

# FOREWORD

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The Chairman of the NAPMO Board of Directors, the NAEW&C Force Commander, and the NAPMA General Manager extend their best wishes on behalf of the 16 Nations who participate in the NATO Airborne Early Warning & Control (NAEW&C) Programme.

The Programme is often cited as one of the most successful collaborative ventures ever undertaken by the Alliance. The fleet of NATO E-3A (NE-3A) aircraft represents the world's first multi-national, fully integrated Air Force – “NATO's Air Force”. As a result, an effective system has been deployed that enhances the ability to counter today's evolving threats. Additionally, the multi-national character of the NE-3A force provides a highly visible symbol of Alliance cohesion and solidarity.

This booklet provides an overview of the programme and reviews its accomplishments with a vision toward the future. We hope you will agree that through the NAPMO nations' collective determination, the NAEW&C Programme represents a true NATO success story.



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# NATO AIRBORNE EARLY WARNING AND CONTROL PROGRAMME

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In the second half of the 1970s, the requirement to detect high speed combat aircraft with low level penetration capability made it necessary to augment NATO's system of ground-based radars with airborne systems that possessed look-down capability. The NATO military authorities determined that an Airborne Early Warning (AEW) capability would provide a key capability to meet this challenge.

The operational requirement for the NATO AEW&C system stressed the need to detect small cross-section, high speed intruder aircraft at long range. The capability to detect maritime surface targets was also specified because of the geographic regions in which the AEW aircraft would be required to operate. The aircraft and mission systems selected to form the NAEW&C Force were based on the USAF's E-3 Airborne Warning and Control System (AWACS). The inherent mobility and flexibility of such a system, especially when employing its battle management function, were also foreseen by NATO planners as key to providing air, maritime, and land commanders with valuable airborne C2 capabilities.

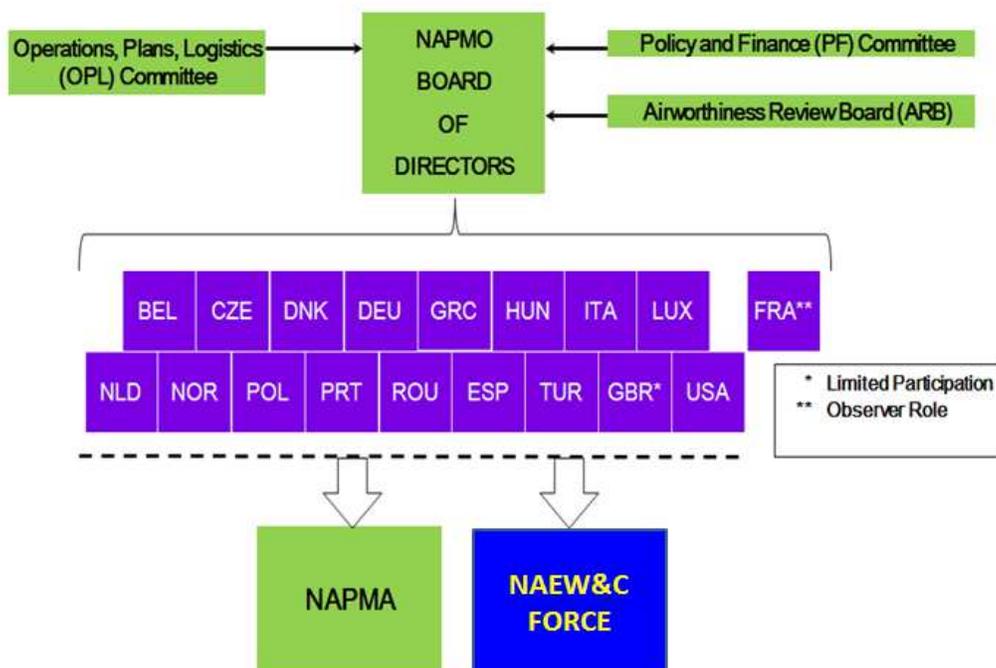
In short, the creation of a NAEW&C Force was designed to make a significant contribution to the Alliance's deterrent posture. Implementation of the concept would require a NATO-endorsed programme and the establishment of a Programme Management Organisation.



