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Predictions and Contests of Including UAV-Based ISR Method in Military: an Watchful change of Emergent Nations

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ABSTRACT

Nowadays the modern warfare is going to be dripping wet with the use of UAVs of varied kinds. UAVs have numerous nifty and unique characteristics that make it a priority one device while selecting sensors for surveillance for both civilian and military use. Therefore, a comprehensive analysis needs to be carried out in this area. In this paper, an endeavor will be made to investigate the existing ISR capabilities of some of the ground forces of developing nations, identify their limitations in broader aspects and scheme out the feasibility of employing drone-based ISR capabilities to enhance the overall operational efficiency in these regards. In the order of discussion, both qualitative and quantitative analyses have been carried out through varied graphical illustrations including SWOT analysis and case study. Various online resources, government publications, administrative census were consulted as primary and secondary data sources Moreover, the study discovered that (more than 80% of responders) the judicious employment of drone-based ISR system in the military through viable modalities of integration will optimize the operational capabilities to a substantial level. In addition, this will also facilitate disaster management organizations, paramilitary forces, and law enforcement agencies in performing their duties. In this paper, the history of UAVs and their use in various wars is discussed first. This follows the classification of drones, their characteristics, capability, and limitations. A comparison will be then made with other sensors which will lead to a conclusion as to why to choose UAVs based on ISR capabilities and how it can influence battles to be fought more efficiently. Finally, a viable methodology for the effective inception of ISR-based UAVs has been articulated in the quest of developing countries..

Keywords UAV, Drones, Intelligence, Reconnaissance, Surveillance, Sensors, Armed forces, and Operational Efficiency.

Acronyms

Unmanned Aerial Vehicle	UAV	Magneto Encephalography	MEG
Intelligence Reconnaissance and Surveillance	ISR	Communication Relay Device	CRD
		Low-Intensity Conflict Operations	LCIO
Intelligence Surveillance Target Acquisition and Reconnaissance	ISTAR	Communication relay device	CRD
		Ground control station	GCS
United Nations Security Council	UNSC	Launch and recovery station	LRS
High Altitude Low Endurance	HALE	Battle Field Surveillance System	BFSS
Medium Altitude Low Endurance	MALE	Battlefield Surveillance Radars	BFSR
Contact Battle Surveillance	CBS	The direction of own arty fire	(DOOAF)
Global Industrial and Defence Solutions(Pakistan)	GIDS	Post strike damage assessment	(PSDA)
		The Democratic Republic of the Congo	DRC

Introduction

An Unmanned aerial vehicle (UAV) is a kind of aircraft with capricious size (from micro to large which has no onboard crew. UAVs comprise both self- directed drones and remotely piloted vehicles (RPVs). "In the 21st century, technology reached a point of sophistication that the UAV is now being given a greatly expanded role in many areas of aviation".Nowadays, all developed as well as developing states like Pakistanand India have already fitted out with modern UAVs not only for surveillance and reconnaissance but also for a striking role as well. UAVs have got a significant role in present days warfare as recently demonstrated in Idlib where the prudent use of UAVs by Turkeys" armed forces has ensured the outcome of the battle in his favor. "UAVs are not only cost-effective rather strategically and operationally more advantageous than conventional aircraft. More significantly,for surveillance ,gathering intelligence, and reconnaissance purpose,UAV is the best option because it is cost-effective – no need fora huge amount of oil, does not require vast for takeoff, low maintenance cost, no risk (avoid human death), able to operate in stealth mode (not so easy to track it), take very little time for takeoff, easy to handle.

Significance of the Study

In the military, more significantly for developing countries the resources will always remain scarce. Conventional ISR systems cannot be effectually engaged in the collection of enemy data before a war situation. The BFSR has got some limitations in terms of range and accuracy. They can only provide an only electronic signature of targets but no photo or video.Therefore, aversatile platform for surveillance needs to be incorporated with a conventional ISTR system due to cover the required area of interest up to maximum depth towards the enemy. Only, platforms like UAV or drone with electro-optical sensors is globally preferred for this purpose. Moreover, this platform will also facilitate many operations other than war e.g. Peace Support Operations, Disaster Management and In Aid to Civil Power.That‟s why this study got a lot of importance. We need to analyze the problems and prospects of incorporating UAV-based ISR capabilities in the military so that developing countries can bring out the best result.

Scope and Objectives of the Paper

The scope of the study only includes the use of drones as surveillance devices in the military of developing countries lagging with technological and economic aspects. The broad objective is to find out the scope of integrating drone-based ISR capabilities with conventional BattleFieldSurveillance and Monitoring System(BFMS) and study its impact of utilization onthe operational efficiency of military forces(of developing countries). The Specific Objectives of this study are illustrated below:

- To emphasis the use of drone-based ISR system and how it is been integrated by other armies
- To analyses the existing ISR and BFMs capabilities of developing states and identify the lacunas to evaluate the necessity for surveillance assets like UAV with ISTR capabilities
- To determine the need and scope of employment of UAV-based ISR capabilities with the existing BFSM system of developing states‟ ground forces.

