

SPACE THEORY AND DOCTRINES

K.K. NAIR

National interests and objectives are the fountainhead of a nation's strategies and doctrines. These, in turn, have a cascading effect on a nation's fundamental, environmental and organisational doctrines, thereby, providing an insight into the likely courses of action and military force structuring individual nations are most likely to follow. While national fundamental doctrines would be the fountainhead of most environmental and further organisational doctrines, with regards to space, the fundamental national ambition would, in most cases, be tempered by the higher levels of technology, cost and accessibility and the same would, in turn, have a cascading effect on the likely courses to be followed by most nations. Unlike in the case of the other three environments where environmental doctrines have matured to almost universal applicability level, leading to military force structures being characterised by largely common doctrinal principles tempered by individual capabilities and applications, with regards to space, no comprehensive universally applicable model exists, and most national doctrines and strategies are characterised by a nation's technological, economical and other prowess. In view of the above, the deliberations here are limited in scope to the "environmental" level and the manner in which space-faring nations presently view the exercise of military power in/through the medium of space.

COMPARATIVE DOCTRINES

It needs to be borne in mind that as in the case of the other doctrines of land, sea and air, the essential factors of geography, technology and history

Squadron Leader **K.K. Nair**, IAF is a Research Fellow at the Centre for Air Power Studies, New Delhi.

have a seminal influence on the evolution of space doctrine. However, the extent of influence of each of these parameters is vastly different. For example, while historical lessons mould the evolution of land doctrines to a far greater extent than geography or technology, maritime doctrines are influenced more by geographical and technological biases, air power doctrines draw from limited historical lessons and, as in the case of space, are largely a by-product of technology and are characterised more by available doctrines being moulded to suit emerging technology rather than vice versa as in the case of land and sea doctrines. Table 1 would serve to influence the above contention.

Table 1

Doctrine	Influence of History	Influence of Geography	Influence of Technology	Period of Evolution
Land	Highest	Higher	Medium	Dawn of civilisation.
Sea	Higher	Highest	Higher	4 centuries+
Air	High	Less	Highest	1 century +
Space	Low	Marginal	Highest	4 decades +

It is obvious from the above contention that space's recent evolution and its technological biases distinguish it to a greater extent from land, a lesser extent from maritime and to a significantly much lesser extent from aerial doctrines. Secondly, just as air power doctrines draw their basic evolution from maritime doctrines and theories as reflected in the common air and maritime terminology as also missions like sea control and denial; modern space doctrines also build upon air power doctrines premised upon the common characteristics afforded by the vertical dimensions like elevation and freedom of movement. The unique characteristic of elevation distinguishes the vertical dimension of air and space from the horizontal dimension of land and sea with its common envelopment and all enveloping

pervasiveness. Thus, modern space doctrines basically build upon basic air power doctrine as reflected in the transmutation of the four classical missions of air power into space as given in Table 2.

Table 2

Role	Typical Air Power Mission	Contemporary Space Mission
Control of environment	Counter-air missions	Counter space missions
Applying combat power	Air-based force application	Space-based force application
Multiplying combat power	Airborne combat support	Space-based terrestrial combat support or force enhancement
Sustaining combat force	Support operations	Space support operations

Additionally, unlike the luxurious timeframes moulding the evolution of land and sea doctrines, air power doctrines were evolved in much more compressed timeframes, and with regards to space, the extent of compression has only increased. In fact, one of the factors precluding the construct of a comprehensive space doctrine is the pace of technological progress in space capabilities. Secondly, humankind's evolution, and the evolution of the environmental doctrines were drawn from contiguous and familiar environs whereas space even now continues to be distant, unknown and not readily accessible. In fact, the vast expanses of space are yet to be fully comprehended beyond an elemental manner and evolution of operational doctrines for conduct of warfare in space may as yet be immature. The same could also be one of the reasons why most space doctrines are focussed on "force enhancement," rather than actual conflict in the realm of space.

ENVIRONMENTAL EXCLUSIVITY AND ITS IMPACT

Unlike in the case of air power theories wherein passive uses of air like reconnaissance, targeting, etc soon gave way to more offensive battles for control of the aerial medium, space, even after four and half decades, is yet

to encounter actual conflict characterised by manoeuvring platforms or falling debris as in case of the other environments. American space doctrines have presumably evolved to the “high-ground;” however, these theories are premised upon prevailing theories of “air supremacy” or “air superiority”

The classic air strategy chart, in the case of space, would need to be read in the reverse order; terrestrial combat support would obviously be the first priority.

which are based upon the premise of dominant strategic force superiority. Space as an environment is less benign of human follies and foibles, it neither provides any “wind beneath the wings” nor for that

matter, gravity to pull down aircraft wreckage or eject aircrew. It needs to be accepted that while war and conflict are inherent characteristics of human nature, outer space and beyond are not forgiving of human trespasses. While planet earth has tremendous capability for absorbing and tolerating human excesses, outer space and beyond does not, as demonstrated by the effects of experimental explosions on the “Van Allen” belts and by the cascading effect that a single “killer ASAT” (anti-satellite) would entail by destroying an enemy satellite. Fragments of the destroyed satellite would not fall down to the earth as in case of aerial platforms but would continue orbiting the earth, hitting other objects like satellites, debris, etc., in turn, forming more debris, setting off a chain reaction of destruction that would leave a lethal halo around the earth.

