Outer Space: "Endless to Explore, Infinite to Learn"

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There is something more important than any ultimate weapon. That is the ultimate position—the position of total control over Earth that lies somewhere out in space. That is…the distant future, though not so distant as we may have thought. Whoever gains that ultimate position gains control, total control, over the Earth, for the purposes of tyranny or for the service of freedom.

— Lyndon B. Johnson, United States Senator, 1958[1]

Abstract

Mankind in outer space has progressed from exploration to exploitation. The future of war and the success of ground forces will be critically dependent upon the effective use of space assets and capabilities across the spectrum of conflict. The coming of space-based systems has added a fourth dimension to modern day warfare and has made it imperative that exploration of space and its dominance have to be concurrently thought about and planned for organisationally.

Introduction

Armies' world over have always considered high ground as the most advantageous and gainful tactical posture for dominance during combat. It enables peering into enemy territory to glean intelligence about his actions; it enables weapons to be brought to bear upon him when he is far away /unaware and at the same time, it provides relative security to the defender. In the same manner, Outer Space[2] assets, while operating high above the

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planet's surface, offer an expansive scope of observation of the earth and can see deep into an adversary's territory. Additionally, soaring in outer space, they offer little risk to humans or machines. Control of the ultimate high ground is critical for space superiority, which enables instant engagement anywhere in the world. Outer space assets have not only enhanced the arena of national security but have also essentially changed military operations. It would be appropriate to contemplate that outer space has progressed from exploration to exploitation.[3] Because of this, outer space is considered the final frontier of mankind and the ultimate battleground for war fighters. Outer space has evolved as the fourth dimension of warfare and is thus considered an imperative subject for military commanders. Consequently, domain specialisation and vertical expertise in this strategic military subject, necessitate in-depth knowledge, familiarity, and experience of it, both academically and on the ground. Keeping in view the progression in practical application of technology and its military effectiveness with respect to outer space, it becomes imperative to educate, train, and prepare military space professionals and enable them to acquire domain specialisation in various facets related to outer space.[4]

Future of Military in Outer Space

Outer space is an exceptionally severe environment containing solar radioactivity, extreme heat, microgravity, ultraviolet radiation, space debris, and asteroids, all of which directly impact the design and survivability of satellites and other outer space assets. The overall consequence is that an outer space system is very fragile and always vulnerable to external threats. Outer space is an emerging field for important military applications and is increasingly being recognised as the military high ground for battleground superiority. The advent of space-based capabilities has indeed added a fourth dimension to modern warfare. Amongst the league of space-faring nations, India is an exception, whose space programmes have advanced primarily in the civilian sphere. Presently, the Indian military rightly symbolises and highlights the country's allegiance towards space-based military applications by establishing the Defence Space Agency to safeguard Indian concerns in outer space and which will deal with prospective space hostilities. India, with a strong conviction on the vast potential of the use of outer space for peaceful uses, has been demonstrating

it through various Outer Space based applications and services for national and societal purposes. India has been actively participating in the formulation of various international treaties on Outer Space Law in Committees of the United Nations. India has been using the outer space systems for national security purposes, as most other nations are also doing, since such uses are per se not prohibited by the UN treaties on space law. However, India strongly opposes any attempt to place weapons in space or conduct any unconventional weapon tests in space, as it would pose a perennial threat to all space systems, regardless of their use for civilian or military purposes.[5]

It has become imperative that exercising the option of exploration of space is done at appropriate levels concurrently to achieve the desirable operational capabilities in space. Space has clearly emerged as the final frontier and is now a crucial element in Command, Control, Communications, Computers, Intelligence, Information, Surveillance, and Reconnaissance (C4I2SR) for all three Services. The ability to utilise space power will be critical for dominance, resulting in victory on the future battlefield, particularly as information reliance becomes more essential and critical in the development of network centric warfare.

Developing trained manpower is a military core competency, and the development of a space cadre is recognised as an enabling capability for employing integrated space capabilities that support the full spectrum of military operations. The Space's professional training and education instill joint-mindedness, make capabilities universally understood, accepted and exploitable by joint forces and create a stronger awareness among military and civilian leadership in space capabilities and exploitation.

