KPMG

Space applications

Opportunities in India

home.kpmg/in

Table of contents

1. Introduction **1**

2. Overview of the global space sector **2**

2.1. Value Chain of the space sector 2

2.2. Market size for key economic areas within the space sector 4

2.3. Global perspective on advances in Space Exploration 5

2.4. Anticipated progression of economic activities in the sector 6

3. Overview of the Indian space sector **7**

3.1. India's journey of Space Exploration 7

3.2. Policy and Regulatory changes to encourage private sector participation 8

3.2.1. Encouragement for private sector participation 8

3.2.2. Draft Spacecom Policy 2020 8

3.3. Drivers of growth for the sector 9

4. Opportunities **10**

4.1. Key applications of satellites 11

4.2. Satellite services 12

4.3. Launch services and launch vehicle manufacturing 14

5. Market Entry Frameworks **15**

5.1. Potential areas for private industry participation 15

5.2. Projected roadmap for building capability 16

5.3. Key Takeaways 17

Abbreviations **18**

Endnotes/references **18**

Acknowledgements **19**

Introduction

Globally, the space industry is witnessing an unprecedented era of growth. This is primarily driven by increase in private sector investment in development of launch vehicles, satellites and other associated systems.

Indian Space Research Organisation (ISRO) has acted as an agent of development for space technologies since its inception and has been instrumental in making space technologies accessible to the common man.

With an increase in satellite applications for both defence and commercial use, it has become imperative for the government to include private sector organisations to fully realise the transformative potential of the sector, in-line with global trends.

The Government has introduced significant policy changes to encourage greater involvement of private sector organisations in the space sector. These changes are intended to increase availability of satellite data to private sector, involve private industries in the manufacture of launch vehicles and satellites and enable private industries to launch, own and operate satellites.

This report presents an overview of the global space sector with an introduction to the perspective on what the sector will look like in the next decade. Next it looks at the India story in a globally vibrant market, it analyses the genesis of the opportunities through the lens of policy reforms brought in to increase private sector participation and looks in detail at the opportunities afforded in the manufacture of launch vehicles and the provisioning of satellite-based services.

The report concludes by presenting a framework for private enterprises to enter this promising sector.

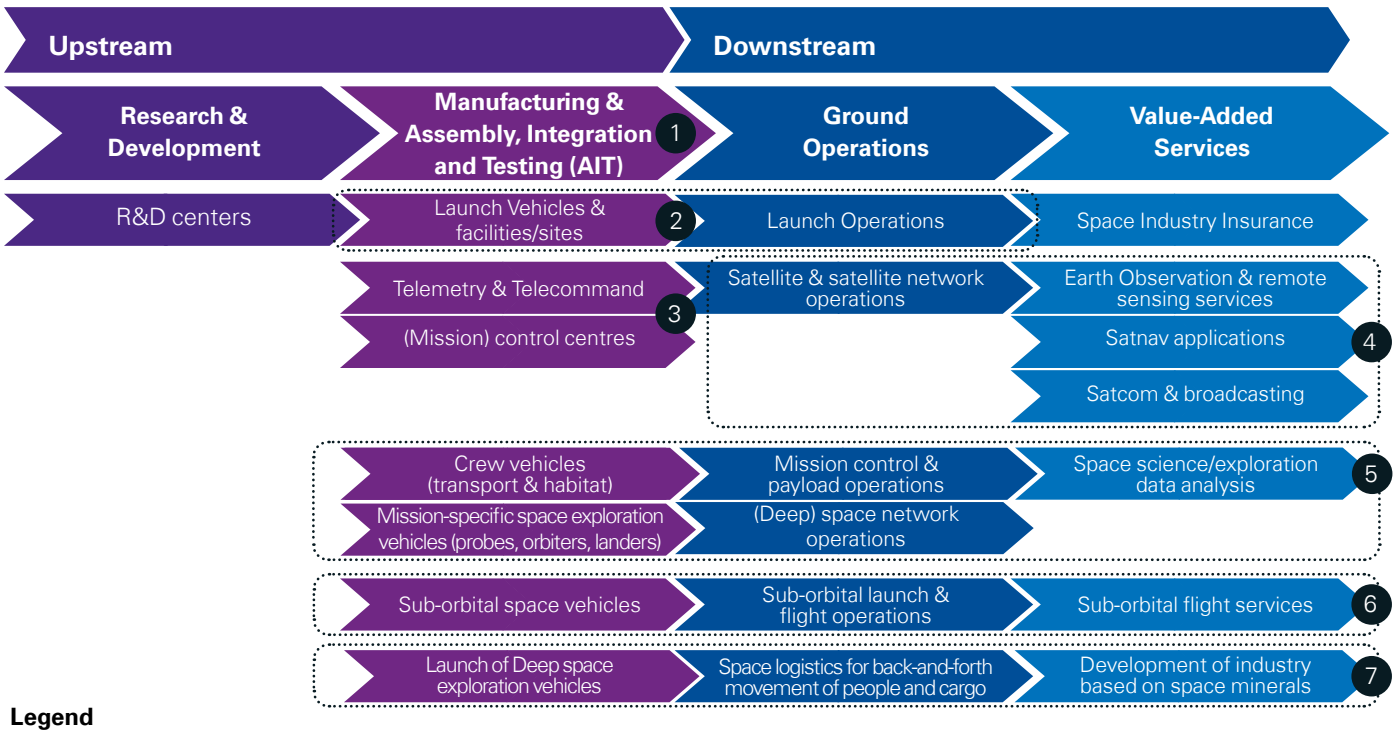
Overview of the Global space sector

Value Chain of the space sector

Revenue is derived in the space sector by providing various space-based services to end users which include defence, media & entertainment, communication, aviation, retail & enterprise, and other industries. To enable the provisioning of such services it is imperative to procure satellite services from satellite operators who launch and maintain satellites in their respective orbits. These constitute the downstream part of the space sector value chain.

The upstream part of the value chain consists of research & development, followed by manufacture of launch vehicles and satellites, culminating in the use of launch of the launch vehicle to put satellites in space.

The following graphic illustrates the value chain.



