AN/TPY-4 3DELRR (3D Expeditionary Long-Range Radar)

Status: New Development
System Type: Ground-Based Radar (Mobile)
November 2022

Program Briefing

The United States Air Force's ***AN/TPY-4 3DELRR (Three-Dimensional Expeditionary Long-Range Radar)*** will replace the current legacy Northrop Grumman AN/TPS-43E/75 radar. The 3DELRR will be the organic radar for the US Air Force Control and Reporting Center (CRC) Weapon System (WS), providing the capability to perform long-range detection of both air-breathing threats and theater ballistic missiles. It will replace the aging TPS-75 radar system, which is at the end of its service life and costly to maintain, and detect and track highly maneuverable, small radar cross section air-breathing targets.

The 3DELRR will employ a single-face, rotating, active electronically scanned array (AESA) antenna with a highly distributed and scalable digital beam forming architecture. The AESA incorporates power-efficient and reliable commercially sourced Gallium Nitride transmitters, low-noise digital receivers, and efficient power conversion.

The 3DELRR was also originally intended to serve as a pilot program for Defense Exportability Features (DEF) to maximize export potential early in the design phase while reducing 3DELRR life cycle costs through increased production.

In mid-2009, the USAF chose two contractor teams – Lockheed Martin and Raytheon/Sensis/Moog – to develop prototypes for the 20-month Pre-EMD Technology Development (TD) phase, to be followed by a 4-year development program. By February 2011, the planned EMD contract award date had slid out to 3QFY13.

In October 2014, the USAF awarded 3DELLR EMD to Raytheon, for a C-band gallium nitride (GaN)-based radar (later designated AN/TPS-81). Later in October 2014, Northrop Grumman and Lockheed Martin both filed protests with the Air Force. A year later, in October 2015, the USAF finally denied Raytheon's counter-appeal to stop the Air Force re-evaluating 3DELLR EMD bids.

In May 2017, the Air Force finally re-awarded Raytheon the $52.7 million 3DELRR EMD contract, to be complete by November 2020.

Eventual full-rate production was to deliver at least 29 USAF systems, with a total USAF acquisition goal of 35 units at Full Operational Capability (FOC). LRIP was scheduled to begin in 1QFY22 and FRP was to continue through FY29.

Well… ten years after program beginnings, with no radar close to being ready… in 2019, the US Air Force conducted a radar market survey and, "identified multiple US and international production-ready alternatives capable of meeting or exceeding 3DELRR requirements at this time."

In FY20, the Air Force re-designated 3DELRR as a Middle-Tier Acquisition rapid prototyping effort to demonstrate in FY20 the performance of production-ready systems for meeting 3DELRR requirements. Based upon the new strategy, the Air Force removed all 3DELRR program funding from fiscal years FY22-FY25 in the FY21 budget released in February 2020, and will use the FY20 prototype capability demonstration results, "to inform the FY22 budget request to be released in early 2021."

In February 2020, the USAF budget stated that, "Due to chronic technical challenges rooted in the current EMD contractor's proposed TPS-81 design, and subsequent schedule delays," the USAF began conclusion of Raytheon's EMD contract in January 2020.

Moving quickly, in May 2020 the Air Force awarded Lockheed Martin, Northrop Grumman, and Australian firm CEA Technologies $500,000 contracts for the 3DELRR rapid prototyping effort, which may include COTS technologies (briefly called "***SpeedDealer***"). The 3DELRR strategy was to select the best solution that meets 3DELRR requirements in order to make the initial production decision in FY21, with the potential to deliver capability to the field no later than FY22-24, with FOC by the end of FY27.

In February 2022, the Air Force chose Lockheed Martin as the AN/TPY-4 3DELRR production contractor.

In April 2022, Program Executive Office Digital executed the Lot 1 initial production option for Lockheed Martin to produce two units, designated IP1 and IP2. The Air Force plans to start government developmental testing on IP1 in 2QFY24 and IP2 in 3QFY24. The Air Force planned for dedicated IOT&E in 3QFY24 to support an initial operational capability of six fielded TPY-4s in FY25.