Global Space Dominance Progression

USA. The place of National Aeronautics and Space Administration (NASA) is well known in the US space program for both civilian and military uses. The emerging strategic importance of outer space encouraged the United States of America to incorporate a Space Force into its military with a mission to bring together both military and civilian assets to maintain and enhance the competitive edge with a focus on protecting its interests and security in space. Its appreciation of this aspect can be understood from the quote a former President of the United States made when he was a

senator in 1958, given at the beginning of this article. A US space command was set up in 1985 but subsequently subsumed by the Strategic Forces Command. It was re-established on29 August 2019 as a Combatant Command, with a renewed focus on space as a warfighting domain.

China. China's space programme is catching up with that of the United States, which is directed by the China National Space Administration. China's current plan includes a permanent Chinese space station in the year 2022, and later crewed expeditions to the Moon and interplanetary missions to explore the Solar System and beyond. It has been assessed by the intelligence agencies that the People's Liberation Army (PLA) will continue to integrate space services such as satellite reconnaissance, positioning, navigation, and communications into its weapons and command and control systems to erode the United States military's information advantage. It made a beginning by establishing the PLA Strategic Support Force (PLASSF) in 2015, which includes aspects regarding the military use of space.

Russia. Russia is one of the few countries to carry out a full range of activities in space. The Russian government supports a number of space programs, from manned flights to civilian and military communication, navigation, and satellite imagery systems. Russia has reached levels of launch facilities that can result in a range of payloads to just about any celestial orbit. These spatial reaches make Russia an important associate in all developments related to military uses of space. A new branch of the Russian Armed Forces, the Russian Aerospace Force, which includes a Space Force, was established in 2015.[6]

Military Space Integration

A nation that has dominance in space will have an asymmetric advantage over others as space-based applications are ideally suited to compliment and optimise defence capabilities in future conflicts. Government agencies have achieved a robust and mature capability in peaceful space applications, ground operations, and launch systems. These are also essential capabilities for the military use of space.

Operations in Space. As relevant as the well-known term 'Air Superiority', 'Space Superiority' is the degree of dominance in

space of one force over any other that permits the conduct of operations at a given time and place without prohibitive interference from space-based threats.[7] In the congested space environment, a framework is essential in which air, sea, space, and ground-based components are used to monitor or support activities in space enabling various capabilities to maintain an awareness of space.

Space power operates differently from other forms of military power due to its global perspective, responsiveness, and persistence. Through space capabilities, simultaneous operations affecting multiple theatres can be integrated and orchestrated — unlike surface forces that typically divide the battlefield into individual and geographically based theatres. Because space-related effects and targeting can be global in nature, application of space power can accomplish an effects-based approach to operations, based on functional capabilities rather than geographic limitations.

The space domain provides a unique degree of persistence with regard to military operations. Space assets offer the potential for presence over any part of the earth. The challenge for payload planners is to ensure space operations are integrated throughout the scheme of manoeuvre across all levels of war. While the equation is no different than any other form of military ability, outer space operations ordinarily happen over great distances and can be conducted by operational units remotely from the battleground. Historically, space operations had a strategic focus. However, with growing ability and future technology, it can also be applied at the operational and tactical levels.

Military Applications. Space-based systems can be used in various integrated capabilities in offensive and defensive domains like surveillance, communication, navigation, precise positioning, remote sensing, early warning, cyberspace, electronic warfare, target analysis, threat capability assessment, situational awareness, Battle Damage Assessment, coverage over denied areas, combat assessments, mission planning, counter space operations, humanitarian assistance and disaster relief, and terrestrial and space environment monitoring. The role of outer space in national defence and security is decisive, resulting in making space capabilities critically essential and a crucial component of successful

military operations. The military use of space continues to grow as newer technologies give greater range for exploitation.

Necessity of Academic Progression in Outer Space Domain

Education broadens understanding of space's overall contribution to military operations and gives space operators an appreciation of how their specific area of expertise impacts global and theatre operations. Academic upgradation is necessary to move space professionals beyond the tactical and technical focus of their day-to-day jobs and to assure the requisite level of skills necessary to sustain the space mission. In addition to the practical acquaintance, academic progression acts as a prerequisite in the diversified fields of outer space and satellite functions which involves study and understanding of various aspects like satellite payload operations, data acquisition, data processing, orbital axis of satellites, geospatial intelligence, photogrammetric science, remote sensing, geographical information system, geodesy, geographical intelligence fusion, space law and space treaties which goes beyond individual service requirements and encompasses all organisations within the national security space environment dealing with the spatial thinking.