Legend

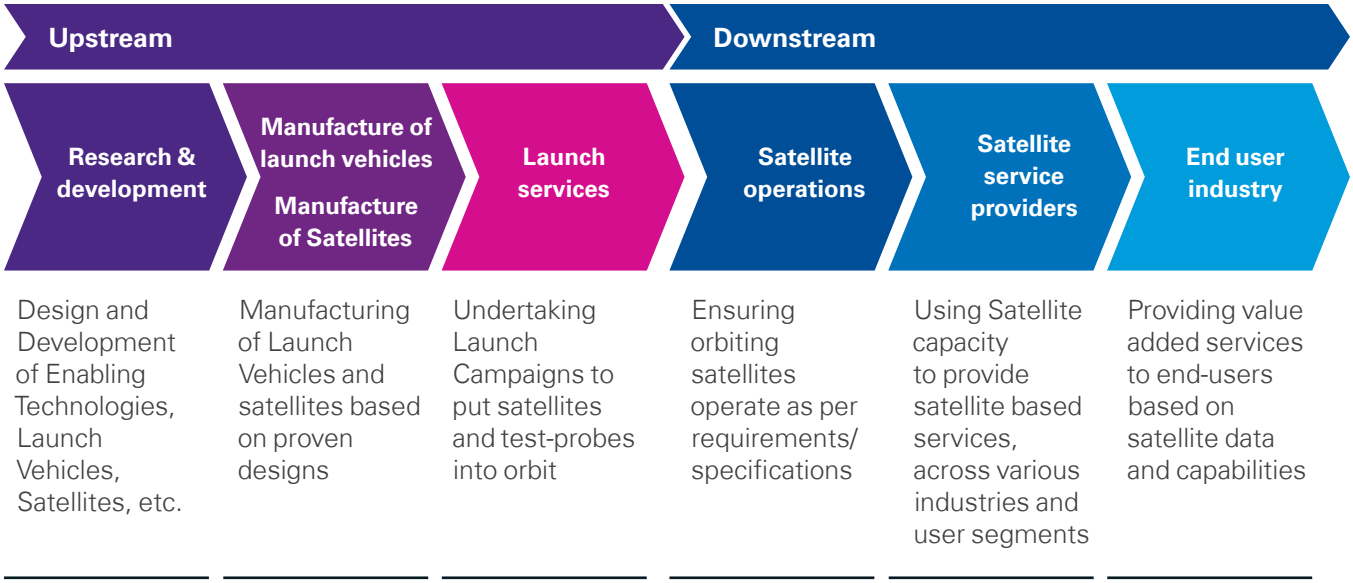
Established
1. Satellite manufacturing
2. Launch Industry
3. Satellite services
4. Ground equipment

Implemented
5. Manned & robotic space exploration

Started
6. Space tourism (including habitat)

Emerging
7. Energy, mining, processing and assembly

The following are the key components of the value chain:



Research and Development (R&D)

The enabling technologies required to manufacture satellites and launch vehicles require substantial research and encompass a wide array of subjects ranging from mechanics of propulsion to inertial guidance and navigation systems. In India ISRO and other scientific establishments under the Department of Space (DoS) have been primary agencies undertaking the R&D for development of launch vehicles and satellites.

Manufacture of Launch Vehicles

Launch vehicles cost in the range of USD 17 Mn to 20 Mn and their flawless operation is critical for the safe delivery of the payload to its intended orbit. Hence the manufacture of launch vehicle components and systems is done in a highly controlled manner with multiple quality and performance checks. The final assembly of the launch vehicle is carried out on the launch platform.

Manufacture of Satellites

Once a satellite is launched, it is expected to operate through its lifespan of 12-15 years without any service support. Hence each component of the satellite is manufactured to exacting standards and tested for performance and endurance at multiple levels. Furthermore, to prevent biological contamination of space, all satellites are assembled in a clean room with adequate safeguards to prevent ingress of foreign object debris.

Launch Services

The process of launching the payload using a launch vehicle is the final critical process in the upstream part of the value chain. This involves controlling the launch vehicle from its launch to the injection of the payload into the desired orbit. ISRO currently has two launch platforms operational at Sriharikota (Andhra Pradesh) through which it undertakes the launch campaigns.

Satellite Operations

Once a satellite is established in orbit, its performance and position are continuously monitored to ensure reliability of services for service operators and end-users. This is usually undertaken by the agency involved in manufacturing and launching the satellite.

Satellite Services

Satellite Service providers act as intermediaries between the satellite operators and the end-user industries. They acquire/procure satellite capacity or data from the operator and package it for use in various applications. They also develop and provide ground equipment to receive satellite communication through control of the transmission and encryption of the signals.

End Use Industries

Industries rely on communication and earth observation satellites for a variety of applications including DTH services for Television Broadcast, in-flight entertainment and communication, mapping, project monitoring, etc.

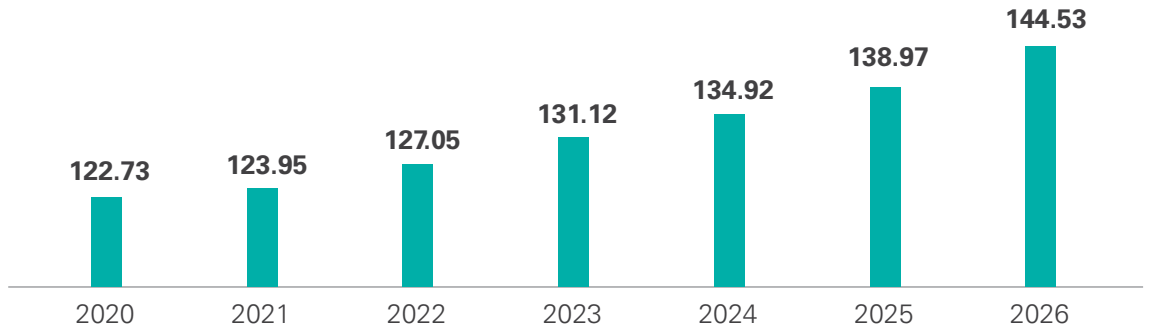
Market size for key economic areas within the space sector

The components of the space value chain can be grouped into two key economic areas: satellite services and launch services.