In early 2023, the 3DELRR program is operating as a Rapid Fielding Middle Tier of Acquisition program, which the Air Force is planning to transition to a Major Capability Acquisition program by December 2023.

Total funding forecast in this report includes $2.5 billion for production, RDT&E, and support of Lockheed Martin's TPY-4 3DELRR and near-term variants.

Executive

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(The MDA for the 3DELRR program is the Assistant Secretary of the Air Force (Acquisition). The Air Force Program Executive Officer (PEO) for Digital Directorate (AFPEO) located at Hanscom AFB, MA is the PEO for 3DELRR. The Air Force Life Cycle Management Center (AFLCMC) located at Wright-Patterson AFB, OH is the contracting authority for the 3DELRR program. AFLCMC provides contracting, legal, comptroller, programmatic, engineering, test and logistics support.)

Manufacturers

Prime

Lockheed Martin Corp.
Rotary & Mission Systems
Liverpool, NY (Syracuse)
(3DELRR EMD [2022-])
(3DELRR Production Contractor)

Raytheon Technologies
Raytheon Missiles & Defense
Woburn, MA
(3DELRR Pre-EMD TD)
(3DELRR EMD [5/2017-2020])
(EMD contract cancelled by USAF)

Lockheed Martin
Rotary & Mission Systems
Bethesda, MD
(3DELRR Pre-EMD TD)

Subcontractors

- MIT/Lincoln Laboratory, Lexington, MA: System Engineering (2020-)
- GTRI, Atlanta, GAL: System Engineering (2021-)
- MITRE, Bedford, MA: Sys. Engineering (2020-)
- Moog, East Aurora, NY: Raytheon 3DELRR TD team
- Sensis, East Syracuse, NY: Raytheon 3DELRR TD team

Functional Description

Configuration (2023)

The United States Air Force's AN/TPY-4 3DELRR (Three-Dimensional Expeditionary Long-Range Radar) will replace the current legacy AN/TPS-43E/75 radar. The 3DELRR will be the organic radar for the US Air Force Control and Reporting Center (CRC) Weapon System (WS), providing the capability to perform long-range detection of both air-breathing threats and theater ballistic missiles. It will replace the aging TPS-75 radar system, which is at the end of its service life and costly to maintain, and detect and track highly maneuverable, small radar cross section air-breathing targets.

The USAF employs CRC WS to conduct battle management, command and control, air surveillance, combat identification, airspace management, and tactical data link management to enable fluid, continuous, offensive and defensive operations. The 3DELRR will provide the CRC WS with a precise, real-time air picture of sufficient quality to:

- Conduct long-range, wide-area surveillance
- Detect and track air-breathing
- threats (including 5th generation fighter aircraft) and theater ballistic missiles
- Support CRC WS threat evaluation for timely defensive and offensive action
- Provide positive control of military aircraft

The 3DELRR will employ a single-face, rotating, active electronically scanned array (AESA) antenna with a highly distributed and scalable digital beam forming architecture. The AESA incorporates power-efficient and reliable commercially sourced Gallium Nitride transmitters, low-noise digital receivers, and efficient power conversion.

The 3DELRR system will provide multiple benefits and increased capabilities to the USAF and to the Joint Services: 1) Replace the aging USAF AN/TPS-75 radar system, which is at the end of its service life and costly to maintain; 2) Detect and track highly maneuverable, small radar

cross section air-breathing targets; 3) Mitigate reliability, operational availability, maintainability, transportability and sustainability issues, which plague the AN/TPS-75 radar system; 4) Enable greater battlefield and battlespace awareness through its precise, real-time air picture of sufficient quality to control individual aircraft under a wide range of environmental and operational conditions; and 5) Provide exchange of information to the United States Marine Corps, Navy, and Army via appropriate interfaces.