4. Characterization of RelevantTerminologies

4.1Drone. According to dictionary.com Drone is an unmanned aircraft that can navigate autonomously without human control or beyond the line of sight. Drones are more formally known as unmanned aerial vehicles (UAV). All unmanned powered air vehicle which can be used repeatedly (unlike missiles) is termed “drone”. These are variously known as Unmanned Aerial Vehicles (UAVs), Remotely Piloted Vehicles (RPVs), or Remotely Operated Aircraft (ROAs). In this research, here onwards drone is used for all sorts of unmanned aircraft.

4.2 Surveillance. Surveillance refers to close observation. It has got armed connotation which means the scheme of information collection on enemy activities and intentions. It is an essential requirement for the effective conduct of the campaign.

4.4 Operational Efficiency. Precisely, efficiency is measured as the ratio between input and output. However, Operational Efficiency refers to the attainment of better with the engagement of relatively fewer force or effort. “In the military, the connotation of efficiency is quick response, timely use of force, and guiding forces avoiding risks “[4].

4.5 ISR Capabilities "ISR is one kind of military maneuveren visioned to assist “decision-makers anticipate change, lessen the risk, and silhouette outcomes”[5]. The U.S. Department of Defense (DOD) defines ISR as “integrated operations and intelligence activity that synchronizes and integrates the planning and operation of sensors, assets, and processing”[6].

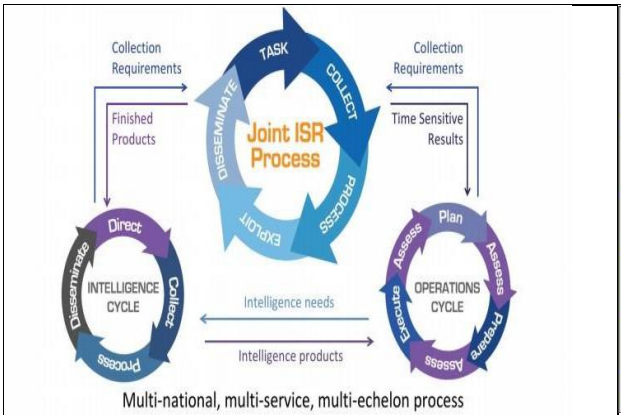


Figure-1: ISR: System Life Cycle [7].

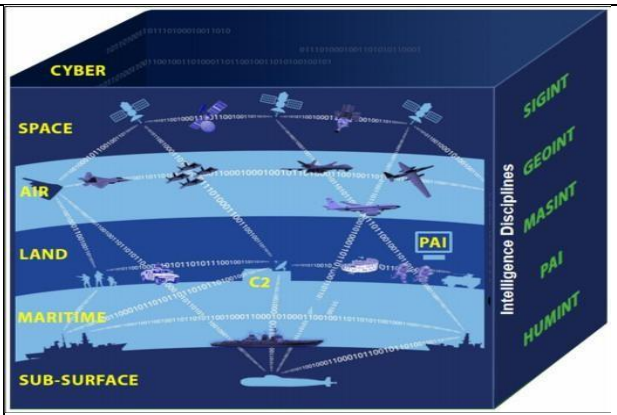
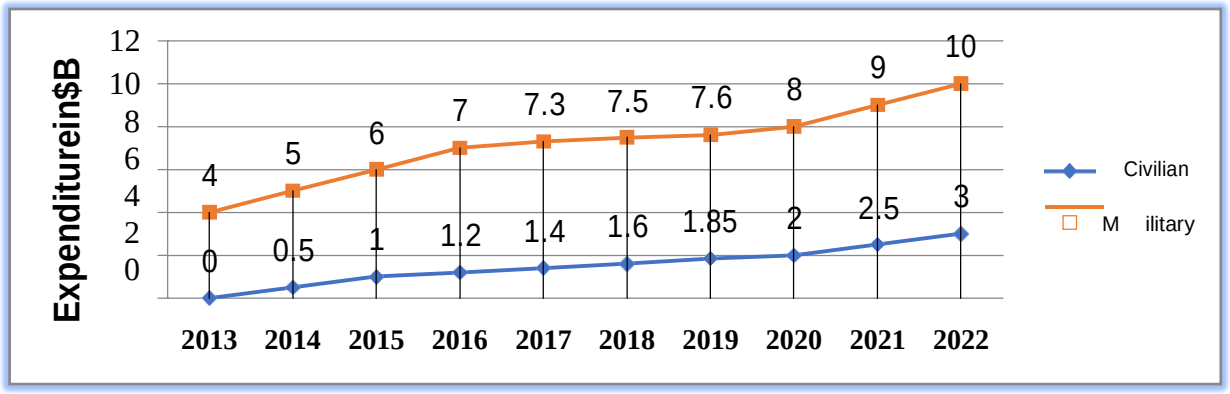


Figure-2: Array of Multi-domain ISR Capabilities [8]

5. Use of UAVs: A Historical Perspective. The history of UAVs is as old as the history of aircraft. The first pilotless remotely operated aircraft were built during and shortly after World War I. Subsequently, thousands of drones were cast off during World War II and the Cold War era. In [9], Shaw reported „‟during the Vietnam War, over a thousand US drones, mapped out North Vietnamese and Chinese logistics networks”.The Gulf War-1991 has revealed that the ISR-based UAVS could yield more intelligence than conventional aircraft. Furthermore, they identified more targets than the entire resources of the US 7th Corps could hit.Graph-1 illustrates the increasing trend of VAVs utilization in civil and military affairs.