Satellite Services

These comprise of all the services that can be provided through satellites and broadly comprise of communication, earth observation and navigation. The global market for satellite services is projected to grow at a CAGR of 2.76 per cent from 2020 to 2026 and reach a value of USD 144.5 Billion. The annual growth trajectory is illustrated in the following chart:

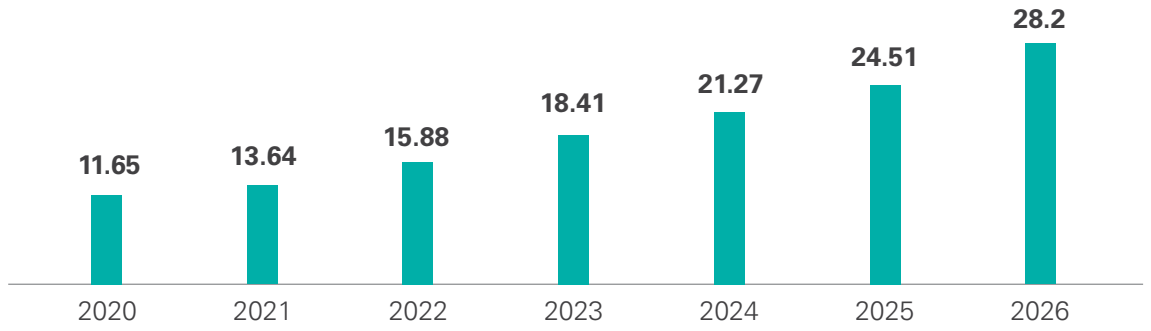
Market Size (Global Satellite Services) USD Billion[1]



Launch Services

These comprise of all the technical services that culminate in the launch of spacecraft. These have the upstream components of research and development, manufacture of launch vehicle and satellite embedded, within. The global market for launch services is expected to grow at a CAGR of 15.87 per cent from 2020 to 2026 and reach a value of USD 28.2 Billion. The annual growth trajectory is illustrated in the following chart:

Market Size (Global Launch Services) USD Billion[1]



Global Perspective on advances in Space Exploration

The global space industry is being driven by a resurgence of government funding into ambitious programmes and private-sector investment into various components of space technologies.

These factors have led to opening up of the space sector to more people and more industries than ever before. Industries spread across the gamut of economic activity are looking towards space for disruptive and transformative solutions. Estimates made by Morgan Stanley[2] suggest that the revenue generated by the global space industry could be worth USD 600 billion by 2030 and surpass USD 1 trillion by 2040.

The space industry holds significant promise over the coming decade. With the aim of bringing to life what our presence in space in 2030 may look like, KPMG Australia spoke to 30 industry leaders – heads of agency, lawyers, surgeons, investors, entrepreneurs, academics and politicians – who painted a very vivid, exciting and challenging vision of what can be expected from the space sector.[3]

The broad outcomes of these conversations with industry leaders have been distilled into the following five verticals the space industry will be pursuing in the next couple of decades.

- **Space tourism:** Space tourism will be a collaborative multinational venture and living in space will be more accessible. However, mass tourism is unlikely. Zero gravity environment may have new medical conditions and new treatments.
- **Deep space exploration:** Manned and unmanned deep space exploration will be accelerated. Feasibility of what are distant possibilities today such as space mining and remote operations of space mines, discovery of extra-terrestrial life and service industry for long space travels might be explored.
- **Space business models:** Most businesses might diversify to include space as a possible market. Emergence of novel business models such as manufacturing in space might emerge to be viable.
- **Space data:** Space data will become completely accessible and democratised. An international regulatory body for space data might be established to regulate accessibility of such data. Leveraging such data sets artificial intelligence might become common place in the future.
- **Sustainability in space:** Sustainability in space might be one of the most challenging problem in the next decade whose answers may benefit sustainability on Earth. Space ecology will be imperative for our millennial generation which might further result in space getting its own legal jurisdiction. Multinational cooperation may also yield peace dividends on earth.

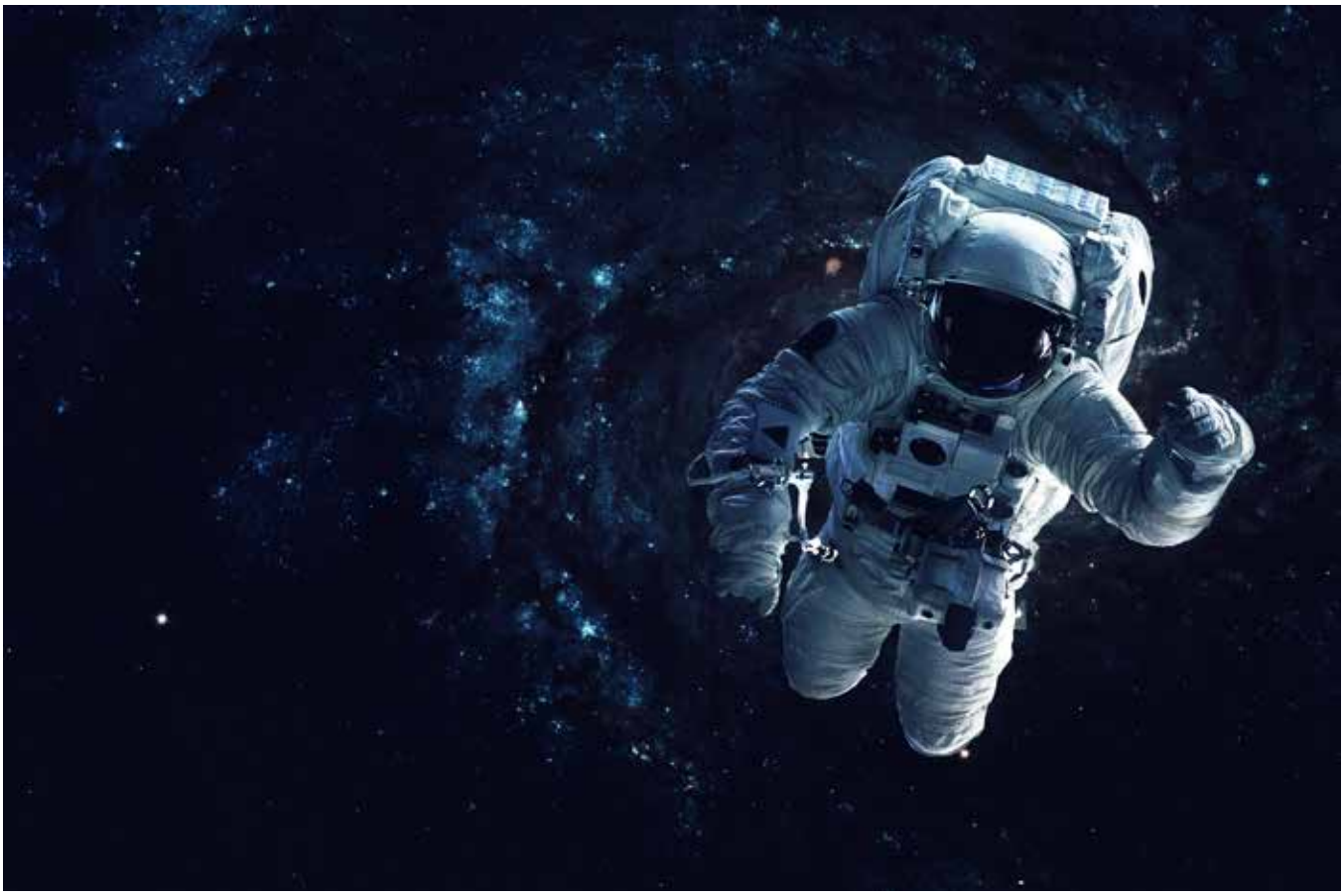
Anticipated progression of economic activities in the sector

Governments and private sector enterprises have both realised the potential of the sector for economic growth and are funding multiple projects to realise this potential.

