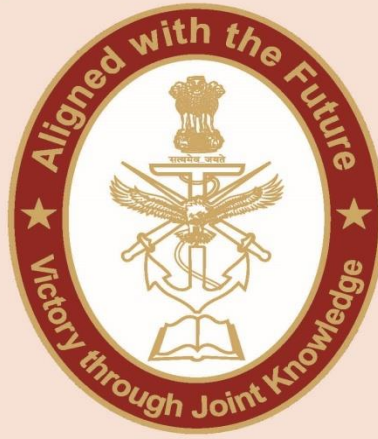
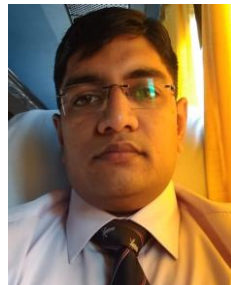


CENTRE FOR JOINT WARFARE STUDIES



CENJOWS

OPTIMAL EXPLOITATION OF UAV MISSIONS: USER'S PERSPECTIVE



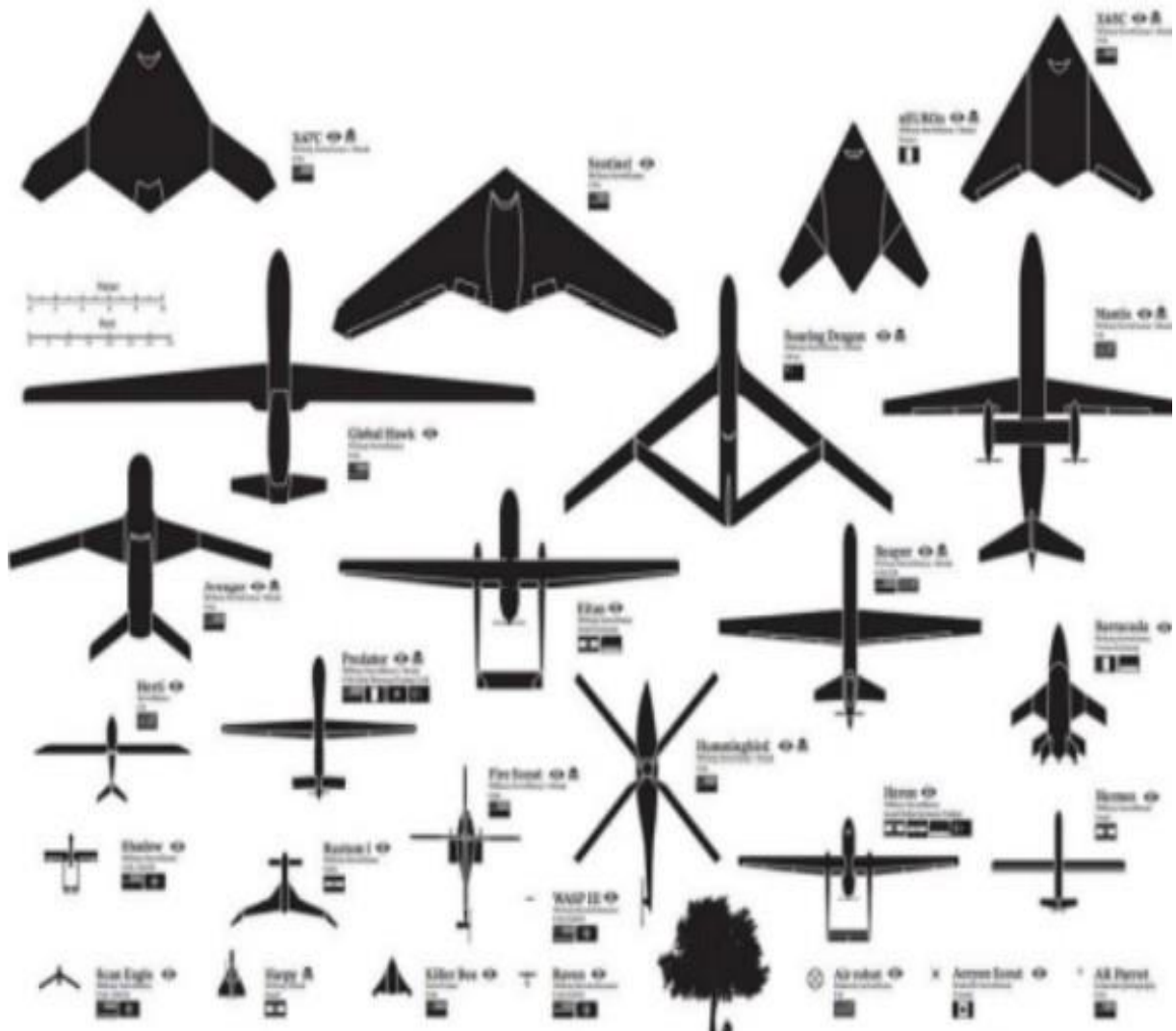
Lt Col Karthik Veeramani was commissioned in a Med Regt (Bofors) in Dec 2007, with B.Tech from MCTE, Mhow. An Instructor in Gunnery, he served in HAA along LC and LAC with his parent Unit apart from a tenure in Smerch Regt along Western Sector and UAV outfit in North-East. A graduate of DSSC, Wellington, the officer is currently posted at HQ IDS.

