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FUSING INTELLIGENCE: DRONES, MANNED ASSETS & SATELLITES

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Abstract

Elaborate, actionable and timely intelligence is essential for planning. preparing and execution of all domain operations. Many different types of platforms like UAVs, manned platforms and satellites are employed to collate intelligence. All intelligence platforms are not the most suitable during different operational environments. Most of them have capability gaps which can be plugged by other platforms and sensors employing different segments of electromagnetic spectrum. Fusing of intelligence from different intelligence platforms and their employment options during different phases of operations would ensure the most optimum collation of the actionable and timely intelligence. This paper brings out the way forward to fusing intelligence from different platforms and sensors, for acquiring comprehensive intelligence during all operational phases.

INTRODUCTION

Intelligence (int) has always been an important element of warfare. It is an ongoing and continuous activity which pervades during peace, 'no peace no war' (NPNW) environment and during hostilities. However, the priorities and targets for intelligence, change during different states of alert. All phases of war fighting from preparation, planning, execution and review of operations require updated, accurate and actionable intelligence

at all levels for commanders to work out military strategy and facilitate operational decisions and for combatants to enhance situational awareness.

To observe the enemy dispositions, intentions and activities, intelligence resources usually exploit 'high ground' to cover larger area and obtain clearer 'picture'. Historically, this activity started with balloons, then graduated to aerial platforms and with launch of satellite in 1957, it transcended the space during the cold war era, to observe deployment of ballistic missiles and provide early warning of missile launches. Unmanned Aerial Vehicles (UAV) came in as inexpensive platforms for intelligence, surveillance and reconnaissance (ISR) missions during the Vietnam War and during the Arab-Israel wars. During Bekaa Valley campaign of 1982, the Israelis employed UAVs so ingeniously, that the world took notice of UAV's operational potential. Ever since then, UAV designs and capabilities have improved tremendously and their shapes and sizes have been tailored to match the user intelligence requirements. While High altitude Long Endurance (HALE) UAVs can stay aloft for more than thirty-six hours streaming live videos and other data continuously, small, backpacked UAVs can be easily launched by soldiers to monitor border area and perimeter security and gain immense tactical intelligence. Significant advances in Information and Communication technology have tremendously enhanced the intelligence data collation, analysis and dissemination process. Rapid advance in sensor technology now provides UAVs with carriage of multiple spectral sensors for observation through all types of weather, including clouds, fog, dark night and foliage.

The intelligence requirements of the armed forces are governed by the scope of their operations, which will further dictate the type of target, depth of area to be monitored and the time criticality. During peace, when operating in a benign environment, any asset could be employed within own borders for regular intelligence updates. However, during hostilities, while operating in a contested and hostile environment, the survivability of the platform and time sensitivity would be the main considerations amongst other factors, for employment of the platform and sensors. Major intelligence platforms are

generally low-density high demand assets, procurement of which requires deep analysis of their employment considerations. It is, therefore, important to analyse the employment considerations of different intelligence platforms during various contingencies and consider the ways to integrate and optimise their employment.

INTELLIGENCE PLATFORMS

UAVs. Many categories of UAVs are operational for specific int requirements. HALE UAVs have an endurance of thirty-six hours, operational altitude of sixty-five thousand feet and can carry an all-weather payload of up to 700 kg. RQ-4 Global Hawk HALE UAV has been employed by the United State Air Force (USAF) as a complement to the U-2 'Dragon Lady' spy plane. Medium Altitude Long Endurance (MALE) UAVs have an endurance of thirty hours and operating altitude of twenty-five thousand to thirty-six thousand feet. The operating speeds are generally low in the region of sixty to eighty knots. Other small tactical UAVs vary from fixed wing to rotary wing types. Bigger UAVs require prepared runway for launch and recovery while the small ones could be launched by catapult or by soldiers themselves. Indian Armed Forces have acquired MALE class and tactical UAVs with many different payloads operating in visual, electro/optical, infra-red and radar regimes. Passive signal intelligence (Sigint) surveillance capability is generally embedded in most of the tactical UAVs. The operational infrastructure for these UAVs includes Ground Exploitation Station (GES) and data link for communication with UAV. GES houses internal pilot to control the UAV flight, and System Operators to manage on board sensors for the required int task. The Indian Army has procured large number of mini-UAVs for perimeter security and tactical intelligence in proximity of troops and to monitor terrorist activities. During peace time, the UAVs are versatile and economical assets for collating intelligence across the border, due to their large persistence, ease of operation from airbase and controllability beyond line of sight. Imagery quality is high, and the payload controller can judiciously control the sensors for as per int requirements. However,