# NATO AEW&C PROGRAMME MANAGEMENT ORGANISATION

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In December 1978, a number of NATO Nations joined together to establish the NATO Airborne Early Warning & Control (NAEW&C) Programme. As a result of the international agreements formally ratified at that time, the NAPMO was created as a NATO Production and Logistics Organisation to implement the programme. NAPMO is a NATO civil organisation established under the provisions of the 1951 Ottawa Agreement and is directly responsible to the North Atlantic Council for all aspects of the AEW&C Programme. The structure of the NAPMO is depicted below.



# NAPMO BOARD OF DIRECTORS

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In its Charter, the NAPMO Board of Directors (BOD) has been granted far-reaching authority and independence in the management of the programme, particularly in the technical, initial system support, financial and contractual areas. The NAPMO BOD consists of one member from each participating nation. The United Kingdom exercises limited participation as a NAPMO member based on her participation in the Air Defence Ground Sites Integration Project and her fleet of E-3D aircraft is also an integral part of the NAEW&C Force. France retains an observer role, but also maintains continuous coordination regarding her fleet of E-3F aircraft to ensure interoperability. The BOD meets a minimum of two times per year to review the programme, resolve major issues and to provide policy guidance and strategic direction. Two Committees – the Operations, Plans, and Logistics and the Policy and Finance Committees whose composition are similar to that of the BOD – meet a few weeks before each BOD meeting to review items within their respective Terms of Reference and to provide recommendations to the BOD.



## *Operations, Plans, and Logistics (OPL) Committee*

- ✦ The OPL Committee considers and makes recommendations to the BOD on those matters related to operations, interoperability, technical, logistics, sustainment, configuration, requirements, and Industrial Benefits associated with Depot Level Maintenance activities.
- ✦ As a matter of routine, the OPL Committee, within the operations, interoperability, technical, sustainment, configuration and requirements aspects of the NATO AEW&C Programme, considers proposals and requests made by NAPMA prior to consideration by the BOD. This process ensures that the BOD, when considering its decisions, has the benefit of OPL Committee recommendations.
- ✦ In its role as a body of national experts created to advise and assist the BOD, the OPL Committee draws to the attention of the BOD matters that warrant BOD attentions and action.

## *Policy and Finance (PF) Committee*

- ✦ The Policy and Finance (PF) Committee considers and makes recommendations to the BOD on matters related to legal, financial, contractual, strategic planning, and the administration of NAPMA, including international agreements, budgets, financial procedures, acquisition strategies, Industrial Participation, business processes, NAPMA personnel establishment and recruitment, and corporate governance.
- ✦ As a matter of routine, the PF Committee, within the legal, financial, contracting, strategic planning, and administration of NAPMA, considers proposals and requests made by NAPMA prior to their consideration by the BOD. This process ensures that the BOD, when considering its decisions, will have the benefit of PF Committee recommendations.
- ✦ In its role as a body of national experts created to advise and assist the BOD, the PF Committee draws to the attention of the Board matters that the PF Committee feels require BOD action.

## *Airworthiness Review Board (ARB)*

- ✦ An Airworthiness Review Board (ARB) is established to assist the NAPMO Nations on airworthiness matters related to the NATO E-3A fleet. The ARB works under clear Terms of References describing its various responsibilities. These responsibilities include conducting an annual review of the airworthiness programmes and procedures established by the Operational Airworthiness Authority (OAA), the Force Headquarters Commander, and Technical Airworthiness Authority (TAA), the NAPMA GM, and reports to the NAPMO BOD on its observations and concerns. The ARB also provides independent advice to the NAPMO BOD regarding the information provided semi-annually by the OAA and TAA.

# NAEW&C PROGRAMME MANAGEMENT AGENCY

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The NAEW&C Programme Management Agency (NAPMA) is the executive agency of the organisation. Within its approximately 115 posts, the A-grade positions are filled by seconded military officers and civilian personnel drawn from the nations that participate in the NAEW&C Programme. While most posts are located in Brunssum, The Netherlands, a small number perform their duties in Manching, Germany, where they conduct retrofit activities. Within the responsibilities granted to NAPMA by the NAPMO BOD, NAPMA manages all aspects of the programme from acquisition through delivery and on through Life Cycle Sustainment.