"O King! Thou must at all times know what thine enemies plot - awake or asleep, near thee or afar. Verily thou must confound thine enemies by telling them that thou knowest the evil thoughts they harbour against thee"

– Advice to King Crow

GENERAL

UAVs have demonstrated their utility in warfare as a surveillance platform, observation platform for directing fire, weapon platforms & as a weapon itself. Their low cost, low radar signature, zero human risk & extensive reach makes them the ideal platform in all forms of warfare. Emerging employment technologies have opened possibilities for expansion of the range of employment of UAVs from tactical depth to op depth & also strategic depth. The flexibility of the platform & advancements in payload tech has given it significant advantages, even over fixed wing aircraft. The emerging techs like UAV swarms, tactical UAVs & others are postured to change the nature of warfare in the coming years.



'Failure to make the necessary critical changes, failure to adopt the emerging future, failure to jettison the baggage of the past, failure to accept the realities of momentous changes, individually as professionals & collectively as an air force, will lead to catastrophic failure of the force.

-Sanu Kainikara

Our Northern adversary apparently enjoys an asymmetric edge, both quantitative & qualitative, in his holding of UAVs. While a part of his claims may be an extension of his IW campaign, the demonstrated profile is also substantial in capabilities. On the other hand, our reliance on a single type of platform, however, comes with a set of disadvantages. Considering limited R&D & no immediate procurement plans, our UAV capability is limited to manoeuvres within the existing capabilities. The article intends to examine the issue holistically and recommend remedial measures.

AIM

To understand the UAV Operations from user's point of view and arrive at concrete mechanisms for optimal exploit of this potent asset.

PREVIEW

The article explores the issue under the following broad heads: -

- UAV Operations and Existing Capabilities
- Factors affecting Execution & Effectiveness of UAV Mission.
- Efficacy Of UAV Effort in Current Security Scenario.
- Recommendations for Optimal Exploitation of the potent asset.

UAV OPERATIONS AND EXISTING CAPABILITIES

UAV Operations

The success of UAV operations are concomitant on the degree of operational readiness of the base as a whole and robust mechanisms that need to be installed for quick demand of the mission and provision of real time feedback/ footage, which needs to be correctly interpreted for fruitful analysis, to draw useful inferences.

Let your plans be dark & impenetrable as night, & when you move, fall like a thunderbolt.

