Defence Space Projects under Make 1 and Make 2

S. No	Component Challenge Title	Make 1/2	Project Brief	Nodal Officer	Email Id
Defence Space Agency(DSA)					
1	Transportable/Mobile Launch Sys for Small Satls (upto 650 Kgs) with integrated Launch Control Centre	**Make 1**	Static launch sites are vulnerable to hostile actions and could be prime targets in case of hostilities. This necessitates development of transportable launchers which can be moved and deployed for launch as per convenience. It is proposed to develop Transportable/Mobile Launch Systems that can operate from ground/ aerial/ sea-based platforms to provide launch capabilities with flexibility of launch windows for different kind of payloads. The launch system should be all weather capable and be able to deploy satellites weighing upto 650 Kgs to altitudes upto 700 Kms. The system should be able to change from transportable position to 'Launch ready position" in not more than 60 minutes.	Col R Jithendra	dirrnddsa.ids@gov.in
2	Mobile Multi Object Tracking Radar with detection range upto 250 Kms	**Make 1**	As a component of the Challenge 1, it is proposed to develop a mobile Multi Object Tracking Radar which can be deployed on any existing suitable military prime mover or develop a suitable one, for mobile operations. This radar should have a detection range of min 250 km or more and should be able to track at least 15 objects (25 x 25 cms) simultaneously. All radar system accessories incl power system should also be integrated with the radar.	Col R Jithendra	dirrnddsa.ids@gov.in
3	Development of modular small satellite bus for rapid integration into the launcher	**Make 2**	As a component of the Challenge 1, it is proposed to develop a modular small satellite bus which is capable of integrating different payloads in short time for LoD purposes. The satellite bus design has to be modular for easy and quick integration with different payloads and finally with the mobile launcher with overall weight between 150-650 kgs. The design should consider the option of multiple small satellites, with in the specified overall weight and space, for integration into mobile launcher.	Col R Jithendra	dirrnddsa.ids@gov.in
4	Small Satellite Launch vehicle for launching satellite weighing 150 -650kg to LEO	**Make 2**	As a component of the Challenge 1, it is proposed to develop a Small Satellite Launch Vehicle, which can be integrated into a transportable/mobile launcher system, deployed on a suitable prime mover. The launch vehicle should be able to accommodate multiple satellite configurations with overall weight ranging between 150-650 kgs and deploy satellites upto 700 km altitudes. It should not take more than 72 hrs to prepare and launch.	Col R Jithendra	dirrnddsa.ids@gov.in
5	Development of a GEO Data Relay Satellite having high speed optical Inter-Satellite Link capable of communicating with Satellites in LEO	**Make 1**	LEO imaging satellites are visible to any single GES (Ground Earth Station) for a short period of time. For rapidly increasing voluminous data download from sensors in space, necessitates more number of GES to enable complete data dump by the satellites before the next imaging session. However, the LEO satellites are visible to a GEO satellite for comparatively more amount of time and GEO satellite is constantly visible to GES. It is proposed to develop a GEO satellite with modular TDRS (Tracking and Data Relay Satellite) payload for communicating with LEO satellites along with the pointing assembly and the power electronics. The GEO TDRS module to have a high speed Laser based Optical Inter-Satellite Link (ISL) facility. This module should be able to seamlessly integrate with a LEO ISR satellite and should be able to transmit data at rates greater than 1.5 Gbps. The TDRS to have a High Throughput System (HTS) for data downlink with GES preferably in Ku band.	Col R Jithendra	dirrnddsa.ids@gov.in

6	Highly Agile (Agility rate > 7°/sec) Small Satellite Constellation (2 satellites) for LEO	**Make 1**	It is proposed to develop two highly agile satellites that will provide significant boost to the imaging capability compared to existing EO satellites. The challenge is to develop two highly agile platforms that can house an Optical and a SAR payload respectively. The agility to be 7°/sec or better and should be compatible with three axis stabilised satellites. The inter-spot imaging distance derived out of this agility rate should be 2 kms or less. The weight penalty of the Attitude and Orbit Control System (AOCS) should be approximately 40 to 60 kgs providing this agility rate.	Col R Jithendra	dirrnddsa.ids@gov.in
