AN/APG-80 Agile Beam Radar

Status: Upgrade & Support
System Type: Airborne Fighter Radar
April 2022

Program Briefing

Northrop Grumman developed the AESA (Active Electronically-Scanned Antenna) ***AN/APG-80 Agile Beam Radar*** for the United Arab Emirates' 80 Block 60 F-16s. The APG-80 has almost twice the air-to-air detection range as the mechanically scanned APG-68(V)7, although it concentrates on air-to-ground modes, with SAR ground imaging.

Flight testing of the APG-80 and Northrop Grumman's AN/AAQ-32 Integrated FLIR and Targeting System (IFTS) began in 2003 aboard Northrop Grumman's BAC-111 testbed. The first 10 Block 60 F-16s had been delivered to the UAE by May 2005, although radar and avionics software development continued. New radar deliveries ended around late 2007.

In April 2013, plans were announced for the UAE to buy 25 (later 30) new Block 61 F-16s, probably with Northrop's AN/APG-83 with the SABR antenna instead of the APG-80.

But by 2022 there had been no word or progress towards a contract for several years, and the new order will now almost definitely not occur.

Executive

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Manufacturers

Prime

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Subcontractors

- Texas Instruments, Inc.: Early co-developer of active-array antenna upgrade to APG-68

Functional Description

Configuration

Northrop Grumman developed the AESA (active electronic-array antenna) ***AN/APG-80 Agile Beam Radar*** for the United Arab Emirates' 80 Block 60 F-16s. The APG-80 will have almost twice the air-to-air detection range of the mechanically scanned APG-68(V)7, although it will concentrate on air-to-ground modes, with SAR ground imaging. SAR resolution is 1 foot or better. The antenna has 1,000 Transmit/Receive (T/R) elements, using the same technology as used in Northrop Grumman's modernized AN/APG-77(V) for the F/A-22 and AN/APG-81 for the F-35 JSF. The APG-80 also shares common hardware modules with Northrop Grumman's AN/AAQ-32 Integrated FLIR and Targeting System (IFTS).

Platforms

The APG-80 is being developed for the Block 60 F-16C/D.

Variants/Related Systems

AN/APG-68(V)—Northrop Grumman's multi-version mechanically-steered antenna radar for the F-16C/D.

Funding History

The AN/APG-80 has been funded by Northrop Grumman and the United Arab Emirates.

Costs

Unit cost could be between $6-7 million in 2004, perhaps $5 million for follow-on buys after UAE full-rate production.

Program Overview

History

APG-80 Development

Westinghouse began developing an active-array antenna for the AN/APG-68 in the early 1990s, before being acquired by Northrop Grumman, largely based on the antenna from the joint Westinghouse/Texas Instruments AN/APG-77 for the F-22. The first APG-77 active-array antenna was delivered to Boeing in July 1995, with a development model with improved Transmit/Receive modules expected in January 1996.

The active-array APG-68 had reportedly been designated the AN/APG-78, but then Northrop Grumman originally used an APG-68 Agile Beam Radar (ABR) designation.

UAE Orders ABR

The United Arab Emirates (UAE) has ordered 80 F-16 Block 60 fighters, which will mount the new APG-80 Agile Beam Radar.

APG-80 Plans

Flight testing of the APG-80 and Northrop Grumman's AN/AAQ-32 Integrated FLIR and Targeting System (IFTS) began in 2003 aboard Northrop Grumman's BAC-111 testbed. The first Block 60 F-16 for the UAE was to be rolled out by the end of 2003, with the first F-16 APG-80 flight scheduled for November, followed a year later by delivery of the first Lot 1 production aircraft, also integrating at least part of Northrop Grumman's Falcon Edge EW suite. The first Lot 2 aircraft will follow in early 2006, with more advanced EW modes and terrain-following radar capabilities. The final Lot 3 configuration is to be deployed by 2007 and will integrate BAE Systems' TERPROM digital terrain avoidance and navigation system with the terrain-following radar, to lower the probability of detection.

APG-80 development will also continue until 2007, with initial versions increasing capability in phases. The first Standard 0 capability will include basic air-to-air and air-to-ground modes, required for the UAE to train in the US.

APG-68 Upgrades?

Northrop Grumman is also looking at upgrading Block 50/52 F-16s with the APG-80, but this will require substantial changes, as the AESA requires liquid cooling and the APG-68(V)'s mechanical antenna is air cooled.

APG-80 AESA to B-1B

Planned upgrades to the B-1B bomber in April 2003 included adding the heart of the APG-80's electronically-scanned array. This will improve B-1B AN/APQ-164 SAR resolution from the current 10 ft to one foot.

APG-80 Offered to Singapore

Northrop Grumman reportedly offered the APG-80 to Singapore, but the F-16 has now been dropped from the competition. There have been no other international offers (as of mid-2005).

First Block 60s Delivered

By May 2005, the first 10 Block 60s (now also being called F-16E/F) were delivered and were being flown by UAE pilots. The rest are on schedule to be delivered by 2007.

These first aircraft are "Standard 1," which include all hardware, but Standards 2 and 3 will add software upgrades to fully utilize the Block 60's potential. Standard 3 will give the full operational capability requested by the UAE.

New SABR Radar Offered

In early 2008, Northrop Grumman proposed a new X-band AESA

SABR (Scalable Agile Beam Radar) for F-16s and other platforms, incorporating some APG-80 attributes but "much less expensive" and releasable to more countries. Development is expected to last two years. There is no launch customer yet, but Northrop suggested the new Korean A-50 light fighter version of the KAI T-50 Golden Eagle.

First Production AESA in Combat

In early 2012, Northrop Grumman reported that production APG-80 AESA radars had been operationally deployed aboard UAE F-16s in the Libya campaign.