Graph-1: Trend of Global Drone Market (Rise)



(Source: Authors Sel-Construct)

5 Related Works/Literature Review

In this segment of the discussion, an attempt has been made to confer some of the concurrent noteworthy works on the recent development of ISR-based UAVs embraced with varied factors on inception in combat and non-combat atmosphere. In [10], Bristeau endeavored to reason out why UAV is chosen for tactical reconnaissance over manned aircraft through a comparison between them. But he did not provide any suggestion whatsoever to develop UAVs through indigenous or local resources. In another research article[11], G.M Atmeh embarked on the principles of employment of the UAVs as an aerial reconnaissance vehicle and developing a philosophy for new doctrines.Y. Sunin his paper [12], highlighted a perceptive idea of technological proficiency required in this field**.** It also gives an understanding of the design approach and construction technique for UAVs.However, he did not provide any inscription regarding modalities of inception in military or civil sectors.

Limitation of Previous Work. All the above writers told about the uses, potentiality, prospects, and technical aspects of UAVs. But nobody emphasized glitches and impediments associated with the inception of UAVs technology in the military inventory of developing states. They did not highlight mitigating the inherent limitations of UAVs‟ employment (Like UAV crashes on Civil Aircraft, etc)

6. Requirements Elicitation (RE)

In the field of engineering, requirements elicitation is the practice of investigating and determining the necessary attributes of a system from the users‟ perspective. In this write-up,RE was carried out to explore the scope of the inception and varied relevant factors modalities of integrating the UAVs- based surveillance system in the military. Therefore, an exhaustive survey has been carried out among twenty combatants of different countries through varied online platforms (Google form). Key Personals Interviews (KPI) were also conducted following the semi-structured questionaries. During this requirements elicitation process, a good number of relevant issues have been identified. All the germane issues have been contented in this write-up.

7.Methodology

The conceptual framework of my paper isillustrated in Figure-3 below:

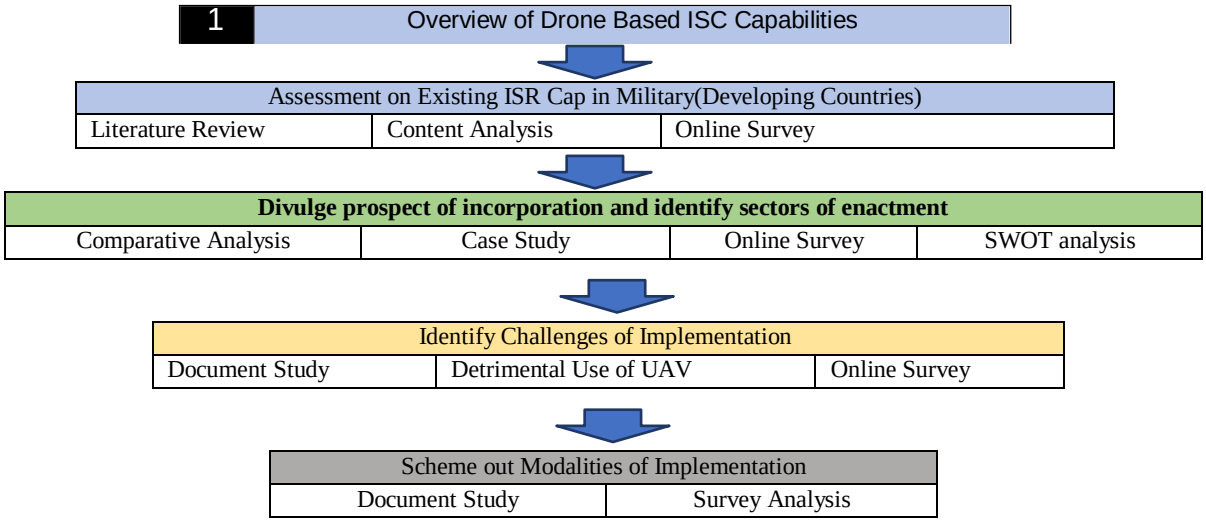


Figure-3:Conceptualframework(Source:Authors‟self-construct)

Section-1: Concept of UAVs

8.How does UAVWorks?

Military commanders use tactics and strategy in combat to inflict as much damage on the enemy while trying to risk as few personnel and resources as possible. This principle was at the heart of the development of the RQ-1 and MQ-1 Predator Unmanned Aerial Vehicle. These high-tech aircraft, controlled by a crew miles away from the dangers of combat, are capable of reconnaissance, combat, and support roles in the hairiest of battles. In a worst-case scenario, if a Predator is lost in battle, military personal can simply "crack another one out of the box" and have it up in the air shortly and that's without the trauma of casualties or prisoners normally associated with an aircraft going down.(Valdes, 2004)

