

A REVIEW ON AIRBORNE EARLY WARNING & CONTROL SYSTEM (AEW&CS), INDIA

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ABSTRACT

This paper deals about the INDIAN AEW&CS system and their role in IAF to counter threats from different enemies, especially from neighbors like Pakistan and china. As India is modernizing its defense forces especially in terms of force projection, network centric warfare capability, information and cyber warfare, and intelligence capabilities. AEW&CS too are a part of this process to bridge the gaps in our defense vulnerabilities. As we know air force plays a crucial role in security of any country, so it must be powerful enough to counter threats and destroy them. Airborne system acts as a force multiplier in this. The necessities of these type of system led our scientists to develop system which can detect enemies early and warns IAF and help them to make country safe, AEW&CS is result of that. In this paper we get almost all information about the working, their role, advantages and their disadvantages also. This paper is completely based on the present uses and future scope of AEW&CS system.

INTRODUCTION

AEW&CS stands for Airborne Early Warning and Control System is a project of India's Defense Research and Development Organization to develop an airborne early warning and control system for Indian Air Force. [1, 2, 3] It is also referred as DRDO NETRA AEW&CS. It was developed by DRDO's Bengaluru-based Centre for Airborne System (CABS). [2, 3, 5, 7] Because radar is effective only to the extent of its direct line of sight, the earth's curvature limits the ability of most surface-based radar to detect low flying aircraft beyond about 30 miles. Modern aircraft can travel this distance very quickly, So it is difficult to detect them easily and early. By elevation early warning radars, say to 30, 000

feet low flying enemy aircraft can be detected at ranges up to 250 miles and wide coverage providing better ability to prepare defenses and eliminate devastating surprise attacks. [1, 3, 5] So it became very useful system for air forces throughout the world. With its ability to sense war situations in air-to air, air-to-surface, all weather, day-and night deployments, the modern Airborne Early Warning and Control (AEW&C) system has come to be regarded as a powerful 'Force Multiplier' in today's military tactical operations. [7, 9] In a path-breaking development, Brazil and India on July 3, 2008 inked a US\$300 million agreement to jointly

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develop an airborne early warning and control system (AEW & CS) for the Indian Air Force (IAF). The agreement was signed by Dr. S Christopher, Director, of the Indian Defense Research & Development's (DRDO) Bangalore-based Centre for Airborne Systems (CABS), and Luis Carlos Aguilar, Embraer's Executive Vice President (Defense and Govt. Market), in the presence of Marco Brandao Brazilian Ambassador to India, and M Natarajan, Scientific Adviser to India's Defense Minister and Secretary, DRDO. [2, 9, 10, 11, 13] For this system the aircraft platform selected was the Brazilian aircraft Embraer ERJ 145. [13] Three ERJ 145 were produced from Embraer at a cost of US\$300 million including the contracted modifications to the airframe. [13, 14, 15] The project goal was to deploy these AEW&C aircraft by 2013 [13, 15]. The first flight of this system takes place on 6 Dec 2011 and handed to Indian Air Force (IAF) in year 2014-2015, from then till now it is in service. The Indian AEW&C system can detect, identify and classify threats present in the surveillance area, and act as a Command and Control Centre to support air defense operations [15, 16]. The system with its multiple communication and data links can alert and direct fighters against threats while providing 'Recognizable Air Surface Picture' (RASP) to commanders at the Ground Exploitation Stations (GES) that are strategically located. The AEW&C system will thus support IAF in offensive strike missions and assist ground forces in the tactical battle areas. Besides, the electronic and communication support systems being developed can intercept and counter unfriendly radar transmissions and communication signals. The primary sensor which is used in AEW&CS is active electronically steered array (AESA) radar, which works in two detection range one is normal detection range while another one is extended range. The AAAU placed on top of aircraft provide 120 degree (being extended up to 150 degree) coverage on both side of aircraft [18]. It work in two operation modes one is surface mode while other is air surveillance mode. The sensors which