7	Development of V-band based Inter-satellite Link communication module for Small Satellites offering data rate upto 1.5 Gbps	**Make 2**	As a component of Challenge 2, it is proposed to develop a RF based ('V' band) Inter-Satellite Link m	Col R Jithendra	dirrnddsa.ids@gov.in
8	Laser based comn system as modular payload for Small LEO satellites offering > 1.5 Gbps data transfer rate between LEO and GEO Data Relay Satl	**Make 2**	As a component of Challenge 2, it is proposed to develop a Laser based Optical Inter-Satellite Link payload for small satellites in LEO to communicate with other LEO satellites and GEO satellite as part of the TDRS system. The system with all its power electronics should be able to easily integrate into LEO satellites. The desired data rate for this system is greater than 1.5Gbps.	Col R Jithendra	dirrnddsa.ids@gov.in
9	Integration of Optical and Radar Sensors into a network with AI based Analytics	**Make 2**	Presently, the capability for detecting, tracking and monitoring satellites/ space debris is very limited. There is a need for development of an integrated optical and radar sensors network along with AI based analytical system. The developed system should be scalable in terms of addition of incremental number of sensors for credible and real time Space Situational Awareness (SSA). The system should be capable of real time monitoring and trajectory analysis of very large number of space objects, confluence analysis and collision prediction of any space object and provide timely warning and window for evasive manoeuvres.	Col R Jithendra	dirrnddsa.ids@gov.in
10	Imagery data fusion for Optical and Radar data sources	**Make 2**	As a component of challenge 4, it is proposed to develop a multi format imagery data fusion platform along with AI analytical tool which is capable of integrating the data received from multiple optical and radar sensors into a unified data set. The AI tool will analyse this unified data set to provide reliable space situational awareness.	Col R Jithendra	dirrnddsa.ids@gov.in
11	Geo-AI based Multi-Sensor Optical/Radar Equipment Siting Simulator	**Make 2**	As a component of challenge 4, a Sensor Equipment Siting Simulator is proposed to be developed which uses Geo-AI tool for easy and efficient siting of optical and radar equipment in our areas of operations. This would greatly assist in faster deployment of future sensors for optimal equipment	Col R Jithendra	dirrnddsa.ids@gov.in
12	Training Simulator for Space Activities	**Make 1**	There is a requirement to simulate space-based contingency scenarios periodically so as to train upon the requisite counter measures and also to test the efficacy of these counter measures once they are developed. It is proposed to develop a space simulator, which is a software-based training simulator specifically designed for simulating dynamic space situations. The simulator should be scalable to include many feasible scenarios and its counter measures.	Col R Jithendra	dirrnddsa.ids@gov.in
13	200-Watt Ka band Solid State Power Amplifier (SSPA) for Satellite Ground Station	**Make 1**	The SSPA plays a critical role in establishing the ground to satellite communication link. Currently, there are no indigenous brands available which offer Ka band SSPAs with a power rating of 200 Watt. With future satellites operating in high frequency bands like Ka which offer high data rates and most LEO imaging satellites using Ka band for satellite to ground links, it would be imperative to develop this capability as an indigenous product.	Col R Jithendra	dirrnddsa.ids@gov.in

14	Development of Orbital Transfer Vehicle for Space Debris removal in LEO	**Make 2**	With the number of satellites being launched by private industries worldwide, the risk of debris and its management will be a major challenge in future. There is a need to develop an OTV which can be operated in space for debris removal. This would require a space vehicle to undertake close proximity operations and development of associated guidance system for autonomous/ semi-autonomous operations. As per the debris detection, the OTV should be capable of shifting from one orbit to other in LEO. The challenge includes development of sensors such as LIDAR, EO etc and associated ground systems.	Col R Jithendra	dirrnddsa.ids@gov.in