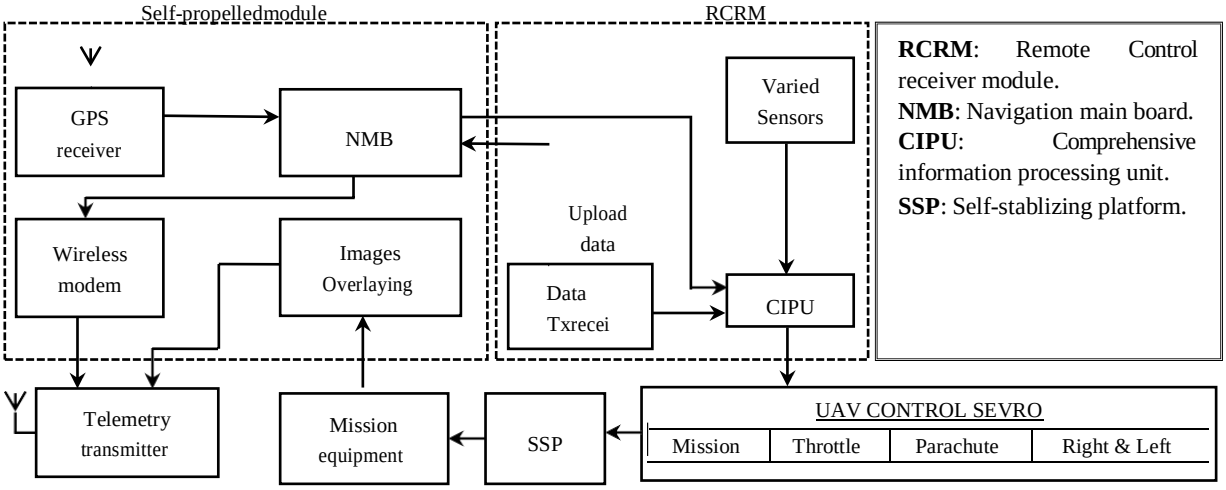


Figure-4 Generalise Functioning Diagram of UAVs'(Source: Authors" self-construct)

8.1. Why to Prefer Drone as Surveillance Device. The drone is a versatile platform that can detect all sorts of targets at a varied range that other surveillance radars cannot do. The figure below shows the coverage by other surveillance means whereas drones can cover the whole spectrum of the area of interest. UAVs assumed a leading role in military operations than other surveillance devices for three reasons. First, their low noise meant that adversaries were less likely to detect their presence. Second, drones could loiter over an area longer than manned aircraft. Lastly, they could fly low and expose themselves to enemy fire to verify the nature of their targets. Consequently, the prospects of collateral damage could be reduced, but not eliminated could fly low and expose themselves to enemy fire to verify the nature of their targets. Consequently, the prospects of collateral damage could be reduced, but not eliminated.

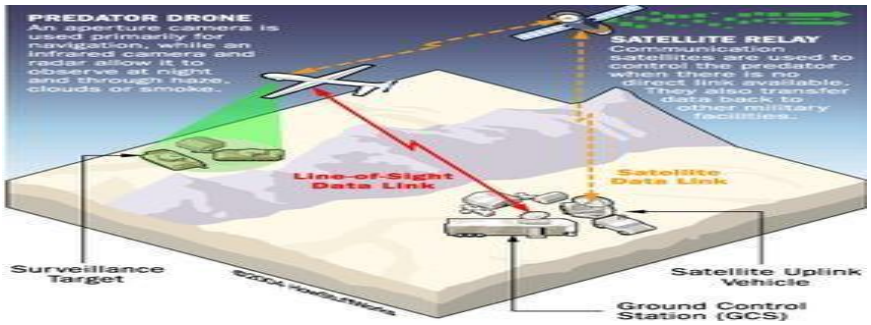


Figure-5 Predator UAV communication System Sources:
https://science.howstuffworks.com/predator.htm

8.2. Classifications ofDrone

According to the Training Notes on UAV, UAVs can be classified according to their capabilities and/or as per the purpose for which they are to be employed. The capabilities, based on which they are normally classified are endurance, range, and altitude. As per CSS [13],analysis, based on use there are three types of drones: strategic, operational, and tactical. StrategicUAVs, also called long-range UAVs, are used for long-range reconnaissance. Operational drones, also known as medium-range UAVs. They are normally deployed at the theatre level of combat and can be used for both reconnaissance and attack purposes. Lastly, tactical UAVs are low altitude, short-range air vehicles. In general, UAVs are classified based on their capabilities and hence may fall into several classifications as stated below in table1:

Table-1 Classification of UAV's according to Unmanned Aerial Vehicle Systems Association Source:[14]

UAV Categories	Acronym	Rang (km)	Climb rate (m)	Endurance (hours)	Mass (kg)
Micro	m (Micro)	<10	250	1	<5
Mini	Mini	<10	150-300	<2	150
Medium Range	MR	70-200	5000	6-10	1250
Medium Range Endurance	MRE	>500	8000	10-18	1250
Low Altitude Deep Penetration	LADP	>250	50-9000	0.5-1	350
Medium Altitude Long Endurance	MALE	>500	1400	24-48	1500

8.3. Employment of Drone. Nowadays UAVs are widely used for ISTAR roles besides their inherent usage as a silent arsenal(attack UAVs/Drones). It is also used for Battle Filed Management System(BFMS), Scheming of Forces Operating behind Enemy Lines (UWF/LR Patrol), Direction of Own Artillery Fire (DOOAF), Post Strike Damage Assessment (PSDA), Information and network -centric warfare, Monitoring NBC Contamination, deliberate Counter Attack and decide on the Application of Reinforcement, Presently, they are extremely used in disaster management framework and Internal Security (IS) duties. Furthermore, UAVs can be Effectively utilized in **Low-Intensity Conflict Operations(**LCIO).