Thus, while the US attempts to operationalise elaborate space weaponisation plans and the Chinese attempt to short circuit the same by developing ASAT weaponry or advertising the development of “asymmetric strategies” via ASATs, etc, the fact of the matter is that the environment of space is friendly to force enhancement to a larger extent, and force application, counter-space operations, etc to a lesser extent. In fact, the classic air strategy chart, in the case of space, would need to be read in the reverse order; terrestrial combat support would obviously be the first priority (history suggests the same) and counter-space campaigns would be slotted in the

last position in view of the cost, legalities, technical and other issues involved in counter-space operations. The above is further validated by the fact that while presently there exist no forms of offensive weaponry in space, the same is primarily because of the technical challenges and cost rather than prevailing treaties or moral and ethical clauses limiting their use. In fact, theories of orbital combat and ASAT weaponry have been in vogue ever since the first Sputnik orbited the earth. The Americans focussed on guided missiles, launched from the air and designed to ram the target satellite directly, whereas the Soviets preferred “killer satellites”—orbiting spacecraft armed with shrapnel charges that could disable enemy craft. Both sides also dabbled in nuclear warheads, orbital bombardment systems, etc. However, all such weaponry was decommissioned and the end of the Cold War killed off most of the systems. As recently as 1998, the Rand Corporation had also decisively concluded that while some nations possessed certain capabilities to acquire space weapons, there existed no immediate compelling threat sufficient to drive a country to weaponise space.¹

Nevertheless, a brief examination of the doctrines driving military space programmes in various space-faring nations would definitely be in order considering that cutting across the spectrum of capabilities, nations ranging from the US and Russia to China, Israel, etc are all focussed on harnessing space for furtherance of national capabilities of both military and civilian nature.

SOVIET DOCTRINES

An examination of the Soviet doctrines, instead of the present Russian doctrines, is undertaken in order to understand the unique thought processes that led to the early evolution of Soviet space capabilities which, well after the demise of the Soviet Union, continues to occupy its position as the second most powerful military space apparatus in the world. The edifice of such an apparatus which continues to withstand adversity, slashed budgets,

1. Bob Preston *et al.*, *Space Weapons Earth Wars* (Rand MR-1209-AF), ch. 6, p.99.

dilapidated infrastructure, etc and yet possess the capability to resurge, is noteworthy for its tenacity and, hence, is deliberated upon.

The political aims of the Soviet state dictated the construct of Soviet military doctrines. Soviet environmental doctrines were a natural offshoot

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of its overall national military strategy and, hence, its military space doctrines were also primarily an extension of its overall national military strategy. Soviet space doctrines drew on fundamental Soviet military

doctrines and, hence, were characterised by an evolutionary rather than revolutionary character like its overall military doctrine which was a derivative of the Stalin era. Thus, doctrinal reevaluations of its military systems complemented existing space doctrines rather than supersede them and thereby endowed tenacity to its military space programme which ensured its survival well beyond the Soviet era and also the near seamless integration into present Russian doctrines. Soviet space doctrines were characterised by a dynamic yet consistent character. The Soviet space programme, in turn, was characterised by incremental/evolutionary improvements over crude basic structures and reliance upon large quantities of individually less sophisticated systems which provided inherent flexibility, economic viability and an overall impressive capability. While requirements of brevity would preclude an overview of Soviet military doctrines and their impact on the Soviet space doctrines, certain overwhelming characteristics of the Soviet military doctrines which decisively fashioned their military space doctrines were as below:

- Soviet military strategy dictates that the best defensive posture is one of military superiority and, hence, Soviet military doctrines were premised upon bringing to bear overwhelming force to completely defeat any enemy and, at the same time, also ensure the protection and survivability of the Soviet Union.

- Soviet military doctrines were also influenced by the fact that it had suffered the maximum number of casualties in World War II (up to 10,000,000) and, hence, the deeply ingrained need for a strategy of assured survival as opposed to assured destruction which consequently led to a defensive bias.
- While Soviet military doctrines had a defensive bias, they also recognised the primacy of offensive operations for decisive victory in any military conflict.
- The defensive concepts of Soviet military doctrines were uniformly applicable to all its environmental doctrines of land, sea, air and space as also to the Soviet armed forces and to each of the five Services of the Soviet military, viz, the strategic rocket forces (SRF), troops of national defence, ground forces, air force and navy.
- In line with its unique doctrinal requirements, Soviet military space doctrine involved a greater role and involvement for the SRF, PVO (*Proti Vovozdushnaya Operatsiya*) followed by the air force, the navy and the ground forces.

It needs to be appreciated that contrary to standard Western connotations, the Soviets did not consider offence and defence to be mutually exclusive or even opposing concepts. Ideologically,

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any weapon developed by them was, by definition, defensive because it was designed to promote “the dictates of history.”² Thus, while the Soviets consider offence as the most basic component of military operations, a defensive component is an essential part of the overall strategy. Strategic offensive and defensive systems must work in synergism to achieve victory. The above is best exemplified by Soviet interpretation of the term “air defence.” To the Soviets, an air defence operation, PVO, is an anti-air

2. Lawrence E. Stellmon, “A Comparison of US and Soviet Programs”, Strategic Studies Report abstract, National Defence University, February 1987, ch.2, p.2.

operation which has the intention of leading to air supremacy (*gospodstvovozdukhe*). Thus, an inherently defensive operation becomes very offensive in nature and vice versa.

Unlike the Americans, the Soviets at no stage had any misgivings or confusion regarding space being an extension of the vertical dimension of air for the conduct of military affairs. They viewed space as a separate dimension by the strictest definitions of physics, but for operational military purposes, they regarded it as an extension of the aerial medium; a fundamental strategic operating medium, which, for doctrine and strategic purposes was an extension of the medium of air. They considered space as a part of a theatre of military operations or *Teatr Voyennikh Deystyii* (TVD), and, hence, their objective of space superiority was integral to, as well as an extension of, the overall objective of air superiority. The above had a decisive influence in shaping their space doctrines, space control missions and also space force structuring.

