



SPACE

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Golden opportunity to Indian Private Industry working on Space technology projects: Two Major Reforms!

Department of Space has promulgated two major reforms in space sector within a short span to give a fresh boost to the space economy.

First is the Establishment of a single window agency titled Indian National Space Promotion and Authorization Center (IN-SPACe) to guide the NGPEs (Non-Governmental Private Enterprises) as approved by the Union Cabinet on 24 June 2020.

Second is the already established single window commercial arm- the Newspace India Ltd (NSIL), incorporated in March 2019 as a wholly owned Central Public Sector Enterprise (CPSE) under the administrative control of the Department of Space.

More than 500 Indian industries like SMEs, PSUs, large industrial complexes participate in all space technology development activities today. The major business areas of NSIL include:

- Production of Polar Satellite Launch Vehicle (PSLV) and Small Satellite Launch Vehicle (SSLV) through industry;
- Production and marketing of space-based services, including launch services and space-based applications like transponder leasing, remote sensing and mission support services;
- Building of Satellites (both Communication and Earth Observation) as per user requirements.
- Transfer of technology developed by ISRO centres/ units and constituent institutions of Dept. of Space;
- Marketing spin off technologies and products/ services emanating out of ISRO activities;

Now, the new body IN-SPACe is expected to enhance the opportunities for the participation of NGPEs including academic institutions, start-ups and

industries in end-to-end space activities. Among others, the IN-SPACe will also handhold the private players on the issue of technology, infrastructure facilities, business promotion, so that partnership will result in more efficient outcomes. The global space sector market size is about \$350 billion as of now while India's share is paltry \$7 billion. This makes it attractive for Indian industry 's participation, provided a compatible business model is introduced. The reforms proposed by Department of Space, GOI, is on right time and in the right direction.

Guatemala becomes a space faring nation

Guatemala from South America joined the community of space faring nations with the launch of its first cube sat named Quetzal-1 on April 28, 2020 with a multispectral sensor onboard to acquire remote sensing data. The satellite was deployed by Japanese Aerospace Exploration Agency (JAXA) from the ISS on Tuesday.

The satellite was developed as a joint collaboration project between United Nations Office for Outer Space Affairs (UNOOSA), JAXA, Universidad del Valle de Guatemala (UVG) under the Kibo CUBE international program. The data from this cube sat will be used to monitor water quality and help achieve clean water and sanitation as part of meeting one of the United Nations Sustainable Development Goals (SDGs).

First of its kind commercial optical ground station in Greece Established!

It is known that optical communication is still not matured to the level expected. But, here is an organisation which establishes a commercial optical ground station in a small town called Nemea in Greece to operationalise such technology. This lead was taken by KSAT in collaboration with



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ASTELLCO of Germany to operationalise such ground based optical down link technology grid to establish optical communication with satellites having optical down links. This ground station is designed in such a way that the specific requirements of KSAT systems like automatic support to multiple missions, and remote operations, with cost effectiveness and less complexity are met as required in any operational setting. Town Nemea is found to be a suitable place with its high clear-sky probability of 95% in summer for cloud free conditions. This idea is to be treated as an add-on to the existing RF systems but not as replacement

Small Optical Link with International Space Station (SOLISS)

Another important development recently reported is creation of high definition bidirectional laser link between ISS and a ground station by technology giants JAXA, NICT and SONY. They could easily communicate fast enough through laser a 100Mbps Ethernet downlink from ISS (Kibo, the Japanese Experiment Module (JEM)) to a ground station.

This is claimed as a first of its kind operation which signifies the possibility of real time data communication between satellites or between satellite and ground.

Sony offered its already well-established optical disc technology for this purpose. The 1.5 micrometer lasers used will be better than RF waves with many advantages such as bandwidth (ref: volume 1 issue 1 January 2019). The impact of this technology will be seen when mass-data communication is needed in space exploration programs such as Mars, Moon and orbiting space crafts or dealing with communication between small satellite constellations. Lot of research is required before we make it commercially viable.

Starlink Satellite Internet – A revolution in the making

Starlink is an ambitious project of SpaceX company to provide a low cost internet access across the surface of the Earth using a constellation of small satellites. The estimated \$10 billion ultimate cost constellation will consist of thousands of small satellites in low Earth orbit (LEO), launched at regular intervals with chosen 60 satellites at a time while linking with corresponding ground transceivers. First 60 operational satellites were launched in May 2019 and is aiming to deploy 1584

satellites of 260 Kg to provide near global service by 2022. All preliminary operational tests were successful leading to get approval from US Federal Communication commission necessary for spectrum allocation. FCC approved spectrum for 12000 satellites already and a case is pending to increase this number to mind boggling 30000. Undoubtedly, this is going to be a disruptive technology in internet communication when it is realized.

Invading Mars with Rovers

Come July, launch rovers to reach the red planet Mars in this season dictated by convenient orbital dynamics and Earth-Mars line up which happens for few weeks in every 26 months. It started with orbiter 'Hope' launched on July 19, 2020 by United Arab Emirates from a Japanese space station on top of a H-2A rocket. It is a first for an Arab State to participate in an interplanetary mission. The second Mars mission in this season is by China on July 23, 2020 with the launching of its fully indigenous rover named Tianwen riding on Long March rocket 5. NASA launched a 3rd rover, 'Perseverance' to red planet on July 30, 2020. Compared to all rovers launched till date, Perseverance is the heaviest and largest in size as big as Maruti car launched on Atlas 5 rocket from Kennedy Space Centre, Florida. All rovers are designed to survive a 6 month journey and all will reach Mars in February 2021 but may choose to land different times and in different locations with different missions.

