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## **AWACS AND MANAGEMENT IN THE AIR**

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### **AWACS and management in the air**

An E-3A Sentry of NATO Airborne Early Warning & Control (NAEW&CF) with call sign Nato 05 approaches the beginning of the runway. The crew was just brought by bus, and all 29 persons brought a good mood took their places. From out of seat 5 in the cockpit, which is meant for training purposes, it all looks very exciting ! After a 'clear to go' the Greek-Italian pilots move the huge plane smoothly in the air on it's way to a new mission, called 'Joint Warrior' which will take place around Scotland.

### **Eye in the sky**

Each day this kind of flights are made by E-3A AWACS (Airborne Warning & Control system) planes out of a fleet of 17, mainly operating from the German base Geilenkirchen, near the Dutch border. (Main Operating Base of MOB). It forms one of the two components of NAEW&CF. Next to that seven E-3D Sentry's of the Royal Air Force operate from RAF Waddington, they are the second component. The planes have been designed for guarding airspace, and they can 'see' hundreds of flying objects all at the same time, which is called 'tracking'. In this process, friend and enemy are separated and marked in 'airspace management' as they call it and support is given to the own units as 'leading tactical guidance'. During our flight also an air-to-air refuelling exercise will be held. Shortly after take of fan 'orbit' is requested on the ground station 'Dutch Mill' where the E-3A will be parked to give the opportunity to a KC-135 tanker - USAF Utah ANG, which took off later - to take position just above and in front of the E-3A. Once this happened, and all systems have been sufficiently checked the radar is started or as they say woken up. The radar makes a turn every 10 seconds in a large round mushroom-form rotodome which is mounted on top of the fuselage. It has Pulse as well as Doppler modes, with multiple functions by means of a number of frequencies which can be changed.

On this rotating part there is also IFF equipment available to identify unknown aeroplanes. There is a surround radar reach, because the radar rotates 360 degrees and this information is cut into small pieces. The reach of this equipment goes that far, that from a height of 9120 meters a part of 400 km can be watched which means that in about 312.000 square kilometers all objects can be seen and AWACS can see everything which scatters the beam back but separation in interesting echoes and background is needed with settings. Three E-3A's can oversee all middle-Europe ! The part under and above the plane which is not in the 'beam' , is completed by information from the ground stations. Meanwhile a great activity exists behind the consoles when the UK-9, the orbit area over Scotland is in reach. To follow the results of the exercise from A to Z the E-3A is first to be brought in exact position.

### **Who are flying in this plane ?**

An AWACS team is delivered by one of the three operational squadrons at Geilenkirchen. They can deliver about 30 complete crews. The crew itself never is in the same setting, it's a matter of who is available. Within the 26 NATO countries

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there are 16 countries that deliver personell with recently now Poland. It really is a joy to see how the many nationalities cooperate together. Mostly there are some twelve nationalities aboard on a mission. In most cases people are listed for a period from three to five years, who (apart from the cockpit crew) mostly had a pre-education 'Radar, electronic or communications-techniques' on ground stations. They get their conversion with NAEW&CF on the E-3A. This conversion exists in half a year for 'basic Qualification', and half a year for 'Combat Readiness' stage. Their own qualities, mastering the English language well, a large degree of insight have influence on the proceeding of the course. By means of 1 of the simulators at Geilenkirchen the learning process can be passed through very thoroughly and also very fast. Depending on your own qualities and tempo you will get hold of how things get within your reach efficiently enough to take part in the missions. Moreover, during missions students are also taken in the air, and in fact an exercise already begins a few days earlier in the 'mission planning', where sometimes large amounts of papers have to be read. After that you do a 'specialized briefing', on what's coming up, and right before the start you'll have a last briefing where the so called 'summarized briefing' is repeated once more. Everything will be cleared in the Air Tasking Order (ATO), after that everyone knows what his or her tasks are and what to do. In the ATO is mentioned who is who, where the take-off will be, who is friend (blue forces) and who is the enemy (Red Forces) etcetera. But you never know, during flight all facts suddenly can change, sometimes they do this on purpose and the crew has to act directly to the new circumstances. Some flexibility is required.

## **ID game**

But all is much more than just a game, however this may look like t to a layman in this area. Without AWACS battleships, jet-fighters and ground stations never could practice such an integrated exercise on such a large realistic scale. AWACS keeps these people capable up till the highest levels. How this works? To answer this question, we make a walk through the plane. In the back there is a radar-technician who is responsible for keeping radar and IFF in the air. Next you'll see two consoles with 'passive controllers', only receiving radar signals. They try for example to identify the 'red forces' who don't talk to AWACS. You can identify this in a data-base with radar-profiles, each type of radar namely has an own characteristic, and sends a frequency with an own specific 'pulse repetition interval' This identifying is called 'fingerprinting'. Passive controllers get information via Electronic Support measure (ESM) antennas who are place don four sides of the E-3A. The passive controller will determine: 'This is an F-16, this is a Tornado, a Rafale, and we think that one may be a Mig. One row ahead again is positioned the section 'surveillance' with 5 consoles. The surveillance operators build an image after activating the radar, and optimising the radar itself and IFF system and bring all flying objects alive in the screens. Now the ID-game can start by an identification matrix, who is who and who is what ? We pass some oil-drilling platforms, and suddenly the female Danish trainee remarks several objects. 'What the heck....??' 'Oh', the instructor explains, 'there's a shit full of helicopters out there', and he explains about the coming and going of oil-platform personnel in helicopters.... By the way, after the digital updated AWACS all operators can have access to/switch to all different screens and functions on their own screen.