The writings of Marshal V.D. Sokolovsky had a seminal influence on Soviet military space doctrines.³ The 1968 version of the Soviet Military Strategy outlined the Soviet view on the military uses of space which was based upon the following three paths:

- The first was creation of space weapon systems to assure combat effectiveness for all branches of the armed services.
- The second was preventing other countries from utilising space.
- The third was development of strategic offensive systems to conduct battles in space.

The above three were broadly analogous to the American doctrines of:

- Force enhancement.
- Space control.
- Force application (aimed at space control unlike in the American context).

The need of a fourth separate mission of “space support,” or “launch-on-demand capability” as in the case of the US was probably not acutely felt

3. V.D. Sokolovskiy, *Soviet Military Strategy*, 3rd edn, trans, Harriet Fast Scott (NY: Crane, Russak 1975), p.84-5.

or articulated by the Soviets because of the simple fact that the Soviet strategy of numerous simple satellites and space systems as opposed to a few expensive systems (as in the case of the US) precluded the need to strive for space support capabilities. Soviet design philosophy of satellite standardisation (down to sub-system and component levels) and mass production allowed inherent replenishment, high launch rate capabilities and the ability to absorb greater losses without serious network degradation. In fact, Soviet launch rates have on many occasions been higher than those of the entire world combined and have mostly outraced its closest competitor—the US—at times to the extent of 5:1 like in 1981, 1985 etc.

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From the foregoing, it can be safely inferred that Soviet military space doctrines at an environmental level were also built upon basic air power doctrines as in the case of the US, albeit in its own unique ways. Secondly, the nuclear backdrop led to a primacy of the “sanctuary school of thought” with regards to space and the present Russian formation of a separate space force could largely be an example of the continuation of the sanctuary school of thought. However, Soviet space programmes were not known to be entirely benign and defensive in character. Its testing of the FOBS and forays into development of ASAT technologies was demonstrative of the popularity the “high-ground” doctrine enjoyed until the SALT-2 negotiations following which it dispensed with the FOBS systems. By 1971, the Soviets also ended their interceptor tests and refocused their efforts back from space control theories to sanctuary.

Amongst the above three missions, most Soviet efforts were dedicated towards force enhancement and Soviet capabilities spanned the entire spectrum of missions from reconnaissance, communications, to navigation, meteorology, etc. However, the preponderance of its survivability doctrine

was reflected by its overwhelming emphasis on application satellites designed to conduct strategic surveillance. The protection of Soviet tactical and strategic strike capabilities, that is, maintenance of a credible deterrence to enemy aggression was the number one Soviet priority. Fundamental to this objective

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were the Soviet space and ground-based sensors which would notify Soviet authorities of an impending attack and allow the exercise of retaliatory forces, implementation of defensive measures, etc.⁴ As a consequence, the Soviets had an elaborate photo reconnaissance programme which was the largest

single satellite project in the world and accounted for up to more than a third of its launches. The next most important mission was of possessing survivable communication links and, hence, communication satellites were the next most numerous satellites. The Soviets had, thus, invested heavily in mobile satellite communications infrastructure. At the theatre level, Soviet satellites provided navigational support for troop deployments, targeting, command, control and communications support via three-tier space communications network; weather prediction for strike planning; reconnaissance for target location, identification and subsequent strike assessment; and intelligence assessment to provide an order of battle and to guide war managers. Over three-fourths of the Soviet space programmes were assigned to carry out the above objectives either on a dedicated or collateral basis.⁵

With regards to space control, the Soviets viewed space as an extension of the vertical dimension and, hence, made no distinction between the vertical dimensions of air and space. Thus, Soviet “air defence” was contiguously extended to include ballistic missile defences as well as space defence. In

4. Nicholas L. Johnson, *Soviet Military Strategy in Space* (London:Jane's 1987) p.198.

5. *Ibid.*, p.199.

fact, the PKO's primary mission was to repel any attack emanating from space. Soviet space control objectives were:

- Prevention of the use of space by the enemy for military, political or economic gain.
- Unhampered utilisation of space assets to further the Soviet system and goals.

The first objective above was targeted towards the North Atlantic Treaty Organisation (NATO). The supply lines and communication links from the US to Europe were dependent on satellites and, hence, satellites, their links and nodes were key targets for Soviet planners. The second objective concerned the protection of Soviet satellites, their links and nodes, etc. In keeping with the above objectives, Soviet space control missions initially laid a lot of emphasis on ASAT and other forms of offensive weapon developments in space; however, these efforts petered out by the Seventies and the focus was realigned on force enhancement missions. As a natural extension of the above thought processes, development of space technology in the Soviet Union and now Russia has proceeded in the following three interrelated directions⁶:

- The first direction involves the development of space technology to serve war-time needs.
- The second direction involves development of systems for bringing remote sensing information to the lowest level of troop command.
- The third direction involves development of dual-purpose systems that solve the problems of both military and civilian users.

Implementation of the above developmental directions was aimed at raising the process of force command and control to qualitatively new levels, thereby, multiplying combat potential several fold. To further comprehend the impact of the thought processes on final development of space programmes and their evolution to present status, a brief view of the

6. Valeriy A. Menshikov, *Military Uses of Space*, Encyclopedia of Space Science and Technology, vol 2, (A. John Wiley & Sons, Inc. Publications, 2003), p.121.

evolutionary path would be in order and the same has been placed as Fig. 1.

