ANALYSIS AND ASSESSMENT OF MILITARY-OPERATIONAL REQUIREMENT FOR AWACS IN IAF

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The ability to detect an enemy target, identify, intercept and destroy it, before the enemy does the same to you, has been a conundrum that has challenged military commanders for centuries. Whilst, within the air environment, airborne early warning (AEW) and airborne warning and control system (AWACS) aircraft are now simplifying this problem, it must be emphasised that the use of the third dimension for surveillance and control is nothing new.

The use of balloons for military operations goes back to the earliest days of flight; and airships and aerostats have, historically, also been used for military surveillance purposes. The use of radar by the Royal Air Force during the Battle of Britain was a vital component that led to the eventual defeat of the Luftwaffe, and subsequently, it was not long before man was designing radars that could be operated in an aircraft, thereby increasing the detection ranges. With the advent of ever improving technologies,

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this airborne radar concept has so evolved over recent decades that AWACS aircraft are now able to gather and present real-time information to numerous air and ground assets within the battlespace, and provide autonomous control over a wide gambit of missions being undertaken within their area of responsibility.

The AEW systems have been employed in a variety of roles over the entire spectrum of the national security paradigm. The main areas of employment could broadly be categorised as:

- Political power projection, coercive/AWACS diplomacy and in support of allies and friendly nations.
- Strategic use of AWACS for implementation of pacts, accords and sanctions. For example, peace enforcement, implementation of no fly zones, sanitisation, regulation or monitoring the air space in support of national security requirements and friendly forces.
- Conduct of direct military operations as command and control and battlefield management platforms to perform the functions of air defence and air combat support platforms for offensive air operations and in support of maritime operations.
- In support of civil administration and armed / paramilitary forces in times of natural calamities and disaster management, anti-terrorism and anti-drug operations.

Starting from an elementary early warning platform for naval forces, the operational needs of AEW systems have continued to grow with the passage of time and their employment in wide ranging roles have engendered capabilities ranging from tactical control of combat aircraft to electronic intelligence, electronic warfare, air traffic management and battlefield management. The current generations of AEW systems are being further upgraded to improve the quality of radars, communications, computing speeds and data management to improve their efficiency as command and control platforms. At this juncture, it would be of relevance to broadly compare the development of these systems and their capabilities.

COMPARISON BETWEEN AEW/AEW&C/AWACS

AEW and AEW&C

Having been convinced of the huge potential of the radar system during World War II, there was a desire to look deeper to detect the incoming enemy. To overcome the limitations of ground-based radars and under the threat of *kamikaze* attacks, the US Navy embarked on a programme to expand the radar horizon by carrying it aloft in an aircraft. Under Project Cadillac in 1944, a TBM Avenger bomber was modified with the AN/APS-20 radar which proved successful in detecting targets over 150 km away. This was the beginning of the AEW. The Avenger was purely an AEW radar aircraft, as the aircraft had a crew of only a one pilot and one radar operator. All control functions were conducted on surface ships, with radar data transmitted via a data link which gave the video image and radar antenna angle, to enable a tactical picture to be developed in the Combat Information Centre (CIC)[1].

The early AEW systems were developed for localised requirements of individual Services. These were smaller systems, with limited range, and did not have any onboard control capability. The data was relayed to a ground/ship-based control station which further controlled the situation. These AEW systems consisted of naval systems like the Oko Eye on Kamov and Searchwater radars on Sea King helicopters.

Buoyed by the success, ambitions grew and Project Cadillac-II was started under which a B-17 bomber was converted to a naval version PB-1W flying command centre, having a number of operators. This can be assumed to be the beginning of airborne early warning and control (AEW&C) systems. Continuous improvements through the 1950s and 1960s saw numerous platforms performing the role of 'eyes and ears' in the air, prominent amongst these being the EC-121 which made history in 1967 by guiding the first successful airborne interception over North Vietnam.

The E-2 Hawkeye was the first carrier-based aircraft designed from the outset for the AEW&C function. Since replacing the E-1 Tracer in 1964, the

1. http://www.globalsecurity.org/military/systems/aircraft/aew.htm

Hawkeye underwent a number of upgrades to emerge as the most widely used AEW&C aircraft in the world today.