- Sun Tzu

Existing UAV Capabilities

It is pertinent to note that India had contracted UAVs from Israel way back in 1999. At that time, the UAV being Searcher Mk -1, with limited altitude ceiling & endurance of six to seven hours, the primacy of UAV ops was towards Counter Insurgency & Border Guarding (BG) roles only. With advent of Heron UAV, coupled with normalcy returning to most of North Eastern states, the bias towards the Northern borders has assumed its rightful importance. Though the primacy of the Israeli UAVs does exist, indigenous UAVs have also been produced with limited success. The

recently developed Rustom 2 UAV has made few heads turn with awe owing to its huge size and lofty capabilities, however yet to tide through all important trials before it can be fielded in the environment. The Project Ghatak which aims to develop the indigenous Unmanned Combat Aerial Vehicle (UCAV) is yet to materialize, however, we must submit to the fact that we as a country, are still in infancy when it comes to Unmanned Aerial platforms.



FACTORS AFFECTING EXECUTION & EFFECTIVENESS OF UAV MISSION

It is imp to understand that a UAV flying over the mission area is the result of numerous non-negotiable & successful events at sub-system level, with comparable analogy of an orchestra playing musical notes. The probability of likes/ dislikes of the music played are intangible factors for the audience/ judges due to varied taste & level of knowledge. Similarly, the quality & profoundness of videos, stills, plot of emitters etc, captured by UAV sensors are highly contingent on the expertise of interpreters (or loosely termed as user representatives). Hence, it will not be incorrect to assume that the so-called UAV footage, as a tip of iceberg & numerous variables have their small but non-negotiable weighted factors which has resulted in getting the same. Though not exhaustive, some of the factors linked to success/ satisfactory exec of UAV missions are enumerated below which are self-explanatory:-

- **Flying Crew.** Availability of trained & recycled crew is an inescapable necessity. The observer, essentially being the first link in the chain of interpreters, needs to be accustomed with the perception & orientation to the video, & be able to quickly pick up prominent reference points/ landmarks on ground, for speedier orientation. Failure to do so may often result in huge delays in spotting the target.



- **Time & Space.** Air space & runway availability in terms of Air traffic; Favourable Air Situation (FAS) & Air Defence (AD) clearances are some of the intangibles in a battlefield milieu.



- **Weather.** Being Fair Weather equipment, the weather at Runway, Dual Site & Mission Area & availability of routine weather updates are essential prerequisites.



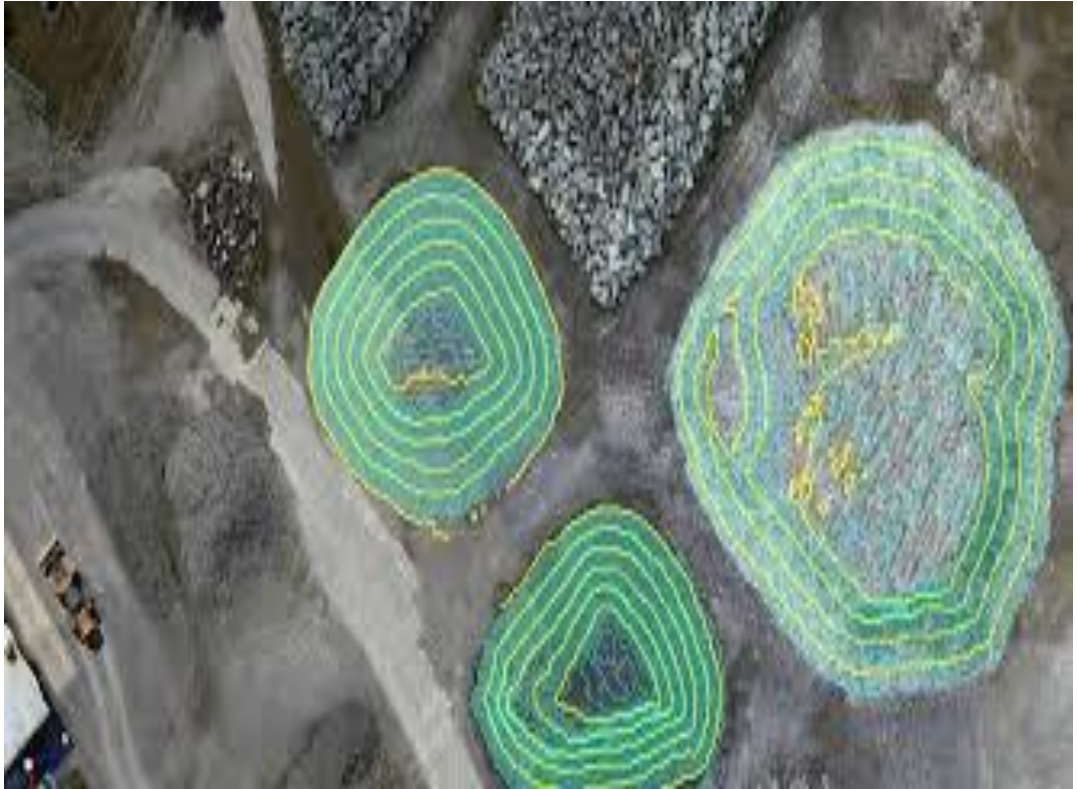
- **Serviceability.** Equipment serviceability along with associated redundancy of the equipment to include:-
 - UAV aircraft & its critical components include payloads as per requirement of mission, weather, time of the day & EEP policy.



