations for decision-making in orbital manoeuvre; however, those decisions are undergoing correction & efforts are being focused on the creation of better space models.

Security concerns are at large for the LEO constellations in space; due to their proximity to space debris in comparison to GEO constellations.

Role of technology in space modelling & risk mitigation

Dassault Systemes' 3D Experience Platform aims to optimize and sustainably deploy satellites by bridging the real and virtual universes to create an innovative environment for space exploration. The platform also aims to mitigate risk through the assurance of successful satellite deployment into orbital slots. By combining the 3D Experience platform with virtual twin technology, space modeling and risk mitigation can be more effectively integrated, and different disciplines can work together more efficiently to pave the way for innovation. The system engineering approach promoted by the platform can enhance the development of products by considering the functional and logical needs of the product and the interactions of different disciplines. This can help to identify and address errors early in the development cycle.

Significance & Challenges of digital processes in New Space

From a global perspective, it is important for space agencies and associations to have a thorough understanding of the digital processes, limitations, and environment in space. This includes the ability to design, develop, and manufacture satellites that can withstand the challenges of space, such as space weather.

Space modeling involves mathematical modeling and requires a significant amount of data, but there are limitations to the design and development of spacecraft due to these requirements. In addition, space modeling requires paying attention to aspects of orbital slots and considering the potential impact of new and emerging technologies that are relevant and sustainable for space modeling. A futuristic view of these factors can help to guide the direction of space exploration and development.

The space industry is facing a shortage of analysts and engineers, but opportunities for collaboration within the sector can help to alleviate some of the demand for specific types of software engineers and analysts.

With the advent of cloud computing, organizations have been able to develop space modeling simulations and take advantage of the scalability and flexibility of this technology. During the pandemic, many organizations in the space sector have successfully used cloud computing and focused on optimizing its utilization. This has demonstrated the potential of cloud technology to meet the needs of the space industry on a global scale.

In-Orbit Technologies

The global space ecosystem does indeed face the challenge of overcrowding in orbital slots and the need to mitigate space debris. In-orbit technologies play a crucial role in addressing these challenges and have a lot of potential for the future.

Many organizations, both large and small, are investing in these technologies, as they have the potential to shape the future of the space ecosystem. Some examples of in-orbit technologies include satellite servicing and repair, on-orbit manufacturing, and space debris removal. These technologies have the potential to increase the efficiency and sustainability of space operations, as well as open up new possibilities for exploration and utilization of space resources.

Future of In-Orbit Technologies in the Global Space Ecosystem

In-orbit technologies involve the development of spacecraft and other technologies that can operate in the space environment, such as space robots and manipulators for repairing or servicing satellites, or 3D printers for manufacturing components in space. In-orbit technologies also include technologies that aim to address the problem of space debris, such as technologies for removing or mitigating space debris, or technologies for tracking and monitoring space objects.

The global space race, driven largely by commercial interests, has resulted in a

rapid increase in the number of active satellites. Ten years ago, there were 500 active satellites in Low Earth Orbit (LEO), but today there are more than 5,000.

In-orbit technologies focus on the manufacturing of space assets and the creation of space factories in space. However, maneuverability is a key challenge for in-orbit technology in space. However, overcoming this challenge opens up the possibility for various dual-use cases. In-orbit technologies also have the potential to clear space debris, which would have a positive impact on the global space debris mitigation system.

Space Machines Co has made significant progress by streamlining key areas such as payloads, usage of in-orbit technologies in space, and orbital slots. Bellatrix Aerospace's disruptive innovations in the space ecosystem have paved the way for new innovations in in-orbit technologies.

In-orbit technologies will allow us to manufacture and service satellites while they are in orbit, rather than launching them from the ground. This will significantly reduce the cost of satellite operations and make space more accessible to a wider range of users.

One solution that could help increase the number of launches in the global space industry is the development of "space taxis," as a means to bridge the gap between demand and supply for launches.

The majority of miniaturized satellites currently face funding challenges, which means they often have to resort to being a secondary customer rather than a primary one when it comes to securing a launch into space. One solution that could help increase the number of launches in the global space industry is the development of "space taxis," which could serve as a means to bridge the gap between demand and supply for launches. The concept of space taxis is still in the early stages of development, but it has the potential to significantly increase the accessibility of space for small satellite operators.

Digantara is focusing on building capabilities in both ground & in space. As a start-up, they are focusing on increasing the capabilities of in-orbit technologies via orbital processing to deliver cutting-edge use cases. The ultimate aim is to develop capabilities for the global space ecosystem in a sustainable manner.

In the next 10 years, an additional 60,000 satellites are expected to be launched into space, increasing the risk of collisions in the global space ecosystem. To address this risk, Manastu Space was created to ensure the sustainable utilization of space assets. Astroscale is also working towards the development of a sustainable space ecosystem, collaborating with JAXA on resolved imagery in space SSA and applying that technology to unresolved imagery as well.

In the coming years, it is likely that we will see significant advancements in in-orbit space technologies, which will have a significant impact on the global space ecosystem.

Space Industry Alliances

Space Industry Alliances between the USA and India have allowed the development of Space Situational Awareness (SSA) through agreements, which have paved the way for national security in defence space. In order to foster further collaboration between the two countries, it is important for the US to create investment-friendly routes and allow free flow of foreign direct investment (FDI) to India. There should be clarity on the segments handled by the government and those handled by the industry.

Both the US and India should work together to develop efficient satellites for the space industry, with the private sector playing a significant role in this collaboration. Previously, technological innovations were primarily developed by the government or military sector, but the private space sector has a major role to play in achieving a technological edge for the space industry as a whole. Recently, the US funded a conclave organized by the Indian Institute of Madras that brought together representatives from the government and private sector from across the Indo-Pacific region to discuss topics such as space policy, scientific research, and space entrepreneurship. In order for the space industry to thrive in India, it is important for the government to create an enabling environment.

It is important for the government to create an enabling environment for the space industry to flourish, as well as facilitate better collaborations between India and other countries. The private sector and commercial industry also require a supportive environment to enable business collaborations and ease of doing business. The government should work to reduce the time required for processes related to the space industry, and encourage collaboration among different states and between the state and national governments. The

efforts of certain states in establishing space parks have been particularly noteworthy in fostering technological developments in the space sector. The role of space start-ups is also crucial in driving advanced technological developments and collaborations in the country.

The Indian Space industry is expected to reach a value of $13 billion by 2025, as the sector continues to grow and attract talent from ISRO and other organizations. The liberalization of the space sector has been crucial in attracting attention to satellite communication and meeting the needs of various industries, including the military and telecommunications sector. India's low-cost launch technology and skilled engineers are valuable assets for both Indian and US companies in the global market. As the space industry continues to advance, it is important for India to foster collaboration and cooperation with other countries, such as the US, to maximize its potential and achieve technological and economic success.

The private sector in India has been encouraged by AtmaNirbhar Bharat and "Make-in-India" initiatives to engage in defence sector manufacturing. It is important for the Government of India

to understand the level of funding and investments needed by the private space sector to sustain this manufacturing in the future. To ensure long-term success, India should adopt a program-based approach with a clear roadmap for the next 15 years, including details on areas to invest in, sources of funding, and technologies to be exported. This will provide clarity and direction for the private sector in the defence manufacturing industry.

International Collaborations

ISRO has consistently followed the principle of collaboration in its launches, including those for the PSLV, GSLV, and the most recent LVM-III. Collaboration has been a critical factor in the successful launch of these satellites. The first remote sensing satellite, "Aryabhatta," was launched from Russia, while the first communication satellite, along with Ariane communication and payloads, was launched by Ariane.

Since the early 2000s, Indian satellites have been powered by indigenously developed cryogenic engines, which were successfully developed by 2014. Later, India launched satellites using the 7-stage cryogenic model provided by Black Kosmos, Russia, which also enabled India to focus on Gaganyaan Missions and the LVM-3 Launcher. This collaboration was instrumental in the development of indigenous technologies for the space sector.

India & World: International Collaborations in Global Space Industry

Currently, India has signed more than 250 MoUs with 60 countries around the world. The Gaganyaan Programme is a pan-India programme, not limited to the boundaries of ISRO. India has good collaborations with Russia and CNES in terms of astronaut training, and good ties with NASA and Australia in terms of ground stations. Therefore, international collaboration is crucial for the success of the Gaganyaan Programme.

The European Space Agency (ESA) supports European and international industries as a single entity and values international collaboration. ESA looks forward to building collaborations with India in the future. In terms of collaboration between India and Australia, Australian companies have advanced significantly in using space technology for agriculture and water management.

India's demand in the agricultural sector could drive collaborations between the two countries. Besides space, there are other significant areas for focus on the ground with an inclination towards critical minerals. One significant technology in Australia is known as "Rare-Earth-Metal Technology," which is focused on rare-earth manufacturing. There is an interest in collaborating with India through joint ventures within legal parameters.

India and France have a long history of collaboration in the space sector, with cordial relations helping to strengthen this partnership over the years. Earlier this year, an MoU was signed between ISRO and the Australian Space Agency (ASA), which has led to conversations

in space agencies throughout Australia and disrupted the military, navy, and aerospace sectors.

In addition to its collaboration with India, France has also established partnerships with other countries in order to advance its space capabilities and achieve common goals. International collaboration is an important aspect of the space industry, as it allows different countries to share resources, expertise, and technology in order to achieve common goals and advance the field as a whole.

Protecting Space capabilities and Cyber Security Framework

Space capabilities and cyber security are both important areas that require protection. In the case of space capabilities, this can include protecting satellite systems, ground infrastructure, and personnel. One way to protect space capabilities is through the use of secure communication protocols, physical security measures, and cybersecurity measures.

In terms of cyber security, it is important to have a robust framework in place to protect against threats such as hacking, malware, and phishing attacks. This can include measures such as strong passwords, network security, and regular updates and patches.

It is also important to educate personnel on cyber security best practices, including how to identify and report potential threats. Overall, protecting space capabilities and ensuring cyber security are crucial for the success and reliability of space-based systems and operations.

Space assets are critical for a variety of purposes, including communication, navigation, earth observation, and military operations. As such, it is important to protect these assets from interference or attack. A cyber security framework can help to ensure the integrity and security of space-based systems and prevent unauthorized access or manipulation. This can include measures such as secure

coding practices, regular software updates and patches, and robust authentication and access controls.

Additionally, it is important to establish protocols for responding to cyber threats and incidents, and to collaborate with international partners to address common challenges and threats in the space domain. Protecting space capabilities is crucial for maintaining the functionality and reliability of these systems, as well as for ensuring the security and stability of the broader global community.

The "Hack a Sat" competition organized by the US Air Force and US Department of Defense's Defense Digital Service showed the importance of protecting space-based assets and the need for a cyber security framework in the global space sector. The competition, which allowed hackers to try and compromise controlled satellite systems, demonstrated the vulnerabilities of space assets and the potential consequences of a cyber attack in this domain.

With the increasing reliance on satellites for a variety of military, civilian, and commercial purposes, it is important to ensure that these assets are protected from cyber threats. This includes not only the physical security of the satellites themselves, but also the cyber security of the ground systems and networks that support their operations. Developing a robust cyber security framework for the space sector will help to ensure the integrity and reliability of these critical systems and protect against potential threats.

The tensions between Russia and Ukraine also underscore the importance of protecting space assets, as conflicts in this region have the potential to disrupt satellite communications and other space-based services. A robust cyber security framework is necessary to protect space assets and ensure the continued operation of these vital systems.

The coding language of the software is irrelevant; even the slightest change in the list of instructions of the code can bring a huge impact on the functionality of the satellite systems.

Space is a critical component of Information Infrastructure (IT); there is a cyber risk associated with satellites predominantly. However, emphasis should be placed on the security of space assets or space infrastructure due to the vulnerability of the space ecosystem.

Space technologies are slowly gearing towards changes in the conventional system of data processing. The entire space system relies on the system of data processing, therefore there is an increased level of risk associated with it as well.

Building a cyber security infrastructure framework is not an easy task; firstly, the

A cyber security system in general requires a high level of investment, hence, an effective approach, with international best practices, must be built with the help of the government & industry, legal experts & academia in totality.

different components of satellites; like transponders, sensors & other critical infrastructure, follow a different kind of software and every software requires a different kind of security system. Secondly, there is a lack of testing for the infrastructure. This makes the work of building a cyber security framework a challenging task.

Building a secure cyber security framework from the initial stage is a critical step to secure the space infrastructure.

Furthermore, the State Government & Defense Establishments; should take an active interest in auditing & vetting the infrastructure of the satellites built for controlling the satellites launched by private space companies. The resilience of Space assets is of the highest importance. The Government & private space industry needs to ensure cyber security for emerging LEO constellations & associated commercial participants.

In terms of investments in the cyber security framework, the expectation of the industry is to have a low-cost affordable cybersecurity system. However, a cyber security system in general requires a high level of investment. An effective approach, with international best practices, must be built with the help of the government & industry, legal experts & academia in totality.

Talking to Machines - Satellites for IoT, Drone and Autonomous vehicles

Satellites can play a crucial role in enabling Internet of Things (IoT), drone, and autonomous vehicle communication and operations. IoT sensors often rely on satellite communication to transmit data collected from remote locations where terrestrial communication is not available. For example, satellite communication can be used to connect sensors in remote oil and gas fields, agricultural fields, and mines to a central network.

Drones also rely on satellite communication to maintain a connection with a ground control station and transmit data while flying beyond the range of terrestrial communication. Autonomous vehicles, such as self-driving cars and ships, can use satellite communication to receive updates on traffic conditions and other important information, as well as to transmit data about their own operations.

Satellite communication plays an essential role in providing beyond-line-of-sight communications to both humans and machines in non-urban settings such as mining, agriculture, industry, and national security. IoT sensors, in particular, are prevalent and provide significant value in these sectors.

Terrestrial networks do not provide broad coverage and the reach of fibre optic networks in the remote corners of the country still remains questionable. In such a scenario, only satellites can meet the communication requirements of remote

and rural habitats. Furthermore, the LEO constellations with their low latency capacity, can provide the next generation connectivity and deliver the needs of unreached sections of the masses.

The importance of evolving IoT connectivity and technology requirements and their perceived applications in the field of agriculture, transportation, logistics, and passenger vehicles is massive. The use cases and applications of drones in various fields, challenges with the existing connectivity solutions and the innovative satellite applications/technologies poised to ensure desired connectivity solutions for safe operations of UAV/Drones are important aspects to be considered. Hybrid satellite-terrestrial connectivity solutions (i.e., 5G and satcom) for drones including new-generation radar surveillance technologies can help provide a safe and affordable drone operation. Robust drone models powered by solar energy with multiple transceivers on board are going to augment the drone markets in the near future.