Limitations

- Despite the advantages, there are some inherent disadvantages in these aircraft. There is a certain amount of space limitation, which, in turn, limits the number of control stations onboard the aircraft, as also the number of aircrew and operational crew. There are also some limitations on data handling capacity in terms of number of tracks and number of simultaneous interceptions/recoveries.
- The aircraft may not have aerial refuelling which limits their endurance to between four to six hours.
- Examples include the Hawkeye, ERJ-145, SAAB-2000, etc.

AWACS

Realising the immense potential of the AEW&C concept, efforts were directed towards performance and role enhancement by the US Air Force which wanted a system with a completely independent onboard battle management capability with a large footprint. The need emerged from a desire to provide effective air defence (AD) against anticipated low level bomber raids and to have effective command and control (C2) in a tactical environment. This was the beginning of the AWACS programme demanding longer endurance, enhanced radar range and, importantly, the ability to track a greater number of targets.

The US AWACS programme began on December 22, 1965, with the establishment of an AWACS System Programme Office by the Air Force Systems Command. The Boeing Company was selected as the prime contractor, after beating McDonnell-Douglas and Lockheed, pitting its 707 against the Lockheed EC-121 and the McDonnell-Douglas DC-8. The company flew the first test airframe in February 1972, and in early 1973, the US Air Force authorised full-scale development of the E-3 Sentry[2]. Some of the other

2. http://www.globalsecurity.org/military/systems/aircraft/e-3.htm

AEW&C & AWACS developed over the years are the Russian TU-126 Moss and A-50 Mainstay, the British Nimrod, the Israeli Phalcon and the Swedish SAAB 340 with the Erieye system.

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Capabilities

An AWACS is capable of providing all-weather surveillance, command, control and communications. A typical AWACS radar has a range of 320 km for low flying targets which goes up to 450 km at higher altitudes. Combined with an IFF sub-system, it is capable of identifying and tracking a large number of threats while simultaneously controlling friendly aircraft. The AWACS contains a secure and jam-proof communication suite with a message priority system, thereby, reducing information overload. The electronic support measures (ESM) capability covers a wide band of frequencies which can be classified and compared with the available threat library. A contingent of up to 20 console operators performs surveillance, communication, identification, airborne control and battle management functions[3].

An AWACS has an endurance of approximately eight hours in mission profile which translates into an on station time of six to seven hours at a distance of about 1,000 km from the launching base. This can be further enhanced with air-to-air refuelling (AAR).

Advantages

A true force multiplier, an AWACS presents numerous advantages. It is a larger platform and has adequate space for the payload and the crew. It has higher endurance with aerial refuelling capability, which further increases its flying time.

The AWACS has a 360 degrees radar scan and a choice to select more than one mode of operation in sectors during a scan. It has an increased radar horizon and capacity to detect over 600 targets while directing up to 30 interceptors simultaneously. This makes an AWACS crucial in the campaign for

3. http://www.fas.org/man/dod-101/sys/ac/e-3.htm

Though becoming increasingly indispensable in any air battle, cost and vulnerability remain two of the main limitations of an AWACS.

control of air. It has an extensive communication network of HF, VHF, UHF and data links through LOS and SATCOM. The efficient data handling systems provide larger track handling capacity (1,000 or more tracks), and 15-16 simultaneous interceptions / recoveries.

It also has an adequate electronic warfare suite: electronic counter-measures (ECM) and electronic counter-counter-measures (ECCM) circuits, signals intelligence (SIGINT) systems, onboard detection, collation, analysis and dissemination or real-time relay to ground stations.

It is a flexible and versatile platform with a potential to project combat support and surveillance functions into a theatre worldwide within 24 hours. In conjunction with other AWACS or singularly, it can be employed in strategic, operational or tactical roles. By anticipating the threat in advance, it can retrograde inside own territory only to reemerge once the threat has subsided. In effect, it is able to channelise the enemy's effort into a theatre of own choosing.

