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Postgraduate Dissertation

Strategic, Technical and Economic Evaluation of the Next-Gen AWACS (Airborne Warning and Control System) for the Hellenic Air Force.

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Supervisor: Panagiotis Artikis

Athens, Greece, May 2026

No classified or restricted information is included in this thesis.

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"I would like to express my gratitude to my supervisor, Dr. Panagiotis Artikis, for his guidance, expertise, and support throughout this dissertation. His mentorship has been crucial to the completion of my work. Above all, I am deeply thankful to my family -my wife and son- for their patience and encouragement, which sustained me through every challenge of this journey."

Abstract

This dissertation examines the Strategic, Technical, and Economic Evaluation of the Next-Generation Airborne Warning and Control System (AWACS) for the Hellenic Air Force. Since one of the main objectives of the Air Force is to maintain national security and NATO interoperability, and given that the modern aerial threats are becoming increasingly complex, it is of great importance for the Air Force to evaluate the replacement or upgrade of its early warning capabilities. This research addresses and analyzes a critical defense challenge. It seeks to identify the optimum solution on how to choose an AWACS platform, which efficiently combines optimal performance, does not entail high acquisition and maintenance costs and, finally, presents a long-term strategic value.

The methodology used is secondary research. Data from defense industry publications, from governmental procurement reports and from academic literature will be used. Using comparative analysis, this dissertation compares existing and emerging AWACS platforms. This comparison will be based on important criteria such as surveillance capability, lifecycle cost, interoperability, technology maturity and strategic alignment.

It can be categorized as a strategic study, because the implications of different procurement paths (including international collaboration, leasing or indigenous development) will be evaluated, by conducting in-depth research, beyond technical specifications.

This dissertation can contribute to the national defense sector by producing a model of evaluation that can be applied to other high-tech military acquisitions. The importance of this study lies in the combination of national defense capabilities with strategic objectives. The result would be a Hellenic Air Force that remains adaptive and resilient in a continuously evolving security environment.

Keywords:

AWACS, Hellenic Air Force, Airborne Surveillance, Air Defense, Strategic Assessment, Technical Feasibility, Cost-Benefit Analysis, Defense Planning.

Στρατηγική, Τεχνική και Οικονομική Αξιολόγηση του Αεροφερόμενου Συστήματος Έγκαιρης Προειδοποίησης και Ελέγχου Επόμενης Γενιάς (AWACS) για την Ελληνική Πολεμική Αεροπορία.

Αναστάσιος Στουρνάρας

Επιβλέπων: Παναγιώτης Αρτίκης

Αθήνα, Ελλάδα, Μάιος 2026

Περίληψη

Αυτή η διπλωματική εργασία, αποτελεί ουσιαστικά μια έρευνα για τη Στρατηγική, Τεχνική και Οικονομική Αξιολόγηση του Αεροφερόμενου Συστήματος Έγκαιρης Προειδοποίησης και Ελέγχου (ΑΣΕΠΕ) Επόμενης Γενιάς, για την Πολεμική Αεροπορία. Δεδομένου ότι ένας από τους βασικούς στόχους της Πολεμικής Αεροπορίας είναι η διατήρηση της εθνικής ασφάλειας και της διαλειτουργικότητας με το NATO και λαμβάνοντας υπόψη ότι οι σύγχρονες εναέριες απειλές γίνονται όλο και πιο περίπλοκες, είναι ύψιστης σημασίας, για την Πολεμική Αεροπορία, να εξετάσει την αντικατάσταση ή την αναβάθμιση των δυνατοτήτων έγκαιρης προειδοποίησης της.

Η παρούσα έρευνα βασίζεται σε μεθοδολογία Δευτερογενούς Έρευνας (Secondary Research), αξιοποιώντας δεδομένα από δημοσιεύσεις της αμυντικής βιομηχανίας, κυβερνητικές αναφορές προμηθειών και την υπάρχουσα ακαδημαϊκή βιβλιογραφία. Με τη χρήση Συγκριτικής Ανάλυσης (Comparative Analysis), υφιστάμενες και ανερχόμενες πλατφόρμες ΑΣΕΠΕ αξιολογούνται με βάση βασικά κριτήρια, όπως η ικανότητα επιτήρησης, το συνολικό κόστος κύκλου ζωής, η διαλειτουργικότητα, η τεχνολογική ωριμότητα και η στρατηγική εναρμόνιση.

Η παρούσα Διπλωματική Εργασία κατατάσσεται ως Στρατηγική Μελέτη (Strategic Study), καθώς αξιολογεί τις επιπτώσεις διαφορετικών τρόπων προμήθειας, όπως η διεθνής συνεργασία, η μίσθωση ή η εγχώρια ανάπτυξη, προσεγγίζοντας το ζήτημα πέρα από τις αμιγώς τεχνικές προδιαγραφές.

Παράλληλα, η εργασία συμβάλλει στον Εθνικό Αμυντικό Τομέα μέσω της ανάπτυξης ενός μοντέλου αξιολόγησης, το οποίο μπορεί να εφαρμοστεί και σε άλλες στρατιωτικές προμήθειες υψηλής τεχνολογίας. Η σημασία της μελέτης έγκειται στον συνδυασμό των εθνικών αμυντικών ικανοτήτων με τους στρατηγικούς στόχους. Το τελικό αποτέλεσμα αποσκοπεί στη διαμόρφωση μιας Πολεμικής Αεροπορίας που παραμένει προσαρμοστική και ανθεκτική σε ένα διαρκώς εξελισσόμενο περιβάλλον ασφάλειας.

Λέξεις – Κλειδιά:

ΑΣΕΠΕ, Πολεμική Αεροπορία, Εναέρια Επιτήρηση, Αντιαεροπορική Άμυνα, Στρατηγική Αξιολόγηση, Τεχνική Βιωσιμότητα, Κόστος-Όφελος, Αμυντικός Σχεδιασμός.

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List of Abbreviations & Acronyms

A2/AD — Anti-Access/Area Denial
A/C — Aircraft
ACE — Allied Command Europe
AEGIS — Advanced Electronic Guided Intercept System (naval air-defense system)
AEW&C — Airborne Early Warning and Control
AESA — Active Electronically Scanned Array (radar)
AI — Artificial Intelligence
AIP — Aeronautical Information Publication
AIS — Automatic Identification System
ΑΣΕΠΕ (ASEPE) — Αεροφερόμενο Σύστημα Έγκαιρης Προειδοποίησης και Ελέγχου (Greek term for AEW&C)
ATS — Air Traffic Service
BVR — Beyond Visual Range
C2 — Command and Control
C4ISR – Command, Control, Communications, Computers, Intelligence, Surveillance and Reconnaissance
CAOC — Combined Air Operations Center
CINA — Combined Intelligence and Analysis (NATO-related term)
EDF — European Defense Fund
EEZ — Exclusive Economic Zone
ELINT — Electronic Intelligence
EO/IR — Electro-Optical/Infrared
ER — Extended Range
ESM — Electronic Support Measures
EU — European Union
EW — Electronic Warfare
FIR — Flight Information Region
FMF — Foreign Military Financing
FMN — Federated Mission Networking
FOB — Forward Operating Base
FOC — Full Operational Capability
FOL — Forward Operating Location
GAF — German Air Force
GaN — Gallium Nitride
GMTI — Ground Moving Target Indication
GPS — Global Positioning System
HAI — Hellenic Aerospace Industry
HALE — High-Altitude Long Endurance (UAV)
HAF — Hellenic Air Force
HCAA — Hellenic Civil Aviation Authority
HELO — Helicopter
HF — High Frequency (radio communications)
HNDGS — Hellenic National Defense General Staff
HTAF — Hellenic Tactical Air Force Command
IADS — Integrated Air Defense System
IAMD — Integrated Air and Missile Defense
ICAO — International Civil Aviation Organization

IFF — Identification Friend or Foe
IGW — Initial Gross Weight
IOC — Initial Operational Capability
IR — Infrared
ISR — Intelligence, Surveillance and Reconnaissance
ITAR — International Traffic in Arms Regulations
JAPCC — Joint Air Power Competence Center
MAWS — Missile Approach Warning Systems
MDO — Multi-Domain Operations
MEDEVAC — Medical Evacuation
MESA — Multi-role Electronically Scanned Array (radar used on E-7 Wedgetail)
MFA — Ministry of Foreign Affairs (Greece)
MISREP — Mission Report
MLU — Mid-Life Upgrade
MOB — Main Operating Base
MRO — Maintenance Repair and Overhaul
NAOC — National Air Operations Center
NAPMA — NATO Airborne Early Warning and Control Programme Management Agency
NATINAMDS — NATO Integrated Air and Missile Defense System
NATO — North Atlantic Treaty Organization
NGA — National Governmental Authority
NGAD — Next-Generation Air Dominance
NSIP — NATO Investment Program
NSO — NATO Standardization Office
ONSTA — On Station
PESCO — Permanent Structured Cooperation
RAAF — Royal Australian Air Force
RADAR — Radio Detection and Ranging
RCS — Radar Cross Section
R&D — Research & Development
RSIP — Radar System Improvement Program (for E-3 Sentry)
SA — Situational Awareness
SAR — Synthetic Aperture Radar *or* Search and Rescue
SATCOM — Satellite Communications
SIGINT — Signal Intelligence
STANAG — Standardization Agreement
TPAO — Turkish Petroleum Corporation (Türkiye Petrolleri Anonim Ortaklığı)
TTP — Tactics Techniques and Procedures
TuAF — Turkish Air Force
TURNAV — Turkish Naval Forces Command
UAS — Unmanned Aerial System
UAV — Unmanned Aerial Vehicle
UCAV — Unmanned Combat Aerial Vehicle
UHF — Ultra High Frequency (radio communications)
UN — United Nations
UNCLOS — United Nations Convention on the Law of the Sea
USAF — United States Air Force

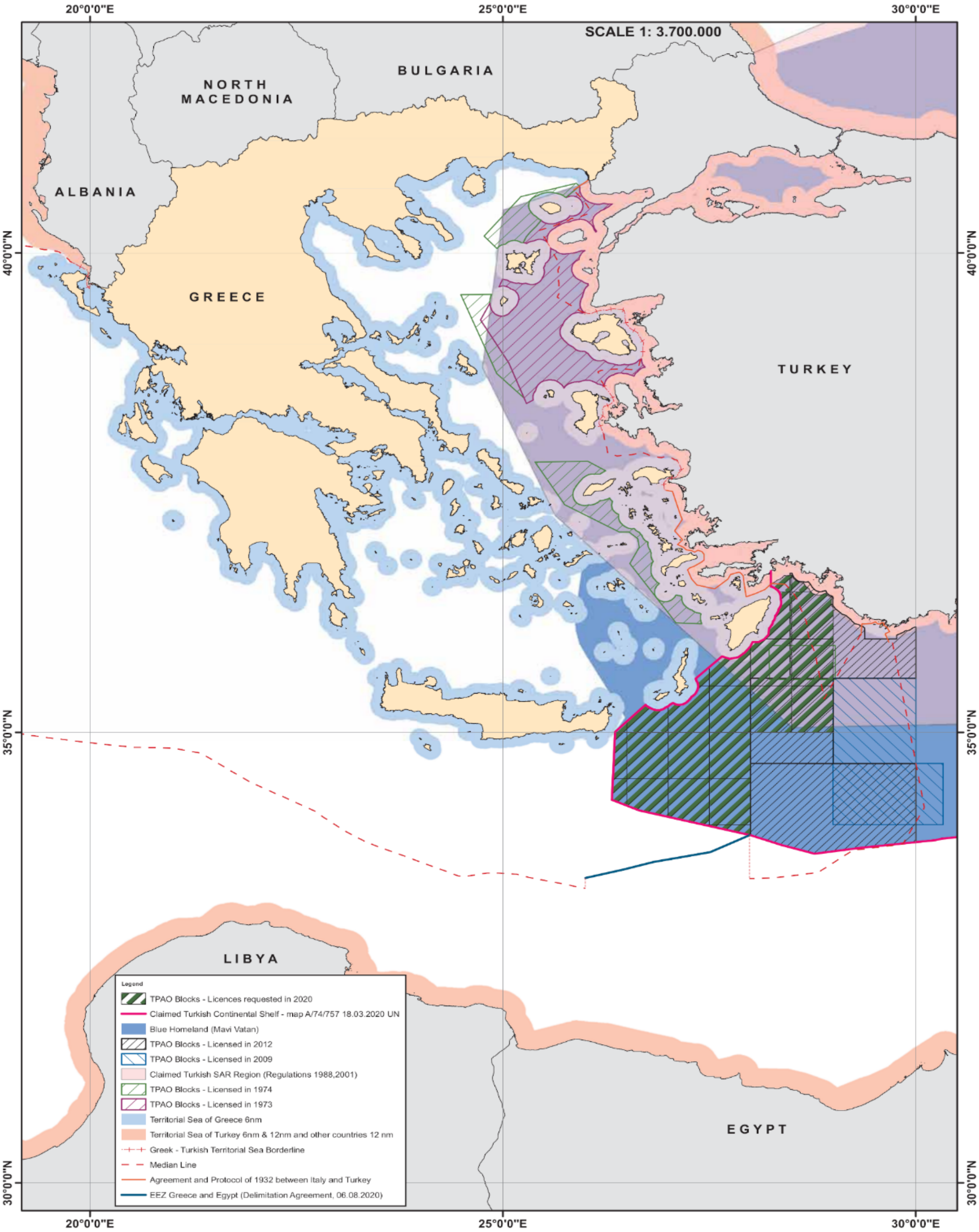
USML — United States Munitions List
VID — Visual Identification
VHF — Very High Frequency (radio communications)

1. Introduction

Modern air superiority is dependent on command/control capabilities and timely, accurate situational awareness (Department of the Air Force, 2023, p. 4). Taking the above into consideration, Airborne Warning and Control Systems (AWACS) are valuable assets in complex threat environments, supporting advanced air defense operations because they provide surveillance, battle management and finally communication support. Greece is located in the strategically sensitive Eastern Mediterranean **(see Figure 1.1)**. For national security and strategic deterrence, the ability to monitor and manage its airspace in real time is of high importance (Kamaras, 2025, p. 10).

The capabilities of airborne surveillance platforms are redefined by technological advancements. There are several next-generation AWACS platforms in the market today that are offering varying degrees of capability, integration potential and cost. Examples of the above options are: the Boeing E-7A Wedgetail, several upgraded E-3 Sentry variants and a number of modern concepts that are based on unmanned or semi-autonomous platforms (Nova Systems, 2020; Breaking Defense, 2024). These options present unique advantages and trade-offs, specifically when assessed against the specific defense posture of Greece, NATO interoperability requirements and fiscal constraints (Stamouli, 2025).

The goal of this dissertation is to inform a procurement strategy, tailored to the operational and economic realities of the Hellenic Air Force (HAF), by providing a structured, multi-dimensional evaluation of the above next-gen AWACS alternatives.



MAP 11 - 2020: Publication of TPAO's applications for hydrocarbon exploration license in the area of the Turkish-Libyan Memorandum

One month later (21.4.2020), TPAO's applications for hydrocarbon exploration and exploitation licenses, for the entire area claimed by Turkey under the illegal Turkish-Libyan Memorandum and as depicted in the above map, are published in the Turkish Government Gazette. Although no license appears to have been granted so far, a decision of the Turkish Council of Ministers granting license to TPAO may be issued and published at any time.

Figure 1.1: **Publication of TPAO requests for permits within the areas of the illegal Turkish-Libyan Memorandum.**

Source: Hellenic Ministry of Foreign Affairs, 2024. "Athens FIR and Airspace Boundaries Map." Available at: https://www.mfa.gr/archive/1/docs/maps/en/map11.pdf [Accessed 1 July 2025]

1.1 Fundamental Question

The following fundamental research question will be addressed:

"*What is the best option for Greece to prepare its air defense for the future? Should it upgrade the current Erieye EMB-145H fleet, buy new Saab GlobalEye or Boeing E-7A Wedgetail platforms, get upgraded E-3 systems or adopt a UAV system with early warning capabilities instead? This requires an assessment of which option best supports Hellenic Air Force operations, ensures interoperability with other systems and remains cost-effective.*"

This research question addresses a critical operational dilemma, that strategic decision-makers are facing today. This dilemma is how to achieve financial sustainability with the acquisition of an advanced AWACS system, while achieving compatibility with allied platforms and being able to respond efficiently to constantly emerging regional threats **(see Figure 1.2)** (Stamouli, 2025).