There is a huge need for the use of GPS and radar sensors to understand the environments of UAV operations for real-time navigation and manoeuvring of the systems. Satellite technology helps understand the operational environment better. Similarly, the sensors from multiple robot systems are useful to collect data in the fields of agriculture and mining. The data from these remote locations can be transported by means of satellites.

Drones' market in India is converging and is estimated to be around USD 45 billion. Drones are poised for extensive use in collecting precision data in the agriculture sector for efficient crop production, weather data, and oil and gas sectors.

The role of drones and their emerging market potential in the Indian context for monitoring purposes beyond visual ranges is of huge significance. Drones' market in India is converging and is estimated to be around USD 45 billion. Drones are poised for extensive use in collecting precision data in the agriculture sector for efficient crop production, weather data, and oil and gas sectors. Cellular technology is useful for Line of Sight (LOC) communication whereas satellite connectivity is crucial for Beyond line of Sight [BLoS] communication. Thus, satellites will play complementary roles to terrestrial technology.

Similarly, the satellite is going to extend connectivity options to provide IoT services in remote and rural areas complementing the mobile and fibre optic connectivity options. Satellite-based IoT and the integration of robots will provide an option for the precision mapping of the operational environment.

Growth and Diversity of Satcom

Different types of satellite networks, including geostationary (GEO), medium Earth orbit (MEO), and low Earth orbit (LEO) satellites, all have a critical role to play in providing satellite communication (SatCom) services. Each type of satellite network has its own strengths and limitations, and the best solution for a given application will depend on the specific requirements and needs.

GEO satellites orbit the Earth at a fixed distance and provide coverage to a large geographic area. They are typically used for long-distance communication and are well-suited for applications such as television and radio broadcasting, as well as for providing internet access to remote areas.

MEO and LEO satellite networks, on the other hand, operate at a lower altitude and provide coverage to a smaller area. They are often used for applications that require higher data rates and lower latency, such as satellite-based mobile phone networks and satellite internet.

In order to reap the full potential of SatCom and achieve higher flexibility and throughput, reforms are needed to address the connectivity needs of multi-orbit systems. This could involve regulatory changes, infrastructure improvements, and other measures to ensure that SatCom systems can operate effectively and efficiently across different orbits and satellite networks.

Satellite technology is well-positioned to play a key role in providing connectivity to underserved areas and GEO/MEO/LEO HTS promises to provide efficient broadband services to key industry verticals and remote areas.

Satellites are used to provide broadband connectivity on land, in the air (in-flight), and at sea. New technologies have enabled the use of smaller and more

efficient satellite gateways, which can help to reduce costs and improve the performance of satellite communication systems.

It is also true that a significant portion of the capacity, nearly 95% of MEO/LEO constellations capacity remains unused in order to provide secure links through sustainable GEO/LEO combinations. This can help to ensure that satellite communication systems are able to operate effectively and efficiently, while also maintaining the necessary level of security.

In order to reap the full potential of SatCom, and achieve higher flexibility and throughput, reforms are needed viz., regulatory changes, infrastructure improvements, and other measures to ensure that SatCom systems can operate effectively and efficiently across different orbits and satellite networks.

Satellite connectivity has immense societal value to connect the unserved and underserved population with high-speed internet connectivity access. The digital divide can be narrowed down only by optimising satellite usage. GEO satellites can provide coverage to only 1/3rd of the earth's surface and now many satellites in polar and inclined orbits ensure better broadband connectivity.

VSAT can enable the required services from the satellite, hubs/gateways for interconnection and Satcom system integration and operations. SatCom, especially in the VSAT markets, has huge potential. The govt has relaxed the levies and simplified the processes for the VSAT operators in India, this would further improve the country's digital connectivity architecture.

Satellites in Mobility

Satellites can play a crucial role in enabling mobility, both in terms of transportation and communication. In the transportation sector, satellites can be used to support a variety of applications, such as:

Autonomous vehicles: Satellites can provide communication and navigation for autonomous vehicles, such as self-driving cars and ships.

Satellite communication can enable real-time updates on traffic conditions and other important information, as well as transmit data about the vehicle's own operations.

Air transportation: Satellites are used to provide in-flight entertainment and connectivity, as well as support air traffic control and other aviation operations.

Maritime transportation: Satellites are used to support ship-to-shore communication and navigation, as well as other maritime operations.

In the communication sector, satellites can be used to provide connectivity for mobile devices and systems, enabling communication and data exchange over long distances. This can be particularly useful in remote and underserved areas where terrestrial options are not available or reliable.

There is a significant increase in demand and applications for connectivity on the move at air, sea and land that can best be served by satellites including direct to the handset. The regulatory and technology issues around these will determine the successful capturing of these markets.

Globally, many terrestrial-satellite networks with the help of next-generation satellites are providing seamless connectivity to billions of people. Multiple components comprising of software-defined satellites, multi-orbit MEO/LEO networks, software-defined networks and end-to-end 5G NTN/ standards are offering unparalleled connectivity experiences to consumers.

The WRC-23, is scheduled to take place in 2023 and is expected to address the aeronautical and maritime electronic SIM (eSIM) requirements, particularly in the Ka bands.

The next WRC, WRC-23, is scheduled to take place in 2023 and is expected to address the aeronautical and maritime electronic SIM (eSIM) requirements, particularly in the Ka bands. eSIMs are embedded SIM cards that allow devices to connect to different wireless networks without the need for a physical SIM card. They are widely used in the aviation and maritime industries to provide connectivity for devices such as tablets and laptops.

After WRC-23, it may take another decade or so to harmonize the framework for eSIM operation in a safe and effective manner. This will involve regulatory changes, technical standards development, and other measures to ensure that eSIMs can operate effectively and efficiently in the aviation and maritime sectors.

India has already adopted in-flight and maritime policies and is in the process of drafting a new space policy. The National Frequency Allocation Plan (NFAP) has also been published by the government, which outlines the allocation of radio frequency spectrum for different uses in the country. These positive developments

will provide a way forward for the smooth implementation of satellite connectivity for moving applications in the future. The adoption of policies and the development of regulatory frameworks will help to create a stable and predictable environment for the development and deployment of satellite-based applications in the aviation and maritime sectors, as well as other areas.

Satellite in the mobility market is estimated around $300 billion market. The market for terrestrial and wireless mobility is growing exponentially. HTS has the game-changing potential for the SatCom industry in terms of optimized solutions and the HTS technology is poised for 1 Tbps+. The GEO/NGSO MEO/LEO multi-orbit constellations offer innovative solutions to provide multi-transport connections for mobility objects (Aero, Maritime, Land).

Satellite communication service providers are offering reliable data connectivity solutions and also innovative digital solutions using satellite communication services. However, the restrictions to operate gateways cost the industry heavily. There are many Market opportunities for providing wi-fi IFC services, and updating the Indian fleet will cost 2-3 crores per aircraft.

The software-defined satellites will immensely help to meet the increasing needs of the mobility market efficiently. There are around 17000 maritime vessels and the majority of them are not connected whereas the demand for data use has grown three-fold. Satellite connectivity for defence fleets is also growing.

The low-altitude constellations with its low latency characteristics offer opportunities for mobility applications in maritime, aero, rail, connected cars, and passenger vehicles. The demand for IFC services from airlines is growing. The mobility sector is a unique segment with huge market potential and post-pandemic. Similarly, there are around 17000 maritime vessels and the majority of them are not connected whereas the demand for data use has grown three-fold. Satellite connectivity for defence fleet is also growing. The software-defined satellites will immensely help to meet the increasing needs of the mobility market efficiently.

Satellites in the 5G Era & Beyond

A more holistic and standardised approach is required towards a fully integrated solution combining satellite and terrestrial IMT integrated networks, whereby the air interface can be common for terrestrial wireless (B/S to UEs & vice versa), earth-to-space, space to earth, and inter-satellite links.

Integration and collaboration of satellite and terrestrial stakeholders will be crucial in overcoming the current challenges of terrestrial 5G deployment. By working together, these stakeholders can help to ensure that the necessary infrastructure and capabilities are in place to support the growth of 5G networks. It is also true that traditional satellite systems can be expensive to build and launch, which can be a barrier to their widespread adoption. As an alternative, smaller and more affordable microsatellites, which are typically less than 50 kg in mass, can be used to provide internet broadband connectivity. These microsatellites are often more reliable and can be built and launched more quickly than traditional satellites. Software-defined microsatellites, in particular, can offer a number of benefits. They can be built in a relatively short period of time, often within a year or so, and can remain in orbit for several years. They are also highly flexible and can be easily reconfigured to meet changing needs or requirements.

The media industry has a significant opportunity for transformation due to the innovations happening in the market. The evolving 3GPP standards and Qualcomm 5G chipsets can help to improve speed, coverage, and capacity, making it possible to reach areas that

were previously difficult or impossible to serve with 3G and 4G networks.

In the Indian context, there is a significant need for reliable broadband connectivity in around 250,000 villages in the country. Satellite backhaul, particularly via geostationary (GEO) satellite constellations, can help to provide the necessary capacity to meet this demand. Satellite backhaul refers to the use of satellites to transmit data and voice signals between the network and the core infrastructure, enabling communication and connectivity in remote and underserved areas.

Overall, the use of satellites in conjunction with terrestrial networks

can help to bring the benefits of reliable broadband connectivity to more people and businesses in India and around the world.

A balanced approach to Spectrum Allocation

Increased demand for connectivity makes efficient spectrum use critical in this day and age of easy communication The upcoming terrestrial (5G/IMT, Wi-Fi 6/6E etc.) and non-terrestrial technologies (HTS/VHTS/UHTS Satellites in LEO, MEO and GEO orbits) have intensified the need to access spectrum in different bands. This calls for well-planned strategic decisions in identifying the spectrum for these diverse technology options and allocation methodologies.

Harmonized spectrum allocation is critical. The reforms taking place in India in the telecommunication sectors, especially the Draft Telecom Bill 2022, are forward-looking. The positive aspects of the bill seek to promote and supplement Atmanirbhar Bharat and Antyodaya Mission of the Government through the proposed Telecommunication Development Fund. The Draft Bill will help to overcome present hurdles currently faced by the spectrum user on account of judicial interventions.

The proposed reforms will help the growth of the telecom and satellite industries. Space ecosystem and a growing number of users, technologies and applications are dependent on the space ecosystem. Light touch regulations are the need of the hour to remove the barriers and ensure the growth of the economy.

It is important that the draft bill addresses the assigning criteria of space spectrum in India with the aim of capacity building for the new economy in mind. Auctions can be a useful tool for allocating resources, but they may not always be the best method, particularly when it comes to critical infrastructure such as satellite communication systems.

In many countries, the assignment of space spectrum is based on a transparent administrative process rather than auctions. This approach can help to ensure that spectrum is allocated in a fair and efficient manner, while also taking into account the needs of different stakeholders and the broader public interest.

Telecommunication is a key enabler for the government, society, and economy of a country, and it is important that any draft bill for the allocation of space spectrum takes this into account. The bill should also consider national security considerations and should not violate the Supreme Court of India's observation on the 2G spectrum allocation. By ensuring that these key considerations are addressed, the draft bill can help to support the development of a robust and reliable satellite communication infrastructure in India.

Emerging Multimedia Broadcasting (BSS) Solutions

Satellites have been the backbone of TV channel distribution worldwide, and much more significantly for the Indian TV and media industry. The changing landscape drives the satellite operator to offer new media solutions

Traditional Pay TV services lead the way in revenue generation and content accessibility making up 63% of market penetration. India is often considered the backbone of the Pay TV industry due to its affordability and availability across the different terrains within the country. In smaller markets, digitization is driving the cable market, which is expected to maintain its lead over the next 10 years. The pay-TV market is expected to continue to grow at a rate of over 2.5% across all services particularly in India. Now, broadcasters are investing in higher-resolution formats as viewers' desire for content variety and quality grows. The emergence of new distribution models like Over-The-Top (OTT) has put some pressure on the linear distribution market due to perks like mobile-first viewing and a seemingly endless variety of content. Though OTT garners a great deal of interest, the market is experiencing oversaturation. Satellite continues to be the most reliable and affordable option for distributing media. Currently, in India, there are around 898 TV channels.

In order to meet the new challenges of video content choice, combining DTH and OTT services is offered to serve changing viewing habits. satellite technology continues to play a key role in delivering video content to end-users

over a vast geographical area. Emerging markets, such as India, can offer new business opportunities as consumers look for linear and non-linear content and channels in their local languages. 5G constraints will remain and therefore backhaul satellite will be critical for last-mile connectivity to target the consumers based on content delivery.

To develop a vibrant start-up ecosystem for space and satellite applications, connections between industry and academia need to be facilitated for innovations in space applications. Satellites are critical for real-time content delivery and the key technology with the required capability and flexibility available for broadcasting sectors. Notwithstanding the delivery technology capabilities, the latest technological trends in the creative content sector are varied and dispersed and accordingly, user needs to revolve around media content creation, user experiences and new forms of content for different platforms adapting to consumer needs. Satellite technology ensures distribution of the content efficiently to the masses.

Corpus-Service Delivery Platform collaborates with multiple content companies and telecommunication media and devices companies for achieving excellence in the field of Hybrid TV, IPTV and OTT across verticals and also on e-commerce/telemedicine. The vision is to provide multiple digital solutions and address the last-mile connectivity constraints. They support and fund start-ups and local entrepreneurs in the fields.

Each technology has its own advantages and therefore no technology including OTT can replace satellite TV broadcasting; OTT has its inherent inefficiency in linear content delivery.

Though the TV/content distribution market is fragmented, there are still good opportunities for growth. OTT is not regulated and a plethora of linear content on OTT platforms is available across the market. Despite OTT domination, linear TV for news/live broadcasts will continue to thrive for the next 5 years.

Each technology has its own advantages and therefore no technology including OTT can replace satellite TV broadcasting; OTT has its inherent inefficiency in linear content delivery. Content transmission in real-time is only possible in satellite broadcasting. Similarly, wi-fi can never meet the interests and satisfaction of consumers and linear TV will continue to remain an option for consumers. Covid helped digital media especially OTT platforms to thrive but ultimately linear TV is expected to emerge as a favourite for consumers in two years.

Satellites in achieving Universal Broadband

With an intent to connect Indian citizens across the 650000 villages, the BBNL and USOF focus on fibre alone deprives generations of these rural citizens from the benefits of connectivity compared to their urban counterparts. Satellites can be deployed to achieve connectivity in a time bound manner and should be a primary option for all rural and remote connectivity requirements.

Satellite communication offers services to both government and enterprise customers and also in rural and remote areas of the country. Broadband penetration is still skewed in the country and only satellite service can complement the requirement. Satellite-based links are the preferred choice for remote locations such as oil & Gas offshore sites and the KA-band capacity is to be augmented in a couple of years.