Limitations

Though becoming increasingly indispensable in any air battle, cost and vulnerability remain two of the main limitations of an AWACS. With each unit costing up to $ 500 million and considering the number of units required for effective utilisation, its cost remains prohibitive for many countries.

A strategic asset, an AWACS is also one of the most lucrative targets whether on the ground or in the air, and needs to be protected adequately at all times. While the communication systems of an AWACS are true over the horizon or satellite capable, the radar, IFF and ESM sensors are limited by radar horizon affecting their range, especially in the case of intervening high terrain. Additionally, there is a cone of blind zone below and above the platform which can be exploited.

OPERATIONAL ROLES FOR AWACS

The flexibility of role and employment of AWACS has blurred the line between the strategic role and operational utilisation. An AWACS not only addresses the line of sight constraints of ground-based radars, it extends an airborne command and control station with long range communication facility in support of national air power. "Radar had the effect of forcing air operations down to lower levels to stay below the radar horizon and, thus, evade detection… an airborne platform, thereby, nullifying the benefits of a low-level approach has been perhaps, the single, greatest force-multiplier in air operations."[4] The impact of AWACS on air operations is explained in the subsequent paragraphs.

- **Radar Cover and Tactical Control of Offensive Missions:** Radar cover of ground-based radars is restricted by line of sight and consequently the ability to pickup low-level targets flying at 100 metres (300 ft) is restricted to 45-50 km, whereas a single AWACS provides a seamless low and medium level cover up to 400 km or more. Flying at 30,000 ft, and approximately 100-150 km inside own territory, an AWACS will provide 250 km of early warning and control capability in enemy territory for six to eight hours. This assumes greater significance in the case of a non-conventional strike, where an AWACS would provide positive cover and control, to ensure that such a mission goes through unhindered.
- **Strike Control:** One of the biggest advantage of the airborne radar platform is the ability to provide extended tail cover; warn and control own strike missions in the adversary's territory, which hitherto was not possible owing to line of sight constraints of ground-based radars. Under positive radar cover, friendly strike missions can fly at medium levels, thus, avoiding the

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4. Squadron Leader Ajai Singh, "The Air War with AWACS Symmetry," *The Indian Defence Review*, © 1995 by Lancer Publishers & Distributors, downloaded www.bharat-rakshak.com/LANCER/index.html

three tier low-level radar cover of mobile pulse doppler radars (MPDR) which are restricted to 4.5 km (15,000 ft) in elevation coverage, and also be safe from en-route short range air defence systems (SHORADS) deployed in the tactical battle area (TBA) which have a slant range of 2.5 to 3 km (8,000 to 10,000 ft).

- **Air Battle Management and Target Designation:** AWACS execute the air battle management in real-time in coordination with ground-based/ship-borne air defence systems, multi-role air superiority fighters (MRASFs), a combination of electronic warfare and strike aircraft, and other combat air support operations like aerial refuelling. This provides it the capability to do real-time allocation and reallocation of weapon systems against enemy assets. In April 1996, rebel Chechen President Dudayev was assassinated with the help of a Russian A-50 AWACS operating over Chechnya. Capable of monitoring communication frequencies, an A-50 located the president's cellular phone frequency and the target data was relayed to a Su-25 ground attack aircraft armed with laser and TV guided bombs, which attacked the precise location to complete the mission.[5] The incident is a classic example of exploiting the system capability for real-time target allocation and shrinking the sensor to shooter loop to achieve the objectives with minimal force and time.
- **Low Level Ingress:** Low level ingress by strike aircraft is aimed at avoiding detection and giving minimal reaction time to the adversary. The gap free low level radar cover extending 250 km or more inside the adversary's territory would afford instant detection, greater reaction time and swift offensive action by fighter sweep, free escorts or tied escorts. Pakistan's lack of geographical depth would place all her main and satellite airfields within the detection ranges of Indian AWACS.
- **Defence in Depth:** AWACS would assist in early detection and interception, maintain continuity in application of firepower and afford opportunity for multiple interceptions, thus, imposing greater attrition

5. Timothy L. Thomas, "Air Operations in Low Intensity Conflict: A Case of Chechnya," *Airpower Journal*, Winter 1997, p.54.

and providing the classical defence in depth. Enhanced early warning and gap free radar cover would facilitate the area defence concept which affords optimal exploitation of speed, mobility, flexibility and firepower of fighter aircraft and greater freedom of action for terminal weapons deployed at vital areas/vital points (VA/VPs).