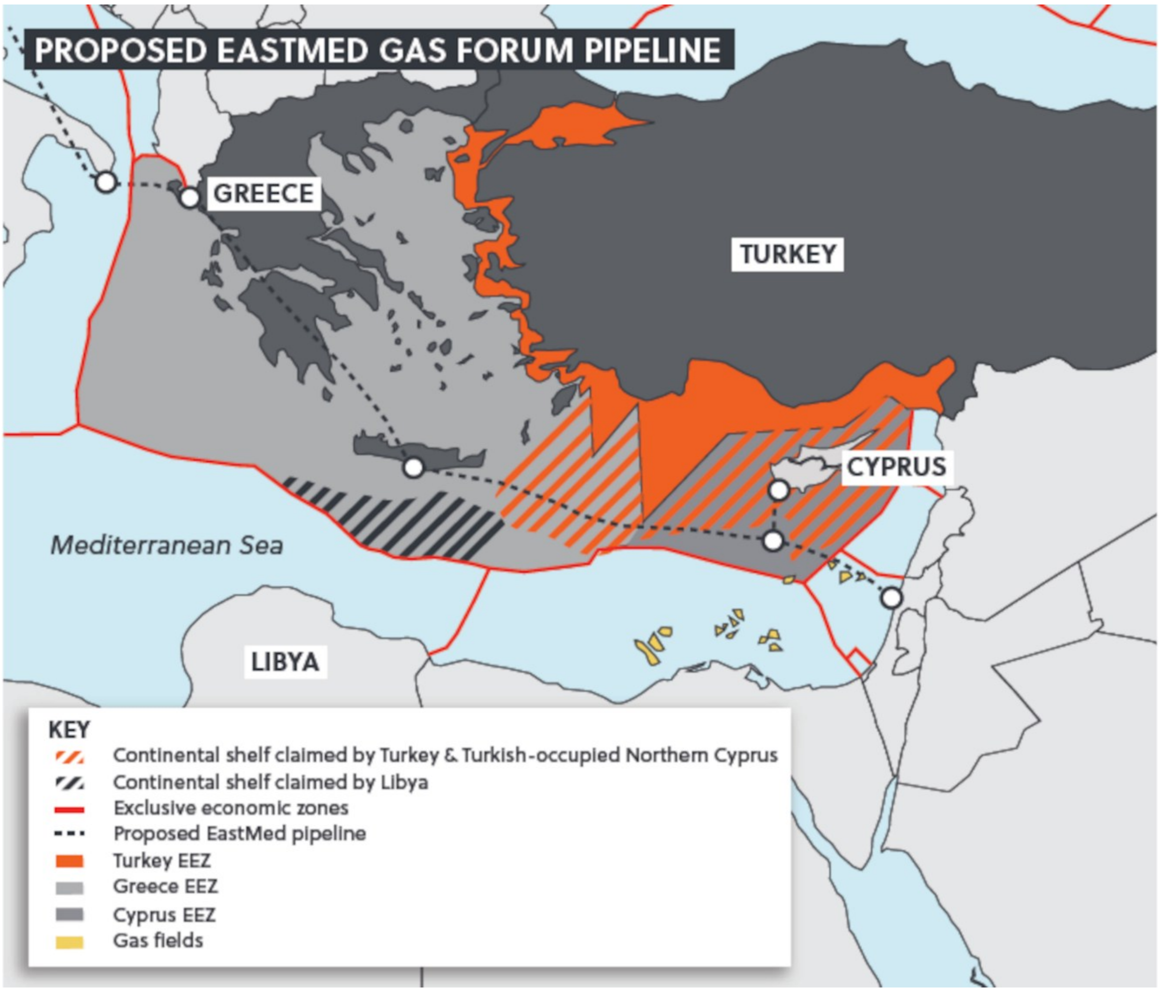


Figure 1.2: Geopolitical Threat Zones (Eastern Mediterranean).

Source: Global Security Insight, 2023. Adapted from "Dangerous Disputes in the Mediterranean: The Greece–Turkey Rivalry" (https://gsi.s-rminform.com/articles/dangerous-disputes-in-the-mediterranean-the-greece-turkey-rivalry) [Accessed 1 July 2025]

1.2 Objectives

The main objective of this dissertation is to recommend a well-supported AWACS procurement path for Greece. In order to achieve this objective, the following specific goals will be covered:

- Comparison of the capabilities, the level of technology and the logistical demands of the next-generation AWACS platforms.
- Assessment of the cost-effectiveness of each option. This assessment considers not only the acquisition costs but also the lifecycle support, the training, and, last but not least, possible integration expenses.
- Evaluation of how each solution fits strategically within Greece's defense doctrine, by taking into consideration NATO requirements.
- Development of a procurement strategy that efficiently aligns with Greece's long-term air defense objectives.

1.3 Methodology

In this thesis, a mixed-methods approach is applied by combining qualitative and quantitative analysis in order to evaluate the next-generation AWACS alternatives (Creswell & Plano Clark, 2018, pp. 3–4, 51–53). Key components of the followed methodology are the following:

- **Cost-Benefit Analysis**: By using available public and defense industry data, it will be performed a comparative review of procurement, operational and lifecycle costs associated with each platform.
- **Threat and Capability Assessment**: This dissertation evaluates Greece's air defense needs in the present and in the future. This is achieved by examining the geostrategic importance of Greece and by analyzing Hellenic Air Force's force structure. Athens FIR defines Greece's Airspace and Greece has the responsibility of monitoring and controlling it. The result of this is that Athens FIR has a crucial role in the national defense planning **(see Figure 1.3)**. As a result, an accurate mapping and surveillance of this region are crucial for identifying operational gaps and ensuring that Greece retains airspace sovereignty (Hellenic Ministry of Foreign Affairs, 2024).
- **Case Studies**: It will be analyzed strategies that were followed by allied countries, like the United States, the United Kingdom and Australia, regarding AWACS adoption and integration. In addition, their experience with the Boeing E-7A Wedgetail program will be examined (NOVA, 2020; Breaking Defense, 2023).
- **Strategic Fit Evaluation**: In the end, all options on how they can better fit in Greece's national defense strategy will be assessed. Furthermore, given Greece's role as an important NATO member, the analysis will evaluate whether each option can ensure interoperability with allied defense systems and integration into the allied command-and-control architecture.

Keeping also into consideration that are many emerging trends in unmanned aerial surveillance platforms and AI-assisted early warning systems, will be briefly assessed as future potential for non-traditional AWACS alternatives (Jordan, 2021).

The results of this mixed-methods approach will form the basis for a final recommendation aimed to guide decision-makers within the Hellenic Ministry of Defense and the Hellenic Air Force's procurement planning process.

Athens FIR boundaries are presented in **Figure 1.3**.

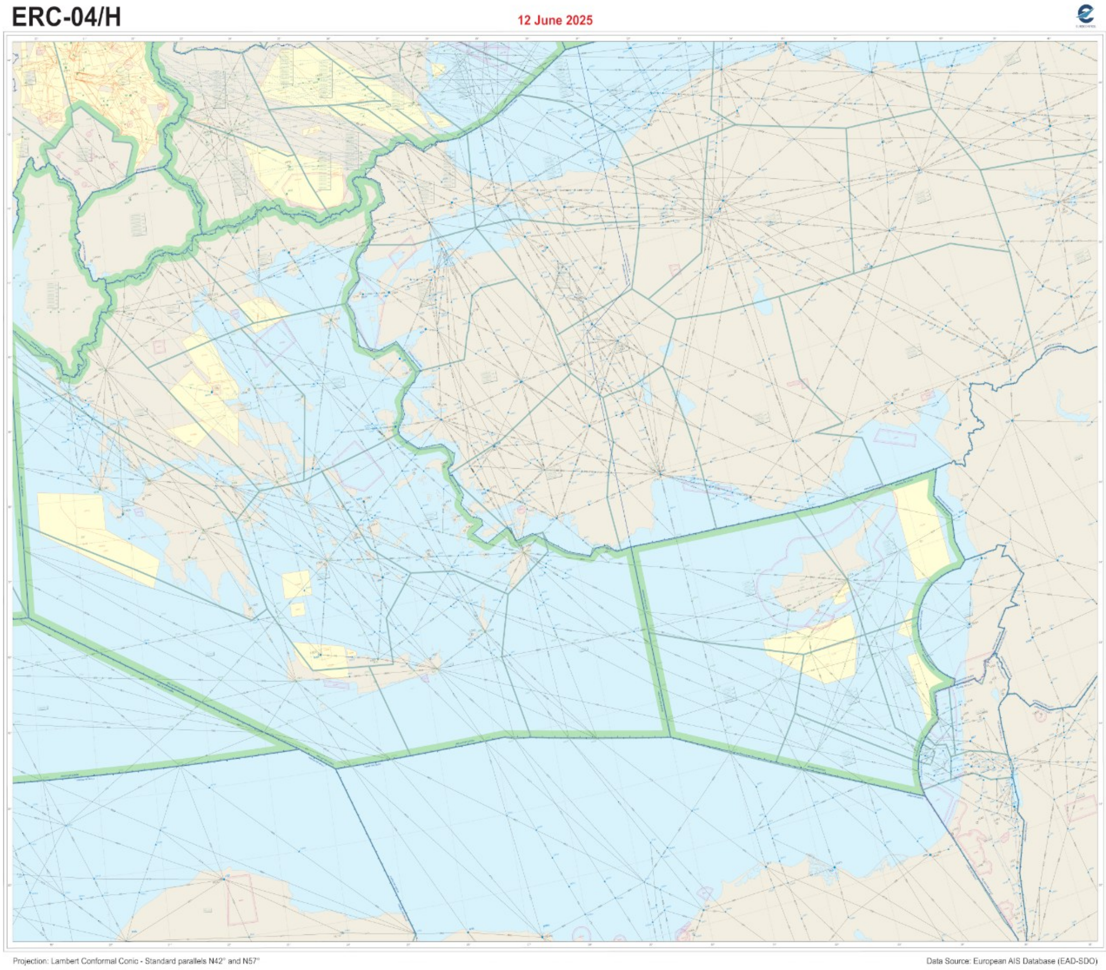


Figure 1.3: Map of Athens Flight Information Region (FIR).

Source: EUROCONTROL, 2025. "European Region Chart (ERC 04H) – 12 June 2025." Available at: https://www.eurocontrol.int/sites/default/files/2025-06/erc04h-12jun2025.pdf [Accessed 1 July 2025]

2. Short/Long-Term National Imperatives for Greece

Since the Hellenic Air Force supports Greece's air defense strategy, two very important factors must be considered. These two factors are: Strategic threat awareness and operational readiness. Chapter 2 analyzes current regional evolving threats. In addition, it presents statistically quantified airspace and territorial sea violations over the last years. In the end it examines if there are any possible structural or technological deficiencies in the Athens FIR. By completing the above, Chapter 2 will be a crucial opening part in the assessment of the need for the next-generation AWACS.

2.1 Explanation of important terms

In this dissertation the following Terms are going to be used very often: Violations of national airspace and Infringements of Air Traffic Regulations (ICAO), Athinai FIR, National Airspace and Territorial Sea. Therefore, they need to be explained.

According to Hellenic National Defense Staff:

- **Violations of national airspace and Infringements of Air Traffic Regulations (ICAO)**

"A violation of national airspace takes place when a foreign aircraft enters without permission (diplomatic clearance) into national airspace.

An infringement of air traffic regulations takes place whenever an aircraft disregards the internationally established flight rules within a Flight Information Region (FIR). Therefore, whenever an aircraft enters ATHINAI FIR without prior submission of a flight plan it infringes the air traffic regulations established by the competent Hellenic Air Traffic Services (ATS) authorities according to the relevant ICAO provisions and recommendations, as well as the international practice. The air traffic regulations aim at ensuring the safety of aviation within ATHINAI FIR.

Turkey, which for decades respected and complied with the air traffic regulations within ATHINAI FIR, ceased doing so since 1974 in the framework of an effort to promote a platform of political claims devoid of any legal basis against Greece, aiming at altering the status quo in the Aegean which has been firmly set out in the relevant international treaties and agreements and the rules of international law.

Hence, Turkey disregards the need for state aircraft to respect the ICAO rules and principles established for ensuring the safety of air navigation, which is the basic aim of ICAO, arguing that the 1944 Chicago Convention does not apply to state aircraft and deliberately ignoring the ICAO air traffic safety provisions and guidelines.

The co-ordination of air traffic, concerning both civil and military aircraft in international airspace, is absolutely necessary for the safety of air navigation and consists in the exchange of all the flight information within an FIR. In this respect the submission of a flight plan is the basic rule of ICAO and accomplishes the "due regard" that state aircraft are obliged to have for the safety of civilian air traffic according to article 3 (d) of the Chicago Convention."

- **Athinai FIR**

"In accordance with the Chicago Convention of 1944, ICAO has assigned to Greece the responsibility to provide Air Traffic Services within the Athinai FIR, the boundaries of which have been established by the relevant ICAO Regional Air Navigation Agreements of 1950, 1952 and 1958 and the ensuing ICAO Council Resolutions with the participation and the approval of Turkey.

Consequently the competent Greek Air Traffic Services authorities have been entrusted by ICAO the responsibility to ensure the safety of civil aviation within the Athinai FIR through the application of the established air traffic regulations.

Turkey's subsequent refusal to respect the obligation of its military aircraft entering the Athinai FIR to submit flight plans disregards the need for civil-military co-ordination with the responsible Greek air traffic services authority as set out in the framework of ICAO for ensuring the safety of air navigation."

- **National Airspace**

"Since 1931 (with the Presidential Decree of 6/18 September 1931) Greece has established a territorial sea of 10 nautical miles for the purposes of aviation and the control thereof.

Turkey raised no objection at the time and for decades on (up until 1975) officially recognized and fully respected Greece's national airspace in its entirety.

According to articles 1 & 2 of the 1944 Chicago Convention for International Civil Aviation and articles 2 & 3 of the 1982 International Convention on the Law of the Sea, the national airspace of a state is the airspace that extends over its land territory and its territorial waters. Therefore, Greek national airspace extends to 10 nautical miles as set out in the aforementioned Presidential Decree of 1931.

Since establishing the 10 nautical mile territorial sea for the purposes of aviation, Greece proceeded without delay to all the relevant necessary international notifications (publication on CINA maps, ICAO maps, Regional Air Navigation Plan of Europe, National Air Information Publication (AIP) etc).

It should be noted that, in the second edition of the air navigation ICAO maps, in 1955, new aeronautical maps, Greek as well Turkish ones, were incorporated, all depicting the outer limits of Greek air space of 10 nautical miles."

- **Territorial Sea**

"Greece established in 1936 (Law 230/1936) a territorial sea of six nautical miles without prejudice to other prevailing particular provisions, which provide for a territorial sea of greater or less extent than six nautical miles. This reservation was referring to the 1931 Decree establishing a territorial sea of 10 nautical miles for the purposes of aviation and the control thereof.

A general purpose territorial sea of 6 nautical miles is also provided for in Article 139 of Greece's Code for Public Maritime Law (promulgated in 1973).

Greece, according to article 3 of the U.N. Convention on the Law of the Sea (Montego Bay 1982), which also reflects international customary law, has the right to extend her territorial sea to 12 nautical miles.

At the time of ratification of the United Nations Convention on the Law of the Sea, Greece stated that the time and way to exercise the right to extend her territorial sea *shall be determined according to Greek national strategy, without this implying that Greece renounces these rights in any way.*

Furthermore, Article 2 of the Greek Law 2321/1995 ratifying the U.N. Convention of the Law of the Sea stipulates that "Greece retains the inalienable right according to article 3 of the ratified Convention to extend at any time her territorial sea up to 12 nautical miles".

Turkey, since 1995 with a unanimous resolution of the Turkish National Assembly (8/6/1995), threatens with war in case Greece extends her territorial sea (casus belli).

It should be noted that the right to extend the territorial sea to 12 nautical miles has already been exercised by the vast majority of the world's coastal states, including Turkey which has extended her territorial sea to 12 nautical miles in the Black Sea and in the South-Eastern Mediterranean.

Between two neighbouring states the issue of maritime boundaries arises wherever the distance between their opposite or adjacent coasts is less than the sum of the extent of both states' territorial waters.

In this respect, the maritime boundaries between Greece & Turkey have been established according to the provisions of international law, both conventional and customary. More particularly:

– In the Dodecanese islands the maritime boundary with Turkey has been set out in the relevant Agreement between Italy and Turkey concluded on January 4, 1932 and the ensuing Procès-Verbal signed between representatives of Italy and Turkey on December 28, 1932. Greece was the successor state in this agreement and the ensuing Procès-Verbal, on the basis of Article 14(1) of the 1947 Paris Peace Treaty (10th February), which ceded sovereignty of the Dodecanese islands from Italy to Greece.

– In Thrace the maritime boundary (3 nm from the Evros river estuaries) has been established by the 1923 Lausanne Peace Treaty and the 1926 Athens Protocol.

– For the Eastern Aegean islands (besides the Dodecanese) the rule of the median line/equidistance applies wherever the distance between Greek and Turkish opposite coasts is no greater than 12 nautical miles (which is the sum of the extent of both countries' territorial waters)."

Source: Hellenic National Defense Staff, 2025. "Explanations of Terms" Available at:

https://geetha.mil.gr/en/explanations-of-terms/ [Accessed 7 July 2025]

2.2 Current and possible future threat

- **Persistent Airspace Incursions (2021–2025)**

According to Hellenic National Defense Staff:

- in 2021 there were 1137 Infringements of Air Traffic Regulations (ICAO), 2744 National Airspace Violations, involving 126 Armed Violating Formations and causing 145 Engagements with HAF interception fighters **(see Figure 2.1)**.