As such, NAPMA is responsible for planning and coordinating acquisition strategies and for managing contracts associated with modernisation of the NE-3A fleet. The NAPMA General Manager is responsible to the BOD for the day-to-day management of the Programme. He is directly aided in this task by a Deputy General Manager, a Legal Advisor, an Internal Auditor and a Chief Engineer. The Agency is then organised around the following Divisions and Offices:

- ✦ The *Programme Management Division* is responsible for implementing projects throughout the development, production, and retrofit phases in response to operational military requirements and for Programme-wide planning and development to include concept definition and project validation studies.
- ✦ The *Programme Support Division* is responsible for contracting, industrial benefits and industrial participation, logistics and configuration management duties, system test activities & quality assurance, and Information Management functions.
- ✦ The *Financial Controller's Office* is responsible for the treasury, budgeting, accounting, and cost analysis functions necessary for the effective execution of the Programme.
- ✦ The *Human Resources and General Services Office* is responsible for all personnel matters, security, and general administrative support services, including travel and registry functions.
- ✦ The *Chief Engineer's Office* is responsible for advising the General Manager, as the TAA, on engineering matters and ensuring that NAEW&C programme adequately address Operational, Safety, Suitability, and Effectiveness (OSS&E) requirements.

# NAEW&C Force

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The NAEW&C Force was created to provide a multinational and immediately available airborne surveillance, warning and control capability in support of Alliance objectives. NAEW&C Force takes its operational directions from and reports directly to the NATO military command structure, while depending upon NAPMO for NE-3A fleet maintenance, sustainability, and other requirements to support the NATO mission. The post of NAEW&C Force Headquarters Commander, a Major General, alternates between Germany and the United States, while the United Kingdom fills the Deputy Force Headquarters Commander position.

The creation from scratch of what was effectively a new air force meant it was necessary to replicate all the elements that support a national air force to include a command structure and operating bases. To this end, the NAEW&C Force Headquarters was established in 1980. The NAEW&C Force has two Components. The Main Operating Base (MOB) for the NATO E-3A Component was established and located at Geilenkirchen, Germany, along with three Forward Operating Bases (FOBs) at Trapani, Italy; Konya, Turkey; and Aktion, Greece, and a Forward Operating Location (FOL) at Oerland, Norway. The NATO E-3A Component is co-located with the Commander NAEW&C Force Headquarters at NATO Air Base Geilenkirchen. The other component of the NAEW&C Force is the Royal Air Force's E-3D Component at RAF Waddington, England.



France's E-3F fleet operates from Avord, FRA. While France is not part of the NAEW&C Force, it regularly performs operations alongside the NE-3A Force.

Over the years, the NAEW&C Force has been called on to support a wide range of operations. During the 1990s the NAEW&C Force was involved in continuous operations in support of UN Security Council Resolutions around the Former Republic of Yugoslavia. The NE-3A aircraft provided a continuous presence and contributed to combined operations with French, British, and American E-3 fleets. After the terror attacks of 11 September 2001, NATO invoked, for the first time in its history, the "mutual defence" clause spelled out in Article 5 of the North Atlantic Treaty. Called Operation Eagle Assist, NATO deployed NE-3As to the USA to fly a variety of security support missions. Since then, the NAEW&C Force has been supporting NATO's counter-terrorism activities in the Mediterranean Sea, deployed in January 2011 to support the ISAF Commander by providing air surveillance over Afghanistan, and played a pivotal role in NATO air operations over Libya. Today, the NAEW&C Force supports NATO Assurance Measures over the Central and Eastern European NATO member nations in response to ongoing situations in Ukraine and is engaged in counter-ISIL air surveillance operations in Syria.

Both components of the NAEW&C Force also provide support to assist with the security of major public events. These high visibility events, such as the 2004 Summer Olympic Games in Athens, the 2006 World Cup Football Championship, the 2012 European Football Championship in Poland and other important meetings held by international organizations such as the Nobel Prize ceremony in 2010. In addition, the NAEW&C fleets have consistently provided air support to Alliance Heads-of-State meetings as well as governmental and non-governmental meetings and NATO summits.