the UAVs presently employed by the Indian Armed Forces have limited sensor range to monitor across the border. In depth targets for standoff precision weapons may be beyond the range of these UAV sensors. During hostilities the UAVs are vulnerable to hostile action due to low speed and lack of self-protection capability. Jet powered high speed UAVs equipped with self-protection suit will have better chances of survival. On 19 June 2020, the versatile and expensive RQ-4 Global Hawk HALE of the USAF was shot down by the Iranian Forces over the Strait of Hormuz.[1] The second vulnerability is the communication datalink between the GES and the UAV, to jamming and interference by hostile forces. In December 2011 Iran forces were successful in taking control of the US UAVRQ-170 Sentinel and forced it to land in Iran.[2] The mounting attrition rate of surveillance UAVs during the ongoing Russia Ukraine War substantiates the vulnerability of int gathering UAVs during hostilities. Mini UAVs can be employed during operations to obtain the valuable battle transparency for better situational awareness as they are expendable entities.

High Altitude Pseudo Satellite (HAPS). Recent incident of the Chinese Balloon overflying the airspace of the USA during January 28 - February 04 2023 has drawn attention of the world to the stratospheric gap between the normal operating heights of UAVs and deployment of Low Earth Orbital (LEO) satellites, which could be exploited for persistent surveillance of very large area in an economical manner. While the balloons have limited manoeuvring and controllability, there is significant development going on to employ High Altitude Pseudonymous Satellite (HAPS).“*High altitude pseudo satellites possess improved functionalities than traditional satellites. HAPS can be maneuvered to fly in different directions and locations. Thus, HAPS are ideal for a range of applications, including surveillance, communication, and environmental monitoring. They can be powered by solar panels and other renewable energy sources. Thus, they are cost-effective as compared to traditional satellites.*[3] In India, Hindustan Aeronautics Limited (HAL) has teamed up with New Space Research and Technologies Pvt Ltd to develop solar powered HAPS that could stay aloft for months.[4] These platforms have extensive growth

potential for both military and civil applications. It can be effectively employed during peace and NPNW environment. However, it is likely to be a vulnerable target during hostilities.

MANNED PLATFORMS

Fighters/Bombers. Historically, balloons were employed in the nineteenth century to observe the disposition of enemy troops. Once the flying machine was invented, aircraft were employed extensively for int gathering due to better performance, survivability, and response. During the World Wars and subsequent conflicts, many available fighters and bombers were modified to take on the reconnaissance (Recce) role. Spitfires, F-4 Phantoms, and the Indian Canberra bombers were appropriately modified as reconnaissance platform. As Surface to Air Missile (SAM) technology matured, very high-altitude Recce aircraft like U-2, MiG 25 Foxbat were inducted to intrude across the border and gather valuable imagery of enemy targets without threat from SAMs. The Indian Air Force (IAF) acquired many Recce Pods which could be attached to the fighters for specific recce missions. Fighter/bomber class of aircraft score over the UAVs for ISR role during hostilities, as they have self-protection capability and can be employed both during peace and war. They fly at much faster speeds and can control the on board sensors as per the mission objectives. Low level intrusions across the border to 'film' targets for the best images can be done only by fighters. In the past the imagery and data gathered through these missions required a large processing time to produce and analyse images. The USAF developed a secure, jam resistant 'Joint Tactical Information Distribution System'(JTIDS) in the seventies to transfer imagery data online to other aircraft and command and control centres (C2C). Today digital imagery is transferred real time to other airborne 'shooters', and Command and Control Centres. Versatility of fighters and better performance capabilities, make them an excellent recce asset during all phases of operations. However, they are expensive assets that could be pulled out for other high priority offensive/defensive roles. The IAF had

106 Strategic Recce Squadron equipped with dedicated photo recce PR 57 Canberra bomber, which provided very valuable imageries during Indo-Pak 1971 War, both in the West, in the East and during Kargil War.[5] The squadron has now been re-equipped with fighter aircraft.