The growth of the sector in the short term is expected to be driven by satellite services. As the need for satellite services progressively increases this is likely to create demand for launching of newer satellites. The technologies developed to meet the demand for launching newer satellites is then likely to boost more complex forms of launch vehicles that are suitable for deep space exploration and space tourism.

This growth story is encapsulated in the following table:

	0-5 years	5-10 years	>10 years
Broadcast and communication	Increase accessibility and connectivity over land, sea and air for applications including broadband connectivity, remote education, tele-medicine, etc.	Launch services for small satellites and use of heavy launch vehicles to create infrastructure for continuous human habitation in space	Deep space exploration for sourcing minerals and other raw materials for use on earth
Earth Observation	Integrating space-based observations into the workflow for infrastructure project monitoring, conservation, etc.	Services to ensure optimal utilisation of orbital slots for provisioning requisite services for communication, earth-observation and navigation	Space tourism and regular cargo transport to support continuous human habitation in space



Overview of the Indian space sector

Today, India has an emerging space sector, which is well recognised for its successes, ambitions and frugality.

While a few critical components of the value chain are under ISRO's control in India, the invitation to the private sector has opened up opportunities in R&D, launch vehicle and satellite manufacturing and satellite services. In time it is anticipated that private sector capabilities will mature and correspondingly its involvement in areas currently under ISRO's control will increase.

India's journey of Space Exploration

ISRO has been the torch bearer of the Indian space programme and has successfully developed the Polar Satellite Launch Vehicle (PSLV) and the Geosynchronous Satellite Launch Vehicle (GSLV) and is using these to undertake path breaking missions including Chandrayan I & II and Mangalyan.

In addition to ISRO, the Government of India (GoI) has established the Space Commission and the Department of Space (DoS). The Space Commission formulates the policies and oversees the implementation of the Indian space programme to promote the development and application of space science and technology for the socio-economic benefit of the country.

The DoS has been allotted a budget of USD 1.85 Billion for the years 2020-21[4], which is a growth of 8 per cent from the year 2019-20, but a 45.2 per cent increase relative to the allocation in 2015-16. This clearly indicates the growing investment in space and India's commitment to the development of its space programme.

Upcoming developments in the Indian space scene include of a new Small Satellite Launch Vehicle (SSLV),[5] the establishment of a new launch pad in Tamil Nadu to increase capacity in line with increased demand for launching domestic and international satellites and launch of Aditya 1, India's first space mission to study the Sun.

Furthermore, to encourage private sector participation, regulatory changes have been introduced. It is anticipated that these changes will provide the private sector easier access to data from India's space assets and encourage ISRO to utilise private sector capabilities in its programmes more effectively.

Policy and Regulatory changes to encourage private sector participation

Encouragement for private sector participation

In the wake of the COVID-19 crisis, GoI announced several policy measures to mitigate the economic impact of lockdowns. One tranche of announcements targeted the space sector. The following key points emerged from the announcements[6]:

a. A new autonomous body - Indian National Space Promotion and Authorization Centre (IN-SPACe) has been created to ensure availability of a level playing field for private companies to use Indian space infrastructure. It will hand-hold, promote and guide the private industries in space activities through encouraging policies and a friendly regulatory environment.

b. The Public Sector Enterprise 'NewSpace India Limited (NSIL)' will endeavour to re-orient space activities from a 'supply driven' model to a 'demand driven' model, thereby ensuring optimum utilization of the country's space assets.

c. ISRO will focus on research and development activities, development of new technologies, pursue exploration missions and human spaceflight programme. Some of the planetary exploration missions will also be opened up to private sector through an 'announcement of opportunity' mechanism.

These reforms are aimed at unlocking value from India's space assets through their commercialisation by private enterprises, entrepreneurs and Public Sector Undertakings under the DoS. It is envisaged that the private sector will move hand-in-hand with the national agency for developing and operating future space exploration technologies and products.

Draft Spacecom Policy 2020

In a follow-up to the announcement encouraging investment in the private sector, the DoS announced the draft Spacecom policy[7].

This policy indicates areas that are being opened to the private sector and lays down the norms, guidelines and procedures to assist private industry in realising opportunities while safeguarding existing space assets. Its Key objectives are as follows:

a. Provide regulatory environment for commercial establishment of space-based communication systems

b. Define measures to monitor the use of space assets and authorise organisations to use these assets

c. Ensure protection of space assets and adopt measures to bring in more space assets under India's administrative control.

Through this policy the DoS intends to encourage Indian organisations to undertake design, development and realization of satellites and associated communication systems. Now, private sector organisations can:

a. Establish satellite system by developing or acquiring satellites

b. Establish Telemetry, Tracking & Command (TT&C) earth stations and Satellite Control Centre (SCC) within or outside India.

c. Directly offer satellite capacity to customers for commercial and societal communications within India as well as outside India.

IN-SPACe shall be the nodal agency for providing necessary authorizations and permissions for all satcom related activities, as per applicable regulatory provisions and statutory guidelines.

Within months of the formation of IN-SPACe and the announcements to open the space sector as many as 24 proposals from Indian and foreign organisations have forwarded to the regulator for review. These range from permissions for ground stations, establishing satellite constelations, to making and launching satelites, launch vehicles and providing applications[11].

Drivers of growth for the sector

With the increasing modernisation, technology innovation, increasing private investment and growing capabilities of the private/commercial entities, the space sector has experienced a mammoth growth.

Some of the trends driving growth particularly in Communication satellites are increase in the SmallSats population, lower latency through Low Earth Orbit (LEO), deployment of reusable rockets, use of satellites in the roll out of 5G networks and as building blocks for IoT deployments.