8.4. Limitations of Drones. UAVs have also got some precincts and limitations like lack of AD protection, vulnerability to ground attack, higher operating cost, etc. The long-drawn-out use of UAVs had substantiated as counter-productive, as they may threaten to lead to information overload. Furthermore, the increased bandwidth requirement of UAVs may escalate the vulnerability to electronic counter-measures such as jamming. UAVs also have two detrimental sideeffects

9. Section-2 Prospect of Incorporating Drone Based IS Rsystem

UAV based ISR System: Overview on Ground Forces of South East Asia

9.1. ***Surveillance Capability of India***. Indian monumental army has passed through a swift and systematic process of technological advancement and inducts numerous sensor-based cutting aged ISTR paraphernalia in the last few years with the indigenous capability of defense industry commonly known as DRDO[15]. Various types of locating, surveillance, and observation equipment are held on the inventory of the Indian Army as shown in figure-6 and 7 respectively. This gives the Indians the capability to conduct operations effectively day and night, thereby contributing to operational efficiency.Recently,DRDO developed UAV based drone fleet with a combination of SBAS[16]. Moreover, DRDO is also working to developa stealthy Unmanned Combat Aerial Vehicle (UCAV)**[17]**

Fig-6: Searcher Mk I

Fig-7: Indian UAV DRDO Aura

Technical Specification of Searcher Mk-I

1. Employability
   - Degradationoperations.
   - ISTAR @ DOOAF @PSDA
2. Sensor Package
   - Day / light TGcamera.
   - IR Sensor, CRD,GCS andLRS
3. Capabilities
   - Endurance -10.3hr.
   - Operating ceiling - 15,000ft.
4. Ranges
   - Mission mode – 100km.
   - Penetration mode – 240 – 250km.

Source:(Source:Authors"self-construct)[18]

9.2 Surveillance CapabilityofPakistan. Pakistan Army Corpshassurveillance Units. They have a good number of cutting aged ISR drones in their inventory. In addition, the Pakistani Electronic Warfare Company (EWC) has organic drones to provide useful information, primarily obtained through intercepting enemy radio transmission systems. Pakistan also has WLR AN/TPQ-36/37, Sound Ranging, UAVs from China and Africa.On 25 November 2013, Pakistan"s armed forces announced that two new unmanned aerial vehicles (UAVs) had been introduced to service. The official declaration gave limited detail about the systems, which were „indigenously developed" by GIDS.

Figure-8 Shahpar ii: Surveillance UAVS (GIDS-Pakistan)[19]

Figure-9.Selex-FC (GIDS-Pakistan)[20]

Source:Authors"self-construct

10. Case Study

In this case study incorporation of surveillance drones by UN forces in the Democratic Republic of the Congo (DRC) has been examined. After the successful induction of Surveillance Drones in operational stratagem, the UN forces could act as a rapid reaction force keeping an extended eye on the cosmic conflict zone.

10.1 Background. UNSC has approved the use of Unmanned Aerial Vehicles (UAVs) by the UN Organization Stabilization Mission in DRC (MONUSCO) in January 2013. During that period, approximately 19,000 UN peacekeepers wereserving in DRC to promote peace and security. This

vast country had 1,500 miles of paved roads only. More than two dozen armed rebel groups were operating in the country. Due to difficult road conditions and reintroduced vehemence by these rebel groups, the UNSC had amended the MONUSCO mandate and included the use of ISR-based UAV in the overall operational stratagem.MONUSCO utilized the unarmed UAVs for four basic functions:

10.1.1 To enhance the overall situational awareness and ability to safeguard civilians and peacekeepers.

10.1.2. To tailing the activities of armed groups and trafficking of arms

10.1.3. To envisage the movements of displaced refugees to better address their needs;

10.1.4. To assess environmental challenges, including weighing the damages from natural disasters

10.1. ***Outcome ofCaseStudy*****.** The outcome of the case study has revealed that the number of occurring hostile activities was reduced drastically (67%) after employing UAVs in an operational scenario**.** Details are illustrated in table-2below:

Table: 2 Impact of use of Unarmed Drone by UN in DRC

Monusco	Year	Hostile activities		Malicious	Other	Total
Before UAV deployment	2010-11	10	30	20	10	70
	2012-13	20	20	15	30	85
After deploying UAV	2014-15	10	10	10	8	38
	2016-17	10	8	5	5	28
	MONUSCO	50	68	50	53	221

Source:Authors"self-construct

11.SWOT analysis

Considering the need for time and opportunities one can conclude to induct unarmed drones into the army. But, there are some weaknesses and threats as well. A strength, weakness, opportunity and threat (SWOT) analysis is shown regarding the integration of drones is given below:

Strengths	**Weaknesses**
→ Predefined Organizationalstructure → Disciplinedmanpower → Exiting infrastructure of Research &Military educationalinstitution	→ Unskilledmanpower → Lack of technologicalexpertise → Lack of integrated C4ISRsystem → Lack of maintenancefacilities → Lack of policyoptions
Opportunities	**Threats**
→ Wide-ranging ISTR capabilities for all sorts of military operation andmaneuver → Suitable for recurrent s indisaster management activities and internal security works.	→ Unskilled handling ofUAVs → WeatherAffect → The possible interception byothers → Embezzlement and misappropriation ofUAVs