- in 2022 there were 2286 Infringements of Air Traffic Regulations (ICAO), 11258 National Airspace Violations, involving 282 Armed Violating Formations and causing 333 Engagements with HAF interception fighters **(see Figure 2.2).**
- in 2023 there were 334 Infringements of Air Traffic Regulations (ICAO), 1172 National Airspace Violations, involving 74 Armed Violating Formations and causing 87 Engagements with HAF interception fighters **(see Figure 2.3).**
- in 2024 there were only 301 Infringements of Air Traffic Regulations (ICAO) **(see Figure 2.4).**
- Preliminary data for Jan–Jun 2025 indicates 337 Infringements of Air Traffic Regulations (ICAO) and 129 National Airspace Violations **(see Figure 2.5).**

2021 Aggregate Incidents' Data

2021	Infringements of Air Traffic Regulations (ICAO)	National Airspace Violations	Armed Violating Formations	Engagements With HAF interception figthers	Overflitghs of National Territory	Total Violating Aircraft
JANUARY	66	128	7	7	6	73
FEBRUARY	46	227	5	8	3	57
MARCH	96	126	11	13	4	111
APRIL	64	137	7	7	2	78
MAY	155	418	13	10	2	153
JUNE	55	243	7	5	-	75
JULY	68	160	8	10	-	84
AUGUST	56	184	5	7	2	68
SEPTEMBER	153	377	23	32	-	181
OCTOBER	103	283	12	15	11	122
NOVEMBER	150	173	8	11	13	138
DECEMBER	125	288	20	20	5	174
TOTAL	**1137**	**2744**	**126**	**145**	**48**	**1314**

Figure 2.1: 2021 Violations of National Airspace – Infringements of Air Traffic Regulations ICAO

2022 Aggregate Incidents' Data

2022	Infringements of Air Traffic Regulations (ICAO)	National Airspace Violations	Armed Violating Formations	Engagements With HAF interception figthers	Overflitghs of National Territory	Total Violating Aircraft
JANUARY	110	380	14	17	18	157
FEBRUARY	138	446	21	22	12	170
MARCH	126	512	10	15	5	165
APRIL	248	1041	25	27	85	242
MAY	199	817	12	13	7	244
JUNE	159	760	11	17	9	209
JULY	158	778	21	25	2	198
AUGUST	199	1126	30	35	18	250
SEPTEMBER	241	1802	15	16	28	259
OCTOBER	263	1220	32	36	16	294
NOVEMBER	206	1223	37	42	16	265
DECEMBER	239	1153	54	68	18	305
TOTAL	**2286**	**11258**	**282**	**333**	**234**	**2758**

Figure 2.2: 2022 Violations of National Airspace – Infringements of Air Traffic Regulations ICAO

2023 Aggregate Incidents' Data

2023	Infringements of Air Traffic Regulations (ICAO)	National Airspace Violations	Armed Violating Formations	Engagements With HAF interception figthers	Overflitghs of National Territory	Total Violating Aircraft
JANUARY	238	978	65	73	21	321
FEBRUARY	46	163	9	14	0	58
MARCH	3	23	0	0	0	3
APRIL	0	0	0	0	0	0
MAY	3	0	0	0	0	2
JUNE	6	0	0	0	0	6
JULY	1	0	0	0	0	2
AUGUST	3	0	0	0	0	5
SEPTEMBER	8	6	-	-	-	8
OCTOBER	4	2	-	-	-	4
NOVEMBER	20	0	0	0	0	21
DECEMBER	2	0	0	0	0	2
TOTAL	**334**	**1172**	**74**	**87**	**21**	**432**

Figure 2.3: 2023 Violations of National Airspace – Infringements of Air Traffic Regulations ICAO

2024 Aggregate Incidents' Data

2024	Infringements of Air Traffic Regulations (ICAO)	National Airspace Violations	Armed Violating Formations	Engagements With HAF interception figthers	Overflitghs of National Territory	Total Violating Aircraft
JANUARY	9	-	-	-	-	5
FEBRUARY	2	-	-	-	-	2
MARCH	3	-	-	-	-	1
APRIL	2	-	-	-	-	2
MAY	27	-	-	-	-	33
JUNE	5	-	-	-	-	2
JULY	11	-	-	-	-	10
AUGUST	29	-	-	-	-	19
SEPTEMBER	39	-	-	-	-	24
OCTOBER	59	-	-	-	-	26
NOVEMBER	91	-	-	-	-	64
DECEMBER	24	-	-	-	-	13
TOTAL	**301**	-	-	-	-	**201**

Figure 2.4: 2024 Violations of National Airspace – Infringements of Air Traffic Regulations ICAO

2025 Aggregate Incidents' Data

2025	Infringements of Air Traffic Regulations (ICAO)	National Airspace Violations	Armed Violating Formations	Engagements With HAF interception figthers	Overflitghs of National Territory	Total Violating Aircraft
JANUARY	73	15				45
FEBRUARY	27	19	-	-	-	15
MARCH	40	25	-	-	-	18
APRIL	41	13	-	-	-	18
MAY	70	31	-	-	-	33
JUNE	86	26	-	-	-	33
TOTAL	**337**	**129**				**162**

Figure 2.5: 2025 Violations of National Airspace – Infringements of Air Traffic Regulations ICAO

Remarks:

- Violating aircraft(s) are identified and intercepted, according to the relevant international rules and procedures.

- Each time violations and infringements are committed, the relevant detailed reports are officially forwarded to the Hellenic Ministry of Foreign Affairs.

Source: Hellenic National Defense Staff, 2025. "Violations of National Airspace – Infringements of Air Traffic Regulations ICAO" Available at: https://geetha.mil.gr/en/violations/violations-of-national-airspace-infringements-of-air-traffic-regulations-icao/ [Accessed 5 July 2025]

The above figures expose a sustained and operational threat to Greek airspace, reaching unprecedented levels in recent years.

- **Violation of Territorial Waters**

Taking into consideration that all modern AWACS platforms have surface-monitoring capabilities and are able to distribute the surface picture to all the major players in the area of interest, it is important to also assess the violations of the Territorial Waters that were committed by Turkish Navy and Turkish Coast Guard vessels.

According to Hellenic National Defense Staff:

- in 2024 there were 2499 Violations of Territorial Waters **(see Figure 2.6).**
- Preliminary data for Jan–May 2025 indicates 1059 Violations of Territorial Waters **(see Figure 2.7).**

2024	VIOLATIONS OF TERRITORIAL WATERS
JANUARY	180
FEBRUARY	123
MARCH	174
APRIL	126
MAY	238
JUNE	49
JULY	365
AUGUST	404
SEPTEMBER	259
OCTOBER	278
NOVEMBER	139
DECEMBER	164
TOTAL	**2499**

Figure 2.6: 2024 Violations of Territorial Waters

2025	VIOLATIONS OF TERRITORIAL WATERS
JANUARY	317
FEBRUARY	155
MARCH	123
APRIL	190
MAY	274
JUNE	
JULY	
AUGUST	
SEPTEMBER	
OCTOBER	
NOVEMBER	
DECEMBER	
TOTAL	**1059**

Figure 2.7: 2025 Violations of Territorial Waters

Remarks:

- Every time violations of Greek territorial waters are committed, the relevant detailed reports are officially forwarded to the Hellenic Ministry of Foreign Affairs.
- All of the above violations of the Territorial Waters were committed by Turkish Navy and Turkish Coast Guard vessels**.**

Source: Hellenic National Defense Staff, 2025. "Violations of Territorial Waters" Available at: https://geetha.mil.gr/en/violations-of-territorial-waters-of-year-2025/ [Accessed 6 July 2025]

- **Longitudinal Increase in Violations**

The number of violations during the first semester of 2025 is 337, compared with 334 in all of 2023 and 301 in all of 2024.That means that a rise in the number of violations for the following years is expected. This estimated escalation will surely lead to a profound shift in the regional strategic behavior.

2.2.1 Regional Military Modernization

In addition to the above-mentioned constant pattern of airspace violations of the Greek FIR, Turkey is persistently trying to upgrade its strategic and operational capabilities in the air and maritime domain by following an agenda of modernization of its armed forces (International Institute for Strategic Studies, 2024, pp. 365–372). The latter developments have severe and direct implications for Greek air defense planning and make the acquisition of a robust airborne early warning and control (AEW&C) solution imperative.

Back in 2019 Turkey acquired from Russia the S-400 Triumf surface-to-air missile system **(see Figure 2.8).** This is a very sophisticated system with a range of up to 400 km, multi-target engagement capability and ability to detect and deter 4^{th} generation fighter jets and even flying platforms with stealth capabilities (Reuters, 2019; The Guardian, 2019). In the present, the S-400 system stays dormant in storage due to a political decision after pressure from NATO and the United States. But if this advanced system becomes fully operational, it will become a major threat that will definitely challenge the effectiveness and the limits of conventional Hellenic Air Force (HAF) operations within the Greek FIR, specifically in periods of tension, crisis or war.

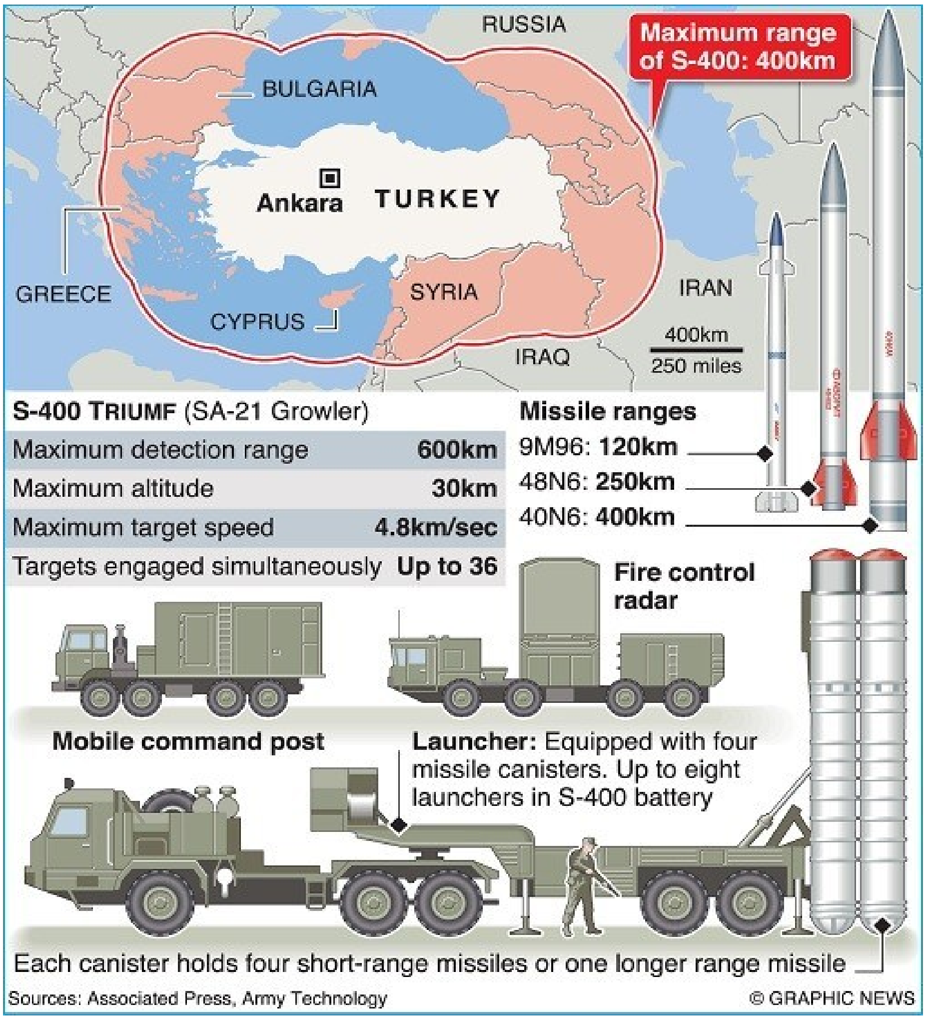


Figure 2.8: Turkey's S-400 Missile Defense System Coverage/Capabilities.

Source: Finance twitter, 2025. "Balance Of Power – After S-400 Missile Defense System, Russia Offers To Sell Su-35 Fighter Jets To Turkey" Available at: https://www.financetwitter.com/2019/07/balance-of-power-after-s-400-missile-defense-system-russia-offers-to-sell-su-35-fighter-jets-to-turkey.html **[Accessed 8 July 2025]**

In addition to the above, Turkey has initiated the modernization of its F-16 fleet under the "Özgür" program. Examples of this program's upgrades are the active electronically scanned array (AESA) radars, the advanced electronic warfare suites and indigenously produced avionics packages that enhance situational awareness, BVR (Beyond Visual Range) strike capability and mission flexibility (The Aviationist, 2024). The result of the above-mentioned programs is that the conventional Turkish F-16 fleet is being upgraded into a fleet that consists of fourth generation multirole fighters with stealth capabilities and high survivability and lethality.

Furthermore, one very important development, is that Turkey has invested heavily in research and production of unmanned aerial systems (UAS), such as the Bayraktar Akinci HALE (High-Altitude Long-Endurance) UAV and the Bayraktar Kızılelma. Both of the above-mentioned UAVs are jet-powered, low-observable combat drones with future carrier capabilities. These platforms are operating at low altitudes and in radar blind zones. This ability makes them capable of supporting ISR sorties, electronic warfare and precision strike missions by remaining hidden from the rival air defense. Those capabilities make them particularly difficult to detect with existing ground-based radar systems (Baykar, 2025).

One of the longer term goals of Turkey, is the development of its indigenous fifth-generation fighter, also known as the TF-X (KAAN) program **(see Figure 2.9).** This aircraft is expected to have stealth capabilities, internal weapon bays and high-speed datalink integration. If Turkey's efforts to make this fighter operational are successful, then, Greece's current radar architecture detection capability, will be heavily challenged. (Defense Security Asia, 2025).

Figure 2.9: Turkey's Fifth-Generation Fighter Jet: The KAAN.

Source: Anadolu Agency, 2025. "Turkey's Fifth-Generation Fighter Jet: The KAAN" Available at: https://x.com/anadoluagency/status/1685017705630347264?lang=cs **[Accessed 8 July 2025]**

Regarding the Turkish NAVY, Turkey is upgrading and expanding its naval air defense capabilities through the MILGEM project and the future TF-2000 destroyers. These ships are expected to have phased-array radars and area air defense systems, capable of extending detection ranges over the Eastern Mediterranean (Naval News, 2025).

These developments indicate a potential shift in regional military dynamics in the near future. Also, the capabilities that Turkey may have in the future cannot be effectively countered using ground-based radar systems alone. A high-altitude operating AWACS platform, will surely be a highly valuable asset for Hellenic Air Force. It can provide a critical over-the-horizon situational awareness with real-time coordination of air operations plus the ability to track stealth, low-flying threats within limited RADAR coverage zones in the Greek FIR.

2.2.2 Hybrid Warfare and Emergency Response

Lessons learned from modern warzones and theaters of operations, like Eastern Ukraine, Syria or Iran, show that Greece, in addition to conventional threats, must also prepare for a diverse and evolving spectrum of hybrid warfare scenarios. Cyber-attacks on critical infrastructure, GPS spoofing and coordinated disinformation campaigns are some examples of those hybrid non-conventional threats. The aim of the above tactics, that are usually below the threshold of armed conflict, is to test national resilience and exploit political or operational vulnerabilities (Galeotti, 2023, pp. 33–58).

The Evros migration crisis of 2020 and the maritime confrontations in the Eastern Mediterranean are real examples of the above-mentioned hybrid threats (Reuters, 2025). In those real scenarios, Turkey applied a combined strategy that went beyond traditional military engagement rules. It achieved that by employing a coordinated mixture of naval posturing, drone reconnaissance, diplomatic messaging and digital disinformation.

Globally, air defense systems, radar networks and national emergency response mechanisms are targeted daily by cybersecurity threats. NATO has made clear to all members that they should take action against cyberattacks on C2 systems. Those attacks can create degradation to response times, bring disruption to surveillance infrastructure with a final result the failure of air operations (NATO, 2022). Therefore, the use of a next-generation AEW&C platform, that operates independently of ground-based networks and is secured against EW and cyber threats, would be the best solution for supporting ISR operations.

Beyond wartime conflicts or crisis periods, the Hellenic Air Force is facing, almost daily, climate-related emergencies like wildfires, floods, search and rescue (SAR) and medical evacuation (MEDEVAC) operations (European Union Civil Protection, 2024; Gerosideris, 2017). Since Greece has experienced a surge of those kinds of emergencies in recent years, it can reasonably be argued that an AWACS platform with multi-mission capability could provide valuable support in:

- Coordinating air, ground and maritime units.
- Monitoring and coordinating civilian air traffic over crucial areas/zones.
- Providing real-time data, like air or surface picture, in crisis areas.

A possible integration of a next-gen AWACS system can offer robust command and control (C2), and situational awareness in wartime, but also in peacetime by supporting operations that involve civil protection, border control and maritime domain awareness.

Strategic Implications: Overall, these trends highlight the need for a persistent, high-altitude surveillance, rapid airborne response and integrated C2 capabilities next-generation AWACS platform.

2.3 Gaps in Greek FIR

All RADAR systems that are based on the ground, always operate under the same physical principles. They emit radio waves and they use the reflected signals to detect and track airborne and, in most cases, surface targets. There are some restrictions though. Effective range and altitude at which RADAR functions is not only a matter of power output and hardware used, it is also heavily affected by the geography of the area that this system covers (Skolnik, 2001, pp. 28-35, 511-525). Three of the most crucial factors for the performance and coverage of a RADAR site are: the terrain, the elevation that the site is positioned and the distance from the operationally relevant area. The above factors can significantly hinder or optimize the site's line-of-sight and coverage.
Since this dissertation does not include classified or restricted information, the Langley Hill Coastal Radar, located on the central Washington Coast in the United States, is used as an illustrative open-source example **(see Figure 2.10).** This civil RADAR system is the ideal example of how terrain features (i.e. mountains, hills, rock formations and coastline curvature) can block or inhibit radar coverage. This distortion is larger at lower altitudes (University of Washington, 2011).
As shown in Figure 2.10, the RADAR might have a theoretical range of over 250 km, but large portions of inland and low altitude areas are obscured by terrain masking. The existence of so many blind spots proves that even advanced RADAR that are based on the ground cannot reliably detect air or surface targets below a certain altitude behind elevated terrain features.

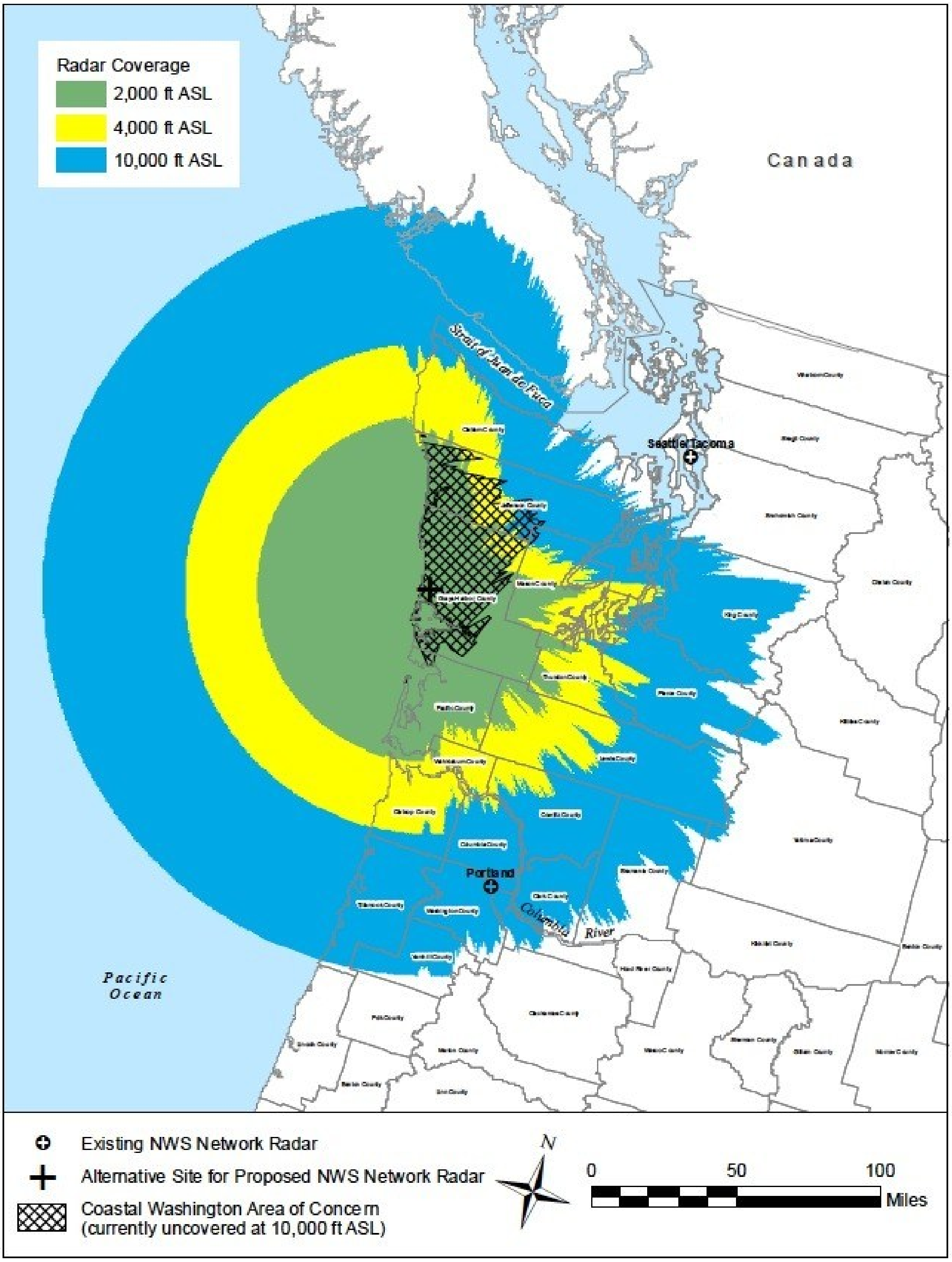


FIGURE 7 ESTIMATED RADAR COVERAGE AT 2,000, 4,000, AND 10,000 ft ABOVE SITE LEVEL FROM LANGLEY HILL SITE (30 m TOWER)

Figure 2.10: Estimated RADAR coverage at 2000, 4000 and 10000ft above site level from Langley Hill site (30m tower).