- Ground Support & Test Equipment (GSTE) to include Flight Line Testers (FLT), Radio Beacons, Cooling fans etc.
 - Control Stations & requisite directional/ omni directional transmitters (with varied transmission power capability & redundancy).
 - Generators.
 - FOL & other expendables.
- **Communication**. Communication arrangements with inbuilt redundancy is an inescapable requirement.
 - **Emergencies**. No occurrence of critical emergencies during flight at critical junctures (despite empirical data being available, probability is not predictable).
 - **Quality of Data Collected**. The weather conditions like mist, haze, sun's shadow on target, & precipitation levels enemy route to mission area are some of the intangibles which have a serious impact on the payload performance & results generated thereof, despite an uneventful & smooth flight to the mission area.



- **Analysis by Interpreters.** The success of UAV mission largely hinges on the capability of the analyst who can draw useful inferences much beyond than what is available in open-source satellite imageries using the real time data collected by UAV sensors.



- **Prolonged Period of Inactivity.** It is an evident that an observer must carefully scan through a huge swathe of area to acquire any valuable input. The requirement to sift through the frivolous info overload leads to prolonged period of inactivity which affects the alertness levels of the crew.
- **Data Link Restrictions.** The UAV footage quality largely depends upon the downlink sig which is contingent on availability of clear LOS. Frequent interruptions in LOS results in “No Report” where the telemetry freezes & image is blacked out. If this phenomenon happens at critical points, the probability of losing data escalates.

EFFICACY OF UAV EFFORT IN CURRENT SCENARIOS

Border Management Posture (BMP) Scenario. With the restriction of flying in proximity to borders lesser than 10 km, coupled with data link limitations, the current setup allows targeted “peep in” across, especially along the Valley beyond the watershed. Further, the immediate ridge line across borders may render successive valleys opaque to us. It is pertinent to note that satellite images of several enemy camps outweigh the quality obtained by UAV especially due to shallow angles at which the payload is pointed compounded by the slant distance, weather & other technical drawbacks. Thus, numerous UAV missions end up in obtaining the same data existing in open domain, albeit at a much inferior quality. Although the plateaus/ flat terrain does allow substantial “peek” into the adversary, but limited settlements & construction activities may not invite much attention. Even for the camps/ villages that generate interest, the quality of satellite images outshines the UAV images in this regard. While the UAV is definitely more potent in observing activities involving substantial troop movement/ changes in infrastructure, even in a comparably low activity scenario like BMP, it has its utility constraints.