BharatNet project implemented by BBNL with approximately 6.5 lakh km fibre to be laid across the country for connecting approx. 2.6 lakh Gram Panchayats to provide high-speed broadband to rural people and institutions. The broadband new strategy involved an optimal mix of fibre, radio and satellite.

VSAT connectivity is considered for remote and hilly terrains using ISRO's High Throughput Satellites. Last-mile connectivity to access wi-fi/broadband

in remote and rural locations remains difficult and still, a lot of villages remain unconnected and at least 20% of villages are inaccessible. Standardization and lightweight equipment are desired for remote areas and disaster sites.

The importance of telemedicine, its delivery and its role during the pandemic has been extremely critical. It is a 3.12 trillion economy and the 3rd largest market. ISRO was the pioneer to start telemedicine in India way back in 2001 and laid the foundation for the telemedicine concept in India. In the past few years, ISRO's telemedicine network has come a long way and has expanded to connect many remote and rural hospitals. 60% of telemedicine delivery depends on space-based technology. To make telemedicine viable to rural and remote populations of the country, feedback must be taken from delivery services on the acceptability and to understand the diffusion. The overall strategy should be to explore the feasibility of locally developed technologies.

In the past few years, ISRO's telemedicine network has come a long way and has expanded to connect many remote and rural hospitals. 60% of telemedicine delivery depends on space-based technology.

The national internet policy was adopted in 1998, wherein DSL/Wireless/satellite helped to deliver broadband internet. In 2000, ISP guidelines to establish satellite gateways were framed and national broadband policy was established in 2004. Many policy constraints were observed. For instance, consumers were dissatisfied with policy constraints of levying cost per Mbps speed leading to high cost. There need to be outcome-based solutions, quality of service, a balanced approach in media use, and supply vs demand are some of the factors to be considered to streamline the sector.

Downstream: Ground network in Hybrid Space Architecture

Space and ground systems need to work hand in hand, and both constitute essential parts that need to be addressed when striving for optimized efficiency. The pace of innovation has accelerated and involves all the main components of the ground segment ecosystem including the baseband/modems, antennas, radiofrequency (RF) equipment, and the software layer to support satellite and ground operations. The trends extend to ground station and data centre integration for insights that leverage AI and cloud innovations.

Under a hybrid network data transmission can be initiated through a GEO network orbit and then jump onto a MEO/LEO network and this network provides secure, assured, and low-latency data communications anywhere on and off Earth. The evolving LEO constellations using S/X band frequencies from O3B (MEO), OneWeb, Spacelink etc. and orbital systems are significant in the evolving market.

LEO constellations in KA and Q/V bands as well as HTS/VHTS market is emerging prominently and scientific and government missions are interested in LEO constellations. Satellite communication is critical in early warning, climate change, natural disasters and UAVs for tracking.

Ground segment is evolving to handle the huge gigabyte markets and the focus is on technology. The large constellation of satellites, software defining of satellites and equipment hardware, and cloud-based architecture help the delivery of efficient and reliable satellite-based connectivity solutions to enterprises worldwide.

Pushing the boundaries on Satellite Remote Sensing

Technology and connectivity play a pivotal role in disaster management, from early warning and mitigation to response and recovery. ISRO provides relevant information in the interactive geospatial domain through various geoportals, such as Bhuvan and the Meteorological & Oceanographic Satellite Data Archival Centre (MOSDAC), to help administrators better understand the impact of disasters and make informed decisions.

Remote sensing is a key technology that can be used to gain knowledge about disasters and their impacts. Remote sensing involves the use of satellite or aircraft-based sensors to collect data about the Earth's surface and atmosphere. This data can be used to create maps, monitor changes over time, and support a variety of applications, including disaster management.

The use of a reliable Decision Support System (DSS) is also very important during emergency situations, as it can help to coordinate and optimize the response and recovery efforts of different organizations and agencies. To be effective, DSSs should be able to incorporate the most advanced technologies, such as artificial intelligence and machine learning, to support early warning, preparedness, and response.

The use of multiple sensors and multi-source remote sensing data fusion

There is a large market and scope for the development of new methods and algorithms for fusing multi-spectral data from different sources, such as synthetic aperture radar, optical images, and LiDAR (Light Detection and Ranging).

techniques can be very helpful in a variety of fields, including satellite earth observation, computer vision, medical image processing, and defense and security.

Multi-source remote sensing data fusion refers to the process of combining data from multiple sensors or sources to create a more comprehensive and accurate view of the Earth's surface and atmosphere. This can be useful in a variety of applications, such as mapping, monitoring changes over time, and supporting decision-making.

There is a large market and scope for the development of new methods and algorithms for fusing multi-spectral data from different sources, such as synthetic aperture radar, optical images, and LiDAR (Light Detection and Ranging). These techniques can help to improve the accuracy and usefulness of remote sensing data, enabling a wide range of applications in fields such as disaster management, agriculture, and environmental monitoring.

In the military context, the ability to monitor the moves of adversaries can be critical to maintaining an advantage and ensuring the safety and security of personnel and assets. Satellite communication and other technologies can be used to support real-time situational awareness and enable rapid response to changing situations.

Leveraging Data from Space

The earth's value chain is inextricably linked and extended to space. India liberalised the geospatial policy in 2021. This will allow private companies and individuals to contribute in a big way to the disaster recovery and management ecosystem. The new policy allows private players to conduct mapping and share geospatial data without prior approval from the government. While India currently relies on foreign resources for mapping, the move aims to realise the Narendra Modi government's goal of an Atmanirbhar Bharat and the vision of a $5 trillion economy.

Open data policies result in generating a huge scope for Big Data from space which is available and needs to be used effectively from a domestic and international perspective. Data Richness and open big data could boost innovation and global cooperation in a more meaningful way with better decision-making ability.

Predictive Analytics can help in cost saving for companies and help reduce deferred maintenance costs. Space information can help corporations to decide whether they need to expand or reduce their Capital Expenditures or funds. The data

GOI liberalized Geospatial Policy in 2021, a watershed movement and enables the Pvt sector to play a great role with satellite imagery to support government projects in the most critical areas of rural and urban infrastructure, utilities and logistics.

obtained from EO satellites are utilized for various applications on the ground including agriculture, forestry, mining, water management, and rural and urban development etc. The data is processed by ISRO and can be obtained by government or private agencies. Some data is made available free of cost for any user.

Border intelligence agencies do make significant use of satellite data for a variety of purposes, such as monitoring the movement of people and goods across national borders, detecting illegal activities, and supporting other security and intelligence-gathering operations. A relatively small percentage of satellite data is used by academicians and researchers, though again this can vary depending on the specific data sources and research areas involved. However, it is worth noting that the use of satellite data in academia is likely to increase in the future as more data becomes available and new research opportunities emerge.

MNREGA geotagging solution can help streamline the implementation of govt schemes, monitor them efficiently, and help plan future developmental programmes. Gati Shakti entails the geospatial mapping of everything where different layers of maps talk to each other, leading to integrated planning with better optimization of time and cost. The introduction of Geo-Spatial technology in governance can improve the ease of doing business and reduce compliance burdens. Advances in mapping technologies are set to become the base for innovation and direct contribution to Projects like Gati Shakti, Smart Cities, and Disaster Management policy.

GOI liberalized Geospatial Policy in 2021, a watershed movement and enables the Pvt sector to play a great role with satellite imagery to support government projects in the most critical areas of rural and urban infrastructure, utilities and logistics.

Human Space flights and deep space opportunities

India will be able to demonstrate its maiden human space flight capability in a year or two. The objective of this space program is to demonstrate indigenous capability to undertake human space mission to LEO.

Human Space Flight is not an ISRO program, it is a pan-India initiative which will infuse the entire ecosystem. Private sector and academia have a major role in it. Additionally, an initiative like this will not be possible without strong collaboration with international partners Russia, USA and EU. There is expected 37% CAGR in human spaceflight market from 2021-2030.

The Gaganyaan programme would lay the foundation for a sustained and affordable human and robotic program in the long run. This will also create an opportunity for broader industry-academia participation and partnership in taking up developmental and R&D activities.

This will leverage India's position strategically in the global arena and be a potent international policy tool,

The reliability of human space flight at 99.7% is considered highly reliable. ISRO places a high emphasis on ensuring the quality, reliability, and safety of its missions, particularly in terms of thermal stability and structural resiliency.

generating ample scope for employment generation and human resource development in advanced science and R&D activities.

The overall programme coordination, systems engineering and implementation will be carried out by ISRO. The major new technologies required for the Gaganyaan programme are – human-rated launch vehicles, crew escape systems, habitable orbital modules, life support system and crew selection, and training and associated crew management activities with a human-rating certification aka man-rating or crew-rating certification of a spacecraft or launch vehicle as capable of safely transporting humans

Reliability of human space flight 99.7% is a highly reliable number. Quality reliability and safety are very important in terms of thermal stability and structure resiliency. The Unknown Unknowns are always there and cannot be avoided, but an absolutely no margin of error mission is what ISRO aims for.

February 2023 will see the initiation of unmanned missions with 2024 set as the target to initiate the first human spaceflight.

ISRO is developing Next-Gen Launch Vehicle (NGLV) to replace operational systems like PSLV. In NGLV, ISRO is looking at a cost-efficient, three-stage to-orbit, reusable heavy-lift vehicle with a payload capability of ten tonnes to Geostationary Transfer Orbit (GTO). This would allow for bulk manufacturing, modularity in systems, sub-systems and stages and minimal turnaround time.

A private space station 'Orbital Reef' by Blue Origin, a Jeff Bezos company is all set to change the game for human spaceflight missions. It is a project involving Blue Origin, Sierra Space, Boeing and a number of other companies and has recently passed its system definition review (SDR) with NASA. Blue Origin has plans for a moon lander known as "Blue Moon set to be ready by 2024.

The need of the hour is to develop positioning technologies to support new operations in space. Synthetic handling of rich data is another aspect that needs to be leveraged. India has the capability to design any kind of LV, from small sats to 600T of the huge rocket. The country is moving from component manufacturing to system integrators and the industry would look for a lot of support from govt in R&D and the semiconductor market.

Inspiring and Skilling for tomorrow's workforce

Skill and manpower requirement is highly essential for a truly capacity-building ecosystem in the country. Human resources for space R&D are essential to manage and develop skills to keep at par with technology developments.

There is a gap between academic research and Industry application for meeting the goals of Space Industry 4.0. Govt agencies and Industry must create sufficient avenues for academic institutions to focus on fundamental research.

ISRO has been encouraging research activities in Academia where institutions are engaged with ISRO centres for carrying out R&D activities in the ISRO focussed areas. ISRO has integrated with 120 institutes for both proactive and reactive research. Every year 250 Proposals are given to the academia to contribute and engage in carrying out joint research.

ISRO has also established Space tech incubation cell [STIC] at various premier engineering institutions for carrying out Joint research. Space Technology Cells (STC) are instituted at IITs' and IISc for advanced research with the respective institution. The focus is primarily on entrepreneurial-oriented projects for start-ups and Regional Academia Centres in the different regions encourage collaborative projects in space. In addition, various centre of excellences, Innovation centres and space science centres are also instituted to promote research in space.

ISRO has signed an MoU with the Ministry of Skill Development to enhance the skills of working technicians at all ISRO centres in the niche areas. Under the initiative, the Skill development council with ISRO has trained 230 people this year and plans to do so every year.

Space Sector Benchmarking is important in India and collaboration and cooperation, and not competition, is the way forward. It is learned that 24% of intellectuals' minds are in India and 60% of the group is below 30 years of age. The country has all the resources necessary just needs to channelize them well.

Atal Innovation Mission is establishing Atal Tinkering Labs in various schools across India to create workspaces where young minds can learn innovation skills, sculpt ideas through hands-on activities. ISRO urges the industry and Ministries to adopt ATLs and foster inventiveness among students in a more aggressive manner.

There is a need to focus on capacity building and skill development in order to achieve a higher absorption rate. Global VSAT Forum has been involved in imparting training courses and certifications based on global standards for different verticals such as satellite communications, advanced satellite systems engineering, operation & installation and maintenance of VSAT, marine, and mobile/SNG satellite terminals, in addition to general and specialized satcom theory.

There is hands-on skills testing, supplementary instructor-led training, and mentored classes supported by GVF Examiners and Regional Training Centers located in every major region of the world.

Spacecraft Design, Production and Mission Success

Within the domain of satellite manufacturing; the advent of technological advancements allows a niche of relaxed technical standards & reduced turn-around time. The spectrum domain is expected to achieve an efficient usage stage; particularly for small & cube satellites.

The downstream segment of the satellite industry is expected to witness increased engagement with earth observation, IoT, broadband, mobility-associated special applications, and in-flight & maritime applications.

The government of India has developed space reforms which led to the creation of IN-SPACe, an autonomous regulatory entity in India. The main focus of IN-SPACe is to provide authorizations for Non-Governmental Entities. IN-SPACe is also required to act as a single window mandate to all non-governmental entities for all the space activities in the country.

According to the Department of Space, during the registration process, certain aspects (conjunction assessment, debris mitigation measures, trackability & manoeuvrability, interference analysis etc) would be considered pre-registration of the Indian Space Object. Operating Licenses & other clearances for ground operations are required from Govt Departments such as WPC, NOCC, MHA, DGFT, MIB; depending on case-by-case analysis for user & ground segment.

IN-SPACe enables the usage of ISRO's test facilities via non-governmental entities. It has envisioned establishing test facilities; which would be significant for the scientific purpose of design, testing, assembly, and integration of small sat; additionally open to using by non-governmental entities.

In 2021, the number of satellites to be designed & built was 68,000; in 2022 the number has increased to 250,000. The current space ecosystem is unable to meet future needs; due to unpredictable timelines & high costs for designing satellites, extensive resources spent on non-mission engineering, and high capital & operating expenses.

Space ecosystem lacks an open software platform; which would enable grass-root level collaboration, app development, and ecosystem development for space. There is an open system software on cloud, which has the ability to virtually build satellites in cloud. The software will help in system engineering; with the usage of software component modules & modular tools. It will also reduce the cost of building satellites; by three times as well as reduce the time-to-orbit.

By providing open software for space, immediate developments would take place in collaboration, creating an ecosystem, and providing hardware and API interfaces for developers & customers for a faster turn-around.

IoT connectivity via satellites is the next big thing. Sputnik-1 was launched decades ago, it was the first artificial satellite under 100 kgs for earth observation. However, very few small satellites were launched after that. Only in the last few years; there has been an increased demand for small sats, cube sats & nanosats. Additionally, small & nanosatellites have a limitation of the focal length. Therefore, the requirements & demands have to be rightly assessed. ensures flexibility in the placement of a satellite in an orbit.

