Seminar Report

SPACE MILITARISATION

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The Centre for Land Warfare Studies (CLAWS), New Delhi, is an autonomous think tank dealing with contemporary issues of national security and conceptual aspects of land warfare, including conventional and sub-conventional conflicts and terrorism. CLAWS conducts research that is futuristic in outlook and policy-oriented in approach.

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EXECUTIVE SUMMARY

A summary of the key recommendations are as follows:

- A Space Commission needs to be formulated, directly under the National Security Agency (NSA). It should have a military as well as civilian component. The military component can be headed by a three-star general and assisted by scientists of the Indian Space Research Organization (ISRO) and Defense Research and Development Organization (DRDO). The executive authority to conceive, configure, and implement military specific space programs should be with space commission.
- The following areas need focus due to restricted capabilities of the country:
    - Space Support, including launching, deploying, maintaining, and recovering space vehicles.
    - Space Control, to encompass surveillance and protection of space assets, and prevention of adversary's ability to use its space assets.
    - Space Force Enhancement, to include Intelligence Surveillance Reconnaissance (ISR), Positioning Navigation and Timing (PNT), command and control communications, tactical warning and attack assessment. The primary requirements are coverage of an area of interest, enhancement of technical ISR capabilities, improved ISR persistence, and enhanced resolution and responsiveness (i.e. launch on demand). Automatic change detection for faster interpretation and dissemination of information to commanders, all weather sub-surface imaging capability for mine detection, stereo imaging capability, for making digital elevation models and thermal imaging capability.
- The capability of Space Situational Awareness, i.e. information delivery regarding space environment, requires special attention, because of the existing capability of India's neighbors.

- Capacity Enhancement of Satellite Communications. Existing transponder capacities necessitate hiring bandwidth commercially from satellites of other countries. These capacities have to be enhanced with Indian bandwidth.
- ISRO is actively pursuing engagement with the private industry. Smaller satellite manufacture and launch capabilities are being handed over to the private industry. However, to meet the aspirations of being a national security enabler, the time frames need to be drastically reduced.
- In terms of future challenges development of hypersonic weapons requires close attention. The nature and pace of development of this technology may lead to the loss of relevance of Ballistic Missile Defense (BMD) technologies/architectures.

DETAILED REPORT

Introduction

Globally space based assets have become an integral aspect of national security. The use of outer space for military functions of reconnaissance, communication, and navigation has reached a certain amount of maturity since such usage does not directly violate any international laws. Additionally, options for cheaper access to space have allowed more nations to join the group of space capable nations. Across the world, private participation is being encouraged to support national space programmes as also for commercial exploitation. Thus, it is essential that the Government and ISRO bring out a clear roadmap to encourage domestic private participation in the sector.

Objectives of the Seminar

The Seminar would debate multiple issues related to space and its exploitation for national security. The objective would be to generate recommendations for a more optimal management of the domain towards national security in general and for utilisation by the Indian Army in particular.

National Security and Indian Space Militarisation

The first and foremost use of space is for information advantage for military and security operations and strategic planning involved in security. Space programmes create technical capabilities which all modern armies have to depend on. In addition to this, it involves national prestige and international influence. The Indian space programme was developed with a primarily civilian focus. However, a re-examination is necessitated today because of major technology advancements in the military space segment in India and adversaries. The Kargil war also starkly brought out the need for use of space assets for the furtherance of military capabilities. Full exploitation of Network Centric Warfare (NCW) requires optimum utilisation

of space and close collaboration, between ISRO and DRDO, which presently is non-existent. Inadequate budgetary support for acquiring minimum space capability is a major constraining factor. Some of the perceived threats to the Indian space assets are as follows:

- Jamming of communication, command, and control systems/ links and cybernetic attack on space systems;
- Physical attack on satellite ground stations;
- Dazzling or blinding of satellite sensors;
- Hit to kill anti-satellite weapons;
- Pellet cloud attacks on low orbit satellites;
- Attack by micro satellites to act as space mines;
- High Altitude Nuclear Detonations (HAND);
- Capture of satellites;
- Space debris; and so on.

Policy of Nations and Legal Framework for Space Exploitation

The stated space policy of most nations is for peaceful purposes only. The Space Vision 2020 of their Space Command calls for USA to become a steward for military space and specifies things like dominate the space dimension for military operations, to protect USA interests, and integrate USA space assets into war fighting capabilities across the full spectrum of the conflict. The Chinese official posture is that outer space is to be used for peaceful purposes only. However, China has established a space operations military branch to speed up space and air integration, as well as sharpen its offensive and defensive capabilities. Russia released its space vision document, 'Space Program Activities Through 2020', in May 2014. The Document highlighted a new lookout for projects and partners including cooperative space projects with China. They plan the creation of space weapon systems to assure combat effectiveness for all branches of the Armed Forces, preventing others from utilising space and developing a strategic offensive system to conduct battles in space. Pakistan has released a document called 'Pakistan Space Program 2040', as part of this

Program. They visualise to launch five geo and six leo satellites till 2040.