Domain Specialisation. The role of outer space in national defence and security is decisive, and, thus, development of space capabilities is a crucial component of successful military operations. All conventional and traditional military missions are gradually migrating to outer space, thereby strengthening the theory that space systems affect every facet of military operations including effective integration of the battlefield. Specialised expertise and domain specialisation in satellite operations necessitate participation of military commanders and staff officers during the planning and designing of a space asset with respect to its application for military operations. Qualified and trained military officers are a prerequisite for deciding payload and satellite operational planning, gaining real-time need-based satellite intelligence, and optimal utilisation of satellite operations. Significant benefits that can be derived for the organisation by specialised study in the outer space domain are enumerated below:

- **Situational Awareness.** Operational and tactical coverage over the entire depth of the tactical battle area in

real time, hence enhancing the situational awareness of commanders and staff.

- **Shortening the OODA Loop.** Enables the military commanders to execute the Observe, Orient, Decide and Act (OODA) loop in an optimised manner.

- **Integration of C4ISR System.** Fusion of data from multiple sources to produce a comprehensive intelligence picture with Command, Control, Communications, Computers, Intelligence, Surveillance, and Reconnaissance (C4ISR).

- **Space-Based Reconnaissance Elements.** Space assets are proving to be ideal reconnaissance systems coupled with their capabilities to protect other space platforms from destruction.

- **Kinetic and Non-Kinetic Firepower.** Introduction of space-based weapons with space to ground capabilities can prove a force multiplier. Space based systems are becoming the new centre of gravity with respect to enlarged battle space.

Qualified and Trained Expertise. Space operators should be trained throughout their careers to integrate various dimensions of space across the range of military operations and during all phases of an operation. Continual training is crucial to maintain proficiency because of the continuous up gradation and evolution of space assets. The fusion of the technical expertise (satellite design) and tactical proficiency (military payload planning) is imperative to act as a bridge for better operational effectiveness. Commanders at all levels should be involved with the training and evaluation of their personnel and should be confident that they meet minimum standards before being certified mission ready. However, the diverse nature of space operations dictates that, over time, military planners should gain knowledge and understanding of the entire spectrum of space operations. As their careers progress, space operators should move beyond the technical knowledge of their core specialty areas and gain a more operational-level focus of space power. Ultimately, the military needs trained, proficient, and qualified military experts with domain specialisation who are space professionals and can articulate how space operations integrate into, contribute to, and improve military operations.

Conclusion

The sphere of influence of outer space has grown to interplanetary travel, commercial space flights, space telescopes, surveillance of near-earth objects, asteroids mining, lunar colonisation and permanent occupation of space stations. Outer space has emerged as a new medium and has highlighted the urgent need to enhance awareness regarding specific space issues. Military applications of space and technological advances coupled with increasing integration of outer space capabilities into security and warfighting doctrines have changed the nature of warfare. In India, academic pursuits and avenues of research are provided by the Indian Institute of Remote Sensing, under the aegis of the Indian Space Research Organisation, by focusing on strengthening the academia and user segments in space technology and its application. The increased use of remote sensing, geographical information system, global navigation satellite system and associated geospatial technologies have created an urgent demand for trained manpower. Therefore, academic progression for the full spectrum of military challenges in space is essential for our country.

Endnotes

[1] Space Operations, Air Force Doctrine Document 2-2 (27 Nov 2006). Accessed Jan 10, 2022, from https://irp.fas.org/doddir/usaf/afdd2_2.pdf

[2] Outer Space here is being written as a proper noun which is area 100 kms above and beyond the earth's surface.

[3] Clementine G. Starling, The Future of Security in Space : A Thirty-year US Strategy (The Atlantic Council of the United States April 2021).

[4] New Frontier of War : Space the New Battleground (Geospatial World, 31 May 2013).

[5] Manish Tiwari, Militarisation of Space, Government of India, Ministry of Space, Lok Sabha (Parliament Questions and Answers, 23 February 2011).

[6] Ministry of Defence of the Russian Federation, Aerospace Forces. https://eng.mil.ru/en/structure/forces/aerospace/mission.htm

[7] Joint Publication, Space Operations 10 April 2018 Incorporating Change 1 26 October 2020, p. I-4. https://www.jcs.mil/Portals/36/Documents/Doctrine/pubs/jp3_14ch1.pdf?ver=qmkgYPyKBvsIZyrnswSMCg%3D%3D