There is also an increased need for intelligent control systems, which would allow flexibility in the placement of satellites in orbit. The rise in the demand for geospatial applications – remote sensing, satellite imagery, navigation & boom in the IoT market, which requires billions of devices to be connected, at all times; further the demand for satellites to power these applications & devices.

The Indian space market faces the issue of connectivity in terrestrial, 5G & 6G; satellites would play a big role in accelerating the growth of IoT use in various industry verticals. creation of an intelligent control system & a number of satellites linked; which would be useful for the design of constellations in future.

In the context of increased space ventures, the responsibility to check space sustainability becomes a critical challenge. Therefore, the satellites must have de-orbiting technologies, to avoid forming space debris. Additionally, IoT connectivity can aid in Space Situational Awareness metrics and can be leveraged for efficient decision-making.

Some of the challenges that hinder the growth of the sector; supply chain management and procurement efficiency and single window policy issues were cited. In India, the space expenditure by the Government hasn't significantly changed over the years. Going by the fact that the Indian space sector has been liberalised & NGPEs have been allowed to participate in end-to-end space activities, Government support in terms of budgetary allocations needs to go up.

There is a need for a single window policy for ease of doing business along with issues with procurement & authorizations. From the policy angle, a missing aspect in the Indian space sector is the process of authorizations and funding links for budding space start-ups. The government of India must step up mentorship and educate the budding space start-ups for the entire process.

Space-ready MEMS, composites and compound semiconductors

One of the catalysts for the new space economy is the introduction of advanced materials, composites and their production methods. The harsh environment of space places stringent demands on materials, composites and compounds from mechanical parts to semiconductors. The ability of space missions to reach the expected lifetime depends on correctly building the survival capability of its various subsystems and the possible failures and abnormal behaviour that might occur. The choice of these foundational elements can be critical for a successful space business.

Space missions need to be very reliable. Today, 99% reliability is acceptable in rockets and is sufficient for people to travel to space which is not enough. Current and future space missions will push the limits of human exploration, taking humans to space like never before and this would require studying and building space-ready materials that are Ideal and most reliable for extreme applications.

Material and component testing is very critical and that makes it very expensive. The example of the Russian Mars 2 probe, consisting of an orbiter and a descent module was sighted during the discussions. While the orbiter sent back data successfully, the descent module didn't work as planned and crashed on the Martian surface. Not only was that

a loss of $160 Million project but also it added to space debris and the issue of space sustainability.

Carbon nano-tube is an ideal material for space, 100 times stronger than steel, radiation resistant, they are very light-weight, the density is one-sixth of that of steel; the thermal conductivity is efficient. It also has efficient water transportation and filtration capacity.

The need for radiation-hardened electronics and components and sensors is important to withstand damage from exposure to radiation and extreme temperatures. There are standards of wafer processing that go through a rigorous testing process to ensure high quality. These quality standards are required for the satellites to sustain a 10-year period.

Many of the Monolithic Microwave Integrated Circuits (MMIC) were designed/ developed and produced at Solid State Physics Laboratory (SSPL) DRDO and Gallium Arsenide Enabling Technology Centre (GAETEC) foundry of DRDO. It is an example of collaborative achievement between two advanced technology departments of Government of India along with the support of industry partners. The use of indigenously designed and developed MMICs is an important step towards Atmanibhar Bharat.

Quality and Assessment are key for space missions and there needs to be an independent agency which qualifies space-ready products and materials.

DRDO has a MEMS foundry which supplies microelectromechanical devices on a contract basis, in prototype to production quantities to the defence sector. MEMS are micro-scale systems (~100 microns) that include both mechanical and electrical devices integrated into a single chip. DRDO handles the R&D for the production of 25-35 MEMS devices.

Quality and Assessment are key for space missions and there needs to be an independent agency that qualifies space-ready products and materials.

India Semiconductor's mission to monitor the semiconductor policy of India will boost the procurement issue and flawlessly import through ToT where the production and scaling are leveraged.

There needs to be an adequate emphasis on skill development with a focus on sustainability. The policies need to incorporate incentives for innovation and R&D in this domain alongside regulatory issues, keeping the sustainability aspects in mind, without restricting the usage of high-end technology. ITAR restrictions are also a hindrance.

IP is critical as space activities are increasingly shifting from being state-owned activities to becoming private and commercial activities with the constant evolution of high technology. The ever-changing geopolitical situation underlines the need for the universal harmonization of industrial and intellectual property laws.

Leverage the usage of AI, IoT and robotics to shorten manufacturing processes in future fabrication facilities, by building responsible timely supply chains. As India strives to become a key 'Semiconductor Nation' adoption of prudent policies, innovative practices by academia, and the industry will not only be the correct waypoints to Industry 4.0 but will also ensure a green future powered by Indian chips.

Evaluating Launcher Options

Reusable LVs drastically lower the costs of launch, in turn lowering the barrier to access to space. It has been assessed that commercial launch costs to the International Stations have been reduced by a factor of 4 over the last 20 years.

For human space missions, there must be extremely high reliability of the LVs that has not degraded after previous missions which requires further development and testing. It has taken many years of adjustments and testing to achieve reliable recovery of the booster stage and recovery of fairings has also proven to be more difficult than expected. Successful reuse of LVs may require improvements in heat shielding and landing engines.

Launch cost has always been the primary constraint in the space business and NGPEs are lofting payloads into space. The other factor is to use the resources of space. The success of Blue Origin's New Shepherd and SpaceX's Falcon 9 is a source of inspiration and India is marching fast in this arena as the development continues.

India in future would need a space station to sustain space transportation. The era is changing and the sats weighing 3-5 tonne has now come down to a mass of fewer than 180 kilos.

The business model is changing from revenue/launch to revenue/LV. Any project in the LV market will take nearly 6-7 years. Space transportation system is seeing a lot of innovation in the spin launch, carbon composite LV, Electric Turbojet engines, new propellant combinations, 3D Print engines etc. However, it is not easy to build a space transportation system.

The multiple launch services market is $12Bn at present and would go on to become $40 Bn by 2030 with a CAGR of 12-15%. LEO launches are dominating the market. 77% of the LEO launches are focused on mega satellite constellations and private investment going into space.

There are multiple projects that are functional with more demand for LEO technologies to benefit the earth.

Pitch right for skyrocketing Start-ups

During the ISC event, space entrepreneurs were given the chance to present their ideas to investors, including those who were on the fence about investing.

The entrepreneurs had the opportunity to showcase their ideas, whether they were related to launch capabilities, satellite systems, communications, remote sensing, data insights, or space sustainability. The event provided a platform for the entrepreneurs to connect with a global network of key decision-makers in the space technology industry, validate their opportunities, and accelerate their businesses. With iDEX and Microsoft as partners, this event marked the beginning of a collaboration that will support and nurture promising space tech startups. Five startups, Astrogate, Blue Sky Analytics, Vellon Space, Delta-V Robotics, and GeneX, had the opportunity to pitch their ideas to industry leaders and investors during the "Pitch Right for Skyrocketing Startups" session where they participated in a mentorship program with senior executives from leading companies. Additionally, Microsoft announced partnerships with 15 space startups through its Founders Hub program, offering them free Azure credits worth up to $150,000.

Microsoft announced partnerships with 15 space start-ups through its Founders Hub program, offering them free Azure credits worth up to $150,000.

Raising awareness: Awarding young talent

SIA-India launched a call for papers initiative as part of India Space Congress 2022, aimed at promoting and inspiring young talent and raising awareness of the potential of the space sector. The initiative received a great response, with over 36 original research papers submitted by students and professionals on a wide range of topics related to space technology. After a rigorous evaluation process, an expert jury panel shortlisted five papers for cash prizes, and the winners were announced. The students who presented their research to professionals engaged with a distinguished audience, and the initiative successfully encouraged and highlighted the potential of the space sector to a new generation of aspiring professionals.

1ST PLACE (SHARED):

Ground Tracking: Parthiban P and K Umadevi, U. R Rao Satellite Centre, ISRO, Bangalore

Airships for Satellite Data Acquisition and Disaster Management: Parthiban P and Thameemunisha M, U. R Rao Satellite Centre, ISRO, Bangalore

2ND PLACE:

Satellite Constellations: Ch Aditya and Parthiban P, Vikram Sarabhai Space Centre, ISRO, Bangalore

3RD PLACE (SHARED):

Solar Sail: Vinay Kumar Reddy Andluri, Shiva Sai Krishna Digamarthi, Dr. Daljeet Singh and Dr. Sumit Kumar, Lovely Professional University

Solar Sail: Karishma Parthipan, Akshaansh Chilakapati, Rohit S Varma and Vm Sreehari, Sastra University

ISC 2022 Key Findings and Suggestion Matrix

Apropos to the ISC-2022 deliberations, a list of challenges and concerns has emerged and has been duly highlighted in the suggestion matrix. The concerned departments have been identified, including the Department of Space (DoS) and the Indian Space Research Organisation (ISRO), the Telecom Regulatory Authority of India (TRAI), the Department of Telecommunications (DoT), the Department for Promotion of Industry and Internal Trade (DPIIT), the Ministry of Statistics and Programme Implementation (MoSPI), the Defense Research and Development Organisation (DRDO), the Ministry of Science and Technology, the Ministry of Electronics and Information Technology (MEiTY), the Ministry of Defense, the Ministry of Information & Technology, the Bureau of Indian Standards (BIS), the Ministry of Commerce and Industry (MoCI), the Software Technology Parks of India (STPI), the Department of Atomic Energy (DAE), the Ministry of Earth Sciences, the Ministry of External Affairs, the Department of Health Research, the National Remote Sensing Centre (NRSC), Antrix Corporation Limited (Antrix), and the Indian National Centre for Ocean Information Services (INCOIS).

We look forward to the support of these stakeholders and to working closely with our member companies towards resolution of challenges and thereby promoting its growth.

Title	Description	Suggestion
Comprehensive Space Act	The current draft policies contain overlapping and unclear rules and functions, making it uncertain who has jurisdiction in the absence of the Space Act. Additionally, the Remote Sensing data policy lacks clear provisions for penalties when violated, and the Madras High Court has noted that the penalties for violations of the National Map Policy were not defined, rendering them unenforceable.	❖ Need for a futuristic Space Act that aligns with current developments and guides future policies, procedures, and mechanisms. ❖ A clear and unambiguous law to address international obligations on domestic players. ❖ Must cover various aspects of India's space goals, definitions of offenses and punishments, barriers of entry for private companies Liability for damages caused in space, etc. ❖ Must allow level playing field for satellite manufacturing, launches, and space-based services with a light-touch regulatory environment. ❖ Consideration of political, economic, business, and military convergence in rule-making for space activities. ❖ Balance between national aspirations, sovereign commitments, private sector ambitions, and end-user requirements in rules. ❖ Law to protect both public and commercial interests.
Long term Vision, Strategy and Technology Roadmap	The space sector is a capital-intensive industry with long development periods, making it crucial to have a long-term vision. To align with the country's needs, the roadmap should consider satellite capacity demand, market sizing for different verticals such as government, enterprise, and consumer businesses. India should aim to be a leader in Space Situational Awareness (SSA) and maintain the sustainability of the space environment. Additionally, the development of independent space surveillance and tracking capabilities is necessary to achieve these goals.	❖ Need for a clear roadmap for the next 25 years by the government policy body. ❖ Preparation of a comprehensive demand assessment report including current and projected future requirements. ❖ A balanced approach to space initiatives, considering both defence and civil needs. ❖ Long-term strategy should focus on space traffic management. ❖ Initiative to collaborate with international entities, particularly in G20 and beyond.

Quantifying the Space Economy	The Indian space economy needs to be quantified with a deep dive into numbers and a clear understanding of its contours, which have been lacking for over 5 decades. It is important to define upstream and downstream sectors and study their induced impact in terms of economic, environmental, regulatory, entrepreneurship, science & tech, and societal factors. Downstream accounting is crucial and will have the maximum contribution to the space economy. To avoid double counting, any analysis must be carefully conducted. Currently, India does not have satellite accounts to provide a framework linked to the central accounts.	❖ Conduct a deep dive into numbers to quantify the Indian space economy, avoiding double counting. ❖ Define upstream and downstream sectors of the space economy and study their induced impacts on various areas such as economic, environmental, regulatory, entrepreneurship, science & technology, and society. ❖ Develop a satellite account as part of the national account statistics, following the US Bureau of Economic Analysis (BEA) framework. ❖ Increase funding for the space sector through enhanced space budget. ❖ Consider both direct and indirect impacts of the space economy, accounting for negative impact and determining the net value.
NewSpace Policy	The lengthy process of obtaining permissions and requests in the space sector can cause delays and missed opportunities with cost overruns. Companies and startups face uncertainty and may need to set up in more business-friendly locations. Satellite service providers in India face limitations in establishing gateways and TT&C centers. In addition to space-related regulations, non-space related factors such as ease of contract enforcement, freedom of commerce, and international trade and investment obligations that are translated into domestic laws play a crucial role in attracting international investments. Approval time can take up to 6-7 months, resulting in 30% of a NGSO satellite operator's mission life being wasted.	❖ Implement a mechanism of 'Single-Window' Clearances for licensing, spectrum, bandwidth and operational clearances to simplify the process and increase accessibility. ❖ Encourage favorable opportunities such as tax holidays, tax benefits, liberal labor regulations, rebates, lower custom duties, and special quotas. ❖ Liberalize domestic investment and FDI norms to attract more investment. ❖ Streamline the regulatory process and reduce barriers to entry to increase certainty for companies and start-ups operating their own satellites. ❖ Facilitate the establishment of gateways and TT&C centers for both fixed and mobile satellite terminals by satellite service providers in India. ❖ Address non-space-related factors such as ease of contract enforcement, freedom of commerce, and international trade and investment obligations by translating them into domestic laws to increase international investment. ❖ Consider ways to reduce approval times, which can be detrimental to NGSO satellite operators, who often have limited mission life.
Spectrum Policy and Assignment	The current spectrum policy in India needs to align with the ITU's identified radio frequency spectrum use to support global harmonization of the spectrum for space activities and protect existing satellite investments from interference. The current orbital slot allocation limits India's capacity if only Indian spectrum is used, so sharing and coordination are crucial as more satellites occupy the same orbital slots.	❖ Make the right spectrum band and required bandwidth accessible to enable growth of satellite services. ❖ Work with other satellite operators with space assets over the Indian orbital arc with a light-touch regulatory framework. ❖ Facilitate access to local companies and provide capacity in India. ❖ Create a conducive investment climate and provide end-user experience with satellite services. ❖ Harmonize spectrum for Indian and foreign players to have easy access to each other's resources. ❖ Assign satellite spectrum transparently through an administrative process. ❖ Protect existing satellite investments from harmful radio frequency interference.