Source: University of Washington, COLLEGE OF THE ENVIRONMENT, DEPARTMENT OF ATMOSPHERIC AND CLIMATE SCIENCE. Available at: https://www.atmos.washington.edu/~cliff/Langleyradar.html **[Accessed 7 July 2025]**

2.3.1 Terrain Complexity of the Aegean and Athens FIR

The Athens FIR presents a far more complex operational environment than coastal Washington. In the Aegean archipelago are more than 200 inhabited and uninhabited islands with rugged coastlines that vary significantly in elevation. The same also applies to the mainland.

This type of geography produces numerous RADAR blind areas. In these areas radar coverage is limited, especially at low altitudes (i.e. below 3,000 feet). Examples of those gaps are the following:

- **Eastern Aegean:** where aircraft or UAVs, by flying low, can exploit RADAR blind areas from island chains.
- **Central Aegean:** where blind zone corridors may be created between overlapping radar footprints. Usually maritime and airborne activity is high on a daily basis in this area.
- **South Crete and the Libyan Sea:** where terrain and distance reduce the effective coverage of ground sites.

Even a unified radar picture that is produced from the integration of military (HAF) and civil aviation (HCAA) RADAR systems, suffers from the basic limitation that comes from the RADAR principle. These systems cannot see "through" mountains or beyond the horizon (Stimson, 1998, pp. 45-52, 78-85).

2.3.2 Implications for Airspace Security

These structural gaps have significant operational and strategic consequences:

- **Airspace violations**: Aircraft flying on a low altitude or UAVs may enter Greek FIR undetected until they are dangerously close to sensitive strategic areas.
- **Interception delays**: Without early warning, fighter aircraft are kept in a constant state of readiness, 7 days a week, 24 hours a day and are scrambled immediately in order to perform VID on the unknown targets. This situation dramatically increases the cost for each flight and reduces the number of tactical options that HAF has in the arsenal.
- **Dependence on NATO assets**: Since Greece is an important NATO member, it can often rely on the NATO E-3 AWACS fleet, which, while capable, may not be available or tasked specifically with Greek needs (JAPCC, 2024).

2.3.3 AWACS as a Solution to FIR Gaps

The analytical data indicates that the capabilities of a Next-Generation AWACS platform will directly address the above-mentioned deficiencies. This category of platforms operates at high altitudes (25,000–35,000 ft.) giving them the ability to provide wide surveillance area across complex terrain, to maintain line of sight with targets over islands, coastlines and maritime areas/zones that ground-based sensors may not be able to cover (Boeing, 2023).

To sum up, a next-gen AWACS platform can offer:

- Simultaneous tracking of multiple airborne and surface tracks
- Real-time data integration and tactical C2 (command and control)
- Participation as coordinator or participant in NATO Link 16 networks and Greek Integrated Air Defense Systems
- Elimination low-altitude radar gaps
- Reduction of the reaction time for scramble aircraft on readiness
- Enhanced situational awareness (SA) over the entire Athens FIR.

2.4 Strategic Assessment

Repetitive violations and hybrid operations place increasing pressure to Greece's eastern airspace. Possible structural vulnerabilities in coverage, delays in response time and C2 integration issues present persistent operational risks. A shift from HAF toward an airborne, network-centric AWACS system becomes a strategic imperative. Geography and more specifically, terrain have always been a decisive factor in air defense planning and RADAR coverage. As demonstrated in the Langley Hill Radar example, RADARs, even if positioned in ideal sites always face geographic limits (University of Washington, 2011). The distinct geography of the Greek FIR, with a large number of islands and complex elevation profile, requires a more adaptive and airborne solution. Consequently, the integration of a next-generation AWACS system should not be considered merely as an option, but a strategic necessity for ensuring sovereignty, safety and operational/tactical superiority in the region.

3. Analysis of Current HAF AWACS Capabilities and Upgrade/Replacement Options

Part of Hellenic Air Force (HAF) fleet are the four EMB-145H AEW&C **(see Figure 3.1)** aircraft that are equipped with the Saab Erieye Airborne Early Warning and Control RADAR. The EMB-145H AEW&C constitutes Greece's only dedicated airborne early warning capability and plays a critical role in airspace surveillance, maritime monitoring and command and control (C2) within the Athens FIR and the broader Eastern Mediterranean operational area. This platform is currently an effective AEW&C solution, specifically suited for surveillance in medium-range missions and in geographically complex environments like the Aegean Sea (Hellenic Air Force, 2025).

Figure 3.1: A Hellenic Air Force EMB-145H AEW&C ERIEYE.

Source: WIKIMEDIA COMMONS. Available at:https://commons.wikimedia.org/wiki/File:Embraer_E145H_Erieye_729_%289504124658%29.jpg [Accessed 11 August 2025]

3.1 Presentation of the Current HAF AWACS – Erieye EMB-145H AEW&C

HAF's Erieye capability is the result of a 1999 procurement program, which was designed to enhance situational awareness and secure NATO interoperability in the Eastern Mediterranean security environment. The alleged contract was signed between the Hellenic Ministry of National Defense, Saab AB, and Embraer (Saab AB, 2022). It covered the delivery of four EMB-145H aircraft with integrated Erieye radar systems, in conjunction with associated mission equipment, training and ground support infrastructure. The deliveries began in 2003 and were finally completed in 2004. Initial operational capability was declared early in 2005 (Hellenic Air Force, 2025).

3.1.1 Platform Background and Acquisition History

EMB-145H AEW&C platform is a military variant of the Embraer ERJ-145 regional jet. It was chosen for its fuel efficiency, operational flexibility and compatibility with HAF's operational needs. The Saab Erieye radar is a fixed active electronically scanned array (AESA) and it is mounted on a dorsal "plank" antenna structure which provides wide-area coverage with reduced aerodynamic drag. This design provides 300-degree surveillance coverage with a significantly reduced aerodynamic penalty compared to traditional rotodomes (Stimson, 1998, pp. 155-160).

After becoming operational, the EMB-145H AEW&C has been a central enabler for HAF's air defense network. It is currently feeding data into NATO's Integrated Air and Missile Defense System (NATINAMDS) and supporting national air policing missions (NATO, 2025). Examples of its operational deployments are:

- Surveillance during large-scale NATO exercises
- Regional crisis monitoring
- Airspace integrity missions in response to repeated airspace violations.

3.1.2 Technical Specifications (Airframe, Radar, Sensors, Comms)

<u>Airframe:</u>

- **Base Model**: Embraer EMB-145 (ERJ-145) modified for AEW&C operations.
- **Length**: 29.87 m
- **Wingspan**: 20.04 m
- **Maximum Takeoff Weight (MTOW)**: ~24,000 kg
- **Engines**: 2 × Rolls-Royce AE 3007A turbofan engines (31.3 kN thrust each)
- **Cruise Speed**: Mach 0.78 (~850 km/h)
- **Service Ceiling**: 37,000 ft (11,278 m)
- **Endurance**: ~9 hours (depending on payload and mission profile)

The EMB-145H airframe, compared to larger AWACS aircraft like the E-3A Sentry or the E-7 Wedgetail, offers a low operating cost, while enabling frequent patrols and deployment from shorter runways, including regional and island airbases (Saab AB, 2022).

<u>Radar and Sensors:</u>

The core sensor is the Saab Erieye AEW&C radar system, a fixed, dorsal-mounted Active Electronically Scanned Array (AESA) with dual-sided antennas (Stimson, 1998, pp. 155-160). Its performance profile includes:

- **Radar**: Saab Erieye AEW&C radar system
- **Type**: AESA with fixed dual-sided antenna
- **Coverage**: 150° per side (300° total), with tactical maneuvering or overlapping coverage from a second aircraft providing full 360° surveillance
- **Detection Range**: Up to 450 km for high-altitude targets with reduced range for low-altitude or maritime targets due to radar horizon limits
- **Target Types**: Fighter aircraft, helicopters, UAVs, maritime vessels and low-speed airborne targets
- **Track Capacity**: 300+ simultaneous targets
- **Maritime Capability**: Surface vessel detection up to ~320 km

<u>Additional Sensors</u>:

- Identification Friend or Foe (IFF) interrogator (Mode 4/5 NATO compatible)
- Weather radar for meteorological situational awareness
- Electronic Support Measures (ESM) for detecting and classifying radar emissions (Saab AB, 2022)

<u>Communications & Data Links</u>

- Secure V/UHF and HF communications for voice coordination
- SATCOM for beyond-line-of-sight C2
- NATO-standard Link 11 and Link 16 integration for tactical data exchange
- Direct interoperability with HAF fighter fleets (F-16 Block 52+, F-16 Viper, Mirage 2000-5, Rafale F3R) and Hellenic Navy air defense vessels equipped with Link 16-capable combat systems (NATO, 2023; Hellenic Air Force, 2025).

3.1.3 Operational Role in the HAF (Missions, Deployment, NATO Ops)

The EMB-145H Erieye operates in three crucial roles in the HAF and NATO framework:

1. **Airspace Surveillance and Air Policing**
    - It is monitoring continually the Greek FIR, by focusing on critical zones in the northern and southeastern Aegean.
    - It is tracking and identifying aircraft and UAVs that are violating Greek airspace and Greek FIR regulations, particularly in areas near the Turkish coastline.
    - It is providing early warning to the Hellenic Tactical Air Force Command (HTAF) for rapid scramble of aircraft in readiness.
2. **Maritime Surveillance**
    - It is monitoring sea lanes in the Aegean Sea, Ionian Sea, Eastern and Southern Mediterranean, focusing on the detection of surface vessels and possible illegal activities.
    - It is coordinating with the Hellenic Navy during maritime security operations, operational exercises and NATO’s Standing Maritime Groups.
3. **NATO and Coalition Operations**
    - It is a part of NATO forces during exercises such as INIOCHOS and NATO Tiger Meet.

- It is deployed in multinational maritime security missions that are part of the Operation Sea Guardian.
- It can provide data fusion with NATO AWACS and allied AEW&C platforms for the production of shared air picture.

Deployment & Basing
The main operating base is the 112 Combat Wing in the Elefsis Air Base and can be effectively deployed to Skyros and Souda Air Bases for forward operations. This deployment capability is one of the main feats of the EMB-145H Erieye and it is essential for covering the entire Greek FIR (Hellenic Air Force, 2025).

3.1.4 Current Performance and Identified Limitations

The EMB-145H Erieye has served Greece effectively for nearly two decades, but assessing operational experience and constantly evolving threat environments have revealed several performance limitations (Hellenic Air Force, 2025).:

1. Endurance and Coverage

The Erieye has approximately 9-hour endurance which limits persistent coverage if it is compared to larger platforms like the E-7 Wedgetail with more than 12 hours or the GlobalEye with more than 11 hours (Boeing, 2023; Saab, 2023). If the goal is to cover the entire Athens FIR continuously it will be required a multiple aircraft rotation. This demanding situation applies increasing strain on the fleet availability.

2. Radar Performance Against Low-Observable Targets

On one hand the Erieye AESA radar is highly capable against conventional threats. On the other hand, its detection range is limited against stealth aircraft, drones that have low radar cross section (RCS) and low-altitude cruise missiles that fly below radar horizon (Stimson, 1998, pp. 180-195). This vulnerability is particularly concerning given Turkey’s investment in stealth technology and unmanned systems (Defense Security Asia, 2025).

3. Sensor Fusion and Processing Limitations

The mission system’s architecture, while still functional, it is becoming obsolete. The data fusion speed, track correlation and automation capabilities of the Erieye lag behind modern platforms. This type of limitations can affect negatively the reaction times in high density threat scenarios (NATO, 2023).

4. Space and Crew Comfort

The EMB-145H’s it is designed with a relatively small cabin that limits crew stations to around 5 to 6 operators. The result is a reduced simultaneous tasking capacity compared to larger AWACS platforms with 10 or even more operators. The crew fatigue might become a factor in case of extended missions.

5. Maintenance and Logistics

It is true that the ERJ-145 platform has a solid reliability record, there is an issue although with the spare-part availability for the specific military modifications (radar, mission systems) because it depends heavily on Saab and Embraer supply chains. In case of high-tempo operations this limitation might create logistics vulnerabilities (FLYAJETFIGHTER, 2025).

Strategic Context of Limitations

The above-mentioned limitations do not render the Erieye obsolete, but they constrain HAF's ability to maintain a solid situational awareness against:

Turkey's emerging fleet of UAVs and stealth fighters (i.e. TF-X KAAN)

Hybrid warfare threats (i.e. drone swarms, cyberattacks and disinformation campaigns)

Demanding maritime surveillance requirements that are essential in covering the potential energy exploration activities in the Eastern Mediterranean

The conclusion is that the Erieye fleet, is facing a capability gap that will surely widen after 2030 unless a significant modernization or a replacement program is undertaken.

3.2 Option 1: Upgrade Existing HAF Erieye EMB-145H AEW&C

The upgrade of the current HAF EMB-145H AEW&C fleet is a cost effective and low risk option of maintaining and enhancing HAF's airborne early warning and control capabilities in the future. Saab offers a Mid-Life Upgrade (MLU) package that is designed for legacy Erieye operators. It is focused on radar performance, mission system architecture and interoperability improvements by upgrading the already existing systems.

3.2.1 Saab Mid-Life Upgrade Package Overview

Since 2020, many operators have access to Saab's Erieye Mid-Life Upgrade program. This program is addressing hardware obsolescence and the need to counter (as mentioned before) stealth aircraft, drones that have low radar cross section (RCS) and low-altitude cruise missiles that fly below radar horizon. These upgrades are focusing on the extension of the Erieye's service life by 10 to 15 years by delivering sensor, processing and communications enhancements.

The 1st level package (I) includes:

- Modernization to the Radar system, in order to increase detection range, improve target classification and enhance the clutter rejection capability in maritime and coastal environments.
- Replacement of the Mission computer with an upgraded open-architecture system, that enables faster data fusion and facilitates easier integration of new software applications.
- Upgrade the electronic support measures (ESM), in order to detect, classify, monitor and locate modern Radar and communication emitters.

- Redesign from the beginning the operator consoles, by improving the ergonomics and replacing obsolete displays with high definition tactical displays.
- Enhancement of the self-protection suite by combining upgraded missile approach warning systems (MAWS) and countermeasure dispensers.

The above-mentioned improvements are designed to upgrade the Erieye and make it competitive against evolving threats, such as fifth-generation fighters, advanced cruise missiles and stealth UAVs (Saab, 2023).

3.2.2 Radar and Mission System Enhancements

RADAR upgrades:

The upgrade to the Erieye's radar is based on Saab's experience from the GlobalEye platform. It incorporates enhanced gallium nitride (GaN) transmit and receive modules in conjunction with refined signal processing algorithms (Saab, 2024). These upgrades result in:

- **Extended Detection Range**: Max range of 550 km for targets that fly on high altitude (versus the Max range of 440km of the current version).
- **Improved Low-Observable Detection**: Enhanced capability in detecting targets with small RCS (i.e. UAVs/drones and cruise missiles flying on low altitudes).
- **Advanced Maritime Mode**: Better detection and discrimination of small vessels operating in sea conditions with heavy clutter.
- **Multi-Role Capability**: Continuous and simultaneous air and maritime surveillance without the need to swap between modes.

Mission system upgrades:

- An open-architecture computing matrix is used for integration of artificial intelligence (AI)-assisted threat evaluation.
- Automated track correlation functions are used in order to reduce operator workload and achieve a quicker target identification.
- ESM system upgrade gives the capability of enhanced passive detection and classification of threats without emitting electromagnetic radiation (Stimson, 1998, pp. 280-295). This ability makes the upgraded Erieye perfect for operating in contested electronic warfare environments with a low risk of being detected.

The above-mentioned radar and system upgrades **(see Figure 3.2)** would not only enhance the Erieye's operational use in traditional air defense but will also improve its role in maritime operations and border security missions.