Application of UAV in BMP. The UAV effort primarily aims in drawing vital inferences by superimposing **Real Time Data** on the existing satellite data / imagery or archival UAV footage thereby leveraging the essence of “**Real time**” imagery for **intelligence preparation of the battlefield (IPB)** in BMP scenario, spot & quantify **changes in infrastructure construction** to evaluate pace of activity; & **assess overall intent** apart from serving as an **Eye in the Sky** when the situation is on the **brink** of turning hostile especially during **proximity situations** like face-off/ standoffs/ transgressions. Also, at times, apparently harmless changes in routine missions may lead to events that can have strategic implications. Several transgressions which came to light only because of UAV missions are a case in point. Also, the present setup being equipped with a large variety of sensors & payloads like optoelectronic, SAR, ESM & laser, it depends upon the ingenious application by the user **to pivot** them to “**peep/ listen**”, “for the right thing, at the right place & at the right time” for priceless inputs.

Applicability of UAV Effort in Conflict Scenario. On the outbreak of hostilities, UAV can be primarily used as a “scope” or a monitoring station as the hostilities unfold for Commanders in chain to take fruitful decisions, DDOAF, PSDA, BDA etc, subject to intangibles of FAS, AD umbrella, & Air Space Management by IAF. However, flying restrictions because of IB/ LAC will be waived off which will allow our assets opportunities for **deep peek** into the enemy territory, subject, of course, to survivability.

Best Case Scenario. It is however felt, that the period immediately preceding outbreak of hostilities is a period of opportunity for UAV ops. The risk of escalation & the risk of being labelled aggressor may prevent/ deter Air Space Violations; however, proximity flying along IB/ LAC may be at its zenith. This is the time when the UAV must be exploited to its full advantage, by hoisting it to max ceiling alt & peeping as far as possible. In extreme case, **Penetration Mode** may be resorted to, along sensitive waypoints pre-fed with a relay UAV firmly on own side to extend the ranges of Mission UAV several kms inside enemy territory, but with a caveat of losing the mission UAV.

RECOMMENDATIONS FOR OPTIMAL EXPLOITATION OF THE POTENT ASSET



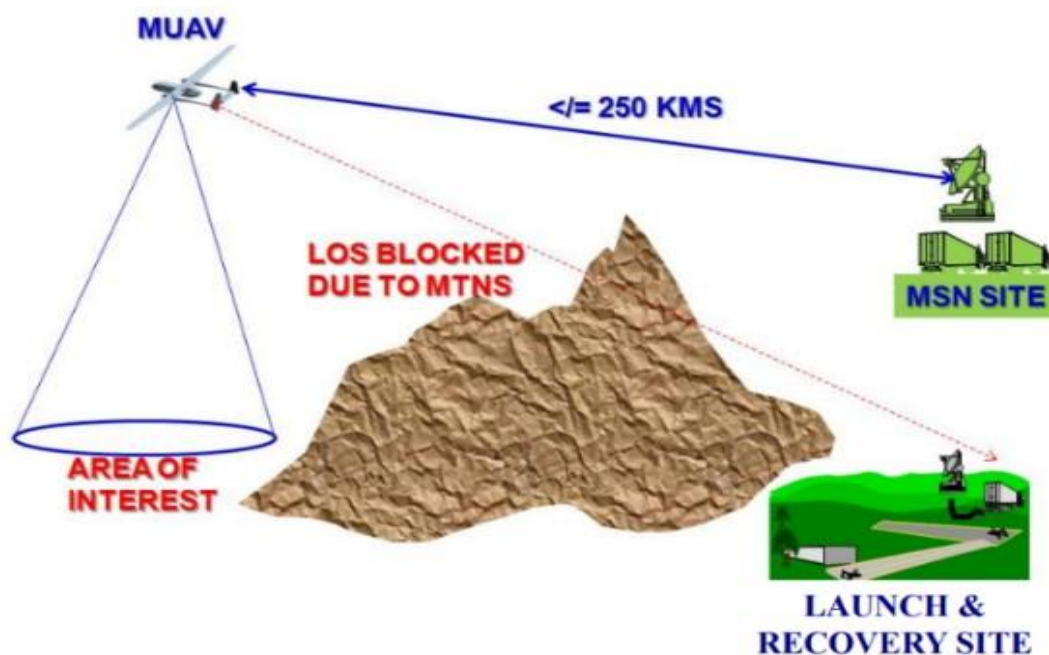
At the macro level, imported UAVs have been in our inventory for more than two decades however our own indigenous UAV, Rustom has undergone very few test flights, & Nishant UAVs development by DRDO has been apparently foreclosed post crashes. This has left a gaping hole in terms of UAV indigenisation which has compelled our Armed forces to go in for importing newer versions of Heron UAV. Especially after a Heron crash suspected of being spoofed by the adversary, new upgrades have been installed to avoid such events in future. Thus, the latitude for employment of UAV by our forces is constrained to the existing assets only. Some of the actions/ mechanisms that can be instituted for optimal utilisation of this theatre asset for operations along Northern borders are outlined in the succeeding paras:-