15	Development of Space-grade robotic arm with ground-control	**Make 2**	As a component of challenge 10, a robotic arm is one of the prevalent ideas for orbital debris removal. It is proposed to develop a 3m long robotic arm, with at least 4 degrees of freedom. This arm must not derive too much power from the host satellite. It must be able to fold easily when not in use. The arm should be dexterous enough to capture even misshapen debris and release them in a designated orbit/towards Earth. Another desirable capability would be that the arm can aid in proximity operations and docking of satellites.	Col R Jithendra	dirrnddsa.ids@gov.in
16	Intelligent Object Identification System with LIDAR and EO sensors	**Make 1**	As a component of challenge 10, it is proposed to develop an AI-based system to recognise potential threats to the satellite from debris. The satellite will carry LIDAR and EO sensors as payloads, whose data will be analysed by the on-board AI tool to predict approaching debris for collision avoidance and for providing inputs to the proximity and docking operations.	Col R Jithendra	dirrnddsa.ids@gov.in
17	Modular SSTO Launch Vehicle System (Land/Sea launch) with Configurable Satellites Integration Mechanism for Launch on Demand of Small Satellites (Upto 150 kgs/400 Kms/48 Hrs))	**Make 1**	Single Stage to Orbit (SSTO) launch vehicles employ non-conventional propulsion and have modular architecture. These launch vehicles have single stage which employs only a specific fuel and hence are restricted by their payload capacity. However, they have an all-weather launch capability and can be readied in record times. Hence, the challenge involves developing a Single stage to Orbit Rocket that employ's only green propulsion and can carry payloads upto 150 kgs to 400 Kms altitude. The launch vehicle should have modular design and should be assembled in 48 hours.	Col R Jithendra	dirrnddsa.ids@gov.in
18	Modular TSTO Launch Vehicle System (Land/Sea launch) with Configurable Satellites Integration Mechanism for Launch on Demand of Small Satellites (Upto 500 kgs/400 Kms/72 Hrs)	**Make 1**	Two Stage to Orbit (TSTO) launch vehicles have the ability to propel to LEO heights and can be assembled in short times. Moreover, these launch vehicles have reduced launch costs and have high mobility factor. The challenge involves developing a Two Stage to Orbit Rocket that can employ either green propulsion or conventional propulsion and can carry payloads upto 500 kgs to 400 Kms altitude. The launch vehicle should have modular design and should be assembled in 72 hours.	Col R Jithendra	dirrnddsa.ids@gov.in
19	Development of a Mini Imaging/Comn Satellites for LoD	**Make 2**	Mini satellites are the game changers for future missions due to their quick developmental times and modular designs. The LoD option would require compatible mini satellites for quick integration into the launch vehicle. Hence development of one mini communication and one mini imaging (EO/IR) satellite for integrating into the LoD launch vehicle is proposed as a challenge.	Col R Jithendra	dirrnddsa.ids@gov.in
20	Develop a high resolution Optical Telescope with Aperture size of 1-3 mtr	**Make 1**	Ground based optical telescopes are essential for sourcing the inputs for Space Situational Awareness (SSA). Optical telescopes have shorter developmental time lines and can be developed in a cost effective way, thereby helping for building sovereign Space Sensor Network capability in shortened time lines. It is proposed to develop a HR optical telescope which should be able to detect and track space objects (minimum size 10cm x 10cm) accurately	Col R Jithendra	dirrnddsa.ids@gov.in
INDIAN ARMY					