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# NATO E-3A COMPONENT

## GEILENKIRCHEN, GERMANY

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The E-3A Component is one of the two operational elements of the NAEW&C Force. It is NATO's only operational unit, making it unique in the Alliance's history. The Component's mission is to provide aircraft and trained aircrews to deliver a surveillance and control platform whenever directed by the AIRCOM Ramstein on behalf of the Supreme Allied Commander Europe (SACEUR).

The actual build-up of the E-3A Component started in January 1980. In October 1980, it was granted the status of a NATO International Military Headquarters by the NATO Defence Planning Committee (DPC). Flying operations began in February 1982 after delivery of the first NE-3A aircraft. The Component was officially activated on 28 June 1982 and reached "Full Operational Capability" by the end of 1988.

The Component consists of an Operations Wing, Logistics Wing, and Base Support elements. Each of these major units is commanded by a Colonel from the NAPMO Nations. The position of E-3A Component Commander alternates between a German and American Brigadier General. The overall integrated manning of the Component currently consists of about 1,400 multinational military and civilian personnel. This figure includes personnel in support functions such as base civil engineering, national support units, and morale and welfare activities.

Sixteen<sup>1</sup> NE-3A Aircraft are assigned to the Component. Normally, only a number of the NE-3A aircraft are at NATO Air Base Geilenkirchen at any given time. The remainder deploys to the Component's Forward Operating Bases and its Forward Operating Location or other airfields. Each of the forward facilities is located on a national installation, although the Component has approximately 20 personnel at each site. While these personnel are officially assigned to the NE-3A Component, all of them are from the respective host nation.

Twenty-two multinational aircrews from 16 of NATO's 28 Nations are assigned to the Component's three operational squadrons. The Training Wing also has a flying squadron – the Aircrew Training Squadron.

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<sup>1</sup> NAEW&C retired one aircraft in 2015 with two more are scheduled to be retired by the end of 2018.

# E-3D COMPONENT

## RAF WADDINGTON, UK

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Since attaining Initial Operating Capability in July 1992, the NAEW&C Force's E-3D Component has shared NATO's airborne surveillance and control mission with its sister Component at Geilenkirchen. From its Main Operating Base at Royal Air Force Waddington, the E-3D Component's fleet of six E-3D aircraft supports NATO missions and provides the United Kingdom with a national capability when required.

Under the day-to-day operational control of AIRCOM Ramstein, the E-3D Component has made a major contribution to every national, NATO, and coalition military campaign since its formation and contributes 25% of the Force's annual operational output. The E-3Ds have engaged in conflicts in Bosnia, Kosovo, Afghanistan, and Iraq and continues to support Assurance Measures and Counter-ISIL operations.

The Component is comprised of six aircraft and appropriate mission support, training, and engineering elements. It maintains an expeditionary capability to respond from a state of high readiness to any operation around the world either as a NAEW&C Force asset, including as an element of the NATO Response Force, or as a national contribution to any coalition.

The E-3D variant of the AWACS is operated by a crew of 18 personnel drawn from RAF and exchange personnel. It is configured to meet the United Kingdom's operational requirements, to maintain interoperability with other Alliance E-3 fleets and to maximise data interchange ability with the NE-3A. The most notable differences from the NE-3A are its engine type and a refuelling probe, in addition to its standard air-to-air refuelling receptacle, aft of the cockpit as depicted below.