The future of the space sector would potentially be shaped by a few key drivers as listed below. These growth drivers impact the trends in the application of satellites and the future of space sector across areas of mobility of people and goods, creation, connection and observation, security & defense and research & exploration.

Macro-economic drivers

With the changing demographic across growing middle class, ageing population, rapid-urbanisation and consumer-driven markets, the stress on resources would continue to grow exponentially resulting in the need for building greater capacities and economies of scale. The emphasis can be witnessed over areas of data traffic, cyber security, universal connectivity/ increasing need for connected devices and Industry 4.0. All these factors have led to new service demands both in the civilian and defense-related markets opening up greater opportunities for players across the Space sector value- chain.

Industry Dynamics

The space industry has had a transformation over the past decades giving rise to new business models, changing competitive & market dynamics, growing capabilities of the commercial space industry, and diversifying of capital sources (e.g., venture capital, private equity, sovereign wealth funds and billionaires). Additionally, there has also been rapid-restructuring of commercial satellite organizations through acquisition, merger, regulatory change, new allocations or reallocation of frequencies and convergence between the various satellite applications markets – both in terms of technology and structural integration.

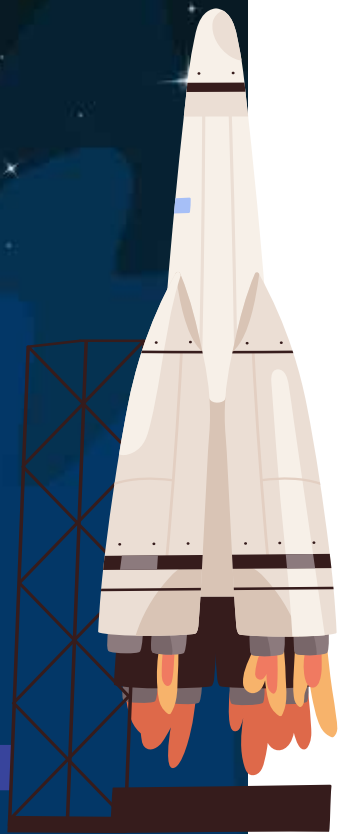
Ever-evolving Technology & Innovation

Innovation has been one of the primary drivers of growth in the space sector ever since its inception. The rise in automation and digitization, need for increasing data and processing power has given rise to profound technology evolution like miniaturisation of satellites, emergence of new low-cost space equipment and fusion of Deep-Tech (AI, VR/AR, IoT) across application and integration services.

Growth of human activities in outer space may prove to be a significant shaper of the growth of satellite systems beyond the coming decade. In line with global cues, India will also need to pursue a strategy of expansion of space-based economic activities.

The opening of the space sector to private industry is a major step in this process and the onus now is on the private industry to recognise the opportunities afforded by the space sector and develop strategies to capture these opportunities to move towards global leadership in the coming decades.

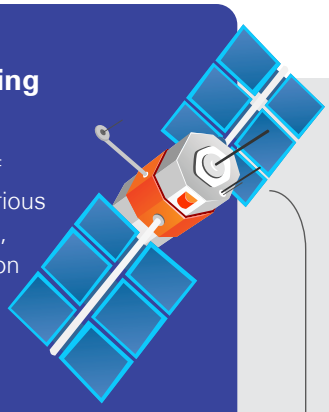
Opportunities



The space sector has hitherto been highly regulated and under the control of the DoS and its associated entities, primarily ISRO. With policy changes to involve the private sector, a large set of opportunities have arisen. While a few critical aspects of the space sector are still under ISRO control, the spectrum of opportunities available to the private sector are illustrated below:

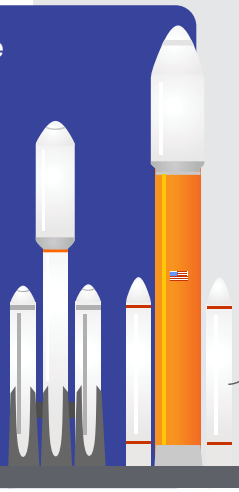
Satellite Manufacturing

Design and development of satellites for various communication, earth observation applications and navigation applications



Launch Vehicle Manufacturing

Design and development of launch vehicles for putting various categories of satellites into their respective orbits

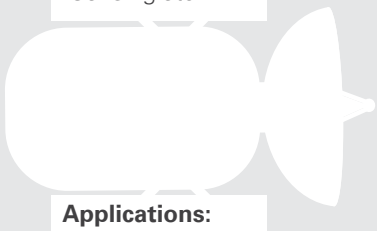


Launch Services

Use of launch vehicle to put satellites in orbit for satellite operators

Satellite Services

Type: Consumer Services, Fixed & Mobile Satellite Services, Remote Sensing etc.



Applications: Media & Entertainment, defence, aviation, retail and enterprise, etc.

Value added services using AI and data analysis to solve real world problems such as remote connectivity, project monitoring, tele-education, etc.

Key applications of satellites

Communication

Satellite application in communication is primarily to provide links between various access connections on Earth. The applications comprise of telecommunications, broadcasting and data communications including television, telephone, wireless, radio, internet, military and data collection.

Satellite technology in communications has advanced from experiential to more mature and proficient. The notion with respect to communication satellites being less cost-efficient, distressed with high latency and having limited bandwidth has been experiencing a significant deflection. The technology development and innovation coupled with growing demand to meet the ever-increasing data traffic and bandwidth requirements have resulted in newer applications. Some examples include flexible payloads that can reconfigure satellites' frequencies, coverage and power allocation for rolling out the 5G network, IoT connectivity, Multiple Radio Access Technology (Multi-RAT), High Throughput Satellites, etc.

Earth Observation

Satellites' application with respect to Earth Observation is to gather and provide information about the physical, chemical and biological systems of the planet via remote sensing technologies, earth surveying techniques encompassing collection, analysis and presentation of data.

Earth Observation satellites have undergone a mammoth progression and have a wide range of applications including usage of small satellites and satellite constellations. Earth observation domain has had disruptive innovation owing to the advent of technologies like cloud processing, data analytics, AI, and Machine Learning. Additionally, steps toward the miniaturisation of satellites, payloads, democratisation of the space sector, advancement in storage and processing of imagery and open data polices have led to game-changing developments in the earth observation industry. This has resulted in the Earth Observation industry being the biggest beneficiary of the Angel investors, Venture Capitalist funds, etc.