THE CHINESE DOCTRINE

The People's Liberation Army (PLA) and its component services are not known to use the term "military doctrine" or the classical doctrinal components of roles, missions, tasks, etc. The closest analogue to doctrine is what they term as "military science," which in effect links theory and practice. Chinese military science primarily comprises:

- Basic military science which includes the fundamental and environmental concepts that govern PLA military operations at various levels of war.
- Applied military theory which broadly deals with application of military force at the various levels of war and is analogous to organisational doctrines.

With regards to space as an environment for the conduct of military affairs, the Chinese have been assiduously studying the effects of space on conventional military capabilities in recent wars and consider the space-enabled revolution in military affairs (RMA) as an essential component for enhancing their comprehensive national power. The PLA has outlined its

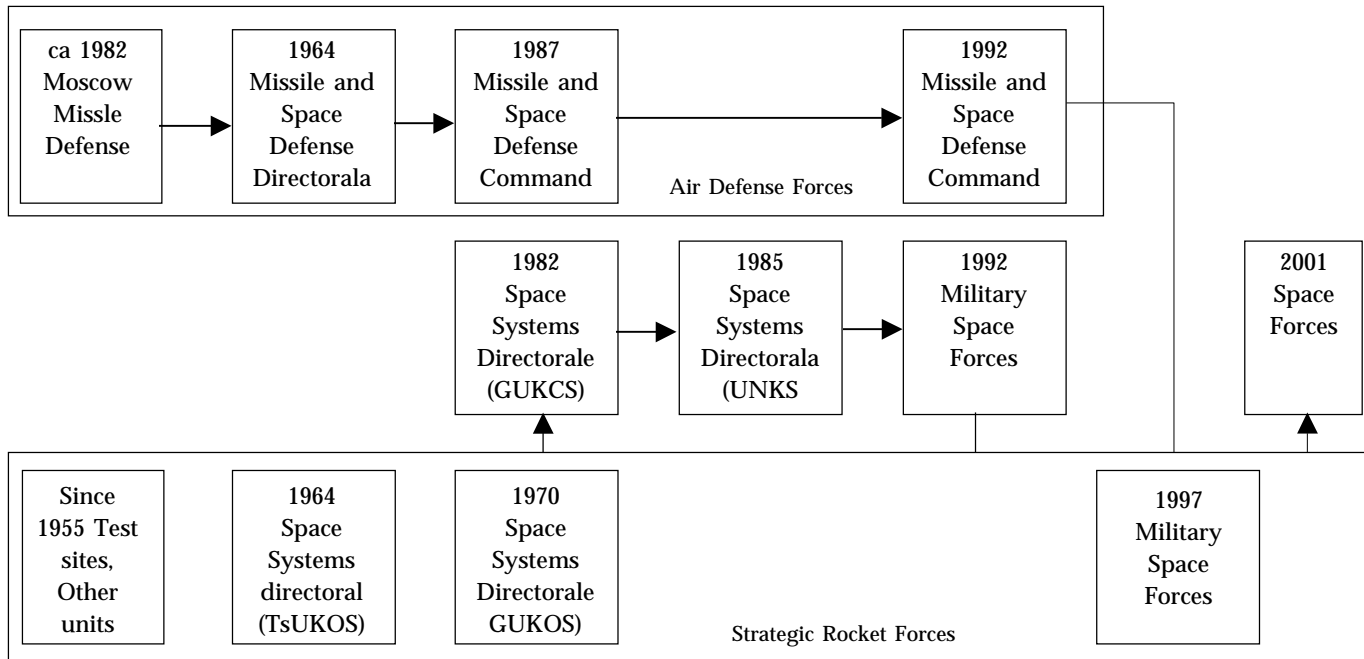
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mission with regard to military space as consisting of two categories.⁷ The first is information supporting and the second battlefield combating which loosely corresponds to missions of "force enhancement" and "counter-space operations" in Western parlance. Its initial aim with relation to military space is

within the realm of information supporting. It has further defined this mission as intelligence, navigation, positioning and communication, all of which

7. You Ji, *The Armed Forces of China* (NY: I.B.Taurus, 1999), p. 84.

Fig. 1. Evolution of Space Forces



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Source: Pavel Podvig, *Russian Military Space Programs* (Moscow Institute of Physics & Technology, October 2003).

correspond to missions of force enhancement. The above strategy is reflected in the importance it gives to information dominance capabilities or what it terms as “informationalisation,”⁸ followed by development of counter-space capabilities. The same is also reflective in its national policy of taking the

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road of “composite and leapfrog development.” Hence, China can be expected to attempt exploitation of the entire spectrum of force enhancement missions in a gradual manner and, at the same time, develop at least rudimentary counter-space capabilities like parasitic ASATs, etc. At a more fundamental level, most literature on the subject in Chinese military

journals and Western military writings is suggestive of the following three strategies:

- Gradual development of capabilities for exploitation of the entire spectrum of force enhancement missions afforded by space.
- Integration of the above into terrestrial military capabilities for overall capability enhancement (most Chinese writings on the RMA are suggestive of the same).
- Acquisition of ASAT capabilities for a semblance of “counter-space” capability so as to possess capability to target US space vulnerabilities, thereby, providing them with limited deterrence capabilities (“asymmetric advantage”) against superior powers.