*E-3D*

# MAJOR PROGRAMMES

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The present configuration of the NE-3A fleet and its associated capabilities result from three major programmes:

- ✦ The Initial NAEW&C Acquisition Programme (1978-1988)
- ✦ The Near-Term Programme (1990-2000)
- ✦ The Mid-Term Programme (1997-2008)

## *The Initial NAEW&C Acquisition Programme (1978-1988)*

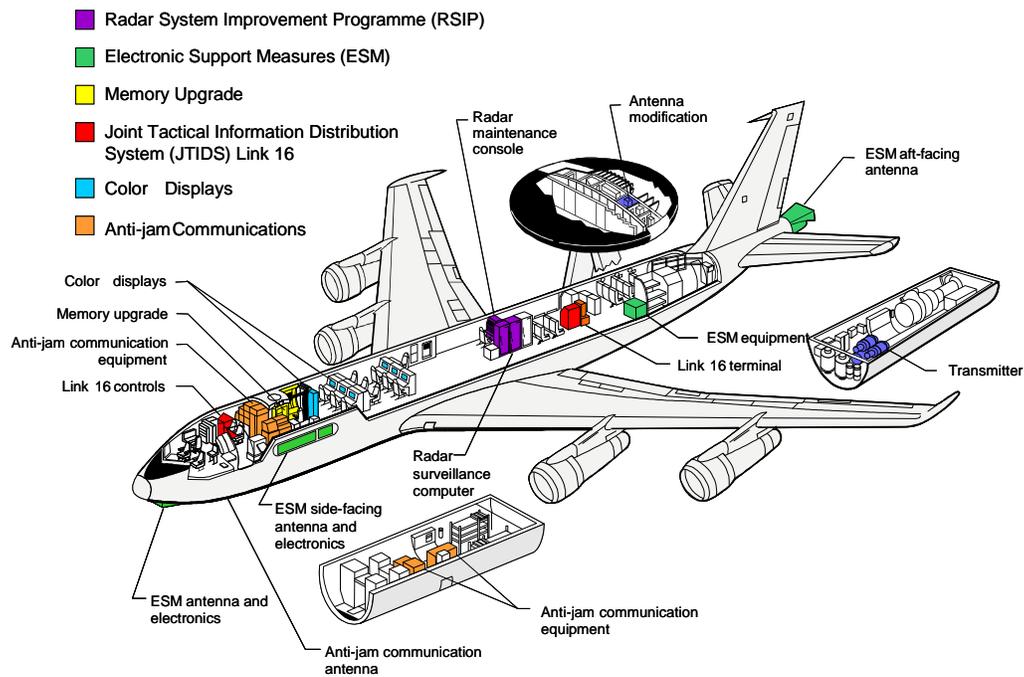


The Initial Programme approved by the Ministers of Defence of participating Nations in December 1978 consisted of:

- ✦ Acquiring 18 NE-3A aircraft and three modified commercial 707 aircraft, for use as Trainer Cargo Aircraft (TCA), as NAPMO assets
- ✦ Upgrading 40 NATO Air Defence Ground Environment (NADGE) Radar Sites
- ✦ Creating NAEW&C Force Command Headquarters
- ✦ Activating a Main Operating Base in Geilenkirchen, Germany, three Forward Operating Bases (Greece, Italy, Turkey) and one Forward Operating Location (Norway) and
- ✦ Establishing initial logistics, training, and personnel support, as required.

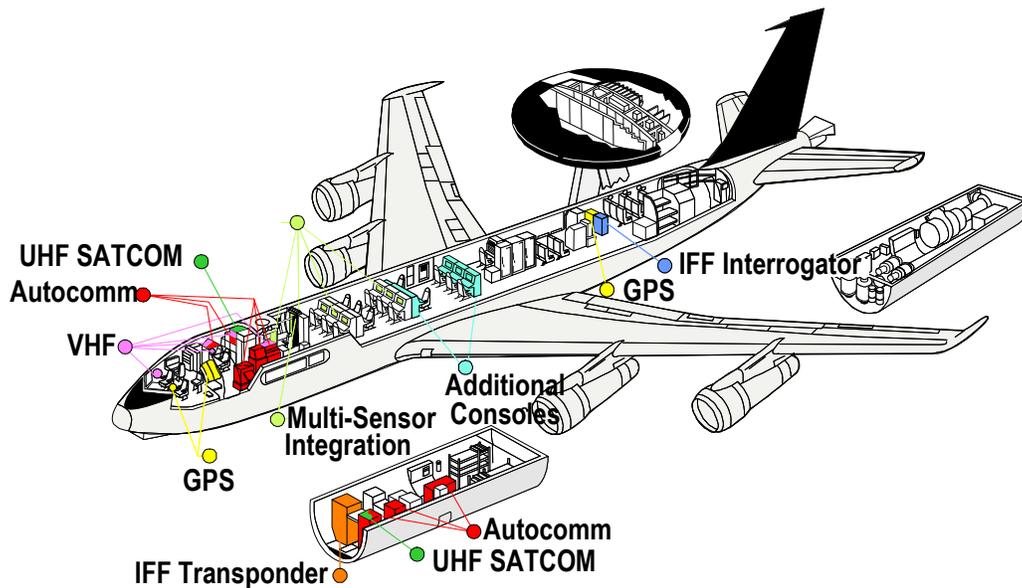
The total cost of this Initial Programme amounted to US\$ 4.1 Billion which was prohibitively expensive for any single Nation, but attainable through the collective resolve of the original 13 NAPMO Nations. This massive investment was met from special budget funded and controlled by the participating Nations and administered by NAPMA.