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***Piloot en Vliegtuig-Aranysas-Cockpit-Topgun-Interception-Aeronautica&Difesa-Fuerza Aerea***

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IFF has mode 1,2 & 3. Mode 3 of 3 Alpha is for civil aviation and 1 & 2 are military, with 1 as fixed code and 2 changing - in wartime - every time-unit of 30 minutes to another (scrambled) frequency to avoid copying. Sending a signal by the IFF is called 'Squawken'. We know what the own units 'squawk', but not what opposing forces do. The emission of the radar is reflected, and meanwhile the IFF system checks the unknown plane. Planes that have no radar or turn them off are 'seen' anyway. The transponder of the examined plane returns a code 1, 2 or three. On the screen the radar gives the plane a small yellow dot by radar echo, and a green dot by IFF-code. The system creates a small symbol or 'identification pending', and the information is sent to the ground stations. They have flight plans and are able to make the new registration a 'Friend', 'Foe' or 'Suspect neutral'. When an aircraft is turning off the transponder also and has very little radar signature like stealth technology it will even for the AWACS almost impossible to notice this aircraft. Surveillance not only receives the reflected radar-echo's of planes, but also ships and the Doppler mode can distinguish low-flying and slowly moving objects on the background. Over the Northsea where we fly today with it's many oil-drilling platforms a lot of helicopters are seen present as mentioned. The surveillance controller has supervision over the whole area. In case of military exercises the area is most of the times controlled and unexpected visitors are avoided.

**Weapons section**

The groundstation for the exercise is Combined Air Operations Centre (CAOC) at the same time, for the blue forces these are RAF High Wycombe (Essex) and RAF Boulmer (Northumberland), and for the red forces RAF Scampton, Lincolnshire.

Weapons section is close with surveillance section and all kinds of agreements exist between them. Someone is calling 'shark is coming in' and Tornado units took off from RAF Lossiemouth and RAF Leuchars. After refuelling in the air they have an 'engagement' with Norwegian F-16's. A 'four ship' flies ahead followed by a 'wave' of six attack planes with bombs. After the 'dogfight' they will proceed with a training session on Spade Adam shooting range near New Castle. By data-link the complete radar-image of the AWACS can be received in the ground station or the fighter jets.

These lasts can turn off their radar to minimize the chance of being discovered. Even in a certain way 'beyond the horizon' information can be provided, because AWACS flies much higher than the 'battle area, which gives the possibility to 'see over the horizon', the earth-curve. The weapons section, mostly three weapon controllers with a 'figher allocator' as supervisor brings the fighters to the enemy (red forces) to eliminate these. When their radar is turned off, but via data-link is tuned in to AWACS, there still is a complete overview for them and they will have the advantage of sudden impact by surprise! Next to that they cannot be hit by anti-radar missiles. AWACS has done his job for them and given them this way the tactical advantage. The front section's task in the E-3A is involved with radio communication, namely radio (UHF) and data-link, Air-air as well as air-ground traffic. A communications and system engineer keeps this section operational and is able to execute reparations up to a limited level. Ventral outside the fuselage antennas are mounted for connection with SATCOM which is used by communication. Head of 'mission crew' is the 'tactical director' (TD) who will keep the complete overview, he is also the link with 'flight deck' in the cockpit. He walks around through the entire plane with a long very flexible

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cable connected on an open connection so he can communicate with everyone where information or correction is required.

### **Very expensive, but very valuable**

AWACS – since being delivered in the beginning of the eighties – has had several update and modernising programs such as in the first phase in 1997 an update of computer memory, UHF anti-jamming communication equipment, colour screens for the consoles, integration of Link 16 data communication system and ESM equipment. In the second phase in 1999-2000 the Radar System Improvement Programme (RSIP) was integrated. Between 1998 and 2008 the 'Mid-term Modernization Programme (NMT) follow. This implicates multi-sensor integration, improvement of interface, automatic digital switching communication, UHF satellite communication and broadband VHF. The navigation-system was improved, (GPS/INS) and a brand new IFF interrogator was mounted. The plane gets a Large Aircraft Intraned Countermeasures System (LAIRCM) for self defence. New consoles were added. This all makes AWACS a very advanced system.

### **Operations area**

AWACS is mainly used within the borders of Europe, namely in exercises to reach a very effective use of fighter planes. We have experienced that suddenly the situation can change to 'real' in the Balkan conflicts where AWACS had a major role in war-situations. Sometimes a far trip comes up like recently Australia and participation for example in the Red Flag exercise from Las Vegas. This last named exercise gives a great challenge to all involved, while sometimes some 150-160 planes are in the air all at the same time. Mostly a deployment will be limited to one of the forward situated bases in Italy (Trapani), Greece (Action) or Turkey (Konya) or a location in Norway (Orland). Deployments take 5 days up to 2 weeks. AWACS always is involved, as it is to NATO Response Forces (NRF) and guarding the air space in case of very large 'terrorist-sensitive events' to avoid another 9-11. Who ever might think that AWACS is a money devouring project, it might be well to realise that in many workflows a very important factor is operating in the background. For the air forces this means the AWACS, seen more or less as the queen on the chess-board, which is seen that way and will be defended that way. Necessary to defend our democratic standards and values and guarantee our freedom as well as the freedom of others.

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**Kees Otten and Wim Das**

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