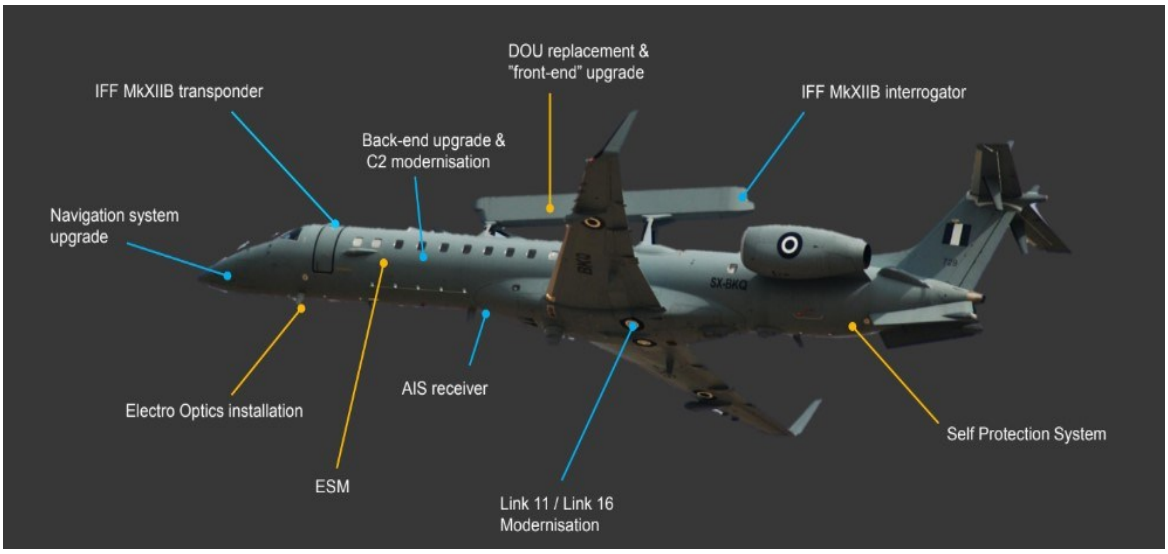


Figure 3.2: Upgrade of the Greek AEW&Cs.

Source: DEFENCE REDEFINED. Available at: https://defenceredefined.com.cy/globaleye-the-modern-platform-of-saab-and-the-case-of-the-greek-aewc/ **[Accessed 11 August 2025]**

3.2.3 Communications, Interoperability and NATO Integration

One of the most important upgrades of the MLU package is the integration of updated NATO-compatible data links (NATO, 2023):

- Full Link 16 capability with the support of J-series messages. This will improve real-time interoperability with HAF fighters (F-16 Viper, Rafale F3R) and Hellenic Navy ships with air defense capabilities.
- Integration with Link 22. This emerging Link will become a NATO standard for beyond-line-of-sight maritime and joint force communication.
- SATCOM capability. Gives to the mission crew the ability to communicate real time via messages with CAOC or NAOC including protected waveforms for secure strategic communications.
- Enhanced cybersecurity in accordance with NATO Federated Mission Networking (FMN) standards.

The result from the above upgrade is that the upgraded Erieye will be able to plug into NATO's Integrated Air and Missile Defense System (NATINAMDS), and act as a sensor node and a battle management platform in joint operations. Those capabilities will make HAF able to integrate with multinational AEW&C task forces by enhancing flexibility in coalition scenarios.

3.2.4 Cost Estimates, Timelines and Industrial Participation Opportunities Cost Estimates

The Erieye MLU is estimated to cost approximately €40 million per aircraft. This estimation is based on open-source reporting and Saab's statements to operators like Brazil and Thailand (UPI, 2013). Regarding HAF's fleet of four aircraft, this program would cost approximately €120-160 million. In this estimation are not taken into consideration potential additional investments in ground support systems and training.

Timelines

- Upgrade Duration per Aircraft: approximately 9 to 12 months.
- Total Fleet Upgrade Program: approximately 24 to 36 months, by taking into account if upgrades are staggered or executed in parallel.
- One option for those upgrades is for Saab to conduct the modifications at its Swedish facilities, the other alternative is to conduct them in cooperation with the Hellenic Aerospace Industry (HAI) for domestic workshare.

Industrial Participation

In case of the cooperation with HAI, the opportunities for Greek industry are the following:

- Component production (i.e. structural modifications and wiring harnesses).
- Software integration and testing with the coordination and under supervision of SAAB.
- Long-term maintenance and overhaul capacity building at HAI.

Such coordination and participation will reduce life-cycle support costs and also enhance Greece's sovereign maintenance capability for AEW&C fleet.

3.3 Option 2: Replace with Saab GlobalEye AEW&C

The Saab **GlobalEye Airborne Early Warning & Control (AEW&C)** system is, currently, the most advanced option of the Erieye radar family (see Figure 3.3). It is designed for **multi-domain, persistent ISR**, while at the same time it offers an unmatched detection range, with maritime and ground surveillance capabilities combined with a highly flexible mission architecture that is suitable for both peacetime and crisis/war scenarios.

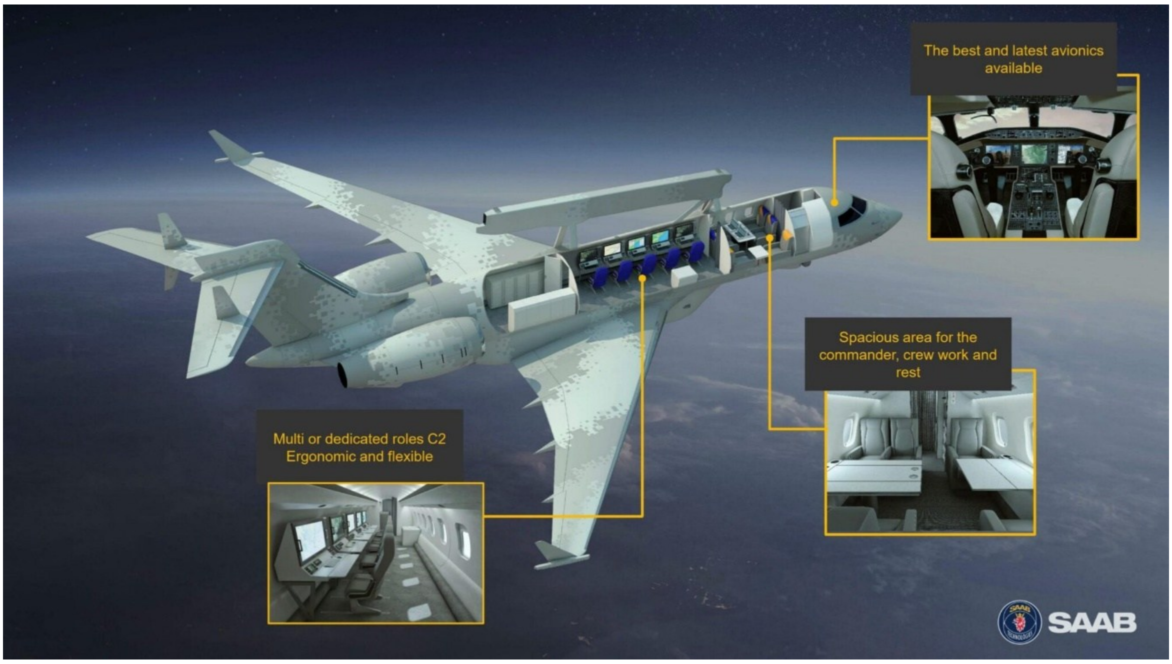


Figure 3.3: GlobalEye is a truly strategic asset.

Source: DEFENCE FORCES. Available at: https://www.defenseforces.com/2025/05/30/saab-offers-globaleye-aewc-solution-to-canada-highlighting-domestic-industry-benefits/ **[Accessed 21 August 2025]**

3.3.1 Platform Overview and Design Philosophy

The Bombardier Global 6000/6500 long-range business jet airframe is used as the foundation for the GlobalEye. It was selected because of its high cruise speed (Mach 0.89), long endurance (up to 11 hours) and operating altitude of over 51,000 ft.

Saab's development of the specific platform focused on:

- **Persistent, multi-domain coverage**: Has the ability to conduct air, sea and land surveillance simultaneously without the need to reconfigure mission systems.
- **Scalability and modularity**: The open-architecture mission systems can accommodate future sensor upgrades, electronic warfare packages and all modern NATO data link standards.
- **Reduced operational footprint**: It has significantly lower fuel consumption and crew requirements when compared to larger legacy AWACS platforms (like the E-3 or the E-7), while it can deliver superior sensor coverage.

SAAB has classified the specific platform as a strategic ISR node capable of coordinating joint-force operations, while contributing to NATO's Integrated Air and Missile Defense System (NATINAMDS) and supporting non-military tasks (i.e. disaster relief or border monitoring) (Saab, 2023).

3.3.2 Technical Specifications and Sensor Suite

Primary Sensor – Erieye Extended Range (ER) AESA Radar:

- **Detection Range**: Compared to the legacy Erieye (with approximately 450 km detection range), the GlobalEye has over 650 km detection range for high-altitude targets.
- **Low-Observable Detection**: The mission system uses enhanced algorithms for detecting stealth aircraft (i.e. low-RCS drones, cruise missiles and stealth capable fighters).
- **Simultaneous Multi-Role Modes**: It has the ability to track air, maritime and ground targets concurrently without degradation in performance or the need to change between modes.

Complementary Sensors:

- **Leonardo Seaspray 7500E V2 AESA maritime surveillance radar.** It provides high resolution/quality detection of surface vessels, including periscopes (for submarine detection) and fast attack small craft in heavy sea clutter.
- **Electro-Optical/Infrared (EO/IR) turret.** It is used for day and night visual identification and tracking of air, land and sea targets.
- **Electronic Support Measures (ESM)/Electronic Intelligence (ELINT) suite.** It detects, classifies and geolocates electronic emissions for use in SIGINT operations.
- **Automatic Identification System (AIS).** It is used for the tracking of maritime vessels.
- **IFF Mode 5/S.** It provides secure and encrypted identification of friendly forces.

Performance Parameters:

- **Endurance**: approximately 11 hours on station.
- **Ferry Range**: Over 11.000 km.
- **Operating Altitude**: The GlobalEye missions are usually conducted at an altitude around 35.000 ft. At this altitude, the AESA Radar can detect low-level (200 ft) targets at ranges that exceed 458 km (247 nm) while providing a maximum detection capability of approximately 550 km.
- **Crew**: 8 mission crew plus 3 flight crew.

3.3.3 Operational Advantages in the Greek Context

Since HAF's major theater of operations is the Aegean and the Eastern Mediterranean, it can reasonably be argued that the GlobalEye offers multiple strategic benefits over the current EMB-145H Erieye. This conclusion is supported by the following factors:

1. **Extended Detection and Reaction Time**. The Extended Range (ER) AESA Radar can detect threats that are present far deeper into neighboring airspaces, which gives HAF leadership more time for faster scramble and intercept decisions.

2. **Maritime Surveillance Superiority**. The integrated Seaspray 7500E AESA maritime surveillance radar and Automatic Identification System (AIS) provides the ability to persistently monitor of Greek EEZ boundaries, crucial shipping lanes and contested maritime zones.
3. **Simultaneous Multi-Domain Operations**. In case of joint-force operations between the Army, Navy and Air Force, the GlobalEye can simultaneously conduct air target tracking, surface vessel detection, and ground moving target indication (GMTI), providing a unified operational picture to all forces.
4. **Enhanced NATO Interoperability**. The ability to use Link 16 and Link 22, in conjunction with the compliance with NATO Federated Mission Networking (FMN), provides the advantage of seamless integration into multinational task forces.
5. **Basing Flexibility**. The extended operational range eliminates the need for forward basing because it allows the coverage of the entire Eastern Mediterranean from mainland bases.

The above-mentioned capabilities lead to the conclusion that if the HAF chooses the GlobalEye, then this new platform will not only replace Erieye, but will no doubt transform Greece's AEW&C fleet into a strategic ISR force multiplier.

3.3.4 Acquisition Cost, Timeline and Offset Possibilities

Cost Estimates:

- By using open-source data, the cost of a GlobalEye is estimated at around USD $350 to 400 million, depending on configuration and support package (SAAB, 2022).
- This means that a procurement of 3 to 4 aircraft would have a total cost of EUR €1.0–1.4 billion. This number includes spares, training and infrastructure.

Timeline:

- From Contract to Delivery: approximately 36 to 48 months.
- Since there is an increased NATO demand, Saab's production capacity and current export commitments mean that early planning is necessary in order to secure delivery slots.

Offset and Industrial Participation:

- Hellenic Aerospace Industry (HAI) could participate in MRO (maintenance, repair and overhaul) work, the integration of mission systems and manufacturing of many different components.
- There is potential for technology transfer agreements that can help strengthen Greece's domestic aerospace sector.
- There are many opportunities to involve local defense electronics firms in the software development, data analysis and testing.

4. Operational/Technical Comparison of possible AWACS Systems

The following provides a comprehensive technical and operational comparison of three viable Airborne Warning and Control System (AWACS) solutions for the Hellenic Air Force (HAF). Those options are: the Boeing E-7 Wedgetail, the upgraded E-3A Sentry, emerging UAV alternatives, and existing or advanced Saab Erieye-based systems. In this evaluation it will be taken into consideration the following factors: radar technology, sensor range, mission endurance, network integration, crew requirements, maintenance implications, interoperability with NATO and allied assets and, last but not least, cost-effectiveness. The aim of this comparative evaluation is to inform strategic decision making based on Greece's unique airspace challenges and security imperatives in the Eastern Mediterranean.

Advantages of deploying AWACS platforms are early warning, airspace surveillance and command and control (C2) capabilities which are essential for maintaining situational awareness and coordinating responses to air and surface threats. Consequently, such systems constitute a cornerstone of modern air defense. In the context of increasing airspace violations, hybrid warfare threats and evolving regional tensions, the selection of an AWACS solution must be aligned with the long-term operational readiness and regional strategic posture of the Hellenic Air Force.

Each AWACS option is analyzed in detail in the following sections, with emphasis on technical specifications, operational use cases, advantages, limitations and implications for integration into Greece’s current air defense network.

4.1 Boeing E-7 Wedgetail

The Boeing E-7 Wedgetail **(see Figure 4.1)** represents the current state of the art in airborne early warning, battle management and airspace control among NATO-compatible systems. It was initially developed for the Royal Australian Air Force (RAAF), followed by the United Kingdom Royal Air Force (RAF), Turkish Air Force (TuAF), Republic of Korea (ROKAF) and finally the United States Air Force (USAF) as an E-3 Sentry replacement (Boeing, 2023). E-7 combines a modern, supportable commercial airframe with a powerful Multi-role Electronically Scanned Array (MESA) radar and an open-architecture mission system. This type of system is designed for rapid upgrade cycles, which is very important for modern air superiority.

Figure 4.1: A Royal Australian Air Force Boeing E-7A Wedgetail.

Source: Wikipedia. Available at: https://en.wikipedia.org/wiki/Boeing_E-7_Wedgetail **[Accessed 23 July 2025]**

4.1.1 Introduction/Brief presentation

The aircraft is built on the Boeing 737-700 Increased Gross Weight (IGW) platform combined with Boeing 737-800 wings and structural reinforcements to accommodate mission equipment, fuel and, of course, the dorsal radar installation. Through-life costs are reduced from the use of a widely supported commercial lineage, compared to legacy military airframes such as the E-3's 707 derivative. One important lifecycle advantage for smaller air forces such as Greece's is the fleet commonality with global 737 maintenance ecosystems. Hellenic Air Force might seek contractor logistics support or regional maintenance pooling more easily (Boeing, 2023).

E-7 Wedgetail's tip of the spear is the Northrop Grumman MESA radar. That is an active electronically scanned array (AESA) mounted in a distinctive fixed dorsal fin, instead of a rotating rotodome. This type of RADAR delivers a 360° coverage by combining side looking arrays and end-fire lobes, which enables continuous track updates without the limitations of mechanically rotating dishes (Northrop Grumman, 2019). Current users have reported air target detection beyond 600 km and effective tracking of low-flying aircraft and surface contacts. Also, the available maritime surveillance modes support surface vessel classification (Boeing, 2023).

The main advantage of a fixed array is that the system eliminates radome drive mechanisms which in turn reduces mechanical failure points and maintenance down-time (Northrop Grumman, 2019). In addition to that, rapid sector re-tasking (electronic steering) improves time-to-track and raid-size evaluation. Those capabilities create a critical advantage in dense airspaces such as the Greek FIR where there might be operating multiple aircraft formations, UAV swarms and civil traffic.

The E-7 Wedgetail typically has a 12-member crew (2 pilots+10 mission crew). The mission crew consists of various specialists who operate the aircraft's advanced radar and other systems to manage air battlespace, control aircraft and gather intelligence (Boeing, 2023). On the other hand, a minimum E-3A crew consists of 15 members, but in order to use the full potential of the system a 20 member crew would be used. The mission computing suite is modular, operator consoles are reconfigurable with the capability of multi-sensor fusion, data correlation and automated track management (Boeing, 2023). Regarding Links and communications, the system integrates Link 16, Link 11, SATCOM (voice and data), HF/VHF/UHF and secure data paths for joint and NATO operations (Northrop Grumman, 2019). Specifically, the UK E-7 program has emphasized net-centric interoperability with F-35, warships that are AEGIS-equipped and IADS nodes that are based on the ground. This integration model would fit perfectly with the Hellenic Air Force needs across air and maritime domains (Boeing, 2023) **(see Figure 4.2).**

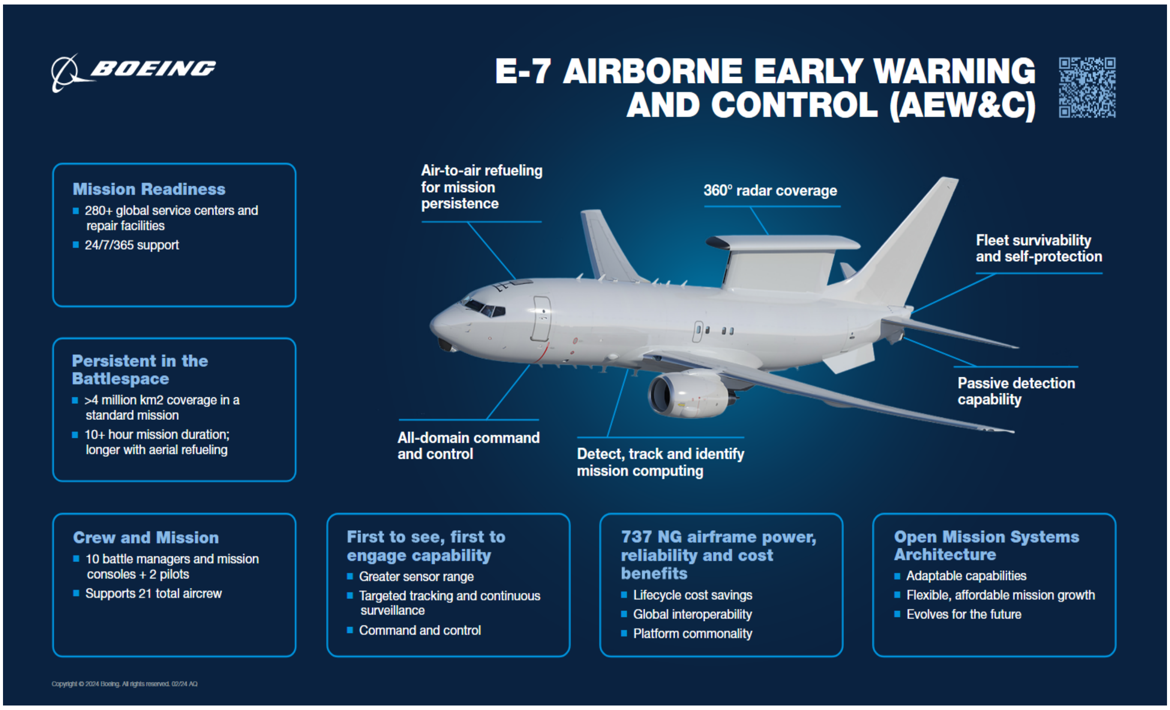


Figure 4.2: A growing global fleet for emergent global threats.