The 3DELRR system consists of the TPY-4 radar, two (2) Heavy Expanded Mobility Tactical Trucks (HEMTTS), one (1) trailer, four (4) Micro Grid generators, and other smaller Government Furnished Equipment (GFE) items.

In 2019, the Air Force conducted a radar market survey and identified multiple production-ready alternatives capable of meeting or exceeding 3DELRR requirements. In FY20, the Air Force re-designated 3DELRR as a Middle-Tier Acquisition rapid prototyping effort to demonstrate in FY20 the performance of production-ready systems for meeting 3DELRR requirements.

Based on the current strategy, the Air Force will use the FY20 prototype capability demonstration results to inform the FY22 Production decision

The total cost of the 3DELRR Rapid Prototyping Middle Tier of Acquisition effort is planned as $299.0 million, including RDT&E and procurement of prototype units. In April 2022, the 3DELRR was fully funded across the Future Years Defense Program (FYDP).

Configuration (Legacy)

The Three-Dimensional Expeditionary Long-Range Radar (3DELRR) program is developing a replacement for the current legacy TPS-75 radar. The 3DELRR will be the principal USAF long-range, ground-based sensor for detecting, identifying, tracking and reporting aerial tracks for the Joint Force Air Component Commander (JFACC) through the Theater Air Control System (TACS). The 3DELRR system will provide multiple benefits and increased capabilities to the USAF and to the Joint Services: 1) Replace the aging USAF AN/TPS-75 radar system, which is at the end of its service life and costly to maintain; 2) Detect and track highly maneuverable, small radar cross section air-breathing targets; 3) Mitigate reliability, operational availability, maintainability, transportability and sustainability issues, which plague the AN/TPS-75 radar system; 4) Enable greater battlefield and battlespace awareness through its precise, real-time air picture of sufficient quality to control individual aircraft under a wide range of environmental and operational conditions; 5) Serve as a pilot program for Defense Exportability Features (DEF) to maximize export potential early in the design phase while reducing 3DELRR life cycle costs through increased production; and 6) Provide exchange of information to the United States Marine Corps (Navy) and the United States Army via appropriate interfaces.

Platforms

The earlier AN/TPS-43E and AN/TPS-75 are transportable radars, mounted on wheeled trailers.

Variants/Related Systems

AN/TPS-43E—This version was first procured in FY80. It added a second operational-type PPI, and a communications facility with 1 HF and 2 UHF radios. The radar signal processing circuits were redesigned, repackaged and integrated into a function Unit Signal Processor. All TPS-43Es were retrofitted with the improved OE-328/T ultra-low sidelobe antenna (ULSA) group.

AN/TPS-70—Derivative of the TPS-43 for FMS clients, first procured in FY80.

AN/TPS-75—The new nomenclature for early version TPS-43s, after being reconfigured with the ULSA antenna.

Funding History

RDT&E ($ Millions)	FY16*	FY17	FY18*	FY19	FY20*	FY21	FY22	FY23*	FY24**	FY25**
PE# 0207455F Three-Dimensional Expeditionary Long-Range Radar (3DELRR)										
Proj. #646002 3DELRR	8.1	47.2	10.6	24.7	23.2	18.9	—	14.5	19.8	0.6
PE# 0207412F Control and Reporting Center										
Proj. #67485L Theater Air Control System Improvement (TACSI)										
3DELRR	12.9	2.4	—	—	—	—	—	—	—	—

Procurement ($ Millions)	FY16	FY17	FY18	FY19	FY20	FY21	FY22	FY23*	FY24**	FY25**
Air Force Other Procurement (OPAF) BA 3										
3D Expeditionary										
Long-Range Radar	—	—	—	—	—	—	96.2	92.6	83.7	96.0
quantity	—	—	—	—	—	—	(2)	(4)	(3)	n/a

**Appropriation*

***Budget Request*

NOTE: Prior to FY14, 3DELLR was funded in PE# 0604283F Battle Management Command and Control (BMC2) Sensor Development, Proj #646002 ($91.7 million in FY13)

Costs

Unit cost for the earlier AN/TPS-43E radar was $5 million in FY85 dollars.