Suggestive Employment of UAVs based ISTR System- Army Training Note on Surveillance(2008) narrates that the concept of battlefield surveillance is primarily based on obtaining knowledge of the battlefield as it exists at a particular time and the capability to detect changes that will indicate the intentions of the enemy. The suggested employment of UAV based ISR platforms in various elements of ground forces, law enforcement are illustrated with table-3below:

Table-3 Suggested Employment of UAVs in Combat Forces and Civil Service

Ser	Fields of Employment	Combat Force	Civil service	
			LEA & PF	Others
1	Long Range real-time situational awareness.	✓	✓	✓
2	Classical ISR.	✓	✓	
3	Night surveillance.	✓	✓	
4	Target detection and tracking.	✓	✓	
5	Fire control and accuracy of Gun	✓		
6	SAS(Search and rescue)missions.	✓	✓	
7	Battlefield management.	✓		
8	Over the hill observation.	✓	✓	
9	Low-intensity conflict zone control.	✓		
10	Counter-Insurgency Operations	✓	✓	
11	Disaster control and management	✓	✓	✓
12	Combat terrorism tasks	✓	✓	
13	Metrological information	✓		✓
14	Developing Counter drone systems	✓		
15	As spotters for long-range rapid-firing artillery,	✓		
16	Force / Convoy Protection	✓		
17	Civil defense and Civil Counter Reconnaissance (CCR)			✓

18	Wood and landscape management			✅
19	Ecological monitoring and sensing(EMS)			✅
20	Infrastructural control(IC)			✅

LEA: Law Enforcing AgenciesPF: Paramilitary Forces

Table-3 Suggested Employment of UAVs in Combat Forces and Civil Service (Authors self-construct)

12. Section-3: Modalities ofImplementation

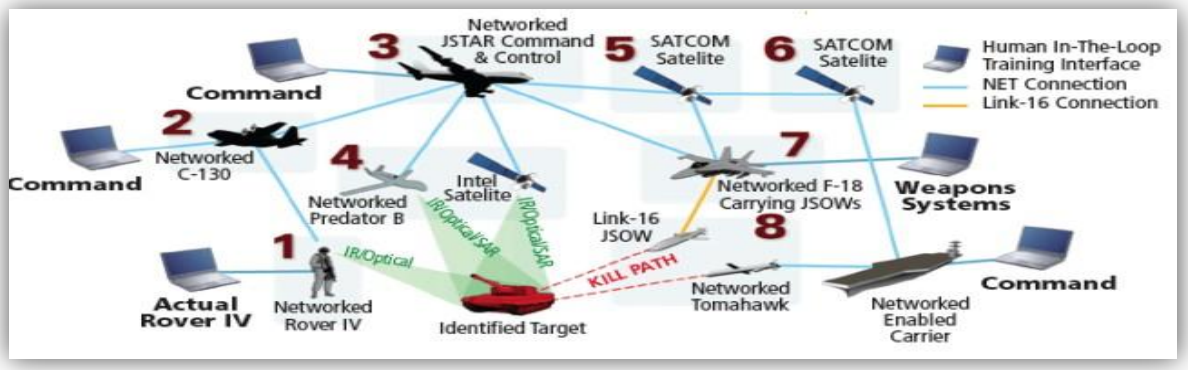
12. **Concept of Battlespace Surveillance inFutureConflicts**. According to the battlefield stratagem of different military institutionssofsoutheastAsiaon,,Surveillance",theconceptofsurveillanceinfutureconflictsisdiscussedbelow:

12.1. ***Contact Battle Surveillance(CBS).*** should be based on the accessibility and convenience of dedicated surveillance aptitude at the operational level in the field. Rugged, man-portable, and user-friendly sensors will be suitable in thisregard.

12.2 ***Deepness of BFSS.*** Samiliar to CBS, it is more desirable to have an integrated battlefield surveillance system at the Zone based formation level. This system could consist of more complex and specialized sensors to be handled by formation surveillanceunits.

12.3 ***SensorsAssortment***. Due to the hi-tech peculiarities of various sensors, it is more essential to carry out inception varied sensors in a common platform and blind the areas of each other to ensure that the complete area of interest is kept under constant surveillance and also to warrantredundancy.

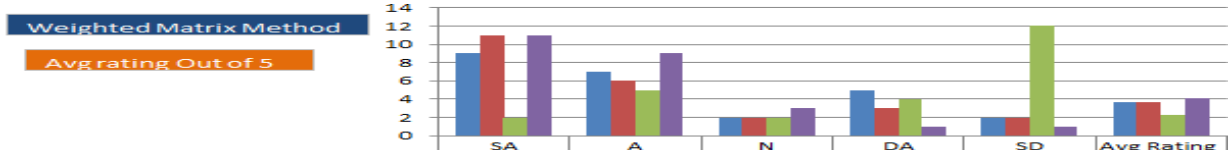
12.4 ***Data Fusion and Communications***. The achievement of the overall surveillance system will be determined through rapid data fusion, processing, and dispersion to various commanders as a decision-making input. Figure 4 illustrates the contribution of UAVs based ISTR system in Network CentricWarfare(NCC)