- **Criticality of Weather Update.** The weather update at runway, dual site (if employed), & mission area assumes considerable significance in the overall success of the mission. It may be prudent to have meteorological stations along the flight path and based on centrality of mission area to have real time & accurate weather updates, cloud pattern & wind conditions for optimal planning of missions.
- **Ferry Mission.** This type of radical procedure adapted to transport UAVs by air, by flying the UAV itself has proved its worth recently, especially when weather / road conditions impinge on transportation of UAV frames by road. This method should be exploited for harnessing the number of UAV available in the theatre to include the birds at nearby bases in case of op exigency where a particular Zone may be in need for more No of birds.
- **Overcome Soda Straw Syndrome.** It needs to be understood that any remote sensing device suffers from the phenomenon of “**Soda Straw Syndrome**”, wherein, in the quest of minute details, the wider view gets affected. This implies the over-riding importance of having pinpoint **Lat / Long** of the target that needs to be monitored instead of tasking UAV for prophylactic surveillance. Mission deliverables need to be carefully planned ab-initio by user formation & UAV crew must be briefed accordingly before taking off. **Wide Area Persistent Stare (WAPS)** Surveillance system like **ARGUS** may be the need of the hour.

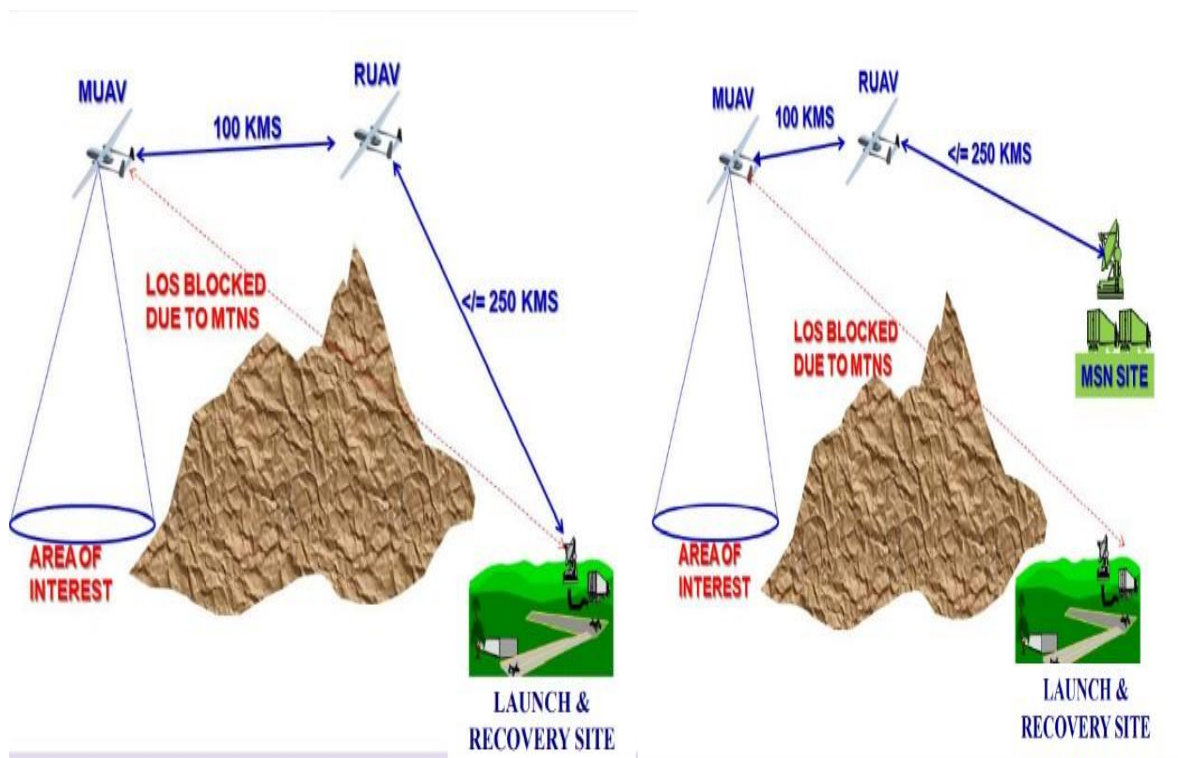


Fair Weather Equipment. Though this might be clouding the capability of UAV, the user representative / formation asking details through a UAV mission should accept the fact that UAV being fair weather equipment, it is susceptible to inclement weather conditions. More importantly, the aim of equipment is not to fly, but to observe from an aerial platform. Weather limitations not only affect the UAV airframe but also deprive observers from getting inputs.