21	Development of V/UHF Handheld Satellite Software Defined Radio (SDR)	**Make 2**	There is a requirement of indigenous handheld V/UHF Satellite SDRs to be utilised in remote areas in Indian Subcontinents. Desirable features are as follows: - • Total weight incl battery – below 500 gm. • Programmable V/UHF Freq band. • SCA 4.1 or above compliant. • Data Rate – Min 8 Kbps at all times over entire band. • MANET Compatibility. • Fall back mode for connecting to terrestrial TETRA/ UHF station. • Support communication on the move the speed up to 60 Kmph.	Col Vikram Singh	spacedomain-01@gov.in
22	Lightweight, Compact Ka band User Terminals for mobile Grnd & Airborne platforms	**Make 1**	Data rates from SatCom are dependent on the frequency band of operation. Higher bands offer higher data rates with a trade-off of attenuation and processing complexity. However, with a greater user demand for higher bandwidths in coming future, the move towards higher frequency bands like 'Ka' is inevitable. But the challenge lies in using Ka band SatCom for platform with high mobility. This is because at high speeds and frequently changing orientation of platform, the doppler shifts induced are great and need to be compensated with signal processing techniques. **Low mobility Ka band terminal:** • Data rates up to 16 Mbps for speeds ranging up to 60 Kmph (min). • net antenna weight should be no more than 50 kg • less than 75 cms in length and the overall volume (excluding the volume of battery bank) should be less than 0.1875m3 • BUC power range of 40W to 50W. **High Mobility Airborne Ka band Terminal:** • Support data rates up to 2Mbps at a speed of 400 Kmph with random acceleration of (+/-) 4g. • net weight including antenna should be no more than 10 kg • overall volume (excluding the volume of battery bank) should be less than 0.1m3 • BUC power range of 12W to 20W.	Col Vikram Singh	spacedomain-01@gov.in
INDIAN AIR FORCE					
23	Development of Multiband Programmable RF Sensor Satellite	**Make 1**	It is proposed to develop a Multiband Programmable RF Sensor Satellite which is capable of detecting RF sources (0.5-40 GHz) from LEO. Critical parameters that are to be measured from the space-based sensor include intercepted parameters comprising of emitter identification along with time of arrival, direction of arrival, frequency range for emitter (minimum and maximum with deviation), all frequency pattern (Fixed, Agile, Batch, Dwell and switch etc.), Pulse Repetition Interval and Pulse Group Repetition Interval (with all PRI pattern like Constant, Jitter, Stagger, Dwell & Switch etc.), PRI associated with each spot frequency Pulse Width, Effective radiated power of emitter along with type of Antenna Scan, Scan Rate, Polarization, Beam width (Elevation and Azimuth), Side Lobe Level (with Standard deviation), Time on Target Wave, Localisation Information (in user defined format) along with Intra Pulse data.	Gp Capt Sandeep	dspace574@iaf.nic.in
24	L/P band Synthetic Aperture Radar (SAR) Small Satellite	**Make 2**	The existing SAR satellites mostly use X-band SAR, which are best suited for detection of man-made objects but performs badly with natural vegetation like foliage or forest cover. L/ P band SAR with sub-metric resolution has capabilities of foliage penetration and detection of sub-surface targets and hence, is desirable for detection of concealed targets. It is therefore proposed to develop an L/P band SAR small satellite for effective foliage penetration.	Gp Capt Sandeep	dspace574@iaf.nic.in

25	Ultralight weight, Sub-Meter Resolution Monolithic SiC Telescope as Optical Payload	**Make 2**	Silicon Carbide (SiC) is the preferred material to develop optical telescopes due to its high stiffness, low coefficient of thermal expansion and high thermal conductivity. As a component of challenge 6, it is proposed to develop a space grade optical telescope using SiC which will offer a sub metric resolution. The optical telescope should be able to integrate as a payload on a small satellite with overall weight of 150kgs.	Gp Capt Sandeep	dspace574@iaf.nic.in
26	Innovative Space Applications of Fourth/ Final Stage of Launch Vehicles	**Make 1**	The last stage of a rocket after separation of spacecraft will be loitering in the outer space for considerable time, before eventually becoming debris. This stage could be converted into a short-term satellite bus for experimental payloads. Integration of an ELINT or EO payload to the final stage of the launch vehicle is proposed as a challenge. The necessary on-board support elements for controlling and extracting the information from the payload would also need to be developed. The challenge should include the required protection mechanism for the payloads during the rocket operation and its deployment on demand.	Gp Capt Sandeep	dspace574@iaf.nic.in