Promoting Start-up ecosystem in Space Sector	The problem of supporting start-ups in the space sector in India remains challenging, as current policies fail to provide timely permissions for payload testing, tech demonstrations, and experimental frequency allocation procedures. The tax structure is also burdensome for space start-ups, and there is a need for rationalization to reduce their financial burden. Additionally, there is a lack of dedicated funds to support start-ups from ideation to revenue. While space clusters can foster innovation, state governments must also provide support through the availability of skilled manpower, enabling policies, market access, and capital. However, even with these efforts, the Space Act alone may not address all the challenges faced by start-ups, such as limitations imposed by telecom regulations, FDI process, export control, public procurement, and defence acquisition.	❖ There needs to be clarity on the permissible scope and associated approvals and processes. ❖ Establish funding and support mechanisms for pilot innovation projects ❖ Implement short-term experimental licensing and nominal fees for approval norms ❖ Ensure availability of space frequencies for trials and data operations ❖ Provide tax benefits/holidays for start-ups and MSMEs ❖ Ease eligibility norms for Indian start-ups in Govt and PSU procurements ❖ Establish clear procurement norms with flexible payment terms ❖ Provide subsidised access to hardware companies for space heritage ❖ Create a collaboration platform with academia, industries, investors, and government for start-up progression ❖ Relax ITAR restrictions ❖ Provide in-country certification facilities ❖ Implement unified policies for start-ups nationwide ❖ Ease experimental frequency allocation procedures and payload testing/tech demonstration ❖ Rationalize the tax structure for space start-ups ❖ Dedicate funds for space start-ups from ideation to revenue stage ❖ Encourage start-ups through space clusters, skilled manpower, enabling policies, market access, and capital ❖ Address issues faced by start-ups through telecom, FDI, export control, public procurement, and defence acquisition laws/ regulations.
Promoting Satellite Manufacturing for Atmanirbhar Bharat	India's space ecosystem is facing challenges that impede its ability to meet future demands, including unpredictable timelines, high costs for satellite design, and high capital and operating expenses. India also lacks a focused national strategy for space technology and manufacturing that prioritizes R&D and production of space-grade electronics and satellites. The PLI scheme currently does not support the space industry. Further, to improve the sector and promote best-in-class quality in space-grade product manufacturing, the stakeholders must focus on advancing materials development. The establishment of more Space Tech Parks would bring the entire space ecosystem together, resulting in cost savings and benefits for consumers. The state government's support is crucial for the industry's success in this.	❖ A single policy, facilitated by inter-ministerial measures, is needed to support the growth of the space industry and secure a strategic position in the global value chain. ❖ The introduction of a Production Linked Incentive (PLI) scheme, similar to the successful policies implemented in the electronics and telecom industries, could boost productivity and attract investment in the space sector. ❖ The space industry requires support in R&D and the semiconductor market as it transitions from component manufacturing to system integration. ❖ India needs a National Strategy for Space Technologies and Manufacturing to address the challenges of unpredictable timelines, high costs, and excessive spending on non-mission engineering. ❖ The country should focus on building the capability to manufacture space-grade products of the highest quality. ❖ A national effort is needed to develop advanced materials for future space programs. ❖ State governments can support the industry by creating technology parks or promoting a cluster-based approach, where multiple ancillary companies grow around major players in industry hubs. ❖ Space Tech Parks will bring together the entire space ecosystem, including manufacturers, application developers, vendors, suppliers, and service providers, to reduce costs and benefit consumers. ❖ AI, IoT, and robotics should be leveraged to streamline manufacturing processes and build efficient supply chains.

Geospatial Policy	The adoption of spatial technology in disaster management is hindered by high costs and lack of awareness. Global tech giants dominate the space in next-gen mapping and GNSS, limiting the growth of homegrown companies. The lack of skilled manpower and clarity on data sharing and collaboration also pose challenges. Most start-ups in the downstream sector face hurdles in accessing imagery data due to barriers and protocols. Increased investment and government support can lead to more accuracy in data and lower innovation costs.	❖ Establish a network of ground control points (GCPs) to enhance data accuracy through mapping imagery with ground coordinates and relative positions on Earth. ❖ Create a centralized database to store all data results and standardize the data entry process. ❖ Ensure smooth availability of high-resolution data through addressing the issue of suitable equipment for capturing such data. ❖ Increase awareness among potential users in government and private sectors through inter-ministerial collaboration and education. ❖ Develop an open software platform for the space ecosystem to enable collaboration, app development, and ecosystem growth. ❖ Implement a geospatial data cloud locally to offer solutions as a service. ❖ Entrust national organizations such as SoI and ISRO with regulation and projects related to national security and scientific significance.
Rural Connectivity via SatCom	Rural broadband penetration in India is low compared to global standards, and digital connectivity policies heavily focus on fiber laying instead of considering alternative options. The "Fiber first" priority hinders the nation from achieving its "Connect India" mission efficiently and effectively. Satellites can play a significant role in providing time-bound and primary connectivity in rural and remote areas, but have been overlooked in the BharatNet Phase-II project. The satellite addressable sites in BharatNet should be expanded to reach unconnected remote areas.	❖ Satellite technology must be used to bridge the digital divide in India, especially in remote and rural areas. ❖ Villages without fiber connectivity should be given priority for satellite connectivity. ❖ VSAT should be used to quickly and effectively roll out satellite backhaul. ❖ USOF corpus should support satellite services that provide widespread and non-discriminatory access to digital services in rural areas. ❖ The focus on fiber-only connectivity policies should be re-evaluated and satellite technology should be a primary option for rural and remote areas. ❖ The role of satellites should be increased in BharatNet Phase-II and the number of satellite addressable sites should be increased to connect more remote and unconnected areas.
Production Linked Incentive [PLI] Scheme	The space sector faces several challenges including high capital intensity and a lack of immediate returns, which makes it difficult for startups and entrepreneurs to thrive. There is no specific policy that boosts the deep tech companies to manufacture in India. A solution to these challenges is to include the space sector in the Production Linked Incentive (PLI) scheme. This would incentivize manufacturers and increase competitiveness, and may also reduce our dependency on expensive imports. The PLI scheme would support the ambitious plans and projects of ISRO and the private sector, promoting independent end-to-end solutions and boosting the aerospace, electronics, and defense industries.	❖ Introduce the PLI scheme for the space sector to boost manufacturing efforts and encourage startups and entrepreneurs. ❖ Attract both domestic and foreign companies to manufacture in India by offering competitive costs through the PLI scheme. ❖ Provide support for ISRO and the private sector to achieve their ambitious plans and projects through facilitating policies. ❖ Reduce imports and increase exports of space goods through incentivizing manufacturers with the PLI scheme. ❖ Use the PLI scheme, which is performance-based, to establish India as a efficient, equitable, and resilient hub for space manufacturing.

Space & Defence to work inter se	Space sector manufacturing can bring Self Reliance to Defence Manufacturing as well. Space manufacturing is critical to meet defence sector needs; such assets are critical to maintaining a high degree of confidentiality and hence indigenous development of space products is of great national importance. Facilitating policies can combine existing technologies in a more prolific manner and lead to the development of state-of-the-art applications and enhance the indigenous manufacturing capacity in a more cost-effective manner and with better commercial traction.	❖ Integrate space capabilities into overall defence strategy to address the issue of space warfare. ❖ Invest heavily in R&D and adopt a program-based approach with a clear roadmap for the next 1.5 decade. ❖ Focus on areas to invest, source of funding, and technology exported out of the country. ❖ Develop policies to promote dual-use technologies and speed up R&D for state-of-the-art defence and space platforms. ❖ Enable access to orbital slots for communication satellites in GEO through a mechanism of PPP. ❖ Consider establishing own critical satellite constellations to reduce dependency on other countries. ❖ Promote self-reliance in defence manufacturing through space sector manufacturing. ❖ Enhance indigenous manufacturing capacity through facilitating policies and combining existing technologies.
Standards	Standards enable interoperability between systems and equipment so that technologies can work together. The judicious use of open standards can help the satellite industry grow both inside and outside its ecosystem, blurring the boundaries to offer more seamless, efficient connectivity around the world.	❖ Adopt open standards to promote interoperability and efficiency in the satellite industry. ❖ Implement a holistic and standardized approach to integrate satellite and terrestrial networks. ❖ Develop self-standardization in India and ensure acceptability by other nations. ❖ Ensure quick and economical certification to meet industry benchmarking needs. ❖ Enhance cyber security measures to secure space infrastructure and minimize cyber risks. ❖ Invest in building a secure cyber security framework from the initial stage, with the collaboration of government, industry, legal experts, and academia. ❖ Emphasize on resilience of space assets and prioritize cyber security for emerging LEO constellations.
IFMC Policy	The IFMC policy has been in place for 4 years, but the market is still struggling due to the high cost of installation, despite 18 companies receiving authorization. The restrictions on gateway operation have a significant financial impact on the industry, with nearly 95% of MEO/LEO constellations capacity remaining unused. The Indian fleet upgrade for Wi-Fi IFC services presents a market opportunity, estimated to cost 2-3 crores per aircraft. Additionally, there are 17,000 maritime vessels without connectivity and growing demand for data use, which software-defined satellites could help to address efficiently. The cost to the industry from the restrictions to operate gateways is also significant. The regulator needs to address these issues and create a favorable investment environment to improve the flight and maritime connectivity experience for end-users.	❖ TRAI needs to accelerate the development of the IFMC ecosystem by addressing key issues, making policy recommendations, creating a favorable investment environment, and improving the flight and maritime connectivity experience for end-users. ❖ Spectrum stability must be provided by the regulator for service providers. ❖ TRAI should consider publishing periodic satellite usage/user data for IFMC and VSATs, similar to other telecom data releases. ❖ Nearly 95% of MEO/LEO constellations' capacity remains unused, highlighting the need for sustainable GEO/LEO combinations for secure links.

Investment and Funding	The space sector in India is facing challenges with capital convertibility and attracting foreign investment due lack of clarity in the regulatory environment. The space economy relies heavily on public sector budgets for research and development and private sector funds, mostly from venture capitalists. The domestic lending rates in India are also a hindrance in attracting investors. The laws regarding "Tokenization" should be modified and the government should change its perception and allow Indian investors with more flexible contracting terms.	❖ Increase budget allocation to the space sector and support academia in R&D activities ❖ Facilitate access to capital through grants, sovereign funds, and other sources ❖ Liberalize FDI norms, allow transfer of technology with low barriers and lower taxation rules ❖ Involvement of International Financial Services Centre to resolve capital convertibility issues ❖ Modify Indian laws on Tokenization ❖ Encourage collaboration between industry, NGOs, and quick access to resources ❖ Change perception towards flexible contracting terms for Indian investors
Insurance Liability Coverage	The space industry is grappling with the challenge of space debris, emphasizing the urgency for the government to establish a comprehensive approach to liability and insurance for private entities in the space sector. The connection of insurance liability costs to the level of collisions and the necessity for precise insurance coverage information highlights the problem of data inadequacy in the global space race and the priority of addressing space debris over space traffic management.	❖ Ensure that insurance liability expenses accurately reflect the intensity of collisions and take into account the mass of catalogued debris and altitude. ❖ Address the issue of data deficiency in the global space race to minimize its impact on space companies. ❖ Recognize the significance of Space Debris and prioritize its management. ❖ Adopt a progressive approach to liability and insurance, aligning with global trends towards limited liability and insurance costs for private entities. ❖ Define the scope of damage in space policy to include all types of damage caused in prelaunch, launch, and in-orbit stages. ❖ Study and incorporate international best practices in the development of space policies in India. ❖ Encourage innovation in insurance solutions for the space market through collaboration with insurance companies to promote private sector participation and risk-taking.
Cyber Security	The Space sector, as a critical component of Information Infrastructure (IT), is facing a significant risk of cyber-attacks, primarily associated with satellites. With the shift towards modernizing the conventional data processing system in the space industry, there is an increased likelihood of cyber risks, as the entire space system depends on the integrity of this system.	❖ Implement robust cyber security measures to protect the emerging LEO constellations and commercial participants in the space industry. ❖ Adopt a proactive approach to cyber security by establishing a secure framework from the outset of any space infrastructure project. ❖ Collaborate with international best practices and involve key stakeholders such as the government, industry, legal experts, and academia to ensure a comprehensive approach to cyber security. ❖ Allocate sufficient resources and investment to establish an effective cyber security system to ensure the resilience of space assets.

Intellectual Property Protection Policy	The space sector in India is facing challenges with regards to Intellectual Property Rights (IPR) protection. The high investment involved in research and development activities in outer space highlights the importance of recognizing intellectual property in this sector. However, the current process of obtaining a Patent award takes 12-18 months, which hinders start-ups from leveraging their IP during the early stages of their development. The absence of a well-defined IPR protection policy in the space sector is limiting the participation of private business entities and restricting the growth of the space technology industry in India. It is crucial to incorporate the aspect of IP in space in the national space legislation and to have clear regulations for Patent and IPR registration in order to support the growth of the space sector in India.	❖ Introduce IPR protection policy in the space sector to recognize and protect intellectual property rights ❖ Incorporate the aspect of IP in space in national space legislation in line with international treaties ❖ Address and protect the interests and rights of private entities in the Space bill ❖ Include enforcement mechanisms to protect against infringement ❖ Create a fast-track route for Patent approvals ❖ Clarify Patent and IPR registration process in India to make it faster and easier.