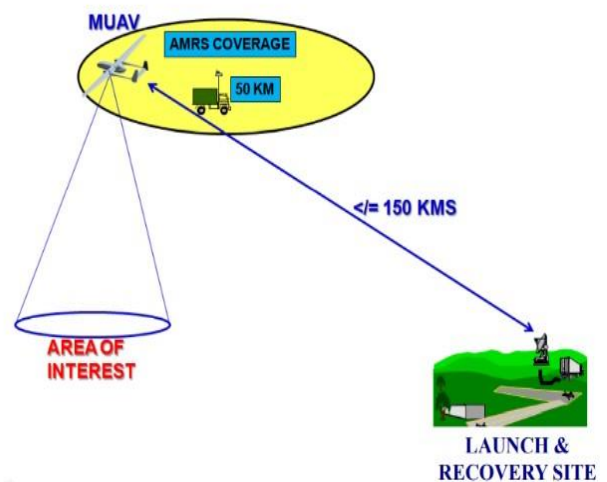
- **Survivability.** Due to the existing sub conventional & conventional threat from adversary, the hangars & maintenance equipment should be preferably housed in protective shelters.
- **Data Link Restns.** The terrain profile along Northern Borders compels the UAV crew to fly at the fringes of the data link primarily due to LOS limitations, constantly posing appreciable risk of Link Loss coupled with poor quality of footage, offering ltd scope of perception & shallow angles towards target resulting in sub-optimal utilisation of effort. This coerces us to observe high value targets from a singular direction only, that too, for a very thin window of observation before being obscured by intervening ridge lines. Probability of high winds/ haze/ shadows entangles the Gordon's Knot further. To tide over these issues, the following options do exist which can be explored/ examined:-



- Dual Site.** Setting up a dual site locations post deliberate analysis on software at GCS using deployment tools, may open up possibilities of extending data link ranges & also overcome the above mentioned issues. However, administrative and logistic challenges and technical aspects of having a Dual Site at the locations must be technically arrived at; need to be thought through prior to carrying out actual deployment, after weighing the spin-offs versus the associated cons.
- ADR Missions.** Although ADR missions have been mastered by the present setup, lot of complications do occur in hoisting two UAVs simultaneously. ADR Missions often cause an avoidable strain on the UAVs health, engine hours, logistic issues & its mechanism. In bases, where runway is in a bowl, ADR missions are the norm. However, in our case, although not necessary, it is still desirable, as it comes with its set of advantages. The decision, based on the payoffs would be taken by the Commanders on ground.