27	High Throughput Communication Satellite in LEO	**Make 1**	At present communication satellite services availed through GEO has inherent disadvantages in terms of its known location and latency. It is proposed to develop a LEO constellation of two satellites for extending satellite communication services. The payload configuration could be 'Ku' or 'Ka or higher bands of microwave spectrum to accommodate high data rate applications. End-to-end solution is envisaged, with ground control systems and hub infrastructure. Multiple SDR based user terminals could be planned depending upon operational utility with data rates better than 100 Mbps. The user terminals could be static, airborne and mobile.	Gp Capt Sandeep	dspace574@iaf.nic.in
28	Development of Network Mgt Port (NMP) for efficient SATCOM Bandwidth Mgt using multiple satls	**Make 2**	Towards effective utilisation of SATCOM bandwidth, a centralized dynamic bandwidth allocation centre (i.e., Network Management Port) to be developed, wherein the bandwidths are assigned to needy user as per user segment capability. Initially 'C' & 'Ku' could be optimized for centralized allotment. Network Management Port should have the complete control over the bandwidth available from all the satellites, with a network of multi band antennas for different satellite. Demand prioritization could be done at space port. A certain amount of unused bandwidth could be kept as reserve to meet emerging requirements. A unified Network Management System has to be developed for converting various user segment protocols into a standard/common protocol for efficient resource allocation.	Gp Capt Sandeep	dspace574@iaf.nic.in
29	On Orbit Maintenance and Refuelling (OOMR) technology in LEO	**Make 1**	Existing satellites be it communication, ISR or PNT will become non-operational once its fuel is exhausted or in case of a malfunction to the component/ sub-system. The concept has significant advantages as the spacecraft or the payload of a satellite could be serviced by a service module for refuelling the spacecraft thereby enhancing its mission life, service/replace an unserviceable module and integrate/ replace an out-dated component with an advanced component. Therefore, it is proposed to develop this OOMR technology for future satellites in LEO.	Gp Capt Sandeep	dspace574@iaf.nic.in
30	On Orbit Propellant Storage and Transfer system	**Make 1**	As a component of challenge 14, it is proposed to develop a space based, on orbit refueller for LEO satellites. This would necessitate transferring fuel from tanker satellite to the receiving satellite. Given the micro-gravity conditions and the extremities of the environment, space grade fuel storage and fuel-transfer system have to be innovated.	Gp Capt Sandeep	dspace574@iaf.nic.in
31	Autonomous Docking Operations for OOMR	**Make 2**	Refuelling, maintenance and upgrading operations in orbit requires precise rendezvous, proximity and docking operations. As a component of challenge 14, it is proposed to develop an AI-based system for these critical operations. Using data from the various payloads, the AI should autonomously calculate and complete the proximity operations, as per the mission objectives.	Gp Capt Sandeep	dspace574@iaf.nic.in

32	On Orbit Space Infra maintenance and upgrade operations	**Make 1**	As a component of challenge 14, it is proposed to develop mechanism to perform in-orbit maintenance of space infra and upgrade operations of satellites/payloads. Sometimes, certain payloads may not work as desired, or may reach their end-of-life. As the satellite is still operational, it is cheaper to undertake maintenance activity to replace the payload via another satellite.	Gp Capt Sandeep	dspace574@iaf.nic.in