The legal framework that the global community has in place with regard to space is composed of a 1967 Outer Space Treaty. Article 4 of this Treaty prohibits placing nuclear weapons and weapons of mass destruction in outer space. At that time there was no visualisation of how weapon systems would evolve, as a result today this Treaty falls short of controlling the growing militarisation of space. Anti-satellite weapon systems, cyber-attacks, lasers, directed energy weapons, etc., are not covered by this Treaty adequately. There is a growing realisation to put in place an all-encompassing legal mechanism to halt this weaponisation. How far that is possible will be seen in the coming years.

Technological Capabilities of India in Space Domain

The primary defense satellites are GSAT 7 which went into orbit in 2013. This Satellite caters to the requirements of the Navy. In 2018, GSAT 7A will be operationalised which is primarily an IAF satellite, with 30 per cent stake of the Army. Thereafter, GSAT 7B is planned, which will be primarily an Army satellite.

There are three primary areas of exploitation of space resources. These are Satellite Communications, ISR, and Positioning Navigation and Timing (PNT). The space programme needs to concentrate on developing the associated technologies in these respective fields. In totality, India has about 13 communication satellites, with a large number of transponders in C, extended C, Ku, and UHF band. Ka band should be available by 2018. Drawbacks in satellite communications are transponder availability and capability. As a result, we have to hire transponders from commercial satellites. Remote sensing satellites are, three in geostationary orbit basically for the weather, and 13 in sun synchronous orbit. Seven navigation satellites are already in orbit, and two satellites for space science. The defense forces require dedicated communication satellites.

In the case of ISR operational surveillance is handicapped, since there are only cartographic satellites, with sub-optimal resolutions

and long revisit times which have its attendant drawbacks. The requirements are as follows:

- Coverage of area of interest with sub-meter, i.e. 0.20-metre resolutions;
- Improved ISR persistence for tactically viable revisit times, and responsiveness, i.e. launch on demand;
- Enhanced ISR capability in terms of accuracy, i.e. in terms of repeativity and revisit. Presently, there is repeativity of 28 days and revisit of 4-5 days. Revisit is required to be reduced to up to 4 hours, with Electro Optic(EO), and, with Synthetic Aperture Radar (SAR) every 6 hours over the area of interest;
- Hyper spectral imaging capability, along with associated hyper spectral libraries;
- Multi-sensor technologies which include hyper spectral and electronic intelligence and direct satellite based dissemination;
- In PNT, requirement is of multi-global navigation satellite system, better than 10-metre accuracy for targeting and navigation which will cover the entire globe, with anti-jamming and anti-spoofing features; and
- Space Situational Awareness, is also a major requirement, which is present with India's adversaries.

India has its own IRNSS system with a total of 11 satellites, 7 for civilian uses and 4 exclusively for defense. For Satellite Based Augmentation System (SBAS), there is GAGAN which is functional. The Global Navigation Satellite System (GNSS) restricted services are under consideration and will be ready in the next 2 to 3 years. Once IRNSS system is fully functional there will be full navigational capabilities in India's areas of interest.

India lacks in the following areas, and requires enhanced capabilities:

- Data processing, data interpretation, and analysis;
- Automatic change detection for faster interpretation and intimation to commanders;

- Day-night all weather sub-surface imaging capability. To facilitate the capability to detect mines;
- Stereo imaging capability, for making digital elevation models, digital terrain models, since accurate heights are required by precision weapons;
- Thermal imaging capability; and
- Dedicated constellation of military imaging satellites. The constellation of micro satellites is required, to have a greater coverage with low resolution, so that once changes are detected high-resolution satellites can be directed over those areas.

Space Militarisation Roadmap

Militarisation of space could have been said to have begun with The Star Wars Initiative of USA in 1983. China has invested heavily in remote sensing networks. At present they have 4-5 functional satellites, within the next 15 years it will be expanded to a network of 138 satellites. The plan is to have 10 minutes revisit time of every part of the world. Other technologies which have been developed globally are near the earth or space systems. This is essentially something above the stratosphere and below the low earth orbit. There can be aerostats or balloons placed in this layer, to replace existing satellite networks.

Space tracking and surveillance systems, are not very fool proof and are in experimental stages. Anti Satellite (ASAT) technologies using kinetic kill, is an important area of research and is being given a lot of attention. There could be lasers, jamming technologies, etc., which could also be used for ASAT. In the future, technology in the realm of early warning satellites and the remote sensing capabilities will dictate the roadmap. Ballistic Missile Defense (BMD) is an area, where targeted research is being carried out by both Russia and USA, focusing on all stages of satellite deployment. In terms of BMD capability, till the time one cannot intercept in outer space, the capability is useless; so from that perspective it is more or less sure that USA will not allow any treaty to come in. Another activity that can happen is the progress of the hypersonic weapons. Today

successful tests have been conducted which allow these vehicles to travel at speeds ranging from 5 Mach to 25 Mach. As a result of which in the future the relevance of the BMD architecture can be totally lost. Thus, it is anticipated that militarisation will continue and no countering activities will happen. Countries like India will always have a fear that an Non Proliferation Treaty (NPT) like situation may be created by the top three or four countries, wherein they get together and declare that only they can have ASAT technologies and other countries are not permitted to develop the same.