The above needs to be viewed not in isolation but against China’s stated national policy of “going with the tide of the world’s military development and moving along the direction of informationalization in the process of modernization, the People’s Liberation Army (PLA) shall gradually achieve

8. For a more elaborate explanation on “Informationalisation,” refer Chinese government White Paper, “China’s National Defense in 2004,” ch. 3.

the transition from mechanization and semi-mechanization to informationalization. Based on China's national conditions and the PLA's own conditions, the PLA persists in taking mechanization as the foundation to promote informationalization, and informationalization as the driving force to bring forward mechanization. The PLA will promote coordinated development of firepower, mobility and information capability, enhance the development of its operational strength with priority given to the Navy, Air Force and Second Artillery Force, and strengthen its comprehensive deterrence and warfighting capabilities.”⁹ Secondly, the Chinese fully appreciate the role of space-based systems pivotal to the RMA and, hence aspire to adapt to the changes both in the international strategic situation and the national security environment, and rise to the challenges presented by the RMA worldwide. China adheres to the military strategy of active defence and is working to speed up its RMA with Chinese characteristics.

THE ISRAELI DOCTRINE

Israel is a country born in conflict, and its basic security situation has not deviated from that. Survival of the state is an all-pervasive national issue, and the short history of the state has been punctuated by a sequence of serious wars. Israel's survival, hence, depends on its acquisition of “asymmetric techniques” to offset its inherent disadvantages as also the numerical advantages of its adversaries. As the principal threat has shifted from the proximate land forces of Syria and Egypt to the longer-range missile capabilities of Syria, Iran and Iraq, Israel sees the need to upgrade and modernise its forces across the board. This need particularly includes extending and upgrading the life-times of its weapons platform, developing over-the-horizon strike capabilities, space, and ballistic missile defence. In response to the increased militarisation and acquisition of sophisticated military technologies by its adversaries and its own unique needs for survival, Israel has developed a “new war theory” based on which its future missions

9. Ibid.

and force structures of the Israel Defence Force (IDF) are being developed. The following are its main elements:¹⁰

- Ensuring that the element of surprise is utilised in any future conflict to achieve a decisive strategic victory for Israel.
- Developing deterrence policies and capabilities, particularly the “deterrence by doubt” factor which aims at intimidating decision-makers in countries that might have tense relations with Israel. This type of deterrence would restrict the movements of Israel’s opponents and limit their options and reactions as a result of their doubts about the size and type of Tel Aviv’s potential response to any military operations.
- Maintaining the technological gap in the fields of armament and military industrialisation between Israel and the Arabs and making this gap as apparent as possible to frustrate the Arabs and convince them it is impossible to defeat Israel in a future war.
- Possessing strategic weapon systems that can constitute an effective deterrence capable of reaching any target in the Arab region and the Middle East in general.
- Constant readiness to launch a military retaliation whenever necessary that wages total war on an opponent to achieve major objectives and stabilise the situation for long periods of time. A corollary to this readiness, as circumstances require, is to launch a limited retaliatory strike on a small scale that would not jeopardise the peace process.

In view of the foregoing, it may be surmised that the prevailing broad space strategy for Israel would be to initially construct a comprehensive surveillance network of small spy-satellites in low earth orbit (LEO) to avoid being surprised and, at the same time, maintain its own “element of surprise” capability. Its missile defence systems would provide it with its much needed deterrence capability and the entire military edifice would be supported by its proposed space communications system. Israel’s strategy of using small satellites coupled with its proficiency at orbital detuning as also micro and

10. Jameel Al-Din Husayn, “Israel Peace and Arms,” *Cairo Rose Al Yusuf*, August 21-27, 1999 (FBIS document ID: FTS 19990826001012).

nano-sat technology would provide it the capability to fulfil its force enhancement and space-support missions, in addition to an incidental “ASAT” capability, if the need arose. Israel fully comprehends the capabilities and opportunities offered by space for enhancing its ability to achieve its security objectives. Israel’s strategic doctrine dictates that space-driven RMA is critical to its future military operations.

Israeli planners view space as a natural extension of air power to be harnessed synergistically to its

advantage as the balance of power in the region shifts increasingly to ballistic missiles. Regular Israeli pronouncements on the subject like “The ability to utilize space is the cornerstone that supports air power,” “Whoever cannot achieve this ... will not be in the forefront of modernization,” etc by former Israeli Air Force commander Major General Eitan Ben-Eliahu, an ardent space advocate, as also pronouncements by its present commander Major General Dani Haloutz,¹¹ “In summary, air and space power complement each other operationally through command and control of air missions, targeting, intercepting ballistic missiles, providing weather information over long-distance areas, and intelligence mission escorting. Building up of military forces should be based on exploring and understanding the trade-offs between air and space requirements—each can be operationally integrated to provide greater capabilities than perhaps might be available separately,” serve to validate the view that Israel fully comprehends the full import of air, space and aerospace power and once its finances stabilise, it would make all-out efforts to boost its comprehensive military power with a generous element of space-based capabilities.

Israel’s strategy of using small satellites coupled with its proficiency at orbital detuning as also micro and nano-sat technology would provide it the capability to fulfil its force enhancement and space-support missions.

11. Maj. Gen Dani Haloutz, commander of the Israeli Air Force quoted in *Air and Space Strategy for Small Powers* (Rand CF-177-FIAS) ch. 6, p.156.

AMERICAN SPACE POWER THEORIES AND DOCTRINES

Worldwide, and in particular American writing on the subject has been profuse ever since the demonstrated effects of space in the Gulf War. Space power theory is also growing. Compared to the works of authors such as Clausewitz, Mahan, and Douhet, space power theory is relatively embryonic. The earliest published works date back to just about four decades. However, most of the meaningful writing on space power occurred in the last decade (not surprisingly after the Gulf War). Nevertheless, for the sake of brevity, some of the popular American theories are outlined in the following paragraphs.