- **Air Space Management over TBA:** The problem of air space management emanates from delayed/no detection and identification of tracks, very little reaction time and unreliable chain of communication. AWACS with onboard long range HF/VHF/UHF RT and large detection ranges could perform the function of battlefield management. Detection ranges beyond horizon, early radio contact, medium level approach and timely communication give options of exercising positive control over AD weapons in the TBA, maximising their freedom of action and reducing the chances of fratricide.
- **Electronic Intelligence:** The SIGINT system on board AWACS can receive, analyse and locate radar and communication frequencies at ranges much greater than the radar range of 400 km. This would supplement the existing intelligence infrastructure. The enemy's electronic order of battle (ORBAT) can be updated for planning of air operations.
- **Air Intelligence:** Monitoring and analysing the adversary's air activity is an ongoing process during peace and during operations. Information on the adversary's capabilities and analysis of such information during flying training and known periods of air exercises would give a good insight into the enemy's tactics and capabilities. An AWACS can monitor air activity deep inside enemy territory and help in forming definite patterns of tactics and manoeuvres practised by the adversary.

INTEGRATION WITH EXISTING AD NETWORK

For any gainful exploitation of the AWACS, AEW&C or other such systems, it is extremely important that they are integrated into the existing AD infrastructure. The surface-based air defence radars which rely on short wavelengths for detection are limited to radar horizon and, therefore,

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oblivious to aircraft beyond the horizon. Even with careful deployment of the radars on mountaintops, the time between fast enemy aircraft/missiles being sighted and weapons being released is too little for effective engagement. These radars are ground-based, and, therefore, vulnerable to enemy attack. Also, the present ground-based system has a very poor low altitude capability.

These problems of vulnerability and lack of adequate low altitude detection can be addressed by the integration of AWACS, AEW&C and aerostats into the existing AD infrastructure. The net result of such integration will be a flexible and highly survivable air defence command and control system with long-range radar coverage at all altitudes over all terrain.

For effective integration of these high value air assets, the first and foremost requirement is that of networking. At the most fundamental level, networking aims to provide a mechanism to rapidly gather and distribute targeting information. A high speed network permits error free transmission in a fraction of the time required for voice transmission, and it also permits data transfer of a wide range of formats. AD involves an interactive decision-making process throughout the battlespace. Therefore, networking of ground-based sensors with the airborne sensors and the processing of data from these sources in order to generate a comprehensive air picture is a vital aspect.

A modern, well-integrated AD system requires a central AD organisation connected to regional and sub-regional control nodes which, in turn, are linked to air bases, missile command posts, autonomous AD zones, and ground-based sensors. This ground network, in turn, has to be dynamically linked to the AEW assets. Such a network will improve the operational tempo by accelerating the observe-orient phases of the observe, orient, decide, act (OODA) loop.

In parallel, data linking between the AEW assets and the combat aircraft is equally important. The Russian A-50 AWACS, for example, has a two-way data link communication with MiG-31 fighters which enables the A-50 to take radar information from the fighters and add it to its own picture, thus, making it possible to cover a much greater area.

For optimum utilisation of the AEW assets, they must also be integrated with the air defence elements of the army and navy.

The second prerequisite for effective integration is to ensure the availability of a reliable, robust and secure communications network. The AWACS would require a very large bandwidth to cater to the huge volume of information and imagery being exchanged. Narrow-band, dedicated point-to-point links need to give way to secure broadband data-links capable of handling large volumes of voice, data and video signals.