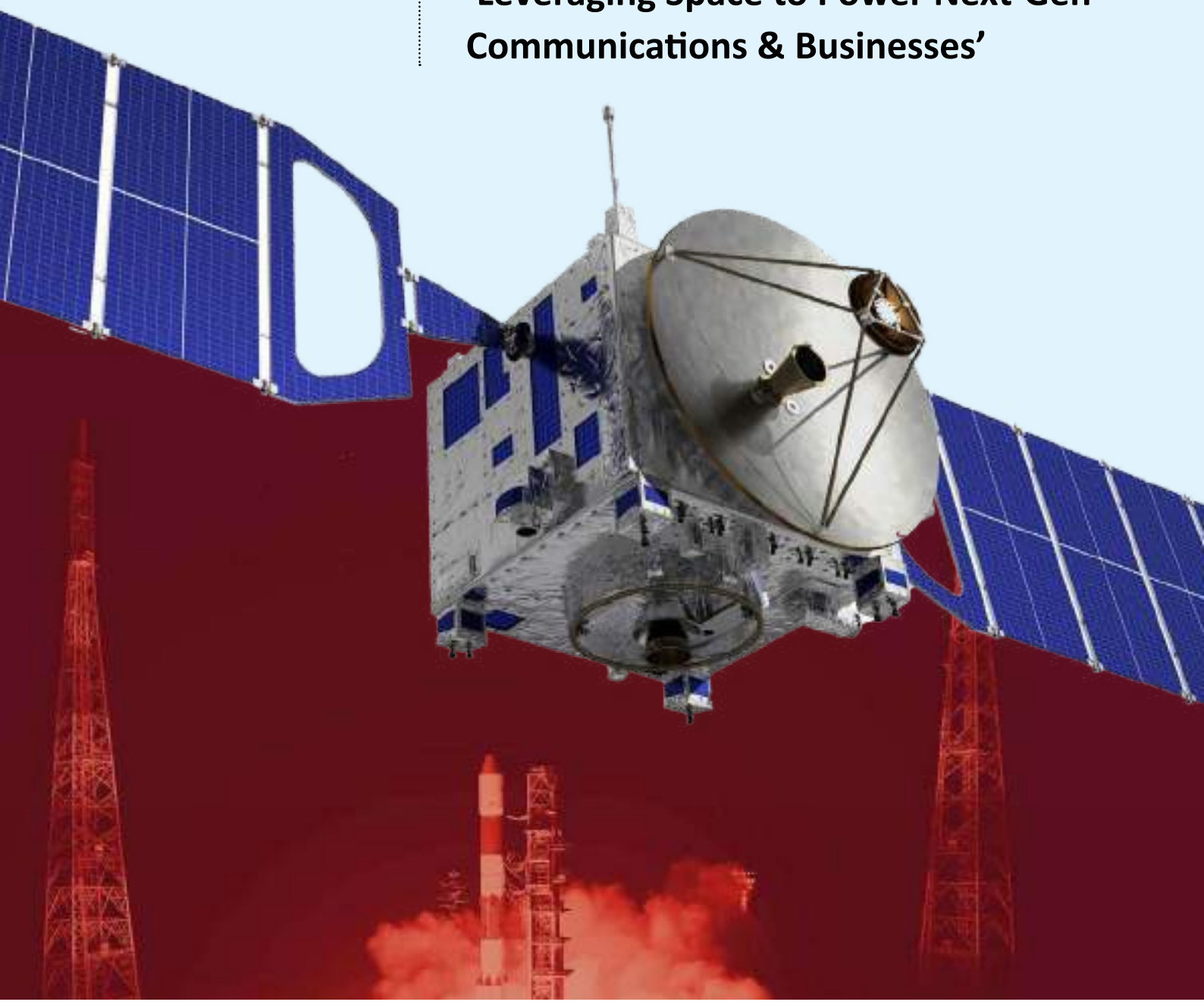
SIAINDIA
SatCom Industry Association

ORGANISED BY

SIAINDIA
SatCom Industry Association

INDIA SPACE CONGRESS 2022

'Leveraging Space to Power Next-Gen Communications & Businesses'



SUPPORTED BY

इसरो ISRO | IN-SPACe | Department of Telecommunications, Ministry of Communications, Government of India | MINISTRY OF DEFENCE भारत सरकार | DEPARTMENT OF DEFENCE PRODUCTION GOVERNMENT OF INDIA | नीति आयोग | NSIL एनसिल

PROGRAM SCHEDULE

Day 1: 26th October 2022, Wednesday Hotel Le Meridien, New Delhi

Start: 09:00
End: 11:40
Duration: 02:40

Opening Plenary (Sovereign 1 & 2)
Welcome Address: Dr Subba Rao Pavuluri, President, SIA-India & CMD, Ananth Technologies Pvt. Ltd
Industry Keynote: Accelerating the Space Economy – Mr. Nathan De Ruiter, Managing Director, Euroconsult
Special Address: Honorary Dr Mike Short CBE, Chief Scientific Advisor, Department of International Trade, UK
Special Address: Shri. A. S. Kiran Kumar, Member Space Commission, Former Secretary, Department of Space
Special Address: Shri. K. Rajaraman, Chairman, DCC & Secretary Telecom
Special Address: Dr Somanath S, Chairman, Space Commission; Secretary, DoS and Chairman ISRO
Inaugural Address: Shri Om Prakash Sakhlecha, Hon'ble Minister – Science & Technology, Government of Madhya Pradesh
MOU Exchange: SIA-India and Australia India Chamber of Commerce (AICC) SIA-India and Taiwan Space Industry Development Association [TSIDA]
Vote of Thanks: Mr. Deepak Mathur, EVP Global Sales Video-SES

Start: 11:30 | End: 11:40 | Duration: 00:10 → Networking Tea Break

Start: 12:10
End: 13:30
Duration: 01:20

Hall	Sovereign 1	Sovereign 2	Desire	Inspire
	India's Space Strategy for future: Turning vision into action India's aspiration to stake its rightful claim in the global space economy needs to be backed up by a strategy detailing the broad direction for the space industry and spectrum usage. **Chair & Moderator:** Mr. A. S. Kiran Kumar, Member Space Commission Former Secretary Department of Space and Chairman, ISRO **Keynote:** Mr. Luigi Scatteia, Partner, PwC Global Space Practice Leader **Speakers:** ❖ Prof. Sachin Chaturvedi, Director General, Research and Information Systems, India ❖ Dr Ajey Lele, Consultant, Manohar Parrikar-Institute for Defence Studies and Analyses (MP-IDSA) ❖ Dr Subba Rao Pavuluri, President, SIA-India & CMD Ananth Technologies Pvt. Ltd. ❖ Mr. Girish Chandran, Vice President & CTO, Viasat Inc. **Launch of Report:** Space for Defence in India by PwC	**Space Missions: Modelling and Risk Mitigation** Developments in computing, modelling and simulation allow us to understand complex system behaviour, especially for space systems that are expected to perform in environments different from the engineering facilities on earth. This allows risk mitigation and performance to expectations for missions in space, be it launch or space assets. **Chair:** Mr. E. S. Padmakumar, Associate Director (Projects), VSSC **Keynote Address:** Ms. Renuka Srinivasan, Brand Sales Director, SIMULIA for Dassault Systèmes India **Moderator:** Mr. Kartik Kumar, CEO, Satsearch **Speakers:** ❖ Ms. Renuka Srinivasan, Brand Sales Director, SIMULIA for Dassault Systèmes India ❖ Mr. Karthik Govindhasamy, Co-Founder & CTO, Antaris Inc. ❖ Dr Dibyendu Nandi, Head, Centre of Excellence in Space Science, Indian Institute of Science Education and Research (IISER) Kolkata	**Talking to Machines - Satellites for IoT, Drone and Autonomous vehicles** The common trait across IoT sensors, Drone communications and communication for Autonomous vehicles is their need for communication that the limited reach of terrestrial communication cannot provide. While IoT sensors abound and create a huge value in mining, agriculture, industry, national security, etc that are a non-urban phenomenon, the role of satellite communication for beyond line of sight communications to man and machine is unquestionable. The session explores a roadmap to solutions for a cooperative network of autonomous vehicles, Drones, IoT Sensors and satellites. **Chair & Moderator:** Dr PSR Srinivasa Sastry, Director, DSP, DRDO **Speakers:** ❖ Dr Arunprakash Jayaprakash, Satellite Application Catapult ❖ Mr. Pradyumna Vyshnav, Technical Program Manager, Mach33 Aero ❖ Mr. D S Govindrajan, President, Aniara Space	**Pushing the boundaries on Satellite Remote Sensing** From extending the satellite imaging capabilities with wider spectral range to remote sensing through advanced SAR techniques and Electromagnetic spectrum sensing, the new players are also pushing the boundaries on payload SWAP features and revisit rates. **Chair & Moderator:** Mr. Rajeev Jyoti, Director TD, IN-SPACe **Speakers:** ❖ Mr. Scott Larson, CEO & Co- Founder, Space Alpha ❖ Dr Rao Ramayanam, Senior Sales Executive-International, HawkEye360 ❖ Lt Col Amandeep Singh, Strategic Image Analyst & Spatial Domain Author ❖ Mr. Denil Chawda, Cofounder & CTO, GalaxEye ❖ Mr. Vinay Simha, Co-Founder and CEO Skyserve.ai

Start: 13:30 | End: 14:40 | Duration: 01:10 → Networking Lunch Break

	Decoding the Space Economy	In-Orbit Technologies	Growth and Diversity of Satcom	Leveraging Data from Space
Start: 14:40 **End:** 16:00 **Duration:** 01:20	Each year multiple consultancies come out with numbers to quantify the global space economy. The divergence in numbers from all points is needed for evolving a quantifying framework that is consistent and granular for verticals and geographies. A discussion by economists to consider the methodology for India. **Keynote & Moderator:** Mr. Jose Del Rosario, Research Director, NSR **Speakers:** ❖ Prof Vinay K Dadhwal, Indira Gandhi Chair Professor for Environmental Sciences, National Institute of Advanced sciences. ❖ Prof. Sunil Mani, Director and Professor, Reserve Bank of India Chair, Center for Development Studies (CDS) ❖ Mr. Sreeram Ananthsayanam, Partner, Deloitte Touche Tohmatsu India LLP ❖ Mr. Saurabh Kapil, Associate Director, PwC - Space Practice	From solutions for increasing life expectancy of satellites by refuelling to in-orbit servicing, Orbital transfers and collision avoidance services through SSA and STM, and further deorbiting & space debris removal, there are opportunities galore to service these business requirements. **Moderator:** Mr. Chethan Kumar, Assistant Editor, The Times of India **Speakers:** ❖ Mr. Piyush Dhaundiyal, Director & GM India, Space Machines Co. ❖ Air Cmde Terry van Haren (Retd.), Managing Director, Leolabs ❖ Mr. Rohan M. Ganpathy, CEO & CTO, Bellatrix Aerospace, ❖ Mr. Tanveer Ahmed, Co-Founder & CTO, Digantara ❖ Mr. Ashtesh Kumar, CTO, Manastu Space ❖ Mr. Navin Gopal, Head of Strategy and Business Analysis, Astroscale	The complementarity between NGSO and GSO brings to fore an interesting proposition for all downstream applications. The experts will discuss the current and future trend, various applications and the challenges. **Chair & Moderator:** Mr. Hanumantha Rayappa, Director, Satcom PO, ISRO **Keynote:** Mr. Deepak Mathur, Executive Vice President, Global Sales, SES Satellites. **Keynote:** Mr. Girish Chandran, Vice President & CTO, Viasat Inc. **Speakers:** ❖ Dr. Laura Roberti, Director for Spectrum and Market Access, Telesat ❖ Mr. Deepak Mathur, EVP Global Sales Video-SES ❖ Mr. Shivaji Chatterjee, EVP & Business Head, Hughes Communications India Ltd. ❖ Mr Vivek S Prasad, Sr Analyst, NSR, Ex ISRO Scientist ❖ Mr. Girish Chandran, Vice President & CTO, Viasat Inc.	The earth's value chain is inextricably linked and extended to space. The question however is how many stakeholders across agriculture, industries, fisheries, mining, logistics etc are truly leveraging the capabilities for this value. Stakeholders who have 'been there, done that' discuss their learnings and ideas to scale these successes across segments. **Chair:** Dr T Ravisankar, Deputy Director, Bhuvan Geoportal & Web Services Area (BG&WSA), NRSC **Moderator:** Lt. Gen (Dr) AKS Chandele, President-Defence, Internal Security & Public Safety, Geospatial World. **Speakers:** ❖ Mr. Arvind Pandey, Director, Ministry of Commerce & Industry, DPIIT. ❖ Mr. Arpan Sahoo, COO, KaleidEO a SatSure company ❖ Mr. Adithya K, Co-founder and ❖ Chief Product Officer, SkyServe

Start: 16:00 | End: 16:30 | Duration: 00:30 → Networking Tea Break

Start: 16:30 **End:** 17:15 **Duration:** 00:45	Turning the spotlight on Mission DefSpace – Defence India Start-up Challenge (DISC 8) iDEX Prime (Space) Mr. Vivek Virmani, COO, Defence Innovation Organisation, iDEX Mr. Mudit Narain, Advisor DIO/iDEX Mr. Vish Sahasranam, Co-Founder & CEO, Forge and Advisor iDEX

Closing Session: Sovereign 1&2

Start: 17:15 **End:** 18:00 **Duration:** 00:45	Demystifying U.S. Export Control Regulations ITAR and EAR for the Indian Space Sector Mr. Jason Chauvin, U.S. Department of Commerce, Bureau of Industry and Security (BIS). Mr. Alex J. Douville, Division Chief, Directorate of Defense Trade Controls, Department of State Moderated by Dr Susmita Mohanty, Director General, Spaceport SARABHAI Summing up the day's proceedings: Mr. Ravi Ailawadhi, Director and Board Member, SIA-India

Day 2: 27th October 2022, Thursday at Hotel Le Meridian, New Delhi

Start: 09:00 **End:** 10:30 **Duration:** 01:30	Opening Plenary
	Welcome Address: Dr Subba Rao Pavuluri, President, SIA-India & CMD Ananth Technologies Pvt. Ltd
	Industry Keynote: Mr. Pranav Roach, President, Hughes Network Systems
	Industry Keynote: Mr. Deepak Mathur, Executive Vice President Video, SES
	Keynote: Shri Arvind Kumar, Director General, STPI
	Special Address: Mr. R Umamaheshwaran, Director Human Space Flight Centre, ISRO
	Shri Rajeev Chandrasekhar, Union Minister of State for Entrepreneurship, Skill Development, Electronics & Information Technology (Chief Guest)