- **AMRS.** The utility of AMRS needs to be optimally utilised to avoid circuitous routing of UAV footage. The deployment of AMRS, needs to be well forward, in proximity of the commanders on ground to have a commanding view of the battle unfolding in order to be able to influence it. Co-location of AMRS with Division Intelligence and Surveillance Centre (DISC) can considerably empower it in filling intelligence voids in near real time.



- **Remote Video Terminal (RVT).** The RVT, not currently held in our inventory, can be the panacea for all the commanders down to unit & sub-unit level. The RVT essentially is a miniature form of AMRS with ltd / no control of the payload. It however, offers real time footage shot from the overhead flying asset. Essentially a handheld video receiver, this device can be a force multiplier to enhance the sit awareness even at platoon & sec levels.
- **Quadcopters/ Commercial Mini UAVs.** UAV effort is readily available, much earlier & easier than satellite resources/ IAF resources. However, routing the UAV footage down to sub-tactical level constantly remains a major challenge. To tide over this issue, especially for junior leaders on critical tactical missions, use of Quadcopters/ commercial mini-UAVs maybe a much better, more responsive & quicker option. Procurement through ACSFP of Commercially Off the Shelf (COTS) drones, can deliver considerable advantages with much lesser effort. These UAVs can also empower tactical level users in regularly monitoring remote areas in their AOR during BMP.



- **Sanctity of User Rep.** The present-day approach of having a user representative plugging the gap based on being in proximity to UAV base instead of the company commander/ platoon commander deployed at frontiers who is actually yearning to see beyond the watershed needs to be logically considered. User representative detailed so, must be clued up with satellite images of the area being observed for immediate recognition & observe the relevant real time details much more than what an archaic satellite photo has to offer. The formation staff should rightly earmark deliverables for each target that needs to be observed in each mission, based on previous video footage, analysis & inferences.
- **Coordinates in Lat/ Long.** Formation staff should ensure that coordinates of targets which need to be observed are given in form of Lat/ Long instead of six fig GR to ease the UAV crew in plotting the targets.
- **Pool of Trained Pilots.** There is an urgent need to muster the existing pilots in the organisation, carryout refresher training and task them if located in near vicinity of UAV bases. This can be a panacea to overcome crew shortages, where these exist, and also allow in exploiting the collective experience in the system.

- **Dual Trade Training.** Mutual exclusivity of trades with regards to Internal Pilot and Observer Pilot results in sub optimal exploitation of the precious human resource. Dual trade training at the level of Mission Commander or Instructors' Course needs to be instituted to offset the mandatory requirement of exclusive trade pilots.

Conclusion

The killing of the Iranian Gen Qassem Soleimani in a US air strike utilising the UAV platform underpins the changing face of warfare. Rapid leaps in UAV technology have led to the creation of a much-needed refuge in the escalatory matrix below that of open conflict. Not only has the platform demonstrated its capability of mounting difficult military aims, it has also consistently shifted the onus of escalation on the targeted side. However, the advantages of any new technology can be reaped only before its mass proliferation.

The procurements notwithstanding, it is equally important to utilise the existing capabilities in the most optimal manner while denying the same to the adversary. UAV utilisation can no more be the exclusive foray of those trained to operate it. It is equally important that the key stakeholders, the troops on ground, those who bear the repercussions of the UAV actions, whether ours or the adversary's, understand its nuances & incorporate them in their tactical planning. It is only then that the existing asymmetry with the Northern adversary can be effectively bridged.

CERTIFICATE

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