Source: Boeing. Available at https://www.boeing.com/defense/e-7-airborne-early-warning-and-control **[Accessed 23 July 2025]**

4.1.2 Operational Use and Lessons from Early Adopters

For the Royal Australian Air Force, Initial Operational Capability (IOC) was achieved back in 2012 while Full Operational Capability (FOC) was achieved in 2015. After this period, the E-7 Wedgetail supported coalition air operations in the Middle East. Its main objectives were to deliver long-range surveillance, tanker deconfliction and composite air picture dissemination across coalition joint forces. Mission Reports (MISREP) following those operations reported high mission availability and strong radar/communications performance in congested airspace (Boeing, 2023).

Initially, the USAF decision to shift from E-3 to E-7 was formalized through development and low-rate acquisition contracts and was driven by concerns over E-3 fleet sustainment, obsolescent avionics and radar limitations in tracking modern threats. Finally, in June 2025 USAF cancelled its E-7 Procurement Plan. In the next part the reasons behind this cancellation policy will be analyzed, because it is important to assess if the same reasons apply to the case of Hellenic Air Force.

4.1.3 Why the USAF Cancelled its E-7 Procurement Plan

Back in 2024, United States Air Force (USAF) made an unexpected decision to pause its planned procurement of the Boeing E-7A Wedgetail, citing shifting priorities and evolving threat environments. Initially, USAF intended to acquire 26 E-7's in order to replace the aging E-3 Sentry fleet. The initial contract was signed with Boeing in 2023. In USAF's 2025 defense budget proposal, the funding for future Wedgetail procurement was removed beyond the two prototype aircraft that were already in development (Air & Space Forces Magazine, 2024).

Senior USAF officials stated that the reason behind this cancellation was a combination of factors. Firstly, the USAF assessed that the large and non-stealthy platforms like the E-7 are vulnerable to advanced anti-access/area denial (A2/AD) threats posed by close adversaries such as China and Russia. As a result, a decision was made to make a strategic shift toward Agile Combat Employment (ACE).

Secondly, due to budgetary constraints and cost overruns in other modernization programs (i.e. the B-21 Raider bomber and Next-Generation Air Dominance (NGAD) initiatives), the available USAF funds were reprioritized. In addition to the above, USAF is relying increasingly on space-based sensors and 5th generation fighters with advanced radar and data-sharing capabilities, resulting in a reduced dependence on traditional AWACS platforms (Air & Space Forces Magazine, 2024).

Last but not least, USAF expressed concerns about E-7's adaptability. It is true that E-7 offers significant improvements over the E-3 in terms of radar performance and reliability, but its design is based on a commercial airframe (Boeing 737-700). The disadvantage is that E-7 might lack the survivability and agility that are required for contested environments.

USAF's decision however, fits its global requirements and does not necessarily reflect the suitability of the E-7 for smaller NATO nations and regional air forces such as the

Hellenic Air Force. After all, other countries, like Australia, the UK, and South Korea continue to operate or procure the E-7 Wedgetail as a cost-effective, interoperable AWACS solution (Boeing, 2023).

4.1.4 Relevance to Greek Operational Environment

Regarding Hellenic Air Force, the E-7 Wedgetail directly addresses several crucial challenges that were described and analyzed in Chapters 1 and 2:

- **Island Terrain & Radar Coverage:** The E-7s high-altitude AESA RADAR coverage will mitigate line-of-sight limitations that are generated by Aegean island chains and mountain formations in the mainland (Boeing, 2023).
- **Airspace Violations & UAV Incursions:** Rapid beam steering capability will enable detection and identification/classification of small, low-RCS UAV/Drone single or mixed formations near the boundaries of the Greek FIR (Northrop Grumman, 2019).
- **Maritime Domain Awareness:** There will be an enhanced support/coordination with Hellenic Navy units thanks to the integrated air/surface surveillance tracking modes in contested EEZ waters (Boeing, 2023).
- **Alliance Interoperability:** The E-7 platform has built-in NATO datalinks that will streamline participation in integrated air & missile defense (IAMD) networks (Northrop Grumman, 2019).
- **Lifecycle Costing:** The operating expenses will be reduced in the long term compared to older AWACS platforms (i.e. the E-3 Sentry) because Wedgetail can rely on commercial 737 supportability and smaller mission crews (Boeing, 2023).

4.1.5 Risks, Costs and Acquisition Considerations

While the E-7 Wedgetail is a state-of-the-art, technically mature platform, it still remains a very expensive and premium acquisition. The UK program was reduced from five to three aircraft because it experienced per-unit cost escalation that was driven by customization, support and inflationary pressure. Oversight reports from the UK Parliament Defense Committee were sharply critical of scope changes and budgeting realism (UK Parliament Defense Committee, 2023).

Royal Australian Air Force demands, plus sustainment priorities, may constrain production slots. The Greek Government should take into consideration that negotiating delivery sequencing and industrial offsets will be important factors for a possible acquisition plan. One viable option might be a phased acquisition (i.e. two aircraft with an option for a third). This could perfectly align with budget windows while building training pipelines and basing infrastructure incrementally (Royal Australian Air Force, 2022; Nova Systems, 2020).

4.2 Upgraded E-3A Sentry

The E-3A Sentry is based on the Boeing 707 airframe and has been the cornerstone of NATO and allied airborne early warning and control since its introduction in the late 1970s **(see Figure 4.3).** According to NATO AEW&W Programme Management Agency (NAPMA) "*The NATO E-3A Component operates from the Main Operating Base (MOB) 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 NAEW&C Force Headquarters is co-located with the NATO E-3A Component at NATO Air Base Geilenkirchen, Germany. The second component of the NAEW&C Force is the Royal Air Force's E-3D Component at RAF Waddington, England*" (NATO AEW&W Programme Management Agency, 2021) **(see Figure 4.4).** The E-3 fleet remains operational but sustainment challenges, aging airframes and obsolescent subsystems have led to a series of Block Upgrades with intention to extend service life into the late 2030s (NATO, 2021; ADN, 2024).

Figure 4.3: NATO E-3A flying in close formation with two GAF (German Air Force) Eurofighters.

Source: Photo provided by the author while serving in NATO E-3A COMPONENT in Geilenkirchen/Germany as Instructor Tactical Director (ITD) [Accessed 23 July 2025]

Figure 4.4: NATO E-3A Bases.

Source: NAPMA. Available at https://www.napma.nato.int/booklet/Info_booklet_NAPMO.pdf **[Accessed 27 July 2025]**

4.2.1 Airframe and Structural Considerations

E-3 uses the Boeing 707-320 platform. This platform is now entirely out of commercial service. As a result, supporting this platform is a major logistical challenge for spare parts, engines and structural maintenance. Hundreds of thousands of flying hours during almost 50 years have created airframe fatigue and corrosion. This situation is combined with diminishing manufacturing sources for critical components. The result is an escalation in sustainment costs. Many upgrades over the years have addressed avionics and mission systems and not structural modernization. So, today, the E-3 remains a platform that is constrained by its 1970s design (Boeing, 2023).

NATO and USAF, over the years have examined engine upgrade programs (i.e. replacing TF33 engines with CFM56). After assessing the E-3 platform retirement timelines, these programs were deemed cost-prohibitive. As a result, all E-3 aircraft retain original engines, with limiting efficiency and range when compared to modern commercial alternatives such as the E-7's 737 IGW base (Boeing, 2023).

4.2.2 Radar and Sensor Suite (AN/APY-1/2)

One of the E-3's unique features is its rotating rotodome. It houses the AN/APY mechanically scanned Pulse Doppler RADAR. It is capable of 360° coverage, but its 6 rpm rotation rate imposes revisit rate limitations in comparison to AESA RADAR equipped platforms, like the E-7. Instead of replacing the antenna, current upgrades have focused on enhancing radar signal processing, which means that the E-3 remains mechanically constrained. On one hand, the E-3s RADAR, under ideal conditions, can achieve a detection range of 400 km for high-altitude targets. On the other hand, its performance against low-RCS UAV/Drones and cruise missiles is inadequate without software optimization (Northrop Grumman, 2019).

The Radar System Improvement Program (RSIP) is focusing on improving the look-down capability and target discrimination in cluttered environments (i.e. the complex terrain and civil/military traffic of the Aegean region). However, RSIP is obsolete compared to the multi-mode flexibility and rapid tasking capabilities of the modern AESA radars such as the E-7's MESA (Northrop Grumman, 2019; Boeing, 2023).

4.2.3 Block Upgrade Programs

One of the most noticeable and significant modernization efforts of the E-3 is the Block 40/45 program. The main objective is the replacement of the legacy mission computing hardware and software with an open-architecture system. These upgrades include:

- Modernized operator consoles and graphical user interfaces.
- Improved track correlation and battle management functions.
- Full Link 16 integration with automated data handling.
- Better satellite communications (SATCOM) and IP-based networking.

Those enhancements **(see Figure 4.5)** would enable the E-3 to remain interoperable with NATO assets, including HAF F-16 Block 52+ adv, F-16 VIPER, Rafale F3R and F-35 fighters, as well as ship-based air defense systems like the newly acquired FDI Hellenic Navy HN Belharra-class frigates and advanced Hellenic Army assets such as upgraded self-propelled artillery and mobile short-range air defense platforms (U.S. Air Force, 2021).

The above-mentioned upgrades provide an incremental, rather than transformative, improvement due to the limitations in airframe sustainability and radar architecture (U.S. Air Force, 2021).

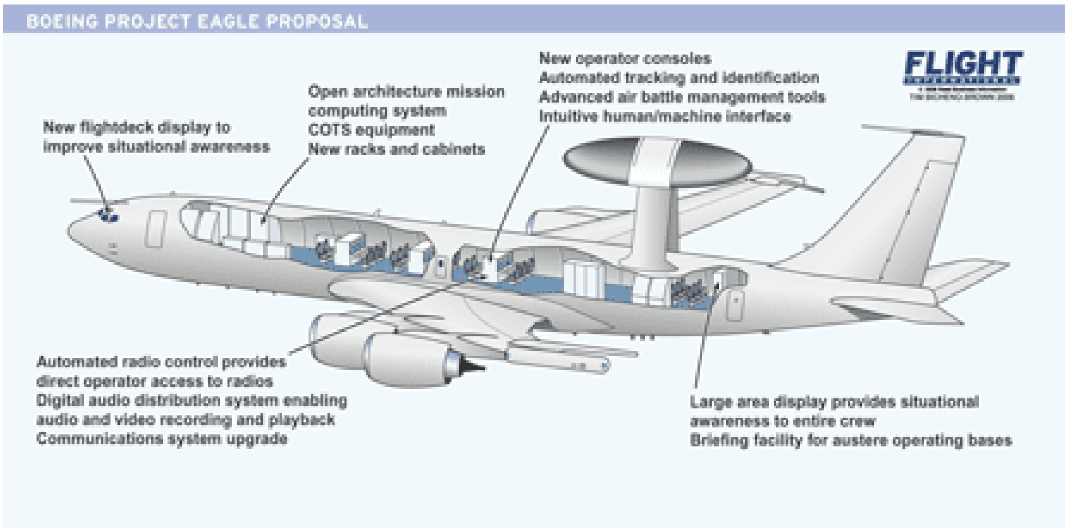


Figure 4.5: Boeing Project Eagle Proposal.

Source: FlightGlobal. Available at https://www.flightglobal.com/boeing-reveals-details-of-uk-sentry-upgrade-proposal/67999.article **[Accessed 23 July 2025]**

4.2.4 Operational Utility for Greece

Theoretically, if Greece considers acquiring surplus E-3 aircraft and apply the Block 40/45 upgrade will surely face several risks such as:

- Very high lifecycle cost due to obsolete platform support (Boeing, 2023).
- There might be a potential operational gap because of NATO transitions toward the E-7.
- Limited growth potential for new sensor packages (U.S. Air Force, 2015).

The upgraded E-3 option might initially be a cheaper alternative than procuring E-7s, but in the long term, sustainment costs and obsolescence will make this a short-term stopgap rather than a strategic solution (Boeing, 2023; U.S. Air Force, 2015).

4.2.5 Comparative Risk Analysis

Key issues for an upgraded E-3 solution:

- **Radar Limitations**: Since the E-3 RADAR uses mechanically scanned array, it lacks the ability to scan, identify and track UAV swarms or hypersonic threats (Northrop Grumman, 2019).
- **Aging Airframe**: Supportability declines every year (Boeing, 2023).
- **Operational Availability**: Significant dependence on NATO scheduling unless Greece owns and operates the platform.
- **Cost-Benefit Ratio**: Possible initial procurement savings are being offset by high maintenance costs (Boeing, 2023).

4.3 Unmanned/drone alternatives

Today, there is clearly a rapid evolution of unmanned aerial systems (UAS). This evolution introduces an alternative approach to airborne early warning and control (AEW&C) missions. Instead of deploying a single manned platform that is considered a High Value Asset (HAVA), modern air forces are exploring the deployment of multiple drones that are equipped with advanced RADAR, electro-optical/infrared (EO/IR) systems, and communication relay capabilities (RAND Corporation, 2023; CSIS, 2024). Regarding the use of UAS-based solutions in the Greek FIR, the operation of these systems in the complex Aegean and Eastern Mediterranean environment, can offer both opportunities and challenges in addressing the surveillance and situational awareness needs of the Hellenic Air Force.
The above-mentioned systems are able to support multi-domain operations (MDO) and distributed ISR networks, by providing resilience against anti-access/area denial (A2/AD) threats while reducing risk to human crews and dependence on a single vulnerable AWACS aircraft (NATO STO, 2023). On the other hand, several issues, like limitations in sensor range, endurance under heavy payloads and NATO interoperability standards, require careful assessment (NATO, 2015).

4.3.1 Current UAS Platforms Relevant to AEW&C Roles

Many countries are currently developing UAS with AEW&C and/or long-range ISR capabilities, the most notable are the following two:

- **Northrop Grumman MQ-4C Triton (see Figure 4.6).**
  This system is designed primarily for maritime ISR. Triton can operate at **high altitudes (55,000 ft)** and offer **endurance up to 24 hours**. These capabilities make it an ideal candidate for persistent radar coverage over sea lanes. On the one hand, it is equipped with **synthetic aperture RADAR (SAR)** and maritime surveillance radars, on the other hand it lacks a dedicated air-search radar like the MESA or AN/APY-2 of the E-7 and E-3 platforms (DOTE, 2023).

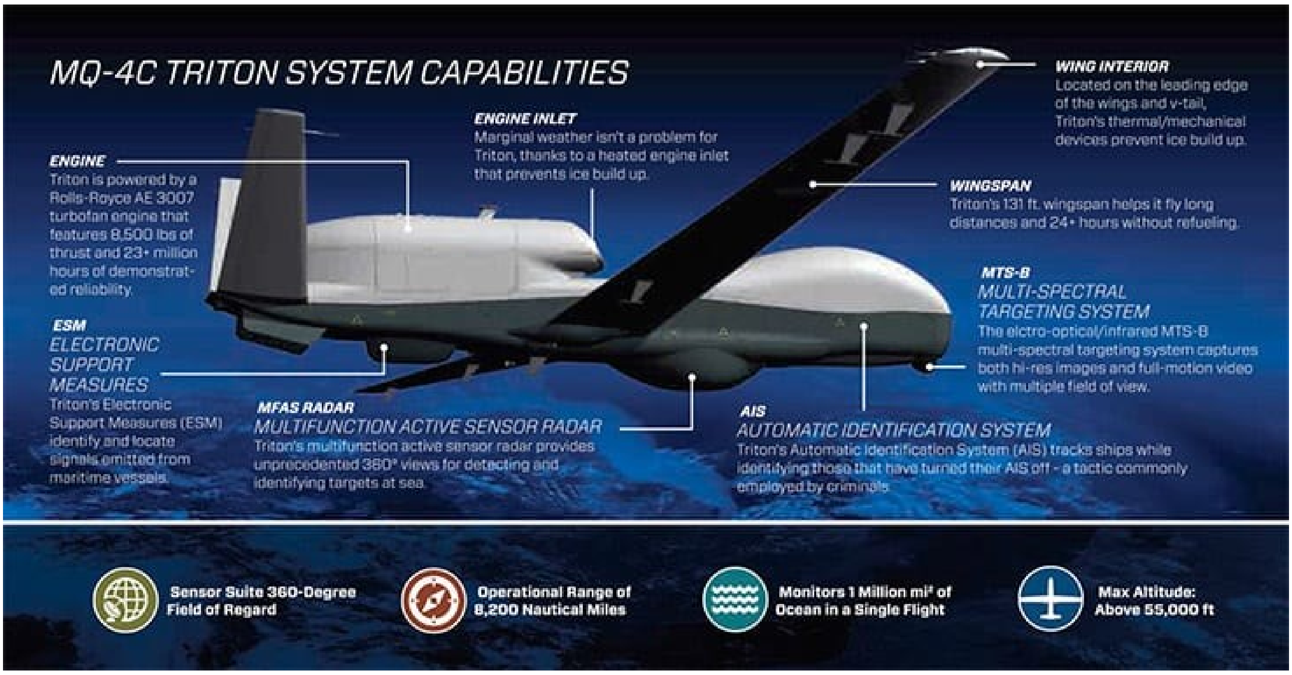


Figure 4.6: MQ-4C TRITON System Capabilities.