are present here have the ability to search, track etc. There are two types of tracking takes place here one is priority tracking while other is high performance tracking. In priority tracking the tracking takes place in full trackmode while in high performance tracking mode an additional measures is taken to improve the tracking accuracy. The active aperture technology which is used here, help operating this system in several modes at a time. [17, 18, 19] The SSR and IFF system used here helps in detection and determination of upcoming aircrafts whether it is friend or enemies. The major sub modules of SSR system are planar antenna array, antenna control unit, transmitter receiver unit, and a signal processor. All these sub modules have been designed and developed by CABS. [19, 20] The SSR modules have been integrated in a roof top installation. The system functionalities have been demonstrated with fixed transponders at known ranges and other opportunistic targets in the air, Whose ID and codes have been validated by air defense radar. Now a day's Indian air force also using Phalcon AWACS (EL/W-2090) system developed by Israel, which is much more modified and gives a coverage of entire 360 degree. [20] IAF also planning for using Boeing aircraft as a primary user for his AWACS system which increase its strengths many times. [21]

LITERATURE SURVEY

Airborne Early Warning & Control System (AEW&CS) help in improvement or effectiveness of air operations takes place in any part of the world. [1] The importance of this system increases much more time in war like conditions, so it is like an important assets for any country around the world. [2] It provides a large and clean view of upcoming threats and help in solving the problems at time when need. The antenna panel which are used in AEW&CS for navigation and detection placed on top of aircraft with a covering of rectangular box like structure called Active Antenna Array Unit (AAAU). [3] The

antenna panels are covered with a covering to protect it from outside weather condition and working properly. [4] In its interior, the AAU houses 160 Transmit-Receive Multi-Modules (TRMMs), the power supply units, and related cables and connectors the foregoing sum arises the efforts made by DRDO towards development of the AESA radar for its current and future AEW&C applications as well as for realizing essential allied technologies [5]. The necessary core competence to evolve futuristic applications in AESA radar has thus been adequately established [6]. The utility of AWACS is unquestionable and India needs to wake up to this reality and fast track both its indigenous program of AWACS-India by DRDO and its foreign off the shelf procurement deals before it's too late or too little [7]. After many attempts the first achievement for IAF comes, when the fully modified aircraft EMBRAER, supplied by Center Of Airborne System (CABS) landed in Bengaluru airport on 22 AUG 2012. [8] It was much modified aircraft which fulfills all the basic needs and much more which is necessary in today's defense scenario [9]. It is quite clear that by 2032, the IAF will face a multitude of major challenges from outside the country and also within the country. It requires identifying these challenges and putting in place viable strategies to deal with these effectively. [10] The major external challenges are from the PAF, PLAAF and the need to field credible capabilities for OOAC. It is important for IAF to work in a dedicated and focused manner to overcome these challenges in the years ahead [11]. Now a day a new concept of MIMO radar is introduced in AWACS system. MIMO communication has proved to be a superior and cost effective alternative to the conventional communication system and the same can be expected from the PMIMO radar system [12]. The potential benefits from the designed system depends on the shape, aerodynamic requirements of the aircraft, the placement of the antenna, separation between the antennas and hence expected to create

interest in this area [13]. If a radar beam bounces off a moving object, the electronic signal returns at a different frequency from the one at which it was sent out [14]. Radar operating in pulse Doppler mode can track a flying Object based on its speed relative to the radar, not just its position [15] If the object is approaching the radar, the wavelength is compressed; if it is going away, the wavelength is stretched out. [16] Computers, processing the raw radar returns, could filter fast-moving airplanes out from slow moving or stationary objects on the ground. [17] Airborne Warning and Control System would surely make any short list of the most valuable military aircraft of all time. When it entered service in 1977, AWACS instantly changed the whole regime of air combat. [18] The radar working range of AEW&CS is around hundreds of miles in almost 270 degree directions. It help in to find an aircraft and track their movement within their range and help Airforce to increase their effectiveness. [19] It works like an eye which have capabilities to see upcoming threats much beyond visual range. [20] With the help of these capabilities, it alerts or forecast about the upcoming aircrafts and missiles much earlier and provide enough time to deal with these problems and play a major role to meet the national security requirements for any country. [21]