The third requirement for successful integration is that of automation. The quality of decisions that emanate at various levels of a networked system depend directly upon the quality of the air picture, and while a comprehensive air picture remains the most essential tool for making decisions, automation remarkably enhances the decision-making process by providing a host of decision support tools for mission planning, threat prioritisation, weapon selection and threat engagement.

For optimum utilisation of the AEW assets, they must also be integrated with the air defence elements of the army and navy. Integrating with the other Services would require automatic data transfer links among the army, navy and air force which will necessitate the development of an integrated command and control system like the integrated air command control system (IACCS). The IACCS integrates with ground-based/aerostat radars, unmanned aerial vehicles (UAVs), communication links (HF, V/UHF, and SATCOM); and the entire gamut could provide a fused data link to fighters on operational data link (ODL). With the implementation of such a system, the integrated real-time air situation picture of the associated area will be available on the joint network.

EMPLOYMENT IN INDIAN CONTEXT

It is now time to consider the employment of these platforms in the Indian subcontinent. The wars of future on the subcontinent are likely to be different. India has been fighting a limited war for the past 25 years, that too under the nuclear overhang. With the northern and western boundaries occupied by nuclear powers, as well as forces which have near parity in numbers, it can be surmised that long drawn, conventional wars are unlikely. Also, there would be near parity and symmetry in technology. Our future conflicts, in all probability, would be of short duration because of a possible third party or international intervention. The territorial wars would be fought not with the aim of occupying territory, but as a tool for strategic coercion. The conflicts would be spread over a limited area in which permanent territorial occupation or shifting of borders would not be the major objective, except when the Line of Control (LoC) or the Line of Actual Control (LAC) is contested.

With a landmass of subcontinental proportions, India occupies a predominant strategic position in Southern Asia and dominates the northern Indian Ocean with a coastline of 7,516 km and a total of 1,197 island territories in the Bay of Bengal and the Arabian Sea. India has an exclusive economic zone (EEZ) of 2.01 million sq km; 90 per cent by volume and 77 per cent of total value of India's trade comes from the seas. The resource rich EEZ provides 68 per cent of its oil production and fish production of 2.82 million tonnes. In addition, the entire import of oil and gas comes by the sea. India's economy, and, therefore, its development, is crucially dependent on the sea on account of the critical role of maritime trade as well as oil and gas, fisheries and other mineral resources[6]. India's land borders exceed 15,000 km which it shares with seven countries, including a small segment with Afghanistan (106 km) in northern Jammu and Kashmir[7] (J&K).

The AWACS would need to be employed over specific sectors and specified time-frames for conduct of operations in that area.

6. http://india.gov.in/sectors/defence/indian_navy.php
7. Brig Gurmeet Kanwal, "India's Borders," accessed through http://www.indiandefencereview.com/?p=379

The topography along these borders dictates that the Indian Air Force (IAF) deploys its early warning sensors in coordination with those of the Indian Army and ship-based sensors and aircraft of the Indian Navy. The extended territorial borders in the west, north and the northeast and a very limited availability of aerostats and AWACS mean that obtaining a gap free radar cover would still be the responsibility of our ground-based radars. The AWACS would need to be employed over specific sectors and specified time-frames for conduct of operations in that area. This would mean that full utilisation of the offensive capabilities with the help of these platforms would be restricted to some extent in time and space, unless India procures copious assets.

Due to the close proximity of both the eastern and western borders, the AWACS over the hilly terrain in the J&K region would be under threat from enemy aircraft.

Here, it would be worthwhile to see the peculiarities of terrain in our country. The terrain along the northern border and in the northeast is primarily mountainous, with prevalence of strong winds at mid and high altitudes. An enemy attack on the airfields or any other vital installation would face the constraints of terrain and altitude of the launching bases. However, the aircraft in the Tibetan region have the capability to reach the targets deep inside our territory. Also, a hostile presence near Coco Islands in the northern Bay of Bengal can create an effective air threat in the eastern theatre. Though the performance of ground-based radars would be limited in this mountainous terrain, the need for medium and high level coverage is being met by these sensors. Due to strong winds, tethered aerostats may be difficult to deploy in this region. Once again, here the AWACS would have to be used to enhance the coverage over a specific sector for limited duration.