Applications of Satellite based Earth Observation not only include Optical and Radar based imagery but also have been exceeding progressing towards non-imagery data sets and applications such as climate change monitoring, (through radio occultation, microwave and green-house gas emissions), Defense & Intelligence, Living Resources, Public Authorities, Energy & Natural Resources, etc.

Other applications include weather forecasting to understand how weather conditions impact plant health, energy pipeline health and shipping and transportation of goods across the globe.

Navigation

Application of Satellites for navigation has been to primarily provide autonomous geo-spatial positioning. The technology can be used for providing position, navigation or tracking the position of a device fitted with a receiver to a significantly high precision. Satellite based navigation systems include global and regional navigation systems (GNSS and RNSS) and satellite-based augmentation systems and are popularly used for Global Positioning System (GPS).

Satellite based navigation is making headways into the fusion of GNSS in the deployment of 5G networks, digitalisation and application of AI in space traffic management and fighting space debris, transmission of highly sensitive data through quantum communication ensuring greater cyber security and safety, and equipping smartphones with GNSS and RNSS.

The GNSS-chip industry has also been witnessing growth in the unmanned aerial vehicle domain and in the automotive industry for monitoring, mapping of large-scale areas, and real-time assessment. It also has ever-growing application in wearable devices such as fitness bands, smart watches, etc.

Other applications

- Space Tourism: Space tourism refers to human space travel for recreational, leisure or business purposes including orbital, suborbital and lunar space tourism;
- Mining and recovery of natural resources outside of the Earth's orbit;
- Satellite servicing of existing satellite reaching end-of-shelf-life and debris retrieval missions;
- Advancement in small launch vehicles and commercial imagery;
- Flexible communication satellites with adjustable power, shape and position of beams;
- Robotic construction of first bases on Moon and Mars; and
- Application of satellites across changing world's mobility patterns from driver-operated to autonomous vehicles, among others.

Satellite services

Satellite service providers offer satellite capacity to end users such as DTH operators, telecommunication companies, and others. These providers buy capacity from the satellite operators to resell voice, broadcasting, and data circuits to several end-user industries. Satellite services can be classified into the following categories:

a. Consumer services, which allow coverage of large areas for broadcasting programs, like TV, radio and broadband connectivity. The end users include DTH providers, radio channel operators and internet service providers.

b. Flight satellite services, which provide high speed connectivity using Very Small Aperture Terminal (VSAT) technology in a fixed location. These are usually used for defence communication, aviation navigation and commercial wireless connectivity with end users including armed forces, airport/airline operators and mobile service providers.

c. Mobile satellite services, which include network of communication satellites used with mobile wireless telephones and data communications that retransmit the signal to satellite land earth stations. The end users of these services include central and state governments and the disaster relief forces for voice communication in case of emergencies or disasters.

d. Remote sensing services are used for Earth Observation (EO) applications like weather & terrain mapping, reconnaissance & intelligence missions, and synthetic aperture radar imagery. The end users include central and state governments, border defence forces and oil & gas companies. There has been a growth in a number of enterprises and start-ups using remote sensing for a variety of purposes including urban traffic management, agriculture, natural vegetation mapping, etc.

e. Space flight management services provide communication capacity between astronauts and the ground stations/missions control. The end user in this case is mostly ISRO.

The following are the growth drivers for satellite services in India:

a. High demand for high-resolution imaging services

b. High demand for managed network services

c. Shift in demand from cable to DTH and OTT platforms

d. High demand from emerging economies

e. Growth in high-throughput satellite (HTS) capacity.

Potential application areas for satellite services:

Cellular and Internet

a. Increased 4G network penetration across remote areas

b. Introduction of 5G networks for commercial and individual use

c. Broadband connectivity in rural areas

d. Adoption of Optical fibre connections across urban areas

e. High speed connectivity to access OTT platforms

Aerospace & Defence

a. Data transmission for deep space exploration

b. Surveillance and border patrol monitoring for national security

c. Introduction of internet services in civil aviation

d. GPS-aided GEO augmented navigation (GAGAN) adoption for navigation and landing services

e. Faster data transmission speeds with forces in remote areas

Commercial

a. Launch of new High Definition (HD) channels on DTH services to compete with OTT platforms

b. Security applications for private, high value establishments, geo-fencing etc.

c. GPS and location-based advertising, special offers and selected customer targeting

d. Increased adoption of IoT in consumer goods and services

e. Logistics and maritime cost optimization

Earth Observation

a. Increased accuracy for natural disaster prediction and reduced loss of life

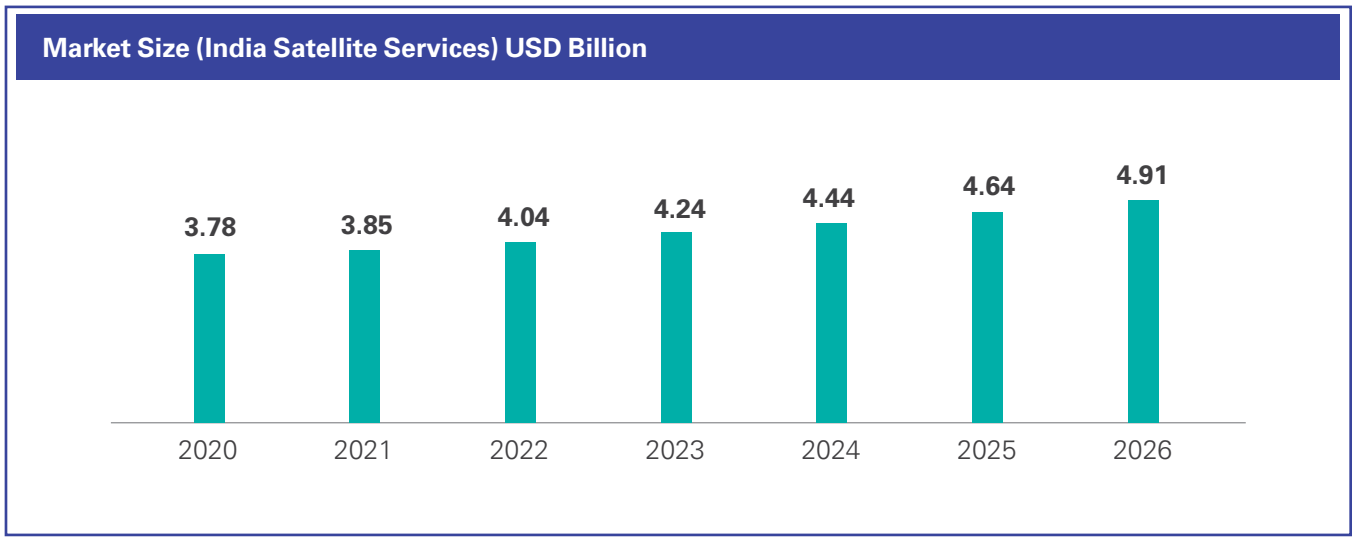
b. Smart cities monitoring and implementation

c. Accurate mapping of agricultural land and identification of wastelands

d. Reduction of pilferage and greater vigilance of government grants for marine agriculture

e. Natural resource management.