WORKING PRINCIPLE& DISCUSSION

The AEW&C system will be capable of interoperating with other AEW&C systems, fighters, and AEW&C/ AWACS aircraft in the air, and with other early-warning and air defense systems on the ground. The data from the radar, ESM, and CSM can be Down -linked to the ground stations and the tactical control data up-linked to the AEW&C system. To this end, the AEW&C system will communicate to the Ground Exploitation Stations through C-band data link and SATCOM. The data links will operate with two voice channels. The Mission Communications System also provides for air-to-air V/UHF voice

and data channels. It enables integrated control of all onboard communication sets and intercom for the entire mission workstation operators as well as the flight crew. The communication channels have in-built ECCM (electronic counter countermeasures) features as well. The various segments of the total operational system in the

air and on the ground would have a multi-service standardized data link structure, which will enable communication among the AEW&C systems other AWACS aircraft, the fighter/interceptor aircraft, and the Ground Exploitation Systems.

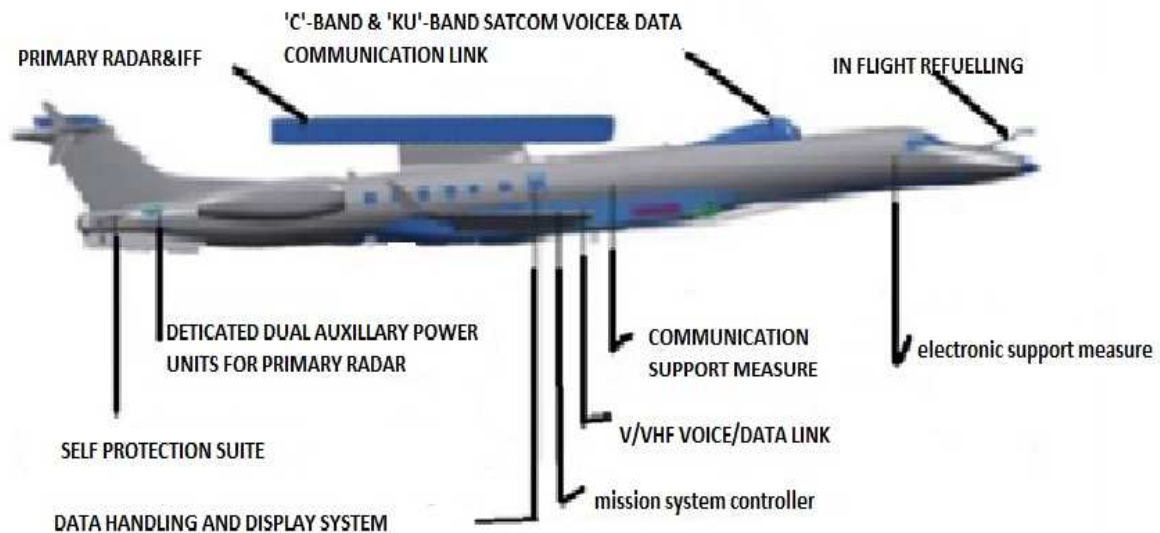


Figure 1.Indian Emb-145 Aew & C System Ref: [3]

ADVANTAGES & DISADVANTAGES

It is helpful in detection of distant object from a large distance, which result in forecast of upcoming threat. It can also be used for controlling fighter air craft and guided missiles. The main disadvantages of this system is, it is expensive due to use of radar technology and antenna.It can only give entire coverage of 240 degree, but it can be extended further.

APPLICATIONS

Like all the AEW&C system in the world Indian AEW&C system also help in detection, identification and classification of upcoming threats. As this system provide almost 270 degree coverage area extended length upto about 100 miles, the aircraft comes within this range can easily be detected and on information present they are classified as whether it is friend or foe. Not only this, system also help in acting as a

command and control center for defense operations which takes place at war like situation, And due to its multiple communication and data link it is also able to deal with multiple targets at a time. All the operations of AEW&CS are control by ground stations which are located on earth.