The terrain along the western border comprises desert in Rajasthan, fertile plains in Punjab and mountains in J&K. The performance of the ground-based radars in these areas is good and achieving a gap-free radar cover is considered a reality.

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Due to the close proximity of both the eastern and western borders, the AWACS over the hilly terrain in the J&K region would be under threat from enemy aircraft. This would entail ensuring an adequate degree of control of air for its safe employment over this region.

In the south, India's maritime interests lie right from Persian Gulf to Malacca Strait. There is a rising western interest in this sea line of communication (SLOC)and increased Chinese presence in the Bay of Bengal. The IAF would have to share the responsibility of defending the coastal and offshore resources and island territories along with the Indian Navy. The navy's proposed induction of the AEW&C aircraft, along with the IAF's AWACS, would play a significant role in the joint effort.

We would employ AWACS effectively to provide early warning for protection of our VAs and VPs on the coasts, such as the nuclear reactors or Bombay High. As and when the air force or the navy acquires more of them, these systems can be deployed to provide early warning to the island territories, to protect our assets deployed on them, to safeguard our SLOCs, such as the Malacca Strait.

The AWACS will be the ideal platform for providing cover and support to an Indian force involved in operations beyond our geographical borders. A naval effort to achieve control of the sea can be very well complemented by the Su-30s of the air force and MiG-29s of the navy, if coordinated by an AWACS platform. The sinking of a pirate mother ship by the INS *Tabar* off the Gulf of Aden in mid-November 2008 is a case in point. For similar operations in the future, an AWACS, along with a couple of fighters, would be able to respond faster to such a contingency. Naval ships may also not need to escort merchant ships in pirate infested waters – the AWACS could provide radar cover and monitor the area and direct the fighters as and when a contingency developed. The Indian Air Force must coordinate its AWACS effort with the AEW&C platform of the Indian Navy, when it is inducted, for an optimum time-sharing solution.

PRIORITISATION ON THE BASIS OF SECTORAL APPROACH

Threat Perceptions

The security challenges facing India are varied and complex. The country faces a series of low intensity conflicts characterised by tribal, ethnic and left wing movements and ideologies as also the proxy war conducted by Pakistan and various radical *jehadi* outfits through the instrumentality of terrorism. India is also affected by the trafficking in drugs and proliferation of small arms and the fact that it is surrounded by two neighbours with nuclear weapons and missiles and a history of past aggressions and war[8].

External security threats come from neighbouring countries and insurgents using foreign border areas as havens for activities in India. Countries such as Bangladesh, Bhutan, and Sri Lanka present no conventional military threat to India, but their inability to police and control areas bordering India has provided Indian insurgents with havens. Indian government and military officials have publicly expressed concern about the political instability in Nepal posed by the Maoist insurgents.

As far as external threats posed by other countries are concerned, popular opinion tends to regard Pakistan as the principal enemy, largely because of the Kashmir conflict and Pakistan's suspected links to numerous South Asian militant groups. Training camps for anti-India terrorists are mushrooming in Pakistan Occupied Kashmir (PoK) where they enjoy a safe sanctuary. The Pakistani government has not done anything to destroy these camps, and has at times even denied the existence of such infrastructure on its soil.

Besides Pakistan on our western border, the next decade and after, the increasing bonhomie between Pakistan and China may also bring in new areas of conflict between India and China. The border dispute between the two countries has its origin in the Chinese claim that the boundary drawn in Indian maps cuts deep into Chinese territory. This includes about 14,500 sq miles occupied in the western sector in 1962—Aksai Chin, some areas of Himachal Pradesh and Uttar Pradesh and the whole of Arunachal Pradesh.

8. http://mod.nic.in/aforces, accessed on November 18, 2008.

Based on the employment philosophy and the threat perceptions, it becomes imperative to draw out a prioritisation for the deployment and use of AWACS.