### NEAR-TERM PROGRAMME (1990-2000)



By 1988, the NATO Military Command had stated its operational requirements for enhanced communications, surveillance, and computer capabilities in order to update the NE-3A system so that it could retain its operational viability to include interoperability with the AEW&C fleets of France, the United Kingdom, and the United States. The NAPMO Nations agreed on the need for such an upgrade and the Near-Term Programme commenced in 1990. The total cost of this upgrade was US\$ 1.1 Billion.

## *NATO MID-TERM PROGRAMME (1997-2008)*

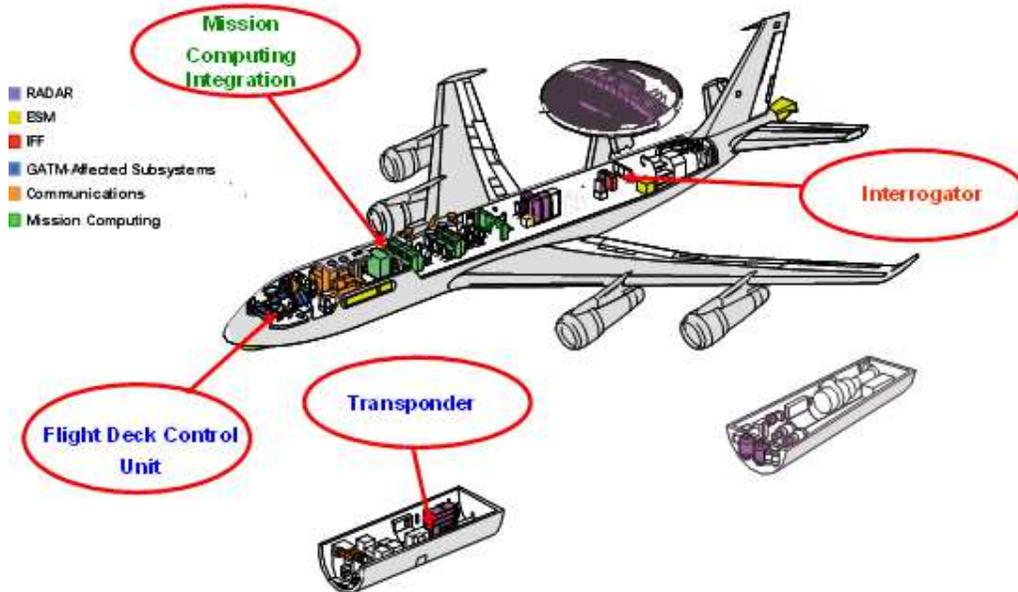


After three years of planning, the Mid-Term Programme commenced in 1997 to further improve the capabilities of the NE-3A fleet enabling the platform to manage foreseen operational challenges of the coming years and improving its overall combat capabilities. This US\$ 1.6 Billion programme has been treated as a single-block upgrade that consists of nine integrated system enhancements including a modern software architecture that supports future growth.

## *FOLLOW-ON UPGRADE PROGRAMME (2010 – 2018)*

Execution of the programme's current modernization projects is underway and progressing. The Follow-on Upgrade Programme (FUP) includes mandated enhancements of the platform's air-to-air interrogation system with Mode-5 and Enhanced Mode-S capability and upgrades to the NE-3A cockpit from legacy analogue technology to a full digital "glass cockpit" environment that will also enable the platform to meet current and emerging air traffic management requirements in dense European airspace.