Transport Aircraft. Business jet class and bigger air transport platforms are specially configured for Intelligence, surveillance target acquisition and reconnaissance (ISTAR) task to provide vast data through optical, infrared, radar and electronic signals and detect targets on the ground, in the air and over maritime areas. Multiple sensors and advance communication systems on board make it a value asset for intelligence during all-weather operations. There are many 'sensor controllers' on board who can monitor the data and manipulate the sensors for better results. As they fly at high altitudes of fifty thousand feet, and have range of at least ten thousand km, very large multi-spectral int data gets collated in a short time. The Indian Navy (IN) P-8I Maritime Patrol Aircraft (MPA) has been derived from the Boeing-737 800 transport aircraft. ISTAR platforms are strategic assets that provide valuable inputs to the commanders for planning and operational decisions. During hostilities, these high value assets (HVA) with embedded self-protection suite are employed in depth of own area and could be provided protection by own fighters. Many transport aircraft can be modified to undertake intelligence missions and some of them have 'roll on roll off' palletised equipment for special missions. Many countries have opted to configure the C 295 transport aircraft for ISR role.[6] The C 295 aircraft have been acquired by the IAF and induction will start within 2023.

SPACE BASED ASSETS

Satellites. Space is the 'highest ground' available for intelligence inputs and surveillance. Uncontested environment of space provides excellent option for deployment of imagery satellites, without violating sovereignty of any nation. Satellite imagery has been used copiously in almost all operations, and the imagery satellite capability has been improving tremendously over the years. In the past, there was delay in obtaining imagery inputs from

satellites, just like the air breathing platforms. It is believed that the US could not provide satellite imagery to Israel during the Yom Kippur War of 1973 as the photographic films had to be recovered and developed further before obtaining the imagery results.[7] Present day Imagery satellites have achieved centimetric resolutions and the data is available in real-time to the operators and the leaders. However, LEO satellites that provide the best imagery have limited dwell time of few minutes over a specific area and revisit period of the same area could be many days. To obviate this delay, 'cluster of satellites can be launched to reduce the revisit time. For better satellite inputs, the USA deployed over one hundred military satellites during the Gulf War. India is well on the way to exploit outer space for military applications. Having learnt from the lack of satellite imagery during the Kargil War, India developed indigenous satellite imagery capability and launched the first Technology Experiment Satellite in October 2001.[8] This was followed by 'Cartosat' series of imagery and the 'Risat' (Radar Imaging Satellites). The space assets are indeed quite expensive and are technology intensive in many fields. Total numbers for intelligence satellite would always be limited. Their path in the space is usually predictive during peace and the enemy could conceal the activity from their gaze, as India did towards preparation of nuclear test at Pokhran test Range in 1998.They are, nevertheless, integral elements of all military operations as they provide intelligence, position and communication links that support net centric operations.

IMINT REQUIREMENTS OF THE ARMED FORCES

Peace Time. Data base and intelligence update is an ongoing process during peace for strategic and tactical operation planning, as well as to for perspective procurement plans. Electronic Order of Battle (EOB) which includes Radars deployment, SAMs, Communication Centres and Ground Control Stations, is required to be updated all the time as the control of the air during operations would require degradation of the hostile Air Defence Assets. Deployment of the Army formations, Logistic nodes, fuel storage

and Ammunition Dumps are some of the important assets to be monitored. Infrastructural development and hostile Armed Forces disposition are crucial intelligence inputs for planning operations. These requirements could be termed as 'strategic intelligence requirement' during peace', for this article. The Army is required to keep the borders under surveillance continuously to keep the battle space awareness updated, detect Kargil like intrusions and the Chinese attempts of occupying unmonitored areas. Intrusion by anti-national elements from across the borders require continuous surveillance. These could be termed as 'border area intelligence' for this article. The Navy is required to monitor the maritime area for submarines, ships, and other elements inimical to the national security. This maritime patrolling is again a continuous activity. As the armed forces have inducted large number of precision weapons with stand-off ranges, it is important have the precise location of the likely targets updated all the time. This could be termed as 'target intelligence'.

During War. During transition to war, ISR assets would be deployed more vigorously to monitor the enemy disposition changes, movement, and changes in the EOB. During war, timely intelligence would be critical to see through the fog of war and take operational decisions. As the AD assets are much more mobile and wartime deployment of these assets could be different from the peace time. Updating the EOB is, therefore, highly prioritised requirement of the Armed Forces. Battle Damage Assessment (BDA) through ISR operations would be an additional task to decide on further attacks. It is important to correlate intelligence with other sources of Sigint, Synthetic Aperture Radar and demand for imagery intelligence of the pinpointed area to achieve the results faster.