India is fast coming up as a nuclear and economic power. Financial power is a precursor to political power and global clout. As has happened throughout history, political posturing will be followed by military tension. Thus, any long-term planning for our AD should tackle China as a very probable adversary. This is all the more likely considering that country's close ties with Pakistan. China has been developing its infrastructure in Tibet and has, besides developing the roads, major operational airfields capable of undertaking all types of aircraft operations. The nuclearisation, militarisation and modernisation of Tibet by China, with missiles aimed at India, is certainly not for friendship. Aksai-Chin also gets China in contact with Pakistan. The Karakoram Highway, passing through parts of PoK, links China with Pakistan. It has been giving active support to Pakistan's nuclear programme, besides helping it with missile technology. Chinese arms have been found in Punjab, Kashmir Valley and the Northeast region—making it almost clear that part of the help to militants in these regions comes from China, directly or indirectly. Besides this, there are reports that China is developing the Coco Islands, a Myanmar territory very close to Andaman and Nicobar Islands in the Indian Ocean, as a naval base[9]. Myanmar remains an area of security interest for India not only on account of the activities of the northeastern insurgent groups that have set up camps across the Indian border, but also because of the activities of countries working against India's legitimate security concerns and the repercussions of the tussle between the forces of democracy and military government on these interests[10]. It will be relevant to mention that Myanmar is rather anti-India, owing to India's stance on the pro-democracy movement in that country.

The whole scenario needs many possibilities to work out, and many of the suppositions, even if they work out to a lesser degree, can result in grave

9. http://en.wikipedia.org/wiki/Coco_Islands

10. http://mod.nic.in/aforces, accessed on November 18, 2008.

implications for India. The wise always plan for the future keeping in mind the past. And the past track record of the players involved in this game is not very positive. India, therefore, must take steps to lay out the basics of what it requires to counter such contingencies. With the acquisition of AWACS and aerostats, a step is being taken in the right direction. By planning for China, the AD network will become truly proactive.

Based on the employment philosophy and the threat perceptions, it becomes imperative to draw out a prioritisation for the deployment and use of AWACS. The prioritisation on the basis of the sectoral approach to the total geographical area of coverage and depth of coverage, both within and outside the Indian territorial region, will not remain static and this prioritisation would have to be reviewed periodically. In the prevailing geo-strategic conditions, which may continue for another decade or more, the sectoral priorities would remain as follows:

Priority One

- In the west, J&K and Punjab with peripheral Rajasthan would remain as high priority.
- The entire area would need overlapping radar cover from low to high altitude.
- Considering the length and depth of the area and the past experiences of wars, there would be a requirement to use AWACS in this region.

Priority Two

- The northeastern region, especially Arunachal and Assam, and the Indian territorial region adjacent to Tibet Autonomous Region (TAR) and Ladakh would come at the second priority. This area also includes peripheral coverage of Bangladesh.
- The region's growing importance in India's security precepts may also put it at priority one in the coming years.
- AWACS may not be very effective in mountainous terrain, but still, will give better radar cover and early warning as compared to ground-based systems and aerostats. AWACS effectiveness could be increased if it is complemented by UAV-borne AEW systems and ground-based systems.

Priority Three

Growth in trade and economy, the importance of securing the SLOCs in view of the growing energy crisis, the importance of maintaining friendly relations with neighbouring countries in the Indian Ocean region, the growing influence of China's naval power and modernisation of Pakistan's navy—together these factors make the Indian Ocean very vulnerable to hostile activities. It, thus, emerges as a third front which needs continuous surveillance and enhanced security coverage in the 21st century. This would ensure security of our SLOCs, EEZ, offshore drilling and mining assets and our island territories.

VULNERABILITY OF AWACS

AWACS being a force multiplier would tilt the balance in the favour of the country operating this aerial platform. Hence, AWACS busting would be the primary aim of any adversary, particularly so when both countries have AWACS in their forces. This would lead to asymmetry, which, in turn, will be decisive for a war.