Hall	Sovereign 1	Sovereign 2	Desire	Inspire
Start: 10:30 End: 11:20 Duration: 00:50	**Power Session: Space Investment Outlook and Funding for New Ventures** Recent investment trends in the commercial space market and how that will impact the immediate and long-term future of the industry followed by a discussion that spotlights on the fund-raising efforts of the new space entrepreneurs for innovation, productization and scaling including best practices, and how to align with the financier's investment objective **Keynote:** Mr. Joseph Joshy, CTO (IT & Fintech), International Financial Services Centres Authority **Moderator:** Mr. Nathan De Ruiter, Managing Director, Euroconsult **Speakers:** ❖ Mr. Joseph Joshy, CTO (IT & Fintech), International Financial Services Centres Authority ❖ Mr. Jacob Poulose, COO, Mach33 Aero ❖ Mr. Justin Bharucha, Managing Partner, Bharucha & Partners ❖ Mr. Benjamin Zeitoun, Investor, Starburst Ventures ❖ Mr. Raghu Das, CEO, Aniara Venture Partner ❖ Dr Susmita Mohanty, Director General, Spaceport SARABHAI		**Satellites in Mobility** There is a significant increase in demand and applications for connectivity on the move at air, sea and land that can best be served by satellites including direct to handset. The regulatory and technology issues around these will determine the successful capturing of these markets. **Chair & Moderator:** Dr V. S. Hegde, Former Scientific Secretary to ISRO and CMD, Antrix **Keynote:** Mr. Sherille Ismail, Associate General Counsel, Intelsat **Speakers:** ❖ Mr. Sherille Ismail, Associate General Counsel, Intelsat ❖ Dr. Laura Roberti, Director for Spectrum and Market Access, Telesat ❖ Mr. Shivaji Chatterjee, EVP & Business Head, Hughes Communications India Ltd. ❖ Mr. Jose Del Rosario, Research Director, NSR ❖ Mr. Harsh Verma, Vice President, Sales Asia, SES	**Human Space flights and deep space opportunities** A chat with leaders at ISRO on their projects for Gaganyan, Deep space missions and how the industry can benefit with participation opportunities **Chair:** Mr. R Umamaheswaran, Director Human Space Flight Centre, ISRO **Moderator:** Dr Chaitanya Giri, Space Consultant, RIS **Speakers:** ❖ Mr. R. Hutton, Project Director, Gaganyan, ISRO ❖ Mr Akshat Mohite, Co-Founder and CEO, Astroborne Defence & Technologies ❖ Mr. Paul Febvre, CTO, Satellite Applications Catapult ❖ Mr. George Weinmann, Sr. Director, Orbital Reef Enterprise Development, Blue Origin ❖ Mr. B M Raghavendra, Sr. Deputy General Manager, Missiles and Aerospace Business, L&T
Start: 11:20 | End: 11:50 | Duration: 00:30 → Networking Tea Break				
Start: 11:50 End: 13:10 Duration: 01:20	**Building an Innovation Ecosystem through Space Clusters** How can a cross-disciplinary approach to innovation be nurtured to strengthen the space sector? Harwell is looked up as a success story for building a catalytic ecosystem for new space, old space, academia and innovations to come together. How are the Space parks in India approaching this issue? **Chair & Moderator:** Honorary Dr Mike Short CBE, Chief Scientific Advisor, Department of International Trade, UK **Keynote:** Mr. Paul Febvre, CTO, Satellite Applications Catapult **Speakers:** ❖ Mr. Mudit Narain, Consultant, Foundation for Advancing Science and Technology ❖ Dr Sudheer Kumar N, Director, CBPO, ISRO HQ ❖ Mr. Paul Febvre, CTO, Satellite Applications Catapult	**Space: Industry Alliances** Following up on the India-U.S. 2+2 Ministerial Dialogue that pledged to expand bilateral space cooperation and building of robust private industry collaboration in Space and Defence, the industry needs to take up the baton. **Moderator:** Mr. Aditya Kaushik, Director, Digital Economy & Strategic Technologies **Speakers:** ❖ Mr. Dustin Bickel, Political/Economic Consul, US Consulate General Chennai, India ❖ Mr. George Weinmann, Sr. Director, Orbital Reef Enterprise Development, Blue Origin ❖ Mr. Willam Blair, Chief Executive, Lockheed Martin India ❖ Mr. Samit Ray, Director Government ❖ Affairs, Raytheon ❖ Mr. Amitabh Ghoshal, Vice President, India Operations, L3 Harris Technologies ❖ Mr. Abhishek Malhotra, Founder & Partner, TMT Law ❖ Ms. Kriti Upadhyay, Founder, Indus Tech Council	**Satellites in the 5G Era & Beyond** Global leaders will discuss a blueprint for future scenarios for satellite communication systems in the face of accelerating changes brought about by deployment of mega constellations, the integration of satellite- terrestrial systems, and implementation of cutting-edge technologies. A more holistic and standardized approach is required towards a fully integrated solution combining satellite and terrestrial IMT integrated networks, whereby the air interface can be common for terrestrial wireless (B/S to UEs & vice versa), earth-to- space, space to earth, inter-satellite links. **Chair:** Mr. Anupam Shrivastava, Former CMD BSNL **Moderator:** Ms Aarti Holla Maini, Secy Gen, GSOA **Speakers:** ❖ Mr. Harvinder Nagi, Senior Systems Architect - Future Networks, Satellite Applications Catapult, UK ❖ Mr. Ajmair Heer, Sales Director, Asia-Pacific, Astranis ❖ Mr. Raghu Das, CEO, Aniara Space ❖ Abheek Saha, Chief Engineer and Head of the Networking and Wireless CoE at Hughes Systique Corporation. ❖ Mr Alec Climer, Solutions Engineering **Paper Presentation:** Maximum Revisit Time Computation for Unsymmetrical Satellite Constellations	**Pitch right for skyrocketing Start-ups** An opportunity for Space entrepreneurs including the ones on the fence, whether you're into launch capabilities, Satellite systems that bring unique advantages, building communications or remote sensing satellite constellations, generating insights from space-based data or even working on space sustainability. The participants get to develop relationships with a global network of key decision- makers driving innovation and economic change in SpaceTech, validating their opportunities, and accelerating their businesses. **Moderator:** Ms. Shagun Sachdeva, E2MC Ventures **Jury:** ❖ Mr. Vivek Virmani, CEO-iDEX ❖ Dr Vinod Kumar, Director, IN-SPACe ❖ Mr. Benjamin Zeitoun, Investor. Starburst Ventures ❖ Mr. Rahul Seth, Investor and Director, Antler ❖ Mr. Raghu Das, Venture Partner, E2MC **Observers:** ❖ Mr. Vinod Sood, Managing Director, Hughes Systique Corporation ❖ Dr N. Ranjana, Director DSTA, DRDO ❖ Mr. Kiran C Kalluri, Venture Partner, Dallas Venture Capital ❖ Cmde Jadumani Jena, Defence & Space Expert, Advisor-SIA India ❖ Ms. Nayani Nasa, Strategic Alliances Specialist, Microsoft **Speakers:** ❖ 5 Pitch Contestant Finalists
Start: 13:10 | End: 14:40 | Duration: 01:30 → Networking Lunch Break				

	Leveraging Industry Base for National Space Capabilities	International Collaboration	A balanced approach to Spectrum Allocation	Inspiring and Skilling for tomorrow's workforce
Start: 14:40 **End:** 16:00 **Duration:** 01:20	India Needs a Dedicated National Strategy for Space Technologies and Manufacturing. R&D and Manufacturing of space-grade electronics and new age satellite constellations and user terminals. Indian regulatory framework required to ease the space businesses by promoting competition and providing legal certainty. of space sector manufacturing. **Chair:** Mr. Radhakrishnan Durairaj, CMD, NSIL **Moderator:** Mr. Shashank Tripathi, Former Advisory Partner PwC **Speakers:** ❖ Mr. B M Raghavendra, Sr. Deputy General Manager, Missiles and Aerospace Business, L&T ❖ Mr. Anurag Garg, Chief Strategy & ❖ Marketing Officer, Thales India ❖ Dr Subba Rao Pavuluri, CMD Ananth Technologies Ltd. ❖ Lt. Gen (Dr) AKS Chandele, President-Defence, Internal Security & Public Safety, Geospatial World.	Key officials from National Space Agencies highlight opportunities for collaboration between the industries of the nations and the benefits the respective industries derive out of such inter-governmental space bridge. **Chair:** Mr. R Umamaheswaran, Director Human Space Flight Centre, ISRO **Keynote:** Honorary Dr Mike Short CBE, Chief Scientific Advisor, Department of International Trade, UK **Moderator:** Ms. R Anitha Nandhini, Director Int. Cooperation & Policy, DOS **Speakers:** ❖ Ms Harriet Brettle, Head of Market Analysis and Business Intelligence, European Space Agency ❖ Mr. Mahadevan Shankar, Director, Arzuh International Pty Ltd and National Convenor of Defence Working Group in the Australia India Chamber of Commerce (AICC) ❖ Mr. Dmitrii Loskutov, Director General, JSC Glavkosmos ❖ Mr. Mathieu Weiss, Counsellor (Space), Embassy of France, India. ❖ Dr Vinod Kumar, Director PD, IN-SPACe	Increased demand for connectivity makes efficient spectrum use critical in this day and age of easy communication The upcoming terrestrial (5G/ IMT, Wi-Fi 6/6E etc.) and non-terrestrial technologies (HTS/ VHTS/UHTS Satellites in LEO, MEO and GEO orbits) have intensified the need to access spectrum in different bands. This calls for well-planned strategic decisions in identifying the spectrum for these diverse technology options and allocation methodologies. **Moderator:** Ms. Aarti Holla-Maini, Secretary General, GSOA **Speakers:** ❖ Mr. Rajeev Kumar, Director Engineering, Prasar Bharti ❖ Dr Laura Roberti, Director for Spectrum and Market Access, Telesat ❖ Dr Mahesh Uppal, Director ComFirst ❖ Mr. Tony Azzarelli, Founder, Access Space Alliance ❖ Mr. Bharat Gupta, Head of Corporate Affairs, Sterlite Technologies Ltd	Actionable for Capacity Building in the Space Sector in India at national, regional, and global levels. A discussion between Academia, Industry and Government to promote space related R&D for commercial space innovation. **Chair & Moderator:** Mr. Sudheer Kumar N, Director, CBPO, ISRO HQ **GVF Trainings Workshop:** Mr. Riaz Lamak, GVF **Speakers:** ❖ Ms. Leena Bokil, Founder, Astro-EDU ❖ Prof. (Dr) S.O. Junare, Campus Director, NFSU, Delhi ❖ Dr Sanat K Biswas, Assistant Professor, IIIT Delhi ❖ Mr. Riaz Lamak, Global VSAT Forum ❖ Mr Vaibhav Varun, MD, Aviakul Pvt Ltd.

Start: 16:00 | End: 16:30 | Duration: 00:30 → Networking Tea Break

Closing Plenary

Start: 16:30 **End:** 17:30 **Duration:** 01:00	Dialogue on Satellite role in Disaster management and resilient infrastructures Ms Harriet Brettle, Head of Market Analysis and Business Intelligence, European Space Agency Mr. Riaz Lamak, Lead, GVF International Programmes, Global VSAT Forum Moderated by Ms. Aarti Holla-Maini, Secretary General, GSOA Summing up day's proceedings: Mr. Pawan Kapur, Board Member, SIA-India

Day 3, 28th October 2022, Friday at Hotel Le Meridian, New Delhi

Start: 09:00 **End:** 10:30 **Duration:** 01:30	Opening Plenary
	Welcome Address: Dr Subba Rao Pavuluri, President SIA-India & CMD Ananth Technologies Ltd.
	Special Address: Shri, Rajesh Bhushan, Secretary Ministry of Health and Family Welfare, Govt. of India
	Special Address: Shri. Apurva Chandra, Secretary, I&B, Ministry of MIB
	Special Address: Dr G Satheesh Reddy, Scientific Advisor to Raksha Mantri, Ministry of Defence

Hall	Sovereign 1	Sovereign 2	Desire	Inspire
Start: 10:30 End: 11:25 Duration: 00:55	**Power session: Space: The Fourth Frontier of Warfare** The strategic edge that the satellites bring with Satellite Intelligence, full situational awareness and always connected man and machine to the defence needs will be discussed with the strategic importance and urgency of each solution in the operational theatre. **Chair & Moderator:** Lt. Gen Vinod G. Khandare, Sr. Advisor, Ministry of Defence **Speakers:** ❖ Lt. Gen PJS Pannu (Retd), Former Deputy Chief, IDS and Distinguished Fellow USI ❖ Air Marshal Gurcharan Singh Bedi, AVSM, VM, VSM (Retd.), Former Director General (Inspection & Safety) ❖ Lt Gen MU Nair, AVSM, SM, SO-in-C ❖ Air Vice Marshal D. V. Khot, Director General, Defence Space Agency **Launch of Report:** 'Space for Defence in India' by PwC & SIA-India		**Emerging Multimedia Broadcasting (BSS) Solutions** Satellites have been the backbone of TV channel distribution worldwide, and much more significantly for the Indian TV and media industry. The changing landscape, however, drives the satellite operator to offer new media solutions **Moderator:** Mr. Gaurav Kharod, Managing Director, Sales, Intelsat **Speakers:** ❖ Mr. Ben Vine, Vice President, Sales APAC & Head of Solution Sales, Emerging Markets, SES ❖ Mr. Paul Febvre, CTO, Satellite Applications Catapult ❖ Mr. M. N. Vyas, Executive Director, Planetcast ❖ Mr. Sachin Tummala, Managing Director, Corpus Investment Group	**Spacecraft Design, Production and Mission Success** The discussion extends the discussion from design, production, testing to include the registration of Smallsats with ITU through In-Space **Chair:** Dr P. K. Jain, Director PMAD, IN- SPACe **Keynote:** Mr. Karthik Govindasamy, Co-Founder & CTO Antaris Inc. **Moderator:** Mr. Tony Azzarelli, CEO, Access Space Alliance **Speakers:** ❖ Dr Raghava Murthy, Adjunct Professor and Advisor to CSR, LPU ❖ Mr. Karthik Govindasamy, Co-Founder & CTO Antaris Inc. ❖ Dr PVGS Jayaram, CEO & Advisor Technology, PVGS Consultants ❖ Mr. Rupesh Kumar, CEO, XDLINX Labs
Start: 11:25 | End: 11:50 | Duration: 00:25 → Networking Tea Break				
Start: 11:50 End: 13:10 Duration: 01:20	Navigating the Laws for Space Business in India The overall regulatory framework, both domestic and international, is what enables businesses to thrive. This session brings forth the critical aspects for space businesses, for large organizations and start-ups, to be aware of while making business plans, running the business and/or new models for businesses **Keynote & Moderator:** Mr. Abhishek Malhotra, Founder & Partner, TMT Law. **Speakers:** ❖ Dr Ranjana Kaul, Partner at Dua Associates, Advocates & Solicitors ❖ Mr. GV Ashok, Partner, Factum Law ❖ Mr. Keyur Gandhi, Head Regulatory, Dhruva Space. ❖ Mr. Rahul Goel, Partner, Anant Law ❖ Mr. Hardik Gandhi, Partner, Deloitte Haskins and Sells	Leveraging dual use capabilities for National Security As the procurement of Space capabilities for defence gains traction different perspectives emerge. What kind of agility needs to be built up into these capabilities. Can some of the requirements be moved from Capex to Opex? Would procurement of commercial services entail a set of hardening norms to make them suitable for defence needs? How can Defence offsets be leveraged for enhancing the existing civil space capabilities for military procurements? The Civil Military fusion has worked for the growth of the space sector in many nations. What should be our nation's strategy? **Chair & Moderator:** Lt. Gen PJS Pannu (Retd), Former Deputy Chief, IDS and Distinguished Fellow USI **Speakers:** ❖ Col KV Kuber, Director (Aerospace and Defence), Ernst & Young ❖ Mr. Vishal Kanwar, Exec Dir, Aerospace & Defence, PwC. ❖ Ms. Kriti Upadhyay, Founder, Indus Tech Council ❖ Mr. Saikrishna Budamgunta, Founder, Saptang Labs	Satellite in Achieving Universal Broadband With an intent to connect Indian citizens across the 650000 villages, the BBNL and USOF focus on fiber alone deprives generations of these rural citizens from the benefits of connectivity compared to their urban counterparts. Satellites can be deployed to achieve in a time-bound manner and should be a primary option for all rural and remote connectivity requirements. Focus on underserved communities **Chair & Moderator:** Mr. R Shakya, DDG-IR, Dept. of Telecom **Speakers:** ❖ Mr. Jacques-Samuel Prolon, Executive Vice President, Kacific Broadband Satellites ❖ Ms. Reena Malhotra, GM NWP-SP, BSNL ❖ Mr. Prakash Advani, CEO, picoNETS ❖ Mr. Gaurav Kharod, Managing Director, Sales, Intelsat ❖ Dr C S Shaijumon, Assoc Prof and Head of Humanities, Indian Institute of Space Science and Technology (IIST). ❖ Mr. Deepak Maheshwari, Public Policy Consultant	Space ready MEMS, composites and compound semiconductors One of the catalysts for the new space economy is the introduction of advanced materials, composites and their production methods. The harsh environment of space places stringent demands on materials, composites and compounds from mechanical parts to semiconductors. The ability of space missions to reach the expected lifetime depends on correctly building the survival capability of its various subsystems and the possible failures and abnormal behaviour that might occur. The choice of these foundational elements can be critical for a successful space business. **Chair & Moderator:** Dr Seema Vinayak, Director, Solid State Physics Laboratory (SSPL), DRDO **Speakers:** ❖ Mr. Gadhadar Reddy, CEO, NoPo Technologies ❖ Mr. Rupesh Kumar, CEO, XDLINX Labs ❖ Mr. Harvinder Nagi, Sr Sys Architect, Satellite App Catapult UK ❖ Mr Anant Naik, CEO, GAETEC **Paper Presentations:** ❖ Solar Sail: A small spacecraft solar sailing mission and deep space observatory ❖ Solar Sail: Design and thermo-structural analysis of lenticular deployable composite booms for solar sails
Start: 13:10 | End: 14:30 | Duration: 01:20 → Networking Lunch Break				