Source: Sea Power Magazine. Available at https://seapowermagazine.org/triton-deploys-at-last-the-navy-takes-its-new-uav-to-the-western-pacific/?print=print **[Accessed 23 July 2025]**

- **Israeli IAI Heron TP with AEW pods (see Figure 4.7).**
  Heron is highly adaptable and can be configured for ISR and communications relay. Also it can integrate compact RADAR systems for early warning. It is a very attractive option for regional powers due to its cost and modularity. In addition to the above, Israel's defense cooperation with Greece could facilitate technology transfer (IAI, 2024; Israeli Ministry of Defense, 2024).

Figure 4.7: Heron MALE UAS conducting high-altitude surveillance mission.

Source: IAI. Available at https://www.iai.co.il/p/heron [Accessed 24 July 2025]

The above-mentioned systems suggest that at least in the near future, **UAS-based AEW&C remains an emerging, hybrid capability** rather than a full replacement for manned AWACS (RAND Corporation, 2023; CSIS, 2024).

4.3.2 Advantages of Drone-Based AEW&C

- **Lower Risk to Personnel:** The deployment of unmanned systems fully eliminates any possible crew exposure during high level threat missions (RAND Corporation, 2023).
- **Flexibility and Scalability:** A combined use of multiple drones (swarm) can create a **mesh network** which increases resilience against single-point failures (CSIS, 2024; NATO STO, 2023).
- **Cost Efficiency (Acquisition):** When compared with manned AWACS platforms costing up to $2 billion each, a drone fleet is offering lower upfront costs, but always depending on required capability (Congress, 2022).
- **Persistent Coverage:** Drones like the MQ-4C **(see Figure 4.8)** which are classified as high-endurance platforms, can remain on station for a day or longer. The result is reduced sortie requirements (Northrop Grumman, 2024).

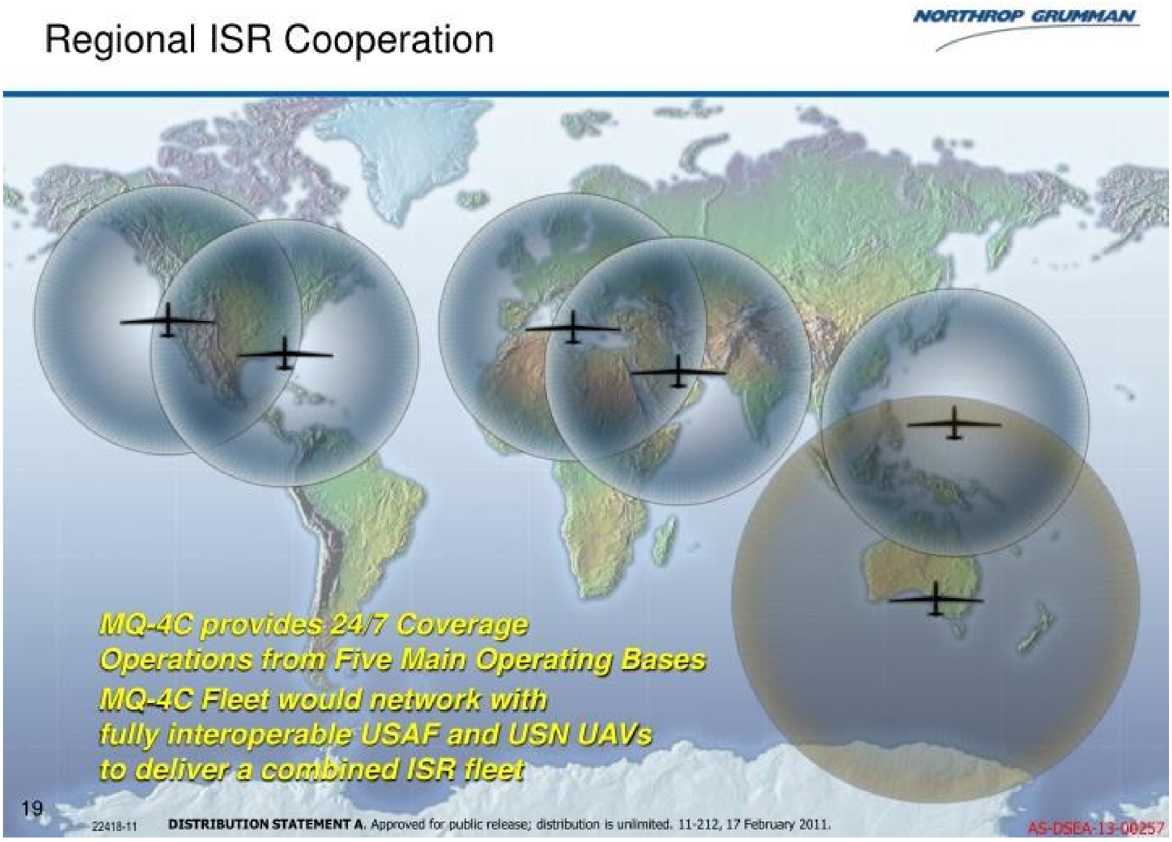


Figure 4.8: MQ-4C TRITON System Capabilities.

Source: Thai Military and Asian Region. Available at https://thaimilitaryandasianregion.wordpress.com/2018/05/05/mq-4c-triton-broad-area-maritime-surveillance-bams-uas/ **[Accessed 24 July 2025]**

4.3.3 Technical and Operational Challenges

- **Radar Power and Aperture Limitations:** Compared to the E-3s and E-7s large, high-power radars, UAS have limited payload capacity.
- **Electronic Countermeasures Vulnerability: Currently all available** UAS platforms are equipped with small onboard defensive suites, which makes them vulnerable to electronic warfare (EW) or GPS spoofing (NATO STO, 2023).
- **Data Fusion and Bandwidth:** In the modern operational environment, the transmission of radar data to ground stations must be real-time. The only way to achieve that is through the use of secure, high-bandwidth SATCOM, which increases infrastructure demands (CSIS, 2024).
- **NATO Interoperability:** All current AWACS systems used by NATO Air Forces operate as C2 nodes. Thus UAS alternatives would require integration with Link-16, MADL, or future combat networks.

4.3.4 Hypothetical Deployment Model for Greece

The above AEW&C concept could include:

- From three to five HALE (High-Altitude Long Endurance) UAVs, with orbiting capabilities at ~50,000 ft. The result would be to form a solid, persistent radar net over the Aegean and the Eastern Mediterranean (RAND Corporation, 2023).
- Integration of mini-AEW radar pods on existing MALE UAVs (i.e. Heron TP leased by Greece) (IAI, 2024).
- Fusion ground-based centers for combining all sensor inputs and creating a unified Recognized Air Picture (RAP) (NATO STO, 2023).

This type of model, on one hand, reduces capital expenditure. On the other hand, imposes new training, cyber defense, and logistical requirements.

4.3.5 Cost and Strategic Implications

The required coverage redundancy might be achieved through a network of smaller UAVs at a fraction of the lifecycle cost of a manned AWACS fleet. Thinking that the unit costs for HALE UAVs, like MQ-4C, exceed $120M each, the network of smaller UAVs is a preferable option (Northrop Grumman, 2024). However, the need for secure communication infrastructure and advanced data fusion systems offset the above mention savings. In addition to that, the survivability of large drones without stealth or robust EW protection in high-intensity conflict is questionable (RAND Corporation, 2023).

In the case of Greece, the UAS alternatives could supplement and not necessarily replace the manned AWACS by acting as force multipliers and providing persistent ISR during peacetime and in crisis scenarios.

5. Analysis of procurement and research of cost-benefit

This chapter evaluates the economic feasibility of the different Airborne Warning and Control System (AWACS) options for the Hellenic Air Force (HAF). In addition to that the strategic return on investment of each option will be assessed. This chapter aims to provide a broader and more complete picture which will include life-cycle costs, funding mechanisms and operational trade-offs, without focusing only on headline acquisition prices (RAND Corporation, 2023).

The analysis will cover:

1. A cost model which compares procurement and long-term sustainment of all the above-mentioned options.
2. An assessment of national and allied sources of funding.

3. A NATO case study from Poland, which is a perfect example of how a layered approach to air surveillance can meet operational needs while staying within budget (Zieliński, 2020; Zięba, 2022).

By combining these perspectives, the 5th Chapter will provide the quantitative foundation for the risk and recommendation analysis that follows in Chapter 6.

5.1 Cost Model

In order to have a complete, robust cost model, more factors than just the purchase price of an AWACS platform must be taken into account. As a common NATO practice, life-cycle costs (LCC) typically range from 150% to 250% of the initial procurement cost over a 30-year service life (RAND Corporation, 2021). The above-mentioned costs include fuel, maintenance, personnel, training, spares and future upgrades.

Greece's choice in upgrading an existing platform versus buying a new one will involve trade-offs between capability ambition and budgetary realism.

5.1.1 Procurement: Comparison of all options

(see Table 5.1)

Option	Estimated Unit Cost	Fleet (3 units)	Delivery Timeline	Remarks
Erieye MLU (EMB-145H)	€30–40M	€90–120M	24–36 months	Uses existing airframes, lowest procurement cost.
Saab GlobalEye	€330–370M	€1.0–1.1B	36–48 months	Step-change in capability, high upfront cost.
Boeing E-7 Wedgetail	€350–400M	€1.05–1.2B	48–60 months	Proven NATO service, large crew & infrastructure needs.
Upgraded E-3A Sentry	€220–250M	€660–750M	36–48 months	NATO standardization, limited by older airframes.
Unmanned AEW&C	€90–150M (per UAV)	€270–450M	24–36 months	Operational concept not fully proven, lower endurance than manned AWACS systems.

Table 5.1 Procurement: Comparison of all options.

Commentary:

- **Erieye MLU** is the option with the lowest cost, which allows capability improvement without the replacement of existing assets (Saab, 2022).
- **GlobalEye** and **E-7 Wedgetail** belong to the same cost bracket. The Wedgetail has larger crew and infrastructure demands that will increase LCC versus the

GlobalEye that has a low operating cost, while enabling frequent patrols and deployment from shorter runways, including regional and island airbases (Saab, 2023; Boeing, 2023).

- **Upgraded E-3A** can be cost-effective only if obtained via NATO pooling. The disadvantage is that the HAF's lack of ownership of existing E-3's, will make this a politically and logistically complex case (ADN, 2024).
- **Unmanned AEW&C** is indeed the cheaper per unit option, but would require multiple UAVs to achieve the complete and persistent coverage of one manned AWACS (RAND Corporation, 2023).

5.1.2 Costs for Lifecycle: Initial investment, fuel, crew training, maintenance and follow on support

(see Table 5.2)

Compared to the procurement figures, that were relatively straightforward, life-cycle costs (LCC) **(see Figure 5.1)** are harder to estimate. The reason behind that is that they depend on the following:

1. **Airframe size and fuel efficiency**. Larger platforms like the E-7 or the E-3 are consuming significantly more fuel than smaller business jet-based designs like the GlobalEye and the Erieye (Saab, 2023; Boeing, 2023).
2. **Crew size and training**. The use of larger crews increases the personnel costs and require more training (i.e. simulators, expertise training courses) (Air Force, 2025).
3. **Maintenance cycles**. An older airframe, like the E-3, need more frequent and expensive overhauls in comparison to newer ones (Air Force, 2025).
4. **Technology refreshes**. With mid-life updates modern mission systems can constantly remain NATO-interoperable (ADN, 2024).

Option	Life-Cycle Cost Multiplier	30-Year Cost (3 units)	Key LCC Drivers
Erieye MLU	x1.5	€135–180M	Fuel-efficient and low retraining cost.
GlobalEye	x2.0	€2.0–2.2B	High-end sensors and business jet efficiency offsets some of the LCC.
E-7 Wedgetail	x2.1	€2.2–2.5B	Large crew and fuel consumption.
Upgraded E-3A	x2.4	€1.6–1.8B	Aging airframes that require high maintenance costs.
Unmanned AEW&C	x1.8	€485–810M	Multiple UAVs are needed for 24/7 coverage.

Table 5.2 Costs for Lifecycle

Example regarding fuel consumption:
A GlobalEye sortie consumes approximately 2,5 tons of fuel per hour. An E-7 sortie

requires almost 5 tons of fuel per hour. Calculating that cost over a 30 year horizon, that difference alone can represent tens of millions of euros in operating costs.

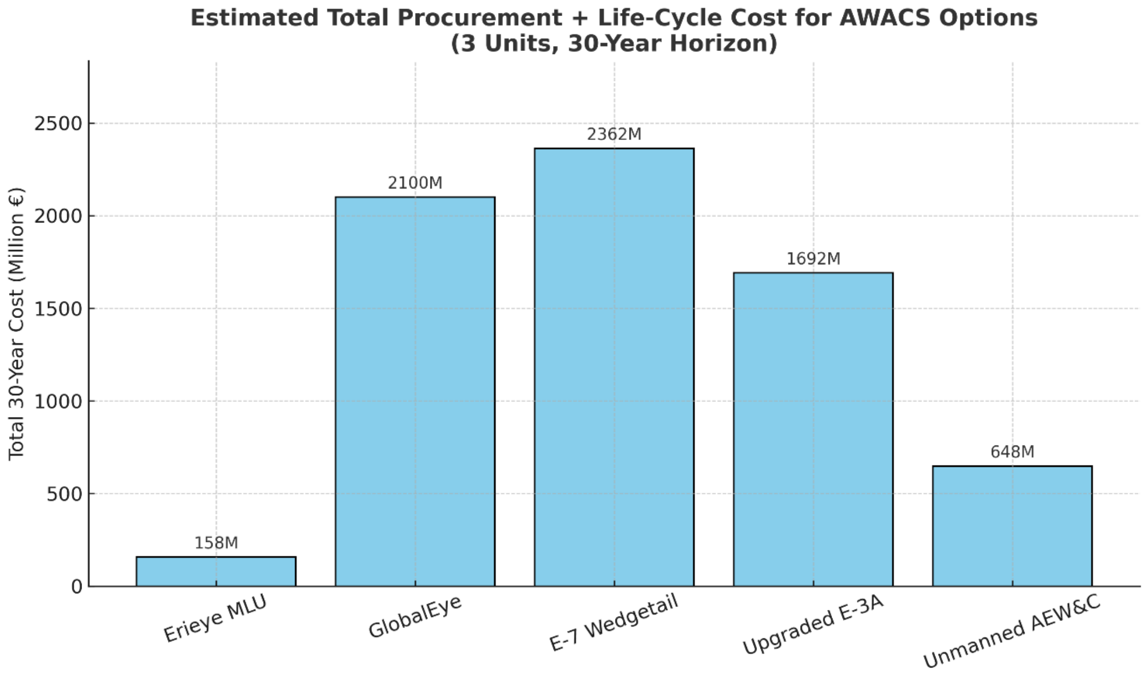


Figure 5.1: Estimated Procurement and Life-Cycle Cost.

Source: Author's own elaboration, based on open-source data (2025).

5.2 Funding options

The acquisition feasibility relies on funding sources. A combination of national budget allocations, EU defense mechanisms, NATO programs and industrial offsets can be a perfect option of reducing net cost.

5.2.1 National Defence Budget

Greece's defense expenditure in 2024 was approximately €7.1 billion, which is a total of 3.1% of GDP (Trade, 2025). However, the biggest part of this amount is already committed to:

- F-35 acquisition. This program is valued at around \$3.5 billion (≈ €3.3 billion) for 20 aircraft plus the required support and training (Trade, 2025).
- F-16 Upgrades. The major upgrade of Greece's F-16 fighter jet fleet to the Viper (Block 70/72 similar configuration) is ongoing. Greece is the only European nation thus far to have opted for upgrading their existing fleet to the advanced F-16 Viper upgrade (Trade, 2025).
- In 2024, Greece purchased 35x UH-60M Blackhawks (\$1.2 billion) and MH60R anti-submarine warfare helicopters, with three of those delivered in 2024 and the

remaining four to be delivered in early 2026. Greece is also modernizing four P3B maritime patrol aircraft through a mid-life upgrade and have an open sustainment case for their eleven S70 Aegean Hawk (Seahawk) helicopters (Trade, 2025).
- Greece has publicly committed to purchasing 3 French Belharra frigates for approximately $3.5-4B and most likely a 4th. Greece's progress toward the CONSTELLATION (FFG62) co-production commenced June 24, 2025 (Trade, 2025).

The above-mentioned programs leave a very limited headroom for AWACS procurement. A viable option for the feasibility of this program is to be phased across multiple budget cycles. This kind of approach, like modernizing the existing Erieye fleet now and transitioning to a brand new GlobalEye later, could easily distribute expenditures over a 10 to 15 year horizon, by mitigating immediate fiscal pressure while ensuring capability continuity (Saab, 2023).

5.2.2 European Defense Fund (EDF) and Permanent Structured Cooperation (PESCO)

The main goal of EDF is to strengthen the EU defense industrial base. This target is achieved by co-financing R&D and prototype development. It is a perfect opportunity for Greece to leverage the EDF for the following objectives:

- The development of multi-domain data fusion software with the participation of other EU users (i.e. Sweden, Finland, Czech Republic).
- The co-funding of UAV AEW&C technology, in order to supplement manned assets.
- The support of sensor upgrades for the existing Erieye platform.

The EDF is usually covering a 20 to 100% of project costs depending on collaboration level (European Commission, 2025; PESCO, 2025).

5.2.3 NATO Investment Program (NSIP)

The main target of NSIP funding is focused on infrastructure and interoperability and not platform acquisitions. However, Greece could use NSIP funding for:

- **Ground C2 nodes** for AWACS integration.
- **Data link upgrades** (Link 16, Link 22).
- **Satellite communications gateways**.

The above infrastructure and interoperability enhancements could account for 10–15% of total program costs, which can, indirectly, reduce Greece's budgetary burden (NATO, 2025).