Lupton's Theory¹²

Most literature on the subject endorses the fact that David Lupton's four space military doctrinal approaches provide an important and comprehensive way to analyse the strategic rationale driving military space activities in addition to providing a useful analytical framework for military applications of space. Each of the four approaches—sanctuary, survivability, control and high-ground—suggests a focus, employment strategy, war-time mission and preferred organisation for space forces.

The sanctuary view of space doctrine believes that the realm of space should not be weaponised. It emphasises that space systems are ideal for monitoring military activity, providing early warning to reduce the likelihood of surprise attack and serving as a means to enable and enforce strategic arms control. The basic tenet of the sanctuary doctrine is that space surveillance makes nuclear war less likely. It is closely linked to the deterrence theory and the assumption that no meaningful defence against nuclear attack by ballistic missiles is possible.

The survivability doctrine emphasises broad utility for military space systems, not only at the strategic level emphasised in the sanctuary doctrine, but also at the tactical level of space support to the warfighter that has

12. David E. Lupton, *On Space Warfare: A Space Power Doctrine* (Alabama, Maxwell Air Force Base: Air University Press, 1983).

emerged as the most important force enhancement mission since the end of the Cold War. It differs from the sanctuary doctrine because it highlights space system vulnerabilities and questions whether space can be maintained as a sanctuary due to ongoing technological improvements in systems such as ASAT weapons. The origins of this approach can be traced back to the late 1970s and early 1980s when Soviet testing of ASAT weaponry led to beliefs that space forces are less survivable than terrestrial forces. The survivability approach consequently argued that space forces must not be depended upon for providing various functions such as communications, navigation, etc because they may not survive in actual conflict. The above gave rise to the space control doctrine.

The space control doctrine is analogous to concepts of air superiority and considers space as another military theatre with the military objective of seeking control over the space environment.

The space control doctrine is analogous to concepts of air superiority and considers space as another military theatre with the military objective of seeking control over the space environment. Thus, the control doctrine sees space as similar to other military environments and argues that both commercial activities and military requirements dictate the need for space surveillance, as well as offensive and defensive counter-space capabilities.

The high ground doctrine had its origins in President Reagan's SDI (Strategic Defence Initiative) which advocates space-based ballistic missile defence. It argues that space is the dominant theatre of military operations and is capable of affecting terrestrial conflict in decisive ways. As a primary example of such capability, the high-ground doctrine points to the potential of space-based ballistic missile defence (BMD) to overturn the dominance of offensive strategic nuclear forces. This doctrine also believes that space has the ability to be the critical factor in determining the outcome of battle. It uses the analogy that domination of the high ground ensures domination of the lower areas and, hence, in the future, space forces will dominate terrestrial forces. The US has over the years presently evolved to this school of thought.

Table 3 would serve to illustrate the above contention.

Mantz Theory¹³

This treats space at the level of an environment only for prosecution of actual combat roles and missions and, hence, is more of space combat theory and incompletely addresses the other missions possible through space. In fact, it almost entirely omits the most important role of force enhancement.

His publication predicted space power to progress in much the same manner that air power has.

It looks more at the application of firepower in space and omits even important aspects of information dominance, etc enabled by space.

Mantz' theory looked at firepower in space. His publication predicted space power to progress in much the same manner that air power has—to the point of being a decisive force by applying long range, strategic firepower (including bombardment) through the sky. Mantz' discussion of space strike operations gives amplification to the idea of decisive space power as a potential war winner. It also gives specific details to accomplish space control in a weaponised space environment. Some of the important aspects of the above theory are given as below:

- Space strike systems can be employed decisively by striking earth forces, both independently and jointly.
- Space strike systems can be employed decisively in war when the enemy's essential means for waging war (industry, transportation, and communications) are vulnerable to attack from space.
- Space strike systems can be employed decisively by striking at the decision-making structure (leadership and command and control) of the enemy.

13. Michael R. Mantz, *The New Sword, A Theory of Space Combat Power* (Maxwell AFB, AL: Air University Press, May1995).

Table 3.

	Primary Value and Functions of Military Space Forces	Space System Characteristics and Employment Strategies	Conflict Missions of Space Forces	Appropriate Military Organisation for Operations and Advocacy
Sanctuary	<ul style="list-style-type: none"> • Enhance strategic stability • Facilitate arms control 	<ul style="list-style-type: none"> • Limited numbers • Fragile systems • Vulnerable orbits • Optimised for NTMV mission 	<ul style="list-style-type: none"> • Limited 	NRO
Survivability	Above functions plus: <ul style="list-style-type: none"> • Force enhancement 	<ul style="list-style-type: none"> • Distributed networks • Redundancy • Hardening • On-orbit spares • Crosslinks • Manoeuvre • Less vulnerable orbits • Stealth • Reconstitution Capability • Defence • Convoy • 5Ds 	<ul style="list-style-type: none"> • Force enhancement • Degrade gracefully 	Major command
Control	<ul style="list-style-type: none"> • Control space • Significant force enhancement 		<ul style="list-style-type: none"> • Control space • Significant force enhancement • Surveillance, offensive, and defensive counter-space 	Unified command or space force
High Ground	Above functions plus: <ul style="list-style-type: none"> • Decisive impact on terrestrial conflict • BMD 		Above functions plus: <ul style="list-style-type: none"> • Decisive space-to-space and space-to-earth force application • BMD 	Space force

- Space strike systems can deter hostile actions by holding forces, decision-making (leadership and command and control), infrastructure (industry, transportation, and communications) at risk.
- Space denial systems can be employed decisively by denying enemy access to space-derived data.
- Space denial systems can be employed decisively by physically denying enemy access to space.
- Space protection systems can be employed to assure friendly access and use of space.
- Total space control (the combination of space denial, space protection, and passive space defence measures) is neither achievable nor necessary.
- Space combat power must be centrally and independently controlled.
- Space power is not intrinsically linked to air power.