- The main vulnerability of an AWACS is that the platform is required to fly at medium/high level, thus, increasing its chances of detection by enemy medium/high looking radars.
- The AWACS platform, because of it being a high value target, and the associated infrastructure would be highly vulnerable to action by enemy strikes, saboteurs and infiltrators.
- The increasing number of long range surface-to-air missiles (SAMs), like the S-300 variants with 150 to 200 km range, S-400 with a range of 400 km[11], beyond visual range (BVR) air-to-air missiles (AAMs) like the Russian Novotor KS-172 AAM with a range of 400 km[12] and the advent of the long range surface-to-air, Chinese anti-radiation missile FT-2000 has further bolstered the case for engagement of AWACS. The possibility of AWACS engagement by these systems cannot be totally ignored.

11. http://www.deagel.com/Surface-to-Air-Missiles/S-400-anti-AWACS-missile_a000990001.aspx, accessed on November 26, 2008.
12. http://en.wikipedia.org/wiki/Novator_KS-172_AAM-L, accessed on November 26, 2008.

These vulnerability issues are a matter of discussion but do not seem to be a cause for worry for the time being. An air strike on AWACS is a difficult proposition, as the strike would be picked up well in time to enable evasion by AWACS or for timely reaction by the AD weapon systems. Moreover, the AWACS aircraft which are deployed at 150 km or more from the border, while flying away from the strike, would remain out of the reach of these airborne threats.

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Also, one has to keep in mind that systems like the E-3C, Phalcon and A-50 have ESM platforms which can detect radar and radio transmissions from ranges larger than that of radar. Such radar and radio transmissions could be analysed to identify an emanating threat and this warning of 250 km is adequate to scramble or divert airborne fighters to engage the threat. As the threat closes in, AWACS would continue to retreat while guiding own fighters or it may hand over the interception to the aerostat or ground-based system in the case of the medium level approach.

Positioning the aircraft deep inside our territory and physical security in terms of hardened aircraft shelters, camouflage and concealment would provide some protection against saboteurs and ground infiltrators.

The possibility of AWACS engagement by missile systems cannot be totally ignored, however, the probability needs to be analysed against the following factors:

- S-300 / S-400 SAMs are mobile and heavy missile systems that are likely to be deployed in depth for defending strategic assets against aircraft and missile attacks and their launch against AWACS flying 130 km or more inside own territory is a possibility with low probability.
- BVR AAMs are the most potent weapons that could be used against AWACS, therefore, protection by air defence fighters equipped with BVR missiles at least 100 km ahead of AWACS becomes vital. The AWACS itself will provide early warning and combat support.
- The FT-2000 has a range of 100-120 km which means that the AWACS should

be flying within that range for it to successfully engage it, whereas the AWACS will operate at a distance of 150 km or more from the missile deployment location. It is a passive radar homing missile, therefore, what would be the impact of switching off the radar or activation of ECM after the missile has been launched is not known. The system has not been tested for its efficacy.

CONCLUSION

In modern air warfare, AWACS emerges as a most potent force multiplier which could easily tilt the balance in favour of an AWACS operator. Strategically and operationally, AWACS provides a decisive edge to air operations and air defence operations in particular. It provides the quantum jump in detection and control capability. The most outstanding feature of this platform is the reach and flexibility that it provides. As an air surveillance, command and control platform, it may be operated anywhere in the area of interest.

So vast is the asymmetry provided by AWACS in war-fighting that no air battle has been lost till now by the side that employed AWACS. With AWACS available only to one side in a conflict, a situation of asymmetry will prevail, leaving little or no chance for the have-nots to stake a claim for air space control. With the capability existing on both sides, although the system's usefulness would not diminish, its potential to shape the air battle by itself may reduce when faced with another AWACS across the border. In such a situation, the methodology of fighting an air war could see a change wherein air-to-air warfare would be the prime instrument of gaining air superiority while air battles could tend to be conducted at medium altitudes. The air battle with both sides having AWACS capability would be highly intense and crucial to the overall outcome for the struggle for air space control. It is in this context that it must be understood that to exploit the AWACS fully, we should aim to create a situation of asymmetry at the earliest by neutralising or destroying the enemy AWACS. The side that can achieve this would be better placed to gain air superiority and ultimately affect battles in the other dimensions as well.

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