Tianwen -1 is a combination of a lander and a rover weighing 240kg signifying a major technological breakthrough hither to not tried by other nations. Tianwen -1 is carrying a large number of scientific instruments which can mostly probe Mars geological, sub surface, magnetic and meteorological characteristics. The Emirates 'Hope' rover is funded by the United Arab Emirates and built by the Mohammed bin Rashid Space Centre, the University of Colorado and Arizona State University to provide a complete picture of the carbon dioxide filled atmosphere and its layers and the reasons for the absence of hydrogen and oxygen gases in Martian atmosphere.

The fully autonomous Perseverance rover of NASA is programmed to land inside the 28-mile-wide Jezero crater which is known to have possessed a river and lake delta billions of years ago. Also, designed to conduct experiments to generate oxygen from Carbon Dioxide. The rover will collect and pickup samples before its return. A small Helo named 'Ingenuity' carried on the rover will fly in the Martian air for the first time. The major aim of this massive program is unravelling the

origin of life on the red planet. The two microphones attached to Perseverance will record the sounds of landing on Mars besides experiencing see, touch and taste. NASA has launched in the past, four rovers namely 'Sojourner' (July 1997), 'Spirit' & 'Opportunity' (January 2004) and 'Curiosity' (August 2012) which all have remained successful missions. Perseverance is the 5th rover from NASA in a row.

CoVID-19 impact shown on Dashboard by Space Agencies

The website <https://eodashboard.org> provides details of CoVID-19 country wise global impact in the form of a dashboard made available by three space agencies namely NASA, ESA and JAXA. This dash board gives up-to date information covering economic, agricultural and environmental indicators across the world. One can see the parameters like greenhouse gasses, Air quality. Nightlights etc.

ALE and JAXA begin joint demonstration of Japanese program on commercialization of space debris prevention device

ALE Co., Ltd and JAXA are jointly working on the "commercialization of space debris prevention devices" by gradually deorbiting the satellite after completion of the mission. As part of this program demonstration, ALE and JAXA will jointly install a space debris prevention device on an ultra-small satellite for trials proposed by 2021 in space. It is claimed that this device will be first of its kind to deploy carbon nanotubes (CNT) electron sources and conductive tethers. When satellite mission is completed, the gadget mounted on the satellite prior to launch will release a long string in space and the orbit of the satellite is lowered under the influence of the earth magnetic field. By lowering the orbital altitude in a relatively short time, the satellite will re-enter the atmosphere resulting in its incineration. (Ref <https://www.jaxa.jp/press/2020/03/20200325-j.html>)

Indo-Japanese cooperation in space Exploration

Indian Space Research Organisation (ISRO) and Japan Aerospace Exploration Agency (JAXA) have come together to launch a joint lunar mission called 'Lunar Polar Exploration' and launch a lander and a rover on to the south pole region of moon surface in 2023 from

Japanese launch pad riding on H3 rocket. JAXA will design and build the overall landing module and rover, while ISRO will be building the lander system.

NASA announce its second operational Space X program to be launched in 2021

Following the successful completion of NASA's SpaceX Demo-2 test flight mission, which returned to the Earth on Aug. 2, NASA and its international partners ESA and JAXA have announced the names of the crew for the second operational SpaceX Crew Dragon flight to the International Space Station. NASA astronaut Shane Kimbrough will serve as commander. While Megan McArthur will serve as spacecraft pilot, JAXA astronaut Akihiko Hoshide and ESA astronaut Thomas Pesquet will join as mission specialists. This program will be preceded by the launch of NASA's SpaceX Crew-1 mission, which is planned for late September. The duration of stay for these astronauts as expedition crew is 6 months on board International Space Station. This will provide a good window for NASA to carry out the planned science experiments.

ISRO set to establish second launchpad in Tamil Nadu

ISRO is set to build second launchpad in Tamil Nadu's Kulasekarapattinam which has a strategic advantage over the launch pads in Sriharikota. Small satellite launch vehicles (SSLV) can transit straight to the south pole on less fuel with reduction in trajectory path by bypassing Sri Lanka on the way. Launch vehicles from Sriharikota follow a trajectory where they fly in the southeast direction after lift-off to avoid flying over Sri Lanka, followed by a sharp manoeuvre before proceeding towards the south pole. This manoeuvre is redundant when launched from Kulasekarapattinam saving the rocket's fuel or enhancing the payload capability. SSLV's generally carry satellites weighing up to 500kg into low-earth orbit which is less than 2,000km above the earth's surface.



Phobos imaged by India's Mars Orbiter Mission on 1st July 2020

Mars Colour Camera (MCC) onboard Mars Orbiter Mission has imaged Phobos, the closest and biggest moon of Mars, on 1st July when MOM was about 7200km from Mars and at 4200km from Phobos. Spatial resolution of the image is 210 m. This is a composite image generated from 6 MCC frames and has been color corrected.



Phobos, a captured asteroid is largely believed to be made up of carbonaceous chondrites. The violent phase that Phobos has encountered is seen in the large section gouged out from a past collision (Stickney crater) and bouncing ejecta. Stickney, the largest crater on Phobos could be seen along with the other craters. (Credits: ISRO web site)

ABOUT THIS NEWSLETTER

This quarterly Newsletter from NIAS, IISc Campus is to bring out various latest and important S&T developments likely to find place in future space programs. The future programs include Man in space, Exploitation of extra-terrestrial resources, space based services, space exploration, science of microgravity, space for national security etc., The intention is to provide brief information to researchers, academicians, R&D personnel, space industry to generate S&T leads in the minds of people. It is our endeavour to keep this newsletter fresh and engaging with well researched content. Interested persons can contribute by way of small articles. Any suggestion(s) for improvement of this newsletter shall be highly appreciated.

-Editor

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