Market potential in India



The market for satellite services in India is expected to grow at a CAGR of 4.46 per cent between 2020 and 2026.

Launch services and launch vehicle manufacturing

Launch services comprise of a series of events that include ordering, construction, stacking and assembly, integration of payload, and launch of the satellite. The global space launch services market was valued at USD9.8 billion in 2019 and is projected to reach USD32.4 billion by 2027, with a CAGR of 15.7 per cent from 2020 to 2027. [8]

Globally, launch services are classified into the following categories based on payload:

a. Satellite – includes commercial satellites for communication, earth observation and navigation services.
   - Small satellite (less than 1000 kg)
   - Large satellite (above 1000 kg)

b. Human spacecraft – crew for the International Space Station (ISS).

c. Cargo – supplies for sustenance of the ISS crew.

d. Testing probes – scientific instruments for conducting atmospheric and earth and space science experiments.

The drivers of growth for the launch services market in India are as follows:

a. An increase in the number of satellites, testing probes and interplanetary missions by ISRO through government funding

b. Building remote sensing and communications capacity for the defence sector

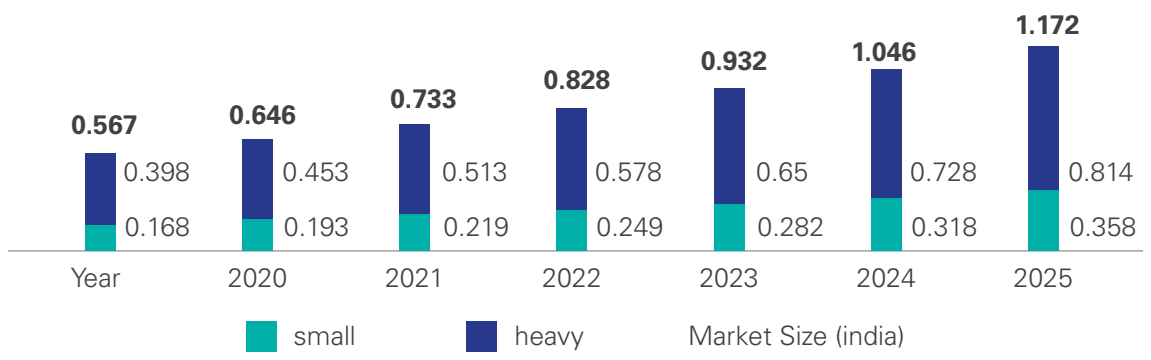
c. Launch of international satellites using PSLV which has led ISRO to seek partners for productionisation of PSLV entirely through the private industry

d. Emergence of start-ups in the space sector which have developed indigenous capability to launch small satellites.

Globally, small launch vehicles are driving the growth of the launch services market. India is following suite with ISRO having announced the development of a Small Satellite Launch Vehicle (SSLV) and start-ups having demonstrated indigenously developed small launch vehicles.

Market potential in India

Market Size (India Launch Services) USD billion[9]

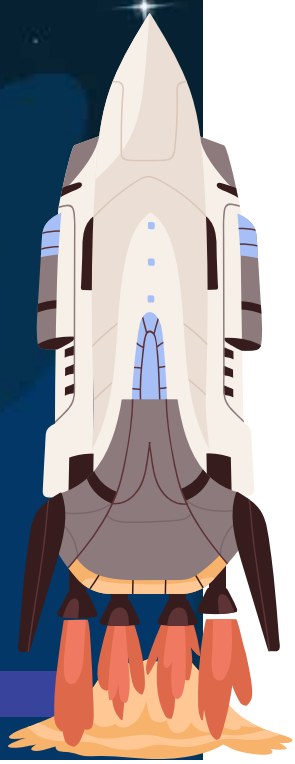


The market for launch services in India is expected to grow at a CAGR of 12.86% between 2020 and 2026[9]

Creation of launch infrastructure

With an estimated capacity to launch 12 satellites per annum, ISRO is the only agency with the capacity to organise launch campaigns in India. It is also in the process of establishing a third launch platform in Kulasekarapattinam (Tamil Nadu) which was proposed to be used for the small satellite launch vehicle. As a part of the policy to encourage private sector participation in space exploration, it has been announced that private sector entities shall be permitted to use ISRO facilities. The mechanism and framework for this is expected to be announced shortly.

Market Entry Frameworks



The space sector is on the cusp of a great expansion. This expansion is likely to impact industries hitherto not connected to the space sector. Globally, both government and private sector organisations have made a significant head start in developing the next generation of technologies and products that will propel them into a new space race.

The emergence of China as a space power has led to further bolstering of investment by U.S. and other countries to maintain their relevance on the global stage.

Considering the importance of utilising space assets for national growth and the gestation period for developing space technologies the Government of India has opened the space sector for private industry participation at an opportune time.

It is the need of the hour for start-ups and MSMEs and large enterprises to enter the sector and bring disruption and long-term capacity creation respectively.

Potential areas for private industry participation

The potential areas for private industry to participate in the emerging space sector are split into two broad categories:

Upstream activities which include manufacturing of components and sub-systems for ISRO or other integrators and developing launch vehicles and satellites with in-house research and development.

Upstream

Manufacture of Launch Vehicles

Manufacture of Satellites

Associate with ISRO and other primes by manufacturing components and sub-systems to understand the intricacies of manufacturing components for space applications

Obtain technology from ISRO through their Transfer of Technology scheme to build expertise in niche areas

Research & Development

Build on the experience of building components by constituting independent R&D to develop sub-systems and systems that can be used by ISRO and other international primes

Use R&D capability to develop a complete satellite/launch vehicle

Launch Services

Develop parallel launch facility to ISRO as a step towards vertical integration for offering end-to-end facilities from component manufacture to assembly integration & testing to launch

Downstream activities which include owning satellites and providing space-based communication services and providing value added services on top of basic communication services from satellites.