PRESENT RESEARCH GOING ON

Now a days The Indian Air Force has successfully carried out its first air-to-air refueling of its Embraer EMB-145-based airborne early warning and control (AEW&C) aircraft. The 'probe and drogue' refueling was carried out by an Ilyushin Il-78 tanker, with only ten minutes of refueling necessary to keep the platform flying for an additional four hours.

FUTURE SCOPE

ForIAF and about their future uses , DRDO and its Bengaluru based center of airborne system (CABS) plan for much powerful and capable AEW&CS, which make IAF much stronger as

compare today. They want to develop AEW&CS with much powerful antenna range, more efficiency, much durability etc. For this purpose they want to use Boeing aircraft, for placement of their AAAU on the top of aircraft. As Boeing aircraft show their importance in AEW&C system for country like America, Israel etc., which have

much more powerful AEW&C system present for their Air Force, so India also try to show interest in this. In addition to this DRDO also plan for using AESA radar for their requirement in AEW&C system, which increase its Capabilities much more time as present. [11]

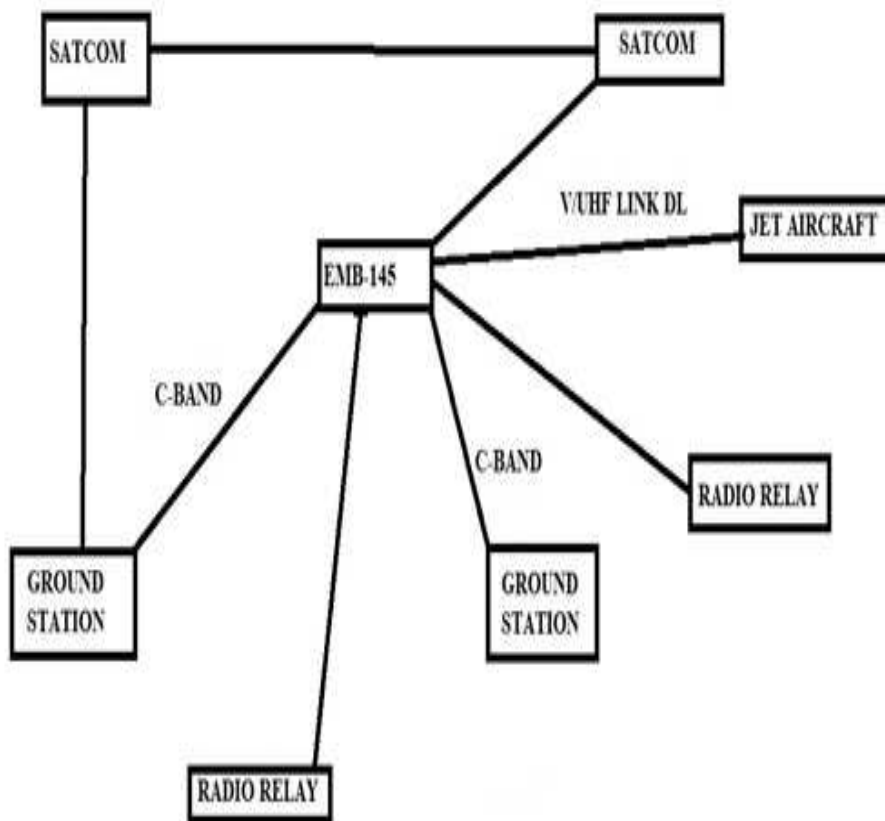


Figure 2. Block diagram of working of AEW&C system

CONCLUSION

As we know India is surrounded by Neighbors like Pakistan & China who always try to harm India by different ways, so India must have to work on his security to counter these types of threats. When there is a matter of security Air force plays a crucial role in this for countering threats, so it must be very powerful and the system like AEW&CS help in making them Stronger. The countries which have stronger Air force in the world emerges as world power, so it's become necessary for INDIAN AIR FORCE to develops itself as per present needs and system like AEW&CS provides a great platform to this. It helps

in detecting enemy aircraft or upcoming threats early and warns air force to counter these threats. It also help in destroying that threats by controlling fighter aircraft, guided missiles and bombs and help country to keep safe from outer threats.

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