Sources: Internal Defence Security and Technology(IDST)-the USA,22 July 2021(https://idstch.com)

13. Major Impediments on Induction of UAV based ISTR Capabilities

13.1. A survey was conducted (with close-ended questionaries) among twenty-five personals from military and relevant civil organizations through an online survey platform (Google form) to identify some noteworthy implementingfactors in this regard. The evaluation and output analysis are carried out through a weighted Matrix Method within a range of 5(four) marks where Strongly agree(SA) is allotted with 5 marks. Subsequently Agree(A), Neutral(N), Disagree(DA) Strongly Disagree(DA) are allotted with4,3,2 and 1 marks respectively.Thesurvey result is appended with Graph- 2below:



	SA	A	N	DA	SD	Avg Rating
Finantial Constrain	9	7	2	5	2	3.64
Indegenous Production Capability	11	6	2	3	2	3.72
Strategic and Operational requirements	2	5	2	4	12	2.24
Skilled manpower and Cutting edge technology	11	9	3	1	1	4.12

Source:Authors'self-construct

13.2. ***Outcomes of Analysis***. Survey analysis shows that the lack of skilled manpower and not the availability of cutting-edge technology is the most significant impediment factor among others. (Average Rating 4.12 out of5).

14. Proposed Surveillance Architecture(SA)

Three layers of command have been considered (usually exist in all military organizations.) to formulate the base of Surveillance Architectures(SA).

There are :

14.1. Layer -1: From Force Head Quarters down to Zone HQs/CorpsHeadQuarters

14.2. Layer-2: From Zone HQs down to AreaHeadQuarters/Field Formation HeadQuarters

14.3. Layer-3: From Field Formation Head Quarters down to FieldUnits.

14.4. Layer-based SA with the provision of the equipment is illustrated in table 4 below. In addition, comparative analysis among them is shown intable-5.

Table-4 Proposed Surveillance Architecture(PSA)[In descriptive form]

SA	**Command Layer**	**Types of UAVs deployed**	**Major Requirements**
1	Layer -1	HALE UAVs in Force as wellasZoneHQs"	1. Interferences between UAS with manned aviation assets 2. Dedicated Airport in Zonal HQ 3. Zonal Base Ground Control Monitoring and Surveillance Station(GCMS) 4. Centralized / Decentralized C4ISRsystem
	Layer -2 Layer -3	MALE UAVs in Zone/Area HQ	
2	Layer -1 Layer -2	MALE UAVs in Force and Zone HQs	1. **MALE-UAVs** are Multi-Rotor Platform-based UAV Systems 2. A dedicated command and control link (C2Link) and a detect and avoid (DAA) system are required for MALEemployment.
	Layer -3	LAME- UAVs in Field Units	
3	Layer -1	**MALE UAVs** in Force and Zone HQs	**For micro drones:** 1. Not necessary to provide air traffic control 2. Need not to be equipped with DAA system;
	Layer -2		
	Layer -3	Micro Drones	

Source:Authors"self-construct

Table-5 Comparative Analysis between Surveillance Architecture (SA)

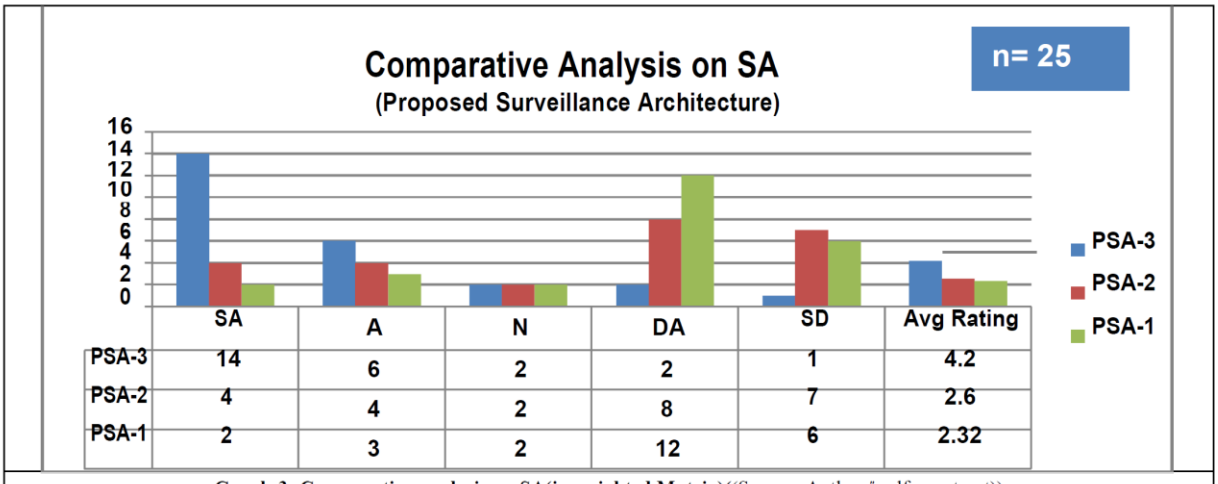
	SA-1	**SA-3**
Pros	1. Optimal utilization ofresources 2. Coordinated effortgeneration 3. Facilitate to have Central MaintenanceFacility	1. 1.Most viable and economic for developing countries 2.Fighting units will have better flexibility in conducting their battles. 3.Optimal utilization of resources 4.Coordinated effort generation
Cons	1. Very Sprawling in terms of economy, infrastructural capability & skill oftroops. 2. Too many UAV mission requests need to be addressed from a single platform. 3. Important sectors may be devoid of UAVcoverage	1. Maintenance load to the fighting units. 2.Vulnerable to enemy direct & indirect fire 3.Lack of adequate facilities in the forward units 4. Range of mini UAV may not be able to support forward units if they are operating in isolation/ independently far from the base of operation