Surprise UAE Order for 25 More Desert Falcons

In April 2013, a senior US defense official told journalists that the UAE would be buying 25 more Block 60 F-16 Desert Falcons, worth just under $5 billion, to add to 81 existing aircraft in service. The DoD later confirmed the plan.

The UAE had been planning on replacing 40 older Mirage 2000-9RAD aircraft, first with Rafales, then in November 2011 it issued an RfP for 60 aircraft, either Eurofighters, F-15s or Super Hornets.

The US announcement is seen as an attempt to warn off Iran, by strengthening the defenses of neighboring US allies. Other more advanced weapons sales were also announced, including V-22 Osprey tiltrotor transports and advanced fighter radars for Israel.

UAE Confirms 30 Block 61 F-16 Requested with DSCA

In January 2014, the United Arab Emirates (UAE) requested the sale of 30 F-16 Block 61 aircraft, as well as upgrades to its 79 existing Block 60s, as a direct commercial sale is for 30 Block 61 aircraft, as well as upgrades to the 79 F-16E/F Block 60 Desert Falcons. The DSCA has not specified the unique components of the Block 61, but DoD official stated that the new Block 61 would have enhanced radar, avionics, and weapons capabilities.

The upgraded aircraft are referred to as Block 60+, suggesting they will not receive all the upgrades of the new aircraft, though this has not been announced.

New UAE Block 61s Still Uncontracted

By early 2017, a contract for new Block 60/61 F-16s requested by the UAE had still not been signed, and there has been no recent indication that new production might still occur.

But Block 60 Upgrades Possible

In February 2017 at the IDEX air show, Lockheed Martin announced that discussions were underway with the UAE for the purpose of guaranteeing that its F-16E/F Block-60s remain operable to 2030-2040.

New HUD for UAE F-16s

In February 2018, BAE Systems was selected by Lockheed Martin to modernize head-up displays (HUD) on Block 60 F-16 aircraft for the UAE, replacing the current analog system with advanced digital technology. BAE Systems will use its Digital Light Engine (DLE) technology to integrate into the F-16's existing HUD space, requiring no changes to the aircraft, cabling, or computing. The advancement will remove the outdated cathode ray tube image source and replace it with a digital projector.

"To the naked eye, the pilot sees no difference in performance when our DLE HUD is installed. It retains the existing optics, video camera, and control panel," according to Andy Humphries, director of Advanced Displays at BAE Systems. "The real difference is the significant cost savings our customer will experience over the product's life cycle as a result of reduced maintenance and spares requirements."

The fully digital system reportedly has the potential to reduce lifecycle costs by 20% and offers at least four times the reliability of legacy analog systems. The DLE HUD features high-resolution symbology that is viewable under any flight condition, and it is designed to accommodate future advancements in symbology and video.

According to BAE, this contract "underpins BAE Systems' world-class position as a premier provider of high-integrity aircraft displays." In 2017, DLE technology was selected to modernize the F-22 HUD for the USAF. BAE provided the original analog HUDs for both the F-16 and F-22. BAE has reportedly produced more than 15,000 head-up displays that have been in service on more than 50 different aircraft types in more than 50 countries around the world.

Teal Group Evaluation

APG-80: Superb, Orphan Radar

Northrop Grumman developed the AESA (Active Electronically-Scanned Antenna) AN/APG-80 Agile Beam Radar for the United Arab Emirates' 80 Block 60 F-16s. The APG-80 reportedly has almost twice the air-to-air detection range as the mechanically scanned APG-68(V)7, although it concentrates on air-to-ground modes, with SAR ground imaging.

We had been forecasting healthy additional production of the Block 60 beyond the UAE order, but the F-16's fortunes were greatly complicated by the increasingly real F-35 Joint Strike Fighter (JSF). The JSF threatened the F-22 for domestic

funding, and the F-16 for international demand. As a result, the F-16 Block 60 looked likely to remain an orphan plane, for the UAE only.

But in January 2014, the UAE requested a 30-unit buy of new Block 61 F-16s, probably with Northrop's AN/APG-83 SABR antenna.

APG-80 AESA Leads to SABR

The APG-80 contributed to development of Northrop's new X-band AESA SABR (Scalable Agile Beam Radar) (now designated AN/APG-83), for F-16s and other platforms, incorporating some APG-80 attributes but "much less expensive" and releasable to more countries. Development was expected to last two years, and SABR was tested aboard a US Air Force F-16 in January 2010.

The radar for any future UAE Block 61 F-16s was never contracted, but we were assuming the APG-80 is now more than a decade old and an APG-83 with the SABR antenna was a more likely choice. Not only would this probably be a better radar for the UAE, but it would also further develop APG-68 upgrades for Northrop to provide for the thousands of APG-68s in service internationally.

But by 2022 there had been no word or progress towards a contract for several years, and the new order will now almost definitely not occur. We have taken it out of the forecast. No one else will buy the type since its price is too close to an F-35 JSF.

APG-80 Block 60+ Upgrades

But with or without new aircraft and radars, we forecast substantial continuing support funding for the legacy APG-80. Our forecast is highly speculative.

Funding Forecast

RDT&E (FY21$ Millions)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
All RDT&E										
APG-80	3.0	4.0	3.0	8.0	18.0	24.0	18.0	6.0	8.0	6.0
Procurement (FY22$ Millions)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
All Upgrade & Support										
APG-80	28.0	16.0	10.0	14.0	20.0	24.0	28.0	38.0	40.0	32.0

Production Forecast

User (Platform)	Through 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
AN/APG-80												
UAE (Block 60 F-16)	80	—	—	—	—	—	—	—	—	—	—	80