The type of space combat missions envisaged were as given in Table 3.

Table 4.

Space Denial Ops	Space Strike Ops	Space Protection Ops
Earth to earth attacks	Space to land/ subterranean attacks	Protecting against earth to earth attacks
Earth to space attacks	Space to sea/undersea attacks	Protecting against earth to space attacks
Space to space attacks	Space to air attacks	Protecting against space to space attacks
Space to earth attacks		Protecting against space to earth attacks

Gravity Well Theory¹⁴

The above was a multi-author effort and was based upon exploiting the combat advantages afforded by gravitational energy as one went higher. It was a virtual extension of the “high ground” theory of land warfare into space. The high ground theory builds upon the premise that by commanding

14. G. Harry Stine, *Confrontation in Space* (Englewood Cliffs, NJ: Prentice-Hall, Inc.1981) p.58.

the hill, one could control the surrounding country and, hence, influence battle in one's favour, thereby winning the war. Harry Stine captured the military significance of the gravity well theory in two axioms:

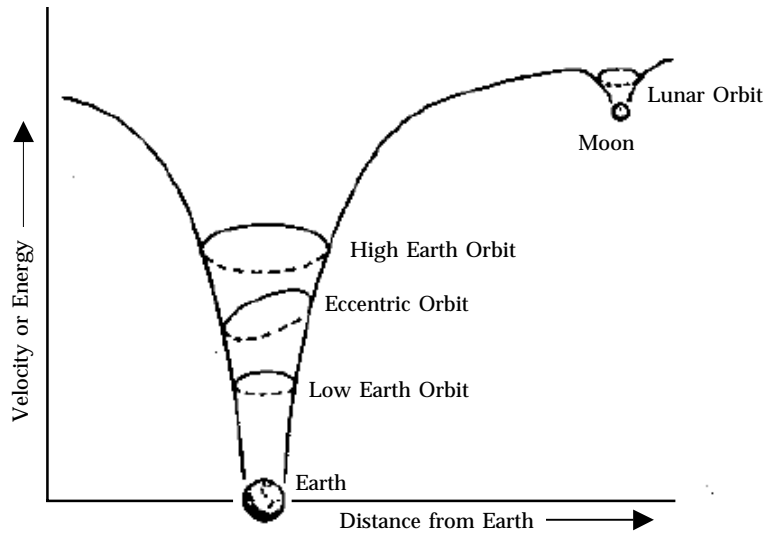
- Control of the moon means control of the earth.
- Control of the L-4 and L-5 libration points means control of the entire earth-moon system (see Fig. 2).

From here, Stine stated that a military commander has the ability to permit or deny passage of space traffic, to deny the use of other military or commercial orbital areas to others, to launch strikes against *any* target on earth, on the moon, or in earth-moon space, or detect and take action against any threat originating anywhere in the earth-moon system.

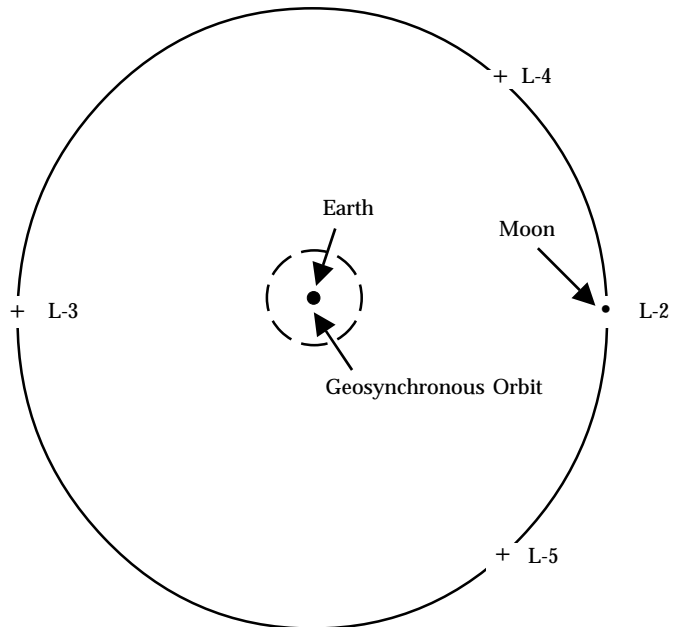
According to Stine, shots fired down the gravity well will travel faster than shots fired up the well. Thus, the higher person has an energy advantage (he will not have to fire his shot as fast in order to maintain the same speed as one shooting up the well). The higher person also has a manoeuvring advantage (all things being equal, the higher person will have more time to observe the attack and dodge the shot than his opponent will). Therefore, to maintain a military advantage in space, one must remain higher up the gravity well than one's adversary.

Stine goes on to discuss exactly where the "highest" ground is in space. According to Stine, a libration point (also called Lagrangian point after Joseph Louis Lagrange, the French astronomer who suggested the existence of these points around 1800) is a location where gravitational forces are theoretically in perfect balance. Three of the five libration points are considered unstable because the moon's non-circular orbit and the sun's gravitational pull adversely affect these points. The last two libration points (L-4 and L-5), also known as Trojan libration points, are not affected by these phenomena and are, thus, considered stable. At these two locations, a body in space would theoretically require little to no energy to sustain its position in the earth-moon system. Therefore, L-4 and L-5 are the highest ground in the earth-moon system.