(Source:Authors"self-construct)

14.5. ***Suggested Architecture.*** In the proposed SA-3, MALE UAVs will be employed at and Zonal HQs in the overall C4ISR system. Besides, field units may in possession of short-range tactical UAV(15 km) for their tactical maneuver and movements. Some HALE UAVs can be incorporated in the overall C4ISR system directly under Force HQS jurisdiction basing on tactical requirements and strategic requirements

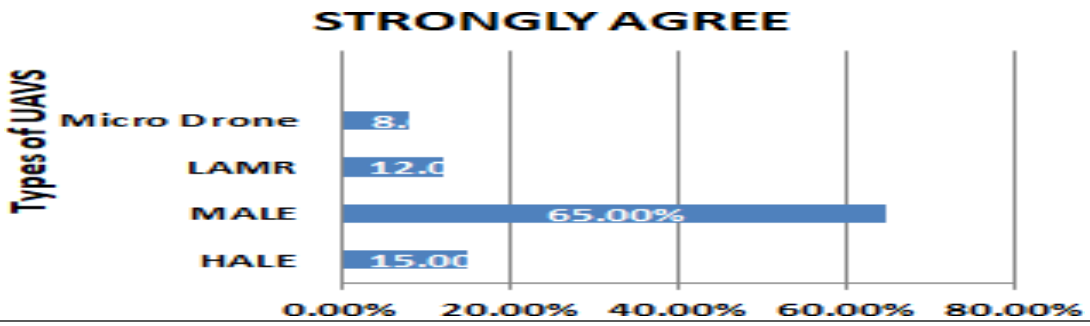
14.6. Survey Analysis

14.6.1. A survey was conducted (n=25) to identify the most suitable SA which can be generally viable for most of the developing countries. The evaluation and output analysis are carried out through a weighted Matrix Method(as illustrated in para 6.2). The survey output is illustrated with Graph-3 and 4respectively.



	SA	A	N	DA	SD	Avg Rating
PSA-3	14	6	2	2	1	4.2
PSA-2	4	4	2	8	7	2.6
PSA-1	2	3	2	12	6	2.32

Graph-3: Comparative analysis on SA(in weighted Matrix)((Source: Authors" self-construct))



Graph-4:TypesofUAVssuitablefordeployment.(Source:Authors"self-construct)

Source:Authors"self-construct

14.7 Output Analysis. The output analysis coincides with the authors" propositions.

14.7.2. Most of the responders (84%) opined for the implementation of SA-3(with average grating 412 out of 5)[Graph-3]

14.7.3. For developing a single-layered Surveillance platform, Male UAVs (65%)will be the bestoption.

15 Conclusion

UAV are engaged in modern NCW as one of the important force multipliers to support the surface forces. Without the up-to-the-minute information, facts, and inclusion on the overall battlefield scenario, no commander would not be able to triumph success over the enemy. To execute any defensive or offensive operation, the latest intelligence of the enemy is a must. especially when the battle is intense and fluid. As such, it demands reliable and relevant intelligence at the appropriate time. UAVs can be recycled effectually in any combat operation. Battlefield surveillance and intelligence, fire control and fire direction, communication, and radar suppression are most mentionable.The effective utilization of UAV will help to perform this job more effectively and will help the commander to make the right decision at right time.

The technological and tactical necessities stretch us a perspective about the cost estimation of UAV. Arguments may upswing to use the pilot manned aircraft (Mig 29.) in a similar role which has the multirole capability with the equally priced payload. However, should we use the valuable aircraft and highly costly pilot if the same task can be executed by very cheap equipment (UAV)? Again the utility and versatility of an ISTR UAV are much superior to a pilot manned aircraft in a similar role. So, it will be advantageous to back up UAVs financially. From the discussion, it is quite distinct that UAV has a boundless role in modern network-centric warfare. Therefore, developing countries like Myanmar, and Bangladesh who are still lagging should incorporate apposite UAV with ISR capabilities in their military inventory as soon as possible.

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[12] The Centre for Security Studies (CSS) at Zurich is engaged in the study of Swiss and international security studies. Its activities are structured into the four pillars of research, teaching, think tank, and the International Relations and Security Network (ISN).

[13] https://www.researchgate.net/figure/Classification-of-UAVs-according-to-Unmanned-Aerial-Vehicle_tbl2_303458608

[14] SBAS is a civil safety-critical system that supports wide-area augmentation using satellites that broadcast the augmentation information of

integrity and correction. The SBAS architecture generally consists of a ground segment, i.e., a network of reference stations, master stations, and a geostationary (GEO) satellite control center, as well as a space segment and dedicated military communication satellites.

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