Start: 14:40 **End:** 16:00 **Duration:** 01:20	**Insurance and liability coverage for space business** With exciting ideas in payloads, launch or satellite solutions, The private sector is rearing to have a go. How is the private sector ecosystem assisted by governments to share the risks and make it practical for space startups to survive and how do space underwriters view this segment from the perspective of heritage and in- orbit reliability of satellite hardware selection, Flight history of launch vehicles for launch risks, Design redundancies and margins etc. A chat with mission experts, policy makers, insurance underwriters and start-ups **Moderator:** Dr. P. K. Jain, Director PMAD, IN-SPACe **Keynote:** Dr. Rachit Bhatia, SSA Applications Engineer, Leolabs Inc. **Speakers**: ❖ Dr. Rachit Bhatia, SSA Applications Engineer, Leolabs Inc. ❖ Mr. Sireesh Pallikonda, Director Business Development, Skyroot Aerospace ❖ Mr. Darshan Parikh, Senior Vice President- Head of Marine and Facultative Reinsurance at Marsh & McLennan Companies ❖ Mr. Kunal Lalvani, Vice President at Aon India Insurance Brokers	**Protecting Space capabilities and Cybersecurity framework** Threats to space assets and their supporting infrastructure pose increasing risks to the economic promise of emerging markets in space. Faced with a unique mix of challenges that makes their cybersecurity, from threat vectors to risk mitigation considerably more complex. There are learnings from IT frameworks however to handle this better. **Chair:** Dr. Gulshan Rai, Chief Information Security Officer at the Prime Minister's Office, Government of India **Moderator:** Col KV Kuber, Director (Aerospace and Defence), Ernst & Young **Speakers:** ❖ Mr. Rajiv Ratan Chetwani, Chief Information Security Officer, DOS/ ISRO, Director, DISM, ISRO ❖ Mr. Saikrishna Budamgunta, Founder Saptang Labs ❖ Dr. Pavan Duggal Advocate, Supreme Court of India Chairman, International Commission on Cyber Security Law	**Downstream: Ground network in Hybrid Space Architecture** Space and ground systems need to work hand in hand, and both constitute essential parts that need to be addressed when striving for optimized efficiency. The pace of innovation has accelerated and involves all the main components of the ground segment ecosystem including the baseband/ modems, antennas, radiofrequency (RF) equipment, and the software layer to support satellite and ground operations. The trends extend to ground station and data centre integration for insights that leverage AI and cloud innovations. **Chair & Moderator:** Mr. AK Anil Kumar, Associate Director, ISTRAC, ISRO **Keynote:** Mr. R. K. Singh, Managing Director, CPI Satcom **Speakers:** ❖ Mr. R. K. Singh, Managing Director, CPI Satcom ❖ Mr. John Saripally, Managing Director, Comsat Systems Pvt. Ltd. ❖ Mr. Srinath Logasubramanian, Director-Commercial Space, Telespazio Germany GmbH ❖ Mr. Jai Dialani, CEO and Managing Director for Leaf Space USA ❖ Mr. Vinod Kaul, RVP, South & South East Asia, Gilat Satellite Networks. ❖ Mr. Manoj Dhaka, Head, SCSG, Defence Electronics Application Lab (DEAL), DRDO **Paper Presentation:** Novel automation algorithm to maintain frozen orbit through ground track maintenance manoeuvres	**Evaluating launcher options** The satellite launch market could not be more diverse than this. Developments extend to both ends of the spectrum from small launchers to the gigantic Starship. How does this impact the launch market dynamics? Are there innovative business models in the offing? **Chair & Moderator:** Mr. MS Anurup, Director STPO, ISRO HQ **Keynote:** Mr. Logan Ware, Director, Commercial & International Sales, Blue Origin **Speakers:** ❖ Ms. Arushi Chaudhary, Agnikul Cosmos ❖ Mr. Logan Ware, Director, Commercial & International Sales, Blue Origin ❖ Mr. Manu J. Nair, Co-Founder & Chief Executive Officer, Ethereal Exploration Space and Defence Private Limited ❖ Mr. Kunal Gupta, Lead - Strategy and Investments, Skyroot Aerospace **Paper Presentation:** Airships: Airships for Satellite Data Acquisition and Disaster Management
Start: 16:00 | End: 16:30 | Duration: 00:30 → Closing of the India Space Congress				
Summing up the three days proceedings: Mr. DS Govindrajan, Board Member, SIA-India				

Message by DG SIA-India

Anil Prakash,
Director General, SIA-India

Dear colleagues,

It gives me great pleasure to extend my sincere appreciation to all the distinguished guests, speakers, and delegates who joined us at the first edition of the India Space Congress. The event was a huge success thanks to your proactive participation. We are honored to have received support from various domestic and international trade bodies, associations, and government entities.

India Space Congress 2022: "Leveraging Space to Power Next-Gen Communication & Businesses" brought together more than 650 delegates, 180 speakers, from 30 countries to explore the potential of space technology in driving growth and development in India's expanding space industry.

It was a great honor to have Shri Rajeev Chandrasekhar, Union Minister of State for Entrepreneurship, Skill Development, Electronics & Information Technology, Shri Om Prakash Sakhlecha, Hon'ble Minister – Science & Technology, Government of Madhya Pradesh, Dr. Somanath S, Chairman, Space Commission; Secretary, DoS and Chairman ISRO, Shri K. Rajaraman, the Chairman of the Department of Communications and the Secretary of Telecom; Shri Apurva Chandra took over as Secretary of, Ministry of Information & Broadcasting, Dr. G Satheesh Reddy, Scientific Advisor to Raksha Mantri, Ministry of Defence, Shri Rajesh Bhushan, Secretary Ministry of Health and Family Welfare, Shri A. S. Kiran Kumar, Member Space Commission and former Secretary, Department of Space and other esteemed leaders in attendance during the Inaugural Session.

The Conference also saw the release of two significant reports:

1) "Space for Defence in India" a report by PwC and SIA-India; which provides insights into the role of space in enhancing defence capabilities, addressing security concerns, and promoting national development.

2) "Why do Indian Founders in the Space Industry Start Their Start-Ups Abroad?" by R Sai Shiva Jayanth and Gopalakrishnan Narayanamurhty, Spaceport SARABHAI presents a detailed analysis of the reasons why many Indian founders in the space industry prefer to start their startups abroad.

The reports will provide policymakers and industry leaders with valuable insight to develop strategies and initiatives to strengthen India's space ecosystem. I congratulate the authors of both reports for their excellent work and thank them for their contributions to the India Space Congress 2022.

SIA-India had Called for Papers, as an ongoing effort to promote and inspire young talent and raise awareness of the space sector's potential as a career option. The response to the initiative has been very envouraging, with over 36 original research papers submitted by tech students, academicians, and research scholars. Our expert jury panel meticulously evaluated the submissions and selected five outstanding papers for cash prizes. The authors had the opportunity to present their papers and engage with a distinguished audience, responding to their queries.

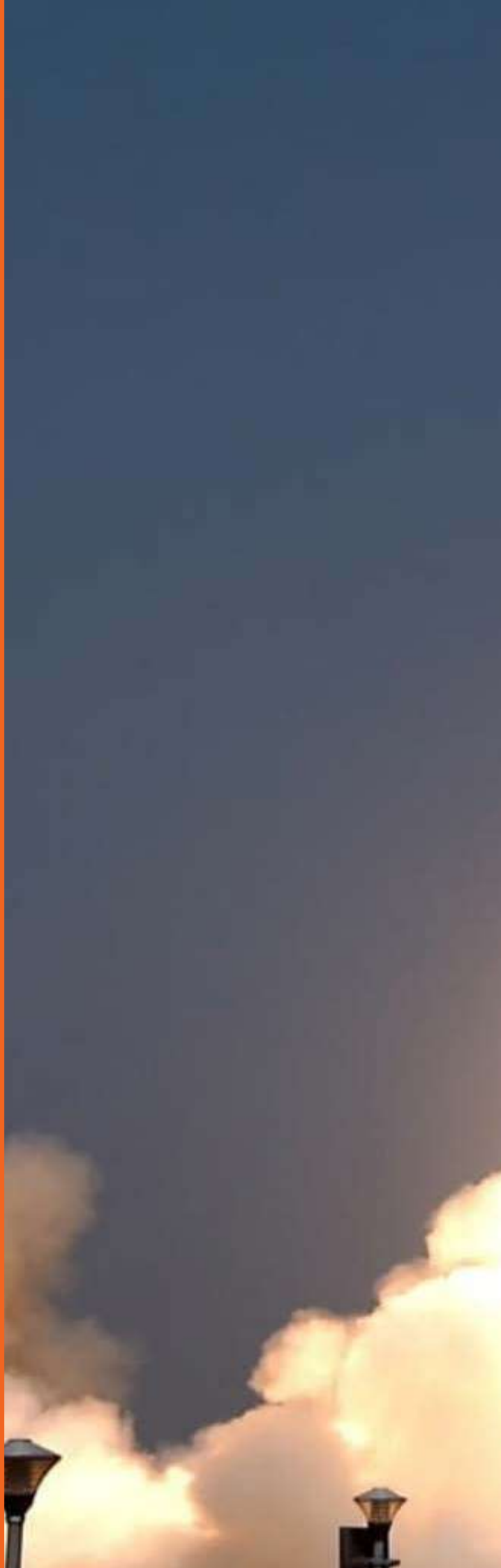
The success of India Space Congress 2022 has inspired us to announce the second edition of our flagship event - India Space Congress 2023: Empowering Industry Growth with Satellite Solutions; to be held in New Delhi between July 12-14, 2023.

The conference will once again have multiple tracks exploring the use of space technology to create opportunities for industry growth while supporting India's socio-economic development. The conference will also focus on India's vision for the G20's "Vasudhaiva Kutumbakam" philosophy, which prioritizes holistic growth while considering the well-being of all life forms and the protection on the planet.

I invite all of you to join us at the India Space Congress 2023 and continue the important dialogues around space technology and its role in fostering economic growth and addressing socio-economic challenges. Once again, I express my gratitude to all the participants and look forward to seeing you at the second edition of the India Space Congress.

Best regards,

Mr Anil Prakash,
Director General, SIA-India




PSLV C31
INDIA

SIAINDIA
SatCom Industry Association

India Space Congress 2022

India Space Congress

Leveraging Space to Power Next-Gen Communication & Businesses

26th - 28th October 2022

Announcing India Space Congress 2023:

Reimagining Space Sector for empowering socio-economic development

ISC 2023: ABOUT THE CONFERENCE

The India Space Congress 2023, a conference and exposition, will take place in New Delhi from July 10th to 12th, 2023. Organized by SIA-India, the event brings together industry leaders, policymakers, researchers, and academics to discuss ways to enhance growth and progress in India's rapidly growing space sector.

The conference will delve into the utilization of satellite technology to enhance socio-economic development in India and review the development of science, technology and innovation policies related to space. The primary goal of the conference is to integrate space into policy and decision making, raise awareness about the activities of various entities involved in space, and emphasize capacity-building efforts and international cooperation and partnerships involving emerging nations and industries. Experts, government officials, and academics from around the world are invited to attend and discuss ways to effectively use space technology to contribute to socio-economic development.

India Space Congress

2022 HIGHLIGHTS

Published by:

SatCom Industry Association (SIA-India)
Suite B-423, 4th Floor, Somdatt Chambers-I, 5,
Bhikaji Cama Place, New Delhi-110066
Tel: +91-11-4604 8743
Email: admin@sia-india.com

SIAINDIA
Satcom Industry Association

Copyright:

Disclaimer:

The annual report is prepared to provide a general overview of the association's activities, financial performance, and operations during the year. It should be read in conjunction with the association's financial statements and notes to the financial statements. The information contained in the annual report is based on data and information available as of the date of the report and is subject to change.

The report may contain forward-looking statements that are subject to risks and uncertainties that could cause actual results to differ materially from those expressed or implied by such statements. SIA-India assumes no obligation to update any forward-looking statements. The report is intended for informational purposes only and should not be considered as a representation of future performance or an endorsement of the association's activities. The association will not be liable for any damages of any kind arising from the use of this report, including, but not limited to direct, indirect, incidental, punitive, and consequential damages.

SatCom Industry Association (SIA-India)
Suite B-423, 4th Floor, Somdatt Chambers-I, 5, Bhikaji
Cama Place, New Delhi-110066
Tel: +91-11-4604 8743
Email: admin@sia-india.com