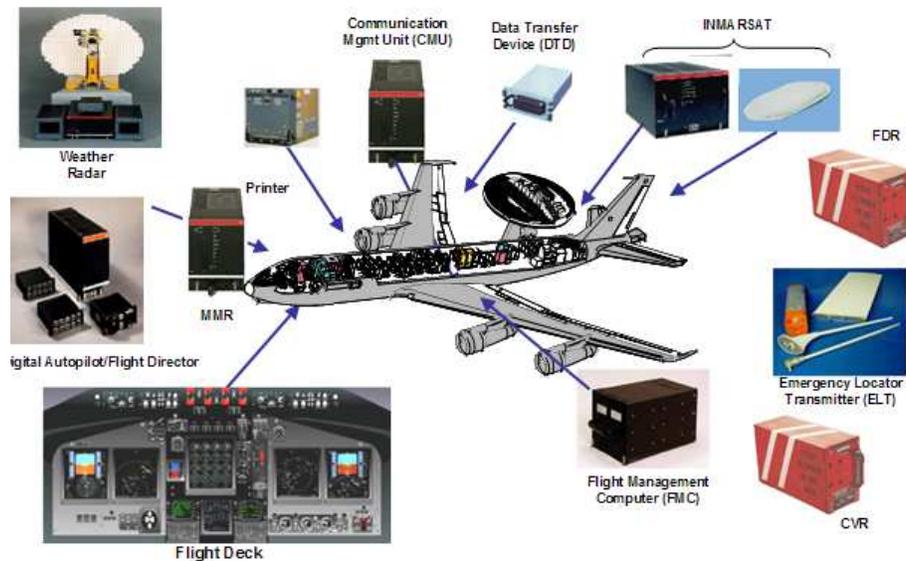
## Mode 5 / Enhanced Mode S



Combat Identification is recognized as an integral element of Force Protection and is essential in enhancing military effectiveness and preventing fratricide. Identification Friend or Foe (IFF) systems have been adopted for their ability to identify co-operating units and rapidly provide Situational Awareness (SA) of friendly air, maritime and ground platforms as part of the Combat ID process. Secondary Surveillance Radar (SSR) systems, the civil equivalent of IFF, are used by both military and civil organizations for the identification and control of air platforms by Air Traffic Service providers and units responsible for compiling a Recognized Air Picture (RAP). Together, IFF and SSR are considered essential safety-critical systems for the provision of Air Traffic Control (ATC) services and the conduct of battle management functions.

- + **Mode 5** is NATO's performance upgrade of the current IFF Mark XII System (Mode 4) and will provide the NE-3A aircraft with an improved NATO and friendly/neutral identification capability.
- + **Enhanced Mode S (EHS)** Military exploitation of SSR systems is driven by the requirement to fulfill military tasks and the need for air platforms to carry SSR transponders in compliance with individual national flying regulations when operating in national and international airspace. Therefore, Mode S compliant transponders will ensure that NE-3A aircraft will have continued unrestricted access to "Mode S airspace". The Enhanced Mode S (EHS) interrogator capability will further assist in the compilation of a Recognized Air Picture in order to safely control aircraft with real-time Mode S information processing.

## Communications, Navigation, and Surveillance / Air Traffic Management (CNS/ATM)



To cope with increasing civil air traffic, Civilian Aviation Authorities will progressively put in place new airspace structures, Air Traffic Management (ATM) procedures and Communication, Navigation and Surveillance (CNS) systems. The new CNS/ATM environment exploits digital technologies, satellite systems and various levels of automation to establish a seamless Global Air Traffic Management (GATM).

Military aircraft such as the NE-3A, which currently do not comply with emerging ATM standards, will eventually be restricted to operate as General Air Traffic (GAT) thereby impeding flying operations. The cockpit modernization project involves an extensive suite of sub-systems aimed at ensuring the aircraft can operate within and transit through any airspace without restriction. The new NE-3A CNS/ATM systems will also enhance information flow, extend surveillance capabilities, and improve navigational accuracy. It will help address existing supportability issues and consolidate the navigation functions into a three position flight crew concept with two pilots and a flight engineer while removing the requirement for a navigator.