National Private Sector and The Indian Space Research Organisation

Considering the large number of existing space assets and the future roadmap, the load on ISRO has gone up in a big way. Today, ISRO is itself developing, integrating, testing and launching the satellites. To ease the load and consequently enhance capability the following partnerships have been planned:

- GSAT series ground segment, ISRO has collaborated with BEL for system integration.
- GSAT 6
    - Messaging terminals, tie up with four companies. ISRO develops the prototype and hands over the technology to the industry for putting into production.
    - Satellite phone, multi-media terminals, and broadcast receivers tie up with one company.
- NAVIC receivers, two companies Data Patterns and Accord Systems have been partnered.
- Ground systems are being jointly partnered with private industry for a long time now.
- Launch vehicle production involved more than 200 companies from day one.

In future, the Government has approved 12 launches per year. Thus, private industry has already started putting up the facilities, since they are assured of business. The first Polar Satellite Launch

Vehicle (PSLV) totally integrated by the industry is supposed to be ready by 2020; Quality Assurance (QA) will still be done by ISRO, the fourth one will come in by 2021, thereafter ISRO will not involve itself in PSLV anymore. ISRO will only place the order on the industry, which in turn will manufacture and launch it. The industry will also be given the flexibility to build their personal launch pad or use ISRO launch pad and pay for it in case required.

The Geosynchronous Satellite Launch Vehicle (GSLV) is still in development stage, so the industry is not involved. However, sub-systems are being made by private industry. For large communication satellites, it has been decided that sub-system manufacture will be given to the industry, however, assembly, integration, testing, and QA will remain with ISRO. For medium satellites like NAVIC or remote sensing satellites, ISRO is collaborating with industry to produce two NAVIC satellites which will be spare on the ground. QA will be done by ISRO. For small satellites, ISRO has planned to give it to the industry. This is awaiting government approval. Future major missions like human space flight, heavy lift launch vehicle, etc., can only happen with private industry participation.

Organisational Structures and Human Resource

The organisational structures within the defense forces require an overhaul. India needs more joint structures. The space agency for the services is due to be formed. A dedicated military space programme is required. It is very important to delineate civil and military programmes and make financial allocations accordingly. The synergy of approach is required between ISRO and DRDO and between various strategic users like the military, National Technical Research Organization (NTRO), Defense Intelligence Agency (DIA), and Research and Analysis Wing (RAW). The Space Commission needs to be formulated, directly under the NSA. It should have a military as well as civilian component. The military component can be headed by three-star general and assisted by scientists of ISRO and DRDO. The executive authority that will conceive, configure, and implement military specific space programmes should be with space commission.

Within the three services, the resource base needs to be improved. One of the challenges is the human resource (HR) management of trained manpower. In spite of best efforts, getting the right man for the right job is difficult. We need to carry out dedicated and highly focussed training for domain specialisation.

Recommendations for Enhancement of Military Space Capabilities

- Enhancement of space capability and creation of space command;
- Create redundancy by deploying a number of satellites;
- Reduce dependence on foreign satellites;
- Dedicated military satellites (if necessary);
- Electronic Warfare and cyber-attack;
- Indigenous missile defense system;
- Quick launch and mobile launch capability; and
- Space security treaty.

Conclusion

Nations can conduct military operations, perform intelligence, security and planning functions without the assistance of space, but they will always be at a disadvantage when compared to nations that do, particularly the adversaries. As far as ISR capabilities are concerned the three paradigms that we require are what, where, and when. We have to cover a lot of ground, as far as technological advancements in the field of ISR is concerned. In the field of ASAT and hyper sonic vehicle technologies, there is a need to expedite the research and induction. To enhance the capacity of ISRO private industry is being associated in many ways, such as in satellite manufacture, ground systems. PSLV launch vehicles are expected to be taken over in totality by private industry in 2020-21 time frame.

PROGRAMME

1000-1030h	**Registration and Tea**
1030-1040h	**Welcome Remarks: Lt Gen BS Nagal, PVSM, AVSM, SM (Retd), Director CLAWS**
1040- 1110h	**Inaugural Address: National Security and Indian Space Militarisation: A Strategic Overview – Lt Gen P M Bali, VSM - DG PP**
1110-1125	**Introduction to the Seminar by the Chair – Lt Gen Davinder Kumar, PVSM,VSM**(Retd), former Signal Officer-in-Chief**
1125-1145h	**Threats to Space Assets and Capabilities of our Neighbours– DACIDS / Lt Col P P Biswas, ISC, HQ IDS**
1145-1200h	Q&A
1200-1220h	**Tea**
1220-1240h	**IA ISR Requirements In The Space Domain – Col Pankaj Sharma, MI 17**
1240-1300h	**Space Militarisation Roadmap: Types of Satellites / BMD / ASAT / Transponder Capabilities / Space Situational Awareness – Gp Capt Ajey Lele(Retd), IDSA**
1300-1320h	**National Private Sector and ISRO: Capacity Building for Space Militarisation – Geeta Varadan**
1320-1345h	Q&A and Closing Remarks
1345-1430h	**Lunch**


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