5.2.4 Offsets and Industrial Participation

Long-term support costs can be reduced by industrial offsets, and additionally can create domestic economic benefit:

- Saab can offer HAI participation in MRO and in the manufacturing of components for GlobalEye and Erieye MLU (Saab, 2023).
- In case of an E-7 deal, Boeing could provide avionics integration work for the Greek industry (Boeing, 2023).
- The option of unmanned AEW&C, could involve local assembly in conjunction with software development and building cyber/ISR capabilities domestically.

Offsets are a critical negotiation point because they typically range from 30 to 100% of contract value in Greek procurements.

5.3 Case Study: Poland’s Multi-Tiered Air Surveillance Strategy

Since both Poland and Greece are facing high-intensity threat environments (Poland from Russia and Greece from Turkey) and both operate with finite budgets, Poland’s air surveillance modernization will be examined, because it offers a useful analogue for Greece (Zieliński, 2020, pp. 115-134; Zięba, 2019, pp. 87-105).

Background

After Russia’s annexation of Crimea in 2014, Poland began an accelerated investment in ISR assets. Instead of committing immediately to an expensive top-tier AWACS, Polish Air Force adopted a layered approach **(see Figure 5.2):**

1. Short-range mobile radars (NUR-15M Odra 3D radar).
2. Medium-range AEW&C (Saab 340 Erieye).
3. Integration with NATO E-3 fleet (Boeing E-3A Sentry).
4. UAV ISR (Bayraktar TB2 and MQ-9A Reaper).

Funding and Offsets

Poland applied three financing methods (Zięba, 2019):

- National defense budget.
- U.S. Foreign Military Financing (FMF).
- EU security funding for C4ISR integration.

It is important to mention that offsets included local MRO facilities for Saab 340 and domestic radar component production (Saab, 2023).

Operational Lessons for Greece

- **Phased modernization avoids capability gaps**. The same procurement can be applied to Greece by currently upgrading the Erieye and later make a transition to GlobalEye or E-7.
- **NATO integration reduces duplication**. On one hand, Poland is using NATO E-3s for long-range coverage, while, on the other hand, is keeping its national assets for sovereignty missions.
- **Industrial participation builds resilience**. By using domestic MRO facilities the dependency on foreign suppliers in crisis is severely reduced.

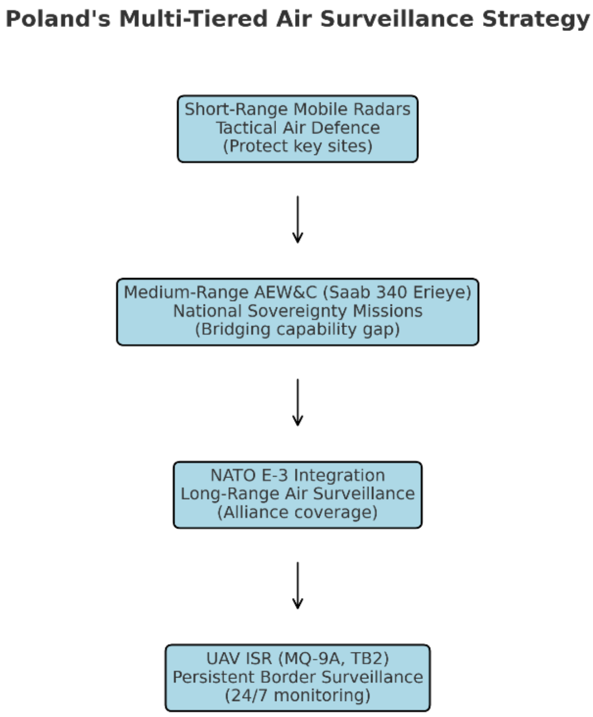


Figure 5.2: Poland’s Multi Tiered Air Surveillance Strategy.

Source: Author’s own elaboration, based on open-source data (2025).

6. Risk Assessment and final Recommendations/Conclusion

6.1 Risk Assessment

One of the most significant investments in airpower capability for Hellenic Air Force (HAF) in the future is the procurement of an Airborne Warning and Control System (AWACS). This dissertation has presented and analyzed 5 suitable options (upgrading existing Saab Erieye EMB-145H AEW&C, acquiring Saab GlobalEye, procuring Boeing E-7 Wedgetail, modernizing NATO E-3A Sentry or adopting unmanned AEW&C platforms). Those options have several distinct operational, technological, financial and geopolitical risks. The following section evaluates these risks across six crucial key dimensions, which are: operational performance, procurement complexity, financial burden, technological maturity, geopolitical dependencies and NATO interoperability **(see Figure 6.1)**, **(see Figure 6.2)**.

- **Operational Risks**
  - **Erieye MLU**: In this case the operational risk is **low** because of the HAF familiarity. There is existing basing infrastructure and established crew competencies. The risk here relates mainly to the endurance limitations (close to 9 hours) and radar range in comparison to newer systems.
  - **GlobalEye**: This option is assessed as presenting **moderate** risk, as its significantly enhanced operational capability is accompanied by the need for new logistics chains, extended crew training and larger basing requirements.
  - **E-7 Wedgetail**: The E-7 choice has a **medium to high** risk, specific in the integration phase. The delivery times are longer compared to all the other options and there will surely be possible production slot constraints due to UK and Australian demands.
  - **Upgraded E-3A**: This option presents a **high** level of operational risk, mainly due to the aging airframe, the likelihood of obsolescence by the mid-2030s and the limited long-term value of upgrades compared with full platform replacement.
  - **Unmanned AEW&C**: This option is assessed as presenting **medium** operational risk. While UAV-based solutions provide endurance and flexibility, their current sensor fusion and C2 relay performance remains behind that of manned AWACS platforms, particularly in contested airspace environments.

- **Procurement Risks**
  - **Erieye MLU**: There is a **low** procurement risk, since there are existing airframes and supplier relationship with Saab. All the above, reduce complexity and the 24 to 36 months timelines can be achieved.
  - **GlobalEye**: **Moderate** risk, mainly because there are long lead times (4 to 6 years), with potential export licensing constraints.
  - **E-7 Wedgetail**: This is a **high** procurement risk option, because, there is a huge global demand and there is also a prioritization of RAF and RAAF production slots.
  - **Upgraded E-3A**: Since this option is dependent on NATO Airborne Early Warning & Control Programme Management Organization (NAPMO) decisions and funding cycles, it is classified it as **medium** risk.
  - **Unmanned AEW&C**: **High** procurement risk due to limited operational history in NATO AEW&C roles and possible ITAR restrictions, which may limit the export and operational flexibility of US produced defense systems.

- **Financial Risks**
  - **Erieye MLU**: **Low**, estimated approximately €30 to 40M per aircraft (FlightGlobal, 2022) versus €300 to 400M for new AWACS units.
  - **GlobalEye**: **High**, estimated around €350 to 400M per unit, including full lifecycle costs.
  - **E-7 Wedgetail**: **High**, UK's cost per unit exceeded £500M, including support (UK Parliament, 2023).
  - **Upgraded E-3A**: **Moderate**, upgrades are less costly than new buys but may have diminishing returns.

- **Unmanned AEW&C**: **Moderate**, procurement costs are significantly lower than manned AWACS but the integration into NATO networks might require expensive ground segment investments.

- <u>**Technological Risks**</u>
  - **Erieye MLU**: **Low to medium**, upgrade maintains proven architecture, but the upgrade sensor is still less capable than GlobalEye's multi-band radar.
  - **GlobalEye**: **Low**, uses mature GlobalEye/Global 6000 platform and Erieye ER radar.
  - **E-7 Wedgetail**: **Low**, it is fielded successfully by Australia, South Korea, Turkey, and soon UK.
  - **Upgraded E-3A**: **Medium**, radar architecture is still based on AN/APY-1/2 sensor, with mechanical scan, even after upgrades.
  - **Unmanned AEW&C**: **High**, the integration of AEW&C functions into UAS will be a challenge and remains an emerging capability.

- <u>**Geopolitical Risks**</u>
  - **Erieye MLU**: **Low**, since Sweden is a politically reliable defense partner and NATO member.
  - **GlobalEye**: **Low**, same supplier base as Erieye MLU.
  - **E-7 Wedgetail**: **Moderate**, heavily reliant on US and Australian industrial base.
  - **Upgraded E-3A**: **Low**, it is a common NATO asset but is dependent on multinational consensus.
  - **Unmanned AEW&C**: **Medium**, the platforms that are sourced from non-European allies may face political/export control fluctuations.

- <u>**Interoperability Risks**</u>
  - **Erieye MLU**: **Low**, Link 16 and NATO-compatible data links are included in the upgrade.
  - **GlobalEye**: **Low**, full NATO interoperability from outset.
  - **E-7 Wedgetail**: **Low**, platform is fully NATO-compliant.
  - **Upgraded E-3A**: **Low**, it is a reliable NATO asset.
  - **Unmanned AEW&C**: **Medium to high**, the standards for AEW&C role data sharing are still evolving.

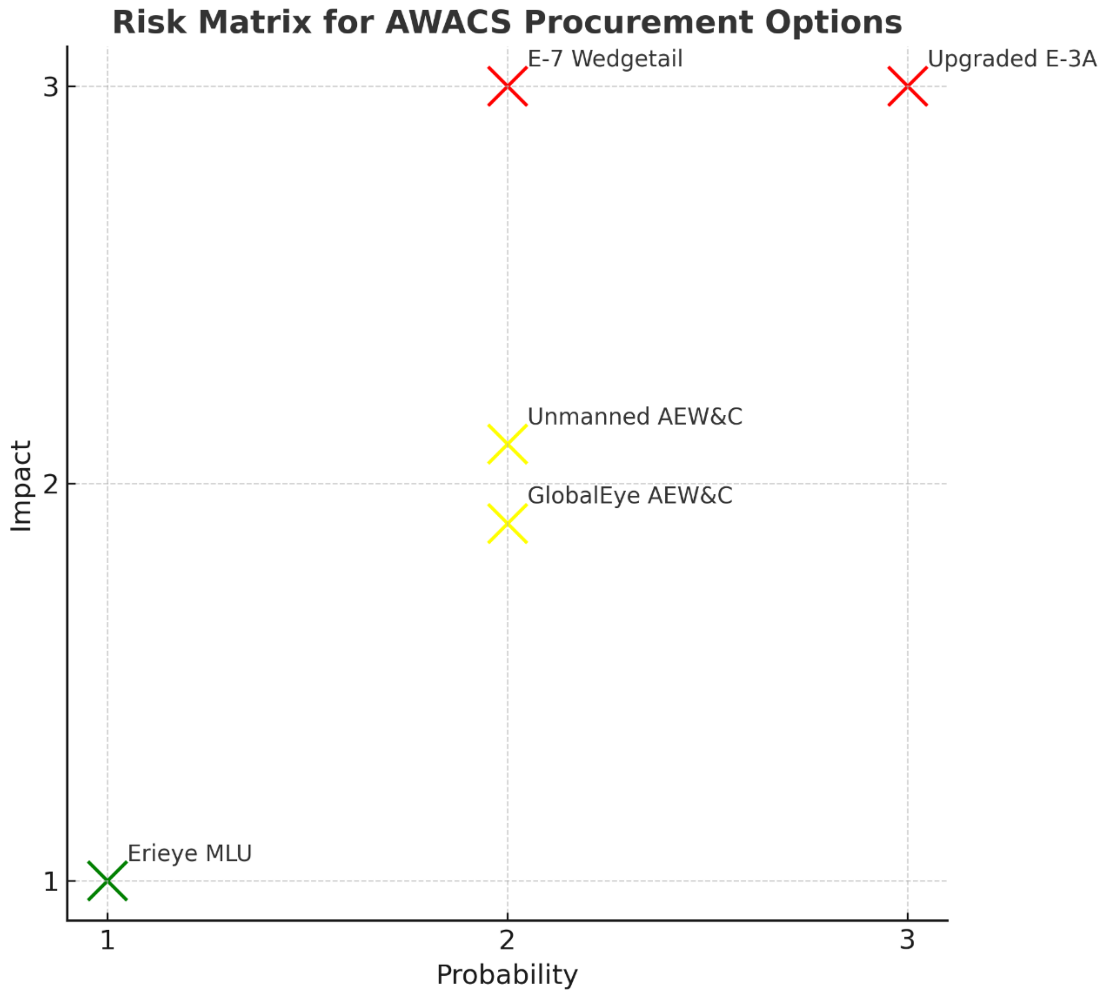


Figure 6.1 Risk Matrix for AWACS Procurement Options.

Source: Author's analysis based on Saab, Boeing, NATO, UK Parliament, and FlightGlobal data.

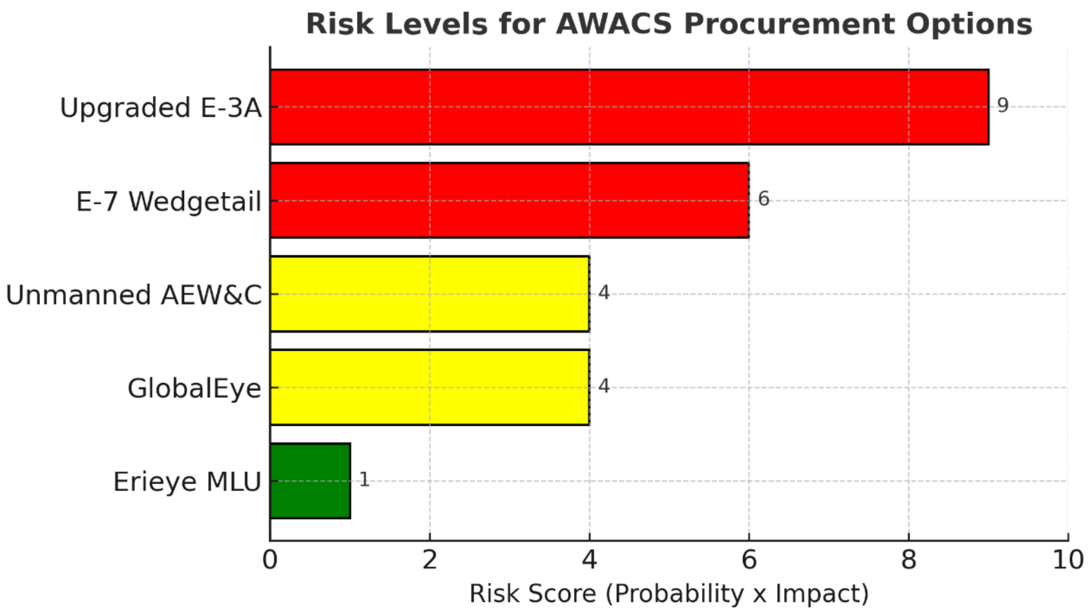


Figure 6.2 Risk Levels for AWACS Procurement Options.

Source: Author's analysis based on Saab, Boeing, NATO, UK Parliament, and FlightGlobal data.

6.2 Recommendations/suggestions

The previous chapters evaluated Greece's strategic airspace defense needs and presented a risk analysis and cost-benefit assessment of the available options. The most suitable recommendation is the upgrade of the existing EMB-145H Erieye fleet through Saab's Mid-Life Upgrade (MLU) programme in combination with the acquisition of medium altitude long endurance (MALE) UAVs with ISR capabilities. It is a hybrid solution that balances cost-effectiveness, operational relevance and delivery speed while, at the same time, it avoids the high procurement and integration risks of buying an entirely new fleet.

- **Key Justifications**

1. **Cost-Efficiency**. The Erieye MLU costs are almost 8 to 10 times lower than the acquisition of a new AWACS, which enables capability improvement within the current HAF budget envelopes.
2. **Rapid Deployment**. 24 to 36 months is a feasible timeline for the completion of the program upgrade, ensuring capability enhancement before the year 2030.
3. **Operational Familiarity**. This option utilizes the existing HAF aircrews, maintenance personnel and basing infrastructure.
4. **Geopolitical Stability**. The partnership and coordination with Sweden ensure predictable export conditions, especially under NATO.

5. **Force Multiplication via UAVs**. MALE UAVs (i.e. MQ-9B SeaGuardian or Heron TP) will provide to HAF the ability to extend coverage and persistence, especially over maritime domains.

- **Implementation Roadmap**

Phase 1 – Contract Negotiation and Programme Initiation (Year 1)

- Signing of the MLU agreement with Saab.
- Secure funding allocation through the national defense budget, combined with potential co-financing via the European Defense Fund (EDF) for C2 upgrades.

Phase 2 – UAV ISR Capability Integration (Years 1 to 3)

- Procurement of 3 to 4 MALE UAVs equipped with AESA radar and maritime surveillance pods.
- Integration of the UAV data feeds into Erieye mission systems.

Phase 3 – Ground C2 and Data Fusion Upgrades (Years 2 to 4)

- Upgrade of the HAF air defense C2 systems in order to ingest multi-platform ISR feeds.
- Satellite expansion and establishment of secure data link capacity.

Phase 4 – Operational Training and NATO Integration (Years 3 to 4)

- Participation in joint exercises with NATO AEW&C assets with the aim to refine combined TTPs (tactics, techniques, and procedures).
- Certification of full NATO interoperability.

6.3 Conclusion

6.3.1 Summary

The analysis has demonstrated that while the GlobalEye and E-7 Wedgetail represent state of the art capabilities, but their procurement and lifecycle costs are prohibitive under Greece's current fiscal and strategic constraints. Upgrading the current Erieye fleet is an affordable option with a low geopolitical risk. If this option is combined with the acquisition of UAVs with ISR upgrades, then HAF will be able to align with NATO's evolving ISR doctrine while extending its airborne early warning capabilities to the 2030s.

6.3.2 Implications regarding the proposed policy

By implementing this approach, Greece's National Defense Policy objectives would be supported by:

- The enhancement of deterrence and situational awareness over the Aegean and the Eastern Mediterranean.
- Maintaining NATO interoperability without overextending Greece's National Defense budget.
- The support of domestic defense industry through participation in maintenance, integration and C2 upgrades.

In conclusion, after the analysis and comparison of all the available options, the best solution that can effectively address Hellenic Air Force's operational air defense requirements, NATO interoperability obligations, and fiscal sustainability is the upgrade of the existing HAF Erieye EMB-145H fleet, following a mid-life upgrade (MLU), with the combination of UAVs with ISR capabilities. This combination offers a balanced, sustainable and strategically optimal solution, while staying within Greece's budgetary constraints and enhancing national and NATO air defense networks.

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