While the Engineering Manufacturing and Design (EMD) phase of the cockpit modernization project was executed in cooperation with the USAF AWACS fleet, the Production and Retrofit (PAR) phase of each fleet will be done under separate contracts.

## Final Lifetime Extension Programme (FLEP)

Studies and analysis on a potential Final Lifetime Extension Programme (FLEP) are ongoing to determine feasible technical solutions to meet unfulfilled operational requirements, maintain the platform's operational relevance and extend the NE-3A fleet's lifetime to support NATO operations to 2035. If approved by the NAPMO Nations, the programme will begin execution in 2019 with initial contract award and be completed by the end of 2025. The NAPMA Nations have, pending final programme approval, set a US\$ 1 Billion ceiling for the effort which will address mandated upgrades to the NE-3A's data link and voice communications capabilities, enhance the Wide-Band Beyond Line-of-Sight airborne networking capability and refresh the NE-3A's mission computing hardware and software infrastructure while simultaneously addressing known and emerging Diminishing Manufacturing Source issues.

# EVOLUTION

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Originally designed as an elevated radar platform, the NE-3A is evolving to address the realities of geopolitical change and NATO's new mission. In emphasizing the control aspect of AEW&C, the NE-3A has become a key provider of Air Battle Management capability.

From the initial buy of 18 NE-3As and three TCAs, as well as upgrades to ground-based radar, and through the various major programmes, NAPMO Nations will have spent or committed a total of more than US\$ 8 Billion on NE-3A initial acquisition and modernisation efforts throughout the life of the fleet.



# THE FUTURE

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Since the NAEW&C Programme was authorised in 1978, the strategic situation has changed and NATO's missions have evolved. Responding to changing environments and supporting future NATO operational scenarios will present continuous challenges. Today, NATO is moving forward in describing a new and improved method of planning and conducting operations. To support the dynamic NATO transformation process, NAPMO will adopt new business approaches, such as streamlined acquisition, to allow new operational capabilities for the NE-3A fleet to be fielded as soon as possible in supporting the overall operational requirements of NATO.



# CONCLUSION

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As a result of the unique arrangements under which the NAPMO Nations have agreed to implement the programme, NATO is the owner of a fleet of technically sophisticated aircraft. No single nation acts alone to ensure that the NATO E-3A fleet maintains its operational viability. The collective NATO responsibility in this regard continues to rest with the NAPMO Nations.

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# NE-3A Aircraft Statistics

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The NE-3A aircraft is a militarized version of the Boeing 707-320B commercial airliner airframe. It is distinguished by the addition of a large, rotating rotodome containing its radar antennae. Its mission system includes surveillance radar, navigation, communications, data-processing, identification, and display equipment. The NE-3A fills the needs of both airborne surveillance and Command and Control (C2) functions for tactical and air defence forces. It provides a highly mobile, survivable surveillance and C2 platform. The NE-3A offers superior surveillance capabilities. Equipped with a "look-down" radar, the NE-3A can separate airborne targets from the ground and sea clutter returns that can limit other radars. Its radar "eye" has a 360-degree view of the horizon and, at operating altitudes, can "see" more than 400 kilometers (215 nautical miles). It also can detect and track both air and sea targets simultaneously.

## MAIN DATA OF NE-3A

Maximum Take-off weight	151955 kg
Length, fuselage	46.62 m
Height, fuselage	12.50 m
Wingspan	44.43 m
Width, overall	4.52 m
Height rotodome above fuselage	3.35 m
Diameter rotodome	9.1 m
Thickness rotodome	1.8 m
Maximum rate of climb	8.7 m/s
Maximum range	9250 km
Speed	800 km/h
Maximum endurance (no refuelling)	More than 11:00 h:min
Aircraft ceiling	10670 m
Four TF-33-PW-100A	4 x 21000 lb
Crew	4 flight crew, 13 operators



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