Fig. 2.



Lagrangian Points in the Earth-Moon System



Apart from Lupton's theory, the remaining theories have not found much favour and have mostly been a subject of academic discussion and debate rather than actual application.

US Space Doctrine

American space doctrines have always been characterised by a preponderance of air force doctrines in exploiting space for military purposes. The above has been the trend since 1957, when following the Soviet Sputnik shock, the Americans entrusted the responsibility for military operations in space to the air force and by November 29, 1957, the first air force space doctrine was announced by the Air Force Chief of Staff, General Thomas D. White which included the ideas that space power would prove as dominant in combat as air power; that there is only one operational medium of aerospace since there is no distinction between air and space; and the air force should have operational control over all forces within this medium. Gen Thomas D. White first used the word aerospace in 1958, and the concept that air and space form a seamless operational medium has been the foundational component of American thinking about space ever since. The above is reflected in the US Air Force's adjustment of its doctrine to accommodate space-based capabilities so as to enable optimal exploitation of the capabilities afforded by space. Air force stewardship of space in the US is apparent considering that the air force provides 90 per cent of the military's space budget, as also 93 per cent of space personnel. Despite a post-Cold War drawdown that has seen all of the Services reduce their size by roughly a third, the air force satellite force has increased by 25 per cent since 1991.¹⁵

Currently, US space operations doctrines have been codified into the operational level space operations doctrine in the Air Force Doctrine Document (AFDD) 2-2, *Space Operations*, and Joint Publication (JP) 3-14, *Joint Doctrine for Space Operations*, respectively. AFDD 2-2 and JP 3-14 are similar in both scope and content. The army also has a rather dated document, Field

15. James Kitfield, "Space and Air Force," *Air Force Magazine*, vol. 81, no.2, February 1998.

Manual 100-18, *Space Support to Army Operations*, July 20, 1995, which has not been revised since and, hence, is not deliberated upon.

Current air force operational level space doctrine resides in AFDD 2-2, last revised in 2001. This document provides significant detail in the areas of command and control (C²) of space forces as well as the planning and execution of space operations. The first chapter serves as a primer on the contribution of space operations to air and space power, examining the relevance and contribution of these operations to the principles of war, tenets of air and space power, air force functions, and air force distinctive capabilities (formerly known as core competencies). The second chapter offers guidance for the C² of both global and theatre space forces. It introduces the construct of a joint force air and space component commander (JFASCC) although this entity has not found acceptance with the other military services. The third and fourth chapters discuss planning and execution of space operations, respectively. The planning chapter covers campaign planning and highlights development of the Air Force Space Operations Plan. The execution chapter provides guidance for conducting both global and theatre space operations. Of particular note are sections that cover the integration of civil, commercial, and foreign space assets into operations and development of the space tasking order. The final chapter addresses training and education for space operations in the context of developing space warriors.

JP 3-14, which treats joint space operations doctrine, was published in 2002 after undergoing development for well over 10 years. Even though a fairly recent document, it needed revision as soon as it appeared due to the merger of US Strategic Command (USSTRATCOM) and US Space Command (USSPACECOM). Divided into five chapters and eight appendices, JP 3-14 includes material similar to that of its Service counterparts. The first chapter provides an overview of military space operations and the operational considerations for space. The second, which covers space organisations and their responsibilities, requires significant revision because of the creation of the new USSTRATCOM. The third chapter offers guidance for the C² of space forces, focussing primarily on global space forces but including limited

guidance on command and support relationships for theatre space operations. The fourth discusses military space operations in the context of the principles of war and the four mission areas for space (control, force enhancement, support, and force application). The final chapter discusses deliberate and crisis-action planning for space operations. The appendices provide a tutorial on several topics, including intelligence, surveillance, and reconnaissance (ISR); integrated tactical warning and attack assessment; environmental monitoring; communications; position, velocity, time, and navigation; and orbital characteristics.¹⁶

Thus, while the Americans are gradually evolving to space control doctrines, the Russians are slipping back into the broad equivalent of the sanctuary doctrine.

In spite of the above, there exists no doctrinal agreement on a comprehensive, all enveloping doctrine capable of addressing all the aspects of space, and vigorous discussions and deliberations on the subject are rife with no commonly accepted theory or doctrine in sight. However, by all available accounts and literature on the subject, the Americans are presently moving onto the “high ground” school of thought to consolidate their gains in space.

CONCLUSION

In view of the foregoing, it is apparent that in the absence of any compelling countervailing theory, most nations have built their space doctrines upon the basic air power doctrine. Basic air power missions form the framework for building upon space power capabilities and in spite of semantic disagreements on the terminology, most nations in their unique fashion build upon the same, depending upon their individual requirements, capabilities and threat perceptions. Thus, while the Americans are gradually evolving to space control doctrines, the Russians are slipping back into the broad equivalent of the sanctuary doctrine and limiting their programmes

16. Available at www.dtic.mil/doctrine/jel/service_pubs/afdd2_2_1.

to force enhancement missions. The Chinese, on the other hand, are attempting a mixed strategy aimed at exploiting the entire spectrum afforded by force enhancement missions and also a leapfrog into counter-space capabilities. The limiting riders in most cases, that is, cost and technology, however, continue to be the same, explaining the wide diversity of force structuring being undertaken within broadly common doctrinal applications.■