OPTIMUM EMPLOYMENT PHILOSOPHY OF ISR ASSETS

For peacetime strategic intelligence, ISTAR aircraft, other Signal Intelligence (SIGINT) platforms, and Satellites would be employed to keep the intelligence updated. Fighters with ISR pods could be flown closer to the border to supplement or further investigate inputs derived from other platforms and

other intelligence inputs. These assets would also be employed to update the 'target intelligence' especially for targets in depth for standoff precision weapons. HAPS would be the most economical and suitable platform for peacetime intelligence task. MALE and Tactical UAVs are best suited for 'border intelligence' and to monitor Naxal activities. These assets could be supplemented by suitable fighters for all weather monitoring and for any special task. Small UAVs would be used by the troops and other paramilitary forces for obtaining better situational awareness against terrorist movements. Maritime patrolling and Maritime domain awareness is ensured by satellites, MPA, suitable MALE class of UAVs and helicopters carrying suitable payloads. There would always be special requirements during peace to monitor natural calamities, for which, the most suitable platform could be employed as there is no risk of hostile action against the platforms. During war, in addition to satellite imagery, ISTAR aircraft, Fighter Recce platforms and other collateral assets earmarked for operations would be employed. Big UAVs would have to be judiciously and selectively employed to update intelligence.

PRESENT GAPS

Considering the vast border of seven thousand five hundred kilometres with hostile neighbours and perpetual intrusion by anti-national elements, India lacks ISTAR types of strategic intelligence platforms. UAVs procured by different services are not inter operable as they do not have common data links. Due to this gap, there are prohibitive delays in disseminating tactical intelligence. The Cartosat series of satellites are LEO and limited in numbers, resulting in long revisit time. They are not sufficient to cover the vast area with better revisit times.[9] All the services need to be on a common network grid to be effectively networked and share filtered intelligence at the speed of light. India lacks common airborne data link like JTIDS due to which digital data or videos of dynamic targets cannot be shared with 'shooters' in the air. Processing and analysis of intelligence inputs from platforms, including the satellites, is done by different agencies resulting

in stove piped inputs. Integrated and fused intelligence data would be much richer in quality and content. Modern airborne platforms like Rafale, Apache helicopter, and Airborne Warning and Control System (AWACS) have advanced sensors that can accurately geolocate Air Defence radars and provide optical and SAR interpreted images. There is a gap in integrating this data with other int inputs. There is growing volume of data generated from varied types of sensors, and this massive data would take months to collate and disseminate and some data may remain unutilised. Only Artificial Intelligence (AI) and Machine Learning (ML) tools would provide faster and better intelligence.

WAY FORWARD FOR INTELLIGENCE FUSION

India needs to ensure interoperability amongst various MALE and tactical UAVs of all the three services. This would be possible with common secure datalinks, standardised GES, and intelligence formats. Interoperable GES configurations would ensure access of information from any of the UAVs operating in the area. The armed forces must insist on this requirement for all future UAV procurements from India and abroad. Headquarters Integrated Defence Services (IDS) should be the central agency to ensure this.

India must ensure common airborne secure datalink for sensors and shooters to share real time data and shorten the sensor to shooter loop.

All intelligence data should be networked on a common intelligence cloud with need based authorised access.

As intelligence assets are bound to increase in future and useful int inputs would be available from modern fighters and helicopters. The most crucial requirement is to have an AI based intelligence management system which can integrate and fuse intelligence information from ISTAR, UAVs, satellites, imagery, SIGINT inputs, other visualisations and create a comprehensive and actionable intelligence data base for effective use by the armed forces. It should be able to extract relevant intelligence data as per priority defined by the commander. This software should be networked

with HQ Defence Intelligence Agency (DIA), Services and Command Headquarters, Intelligence Directorates and field formations. The package should have 'change detection' capability and generate multiple layer intelligence for 'target folders'. Another advancement would be for the system to suggest target priorities for faster decision making. This open architecture system should be able to seamlessly integrate any new induction of intelligence platform. The system should have efficient and secure information distribution system to ensure efficient dissemination of intelligence to the right recipient. Such systems are operational in many Air Forces that employ multiple intelligence platforms. An example of such a system was press released by Rafael Company prior to the Paris Air Show.[10] It describes such system in greater details.

During hostilities, the intelligence assets would always be in high demand and the tempo of the operations would dictate the priority of ISR inputs. Service Headquarters should centrally control the intelligence assets during such eventualities.

Manned Unmanned Teaming assets under development by HAL, must include advanced and networked ISR capabilities to support manned fighters in future war scenarios. Their inputs would be accessed near real time by other agencies through intelligence cloud.

Data analysis and interpretation of the massive data base is crucial, especially during war when time and access to the information at the right time is crucial. Employment of AI and ML based tools and common intelligence cloud is the answer to ensure timely analysis and information dissemination. To effectively exploit stand off weapons and stay ahead of the game plan of the enemy, actionable and timely intelligence to all decision makers is an essential requirement for the armed forces. HQ IDS is the right agency to pave the way and acquire this crucial capability.

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NOTES

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