33	Development of a Computer Defence System for Cyber Situational Awareness to Secure own Satellites from Cyber Attacks.	**Make 2**	The existing satellites have limited capabilities to withstand sustained EW or Cyber-attacks. With space being increasingly contested, it is matter of time that space assets become more prone to EW and Cyber-attacks by adversaries in a hostile climate. There is a need to identify vulnerabilities in the current satellites to develop EW and Cyber suites that overcome these vulnerabilities. Such suites will have to be incorporated in future satellites to make them EW and Cyber hardened. Therefore, it is proposed to develop EW and Cyber hardening suites for incorporation in LEO and GEO satellites.	Gp Capt Sandeep	dspace574@iaf.nic.in
34	Cyber hardening Suite for Satellite Comn links/Hubs	**Make 2**	As a component of challenge 15, it is proposed to develop a hardening suite that is capable of automatically detecting security weakness in communication links and Hub infra. This technology should have the potential to identify hackers interfering and controlling links or breaking into a ground station or tampering with user terminal and sending malicious inputs. All attack vectors of cyber domain including injection attacks, replay attacks, spoofing attacks etc should be prevented by the system.	Gp Capt Sandeep	dspace574@iaf.nic.in
35	Modular, Multi payload Configureable VLEO Vehicle/Bus	**Make 1**	VLEO is Very Low Earth orbit, which is usually populated by small satellites. These satellites are low cost but carry certain payloads from which useful information can be derived. It is proposed to build a VLEO satellite bus, which is modular, low cost and easily integratable with multiple payloads, should have efficient propulsion system to effectively perform housekeeping operations and also achieve the mission life. This satellite bus should be able to carry miniaturised payloads, depending on the mission requirements.	Gp Capt Sandeep	dspace574@iaf.nic.in
36	Ultra High Resolution Optical payloads with Edge Computing for VLEO Bus	**Make 2**	Edge computing is a distributed information technology architecture in which client data is processed at the periphery of the network, as close to the originating source as possible. As a component of challenge 16, it is proposed to develop an ultra-high resolution optical payload to be deployed on a VLEO satellite along with Edge Computing based On-board processing system. This on-board edge computing tool should be able to process huge data received from UHR payload of VLEO satellite.	Gp Capt Sandeep	dspace574@iaf.nic.in
37	CBRN Threat detection and Monitoring Sensors for VLEO Bus	**Make 1**	Space based surveillance has the capability for early warning and detection of any CBRN activity on ground. Space based sensors will act as the primary triggering layer for early detection of these CBRN activities. As a component of challenge 16, it is proposed to develop specific sensors for detection and identification of CBRN (Chemical, Biological, Radiological, and Nuclear) activities and their sources. The sensors should be easily integrated into the VLEO satellite bus.	Gp Capt Sandeep	dspace574@iaf.nic.in
38	HySIS Payloads for VLEO Bus	**Make 2**	As a component of challenge 16, Hyper Spectral Imaging Spectrometer (HySIS) payload is proposed to be developed for satellites to be launched in the Very Low Earth orbit (VLEO). The challenge also includes real-time processing of data and storage of the data generated. This payload may be miniaturised for deployment on smallsats.	Gp Capt Sandeep	dspace574@iaf.nic.in
39	Advanced Extremely High Frequency (AEHF) GEO Satellite for Secure Comns	**Make 1**	AEHF satellites provide a network of encrypted, jam-proof communications for strategic for tactical secure communications. It is proposed to develop an AEHF GEO satellite which should capable of handling ten times more data than the existing rate and feature advanced encryption technology.	Gp Capt Sandeep	dspace574@iaf.nic.in
INDIAN NAVY					

40	Quantum Encryption Modules for Secure Satellite Communication	**Make 2**	The present satellites use traditional cryptographic algorithms for ensuring confidentiality of data. The requirement of employing Quantum Encryption in satellite communication is the need of the hour. The quantum encryption module should be able to support standard data rates of DVB-S2 modems which are typically at 2 to 4 Mbps. The module should be in a plug and play form factor. The module should be able to interface with the existing antenna systems.	Capt Manish	insc-navy@nic.in