Downstream

Satellite Operations	Satellite Service Providers	Value added services for End User Industry
Acquire launch and operate satellites to provide communication, earth observation or navigation related services	Acquire satellite bandwidth from owners of existing satellites and provide trunk connectivity services for various applications like DTH television broadcasting, cellular communication backhaul, high throughput services, etc.	Develop algorithms/models to interpret and manipulate earth observation data from satellites for use in real-world applications like project monitoring, Provide application specific communication services like real-time inventory and logistics monitoring across manufacturing locations using existing satellite communication links

Projected roadmap for building capability

With the opening of the space sector to private industry, each component of industry viz. start-ups, MSMEs and large enterprises must partake in the wide range of activities required for a vibrant local space economy.

Start-ups

India has traditionally looked towards foreign technology providers for seeding base competence. While ISRO has been successful to a large extent in developing indigenous systems based on the transfer of technology in the past, to keep pace with global leaders it is imperative that India develop indigenous systems at the same pace as private industry in foreign countries. Start-ups can play a vital role in this aspect.

MSMEs

MSMEs are the backbone of manufacturing in any economy and are well suited for small and medium size batch production of critical components and sub-systems. They must come forward to acquire and accept technology from ISRO and various start-ups and facilitate cost-effective manufacturing of products based on these technologies. A large portion of small but critical components are imported by India due to lack of local manufacturing support. This is as true for the space sector as it is for the larger Aerospace and Defence manufacturing sector. MSMEs can play a key role in absorbing such technologies and then aspire towards global leadership in niche areas on the basis of cost advantages inherent in Indian manufacturing sector.

Large enterprises

Large enterprises have the financial capacity to build infrastructure that compliments existing government infrastructure while creating opportunities for other private sector players both large and small to access the infrastructure. In addition to infrastructure creation, large enterprises must also invest in R&D that compliments the work being done by ISRO and other DoS labs, especially in the area of dual use technologies and materials.

Key Takeaways

The space sector provides a large gamut of opportunities across the board for industries. An indicative opportunity roadmap and growth path for Start-ups, MSMEs and large enterprises is summarised in the following table.

	0-5 years	5-10 years	>10 years
Start-ups	Develop disruptive technologies in the areas of communication systems, launch vehicles and space exploration	Productise developed technologies and commercialise solutions	Scale-up through partnerships and joint ventures
MSMEs	Supply components and sub-systems to ISRO	Acquire technology and partner with ISRO and other Primes to develop sub-systems for emerging applications	Develop niche products for Indian and Global space primes
Large Enterprises	Create soft and hard infrastructure to augment ISRO capability in partnership with ISRO or global space agencies	Leverage learnings to create parallel infrastructure to compliment/surpass existing capabilities	Compete globally for providing world class services

In addition to the technical opportunities available to start-ups, MSMEs and large enterprises, novel opportunities in allied services are also expected to open-up. These include financial services for creation, maintenance and operations of space assets, insurance for vehicles, cargo and passengers, navigation, tracking and traffic control for operations and a myriad of other support services.

Investment in the space sector is a long-term proposition and considering the paths taken by various countries and global private sector enterprises, the time is now for the Indian private sector to step-up and work together with the government enterprises to build competitive space infrastructure and ecosystem.

Abbreviations

ISRO	Indian Space Research Organisation
DoS	Department of Space
R&D	Research and development
GoI	Government of India
PSLV	Polar Satellite Launch Vehicle
SSLV	Small Satellite Launch Vehicle
GSLV	Geosynchronous Satellite Launch Vehicle
VSAT	Very Small Aperture Terminal
EO	Earth Observation
HTS	High Throughput Satellite
DTH	Direct To Home
TT&C	Telemetry Tracking and Command
SCC	Satellite Control Centre
IN-SPACe	Indian National Space Promotion and Authorization Centre
MSME	Micro, Small and Medium Enterprise
MAIT	Manufacturing, Assembly Integration and Testing
CAGR	Compound Annual Growth Rate
NSIL	NewSpace India Limited
LEO	Low Earth Orbit
AI	Artificial Intelligence
AR/VR	Augmented Reality/Virtual Reality
IoT	Internet of Things
Multi-RAT	Multiple Radio Access Technology
GNSS	Global Navigation Satellite System
RNSS	Regional Navigation Satellite System
GPS	Global Positioning System
OTT	Over The Top
GAGAN	GPS-aided GEO augmented navigation
HD	High Definition
ISS	International Space Station

Endnotes/references

1. KPMG in India analysis, 2020
2. Investing in Space, Morgan Stanley, 2020
3. 30 voices on 2030 – Future of Space, KPMG, 2020
4. Department of Space budget - 2020, Open Budgets India, 2020
5. ISRO's 2020 plan, News report – Science, The Wire, 2020
6. About ISRO, Department of Space, 2020
7. Policy Reforms to fast-track Investment – Effort towards AtmanirbharBharat, Minsitry of Finance, 2020
8. Draft Spacecom policy, ISRO, 2020
9. Global Space Launch Services Market 2020-2027, Allied Market Research, 2020
10. Global Satellite Services Market 2019-2026, Allied Market Research, 2019
11. Big Bets on India: Amazon, OneWeb, 24 others seek nod for space business, Times News Network, 2020

Acknowledgements

Business Team:

Varun Parchure

Anveet Chawla

Nikhil Kumar

Aparna Veerarouthu

Abhranil Chatterjee

Markets Team:

Satyam Nagwekar

Shveta Pednekar

Venkatesh R

Rahil Uppal

KPMG in India contacts:

Vinodkumar Ramachandran
Partner
Advisory Management
T: +91 91674 57621
E: vinodkumarr@kpmg. com

Abhishek Verma
Partner
Aerospace & Defence
T: +91 99309 67757
E: abhishekverma5@kpmg. com

Capt. Vinod Narasimhamurthy
Director
Aerospace & Defence
T: +91 8130800288
E: vinodn1@kpmg. com

home.kpmg/in

#KPMG josh

Follow us on:
home.kpmg/in/socialmedia

KPMG Assurance and Consulting Services LLP, Lodha Excelus, Apollo Mills Compound, NM Joshi Marg, Mahalaxmi, Mumbai - 400 011 Phone: +91 22 3989 6000, Fax: +91 22 3983 6000.

KPMG (Registered) (a partnership firm with Registration No. BA- 62445) converted into KPMG Assurance and Consulting Services LLP (a Limited Liability partnership firm) with LLP Registration No. AAT-0367 with effect from July 23, 2020.

This document is for e-communication only. (056_THL1220_SP)