The AN/TPS-75 (including upgrade) unit cost was about $8.5 million.

In March 2012, the GAO estimated 3DELRR Total Program Cost at $2.1 billion, including $754.6 million for RDT&E and $1,369.4 million for procurement, for 35 USAF systems.

In April 2022, total cost of the 3DELRR Rapid Prototyping Middle Tier of Acquisition effort was planned as $299 million, including RDT&E and procurement of prototype units. In April 2022, the 3DELRR was fully funded across the Future Years Defense Program (FYDP).

In March 2023, the total cost of the 3DELRR MTA effort was to be $360.5 million, including RDT&E and procurement of prototype units. The 3DELRR program was fully funded across the Future Years Defense Program.

In March 2023, 3DELRR unit cost in full-rate production seemed to be funded at about $25-30 million per radar, including initial spares and support.

Program Overview

History

TPS-43/75 Development

The AN/TPS-43 is a standard transportable tactical air control radar used by the US Air Force since 1966. It has undergone continual upgrade and improvement since then, with the TPS-43E ULSA being the final production type. Work on the ULSA began in FY80 and progressed to full-scale engineering development in FY81. The first ULSA antennas were retrofitted to the TPS-43 in FY88. Developmental programs were funded under PE# 0207412F, Theater Air Control System Improvement. AN/TPS-75 is the new nomenclature given to all upgraded early-version TPS-43s, reconfigured with the ULSA. There are no new-build TPS-75s.

3DELRR TD Contracts

In mid-2009, the USAF chose two contractor teams to develop prototypes for the 20-month Three-Dimensional Expeditionary Long-Range Radar (3DELRR) Technology Development (TD) phase. Sensis, East Syracuse, NY won a $21.9 million contract to lead Moog, East Aurora, NY, and Raytheon Integrated Defense Systems, Tewksbury, MA. Lockheed Martin, Bethesda, MD won a $24.9 million contract. TD will be followed by a four-year development contract.

3DELRR Plans

In FY11, the 3DELRR will continue its risk reduction and TD Phase, including maturation of Critical Technology Elements (CTEs), design options analysis, requirements refinement, life-cycle cost estimate revision, and Milestone B (MS-B) documentation development. The Program Office will conduct Preliminary Design Reviews (PDRs), Competitive Prototype Demonstrations, and other verification of Technology Readiness Level (TRL) 6 for all CTEs used in the contractors' proposed design and ensure the collection of information required for the Government to produce the required documentation for MS-B, including approved Technical Requirements Document. Successful completion of PDRs and completion of the direction in the Acquisition Decision Memorandum (ADM) are milestones for entry into the Program Definition Risk Reduction (PDRR) phase.

The Program Office also anticipates completing a full and open competition source selection and will award the contract to commence PDRR.

G/ATOR Offered for USAF 3DELRR

In September 2010, Northrop announced it would offer G/ATOR for the Air Force's Three-Dimensional Expeditionary Long-range Radar (3DELRR) program, its effort to replace aging TPS-75 air defense radars (in service since the late 1960s).

3DELRR RDT&E Plans

In FY12, under its new PE# 0604283F, the 3DELRR Program will continue Technology Development (TD) Phase efforts with the Program Definition and Risk Reduction (PDRR) Period. Acquisition activities will include, but are not limited to, preliminary design development, software and hardware subsystem-level development, modeling and simulation to support system development, implementation of mitigation techniques to combat existing and emerging system threats (including cyber warfare), test planning, and execution of the program protection plan. The PDRR period will include System Requirements (SRR), System Functional (SFR) and

Preliminary Design Reviews (PDR) leading to a single, mature system design. Activities also include continued development of Milestone B documentation as well as studies and analyses to support both current program planning and execution and future program planning.

3DELRR Acquisition Strategy

In February 2011, the 3DELRR was planned to take a single-step-to-full-capability acquisition approach via full and open competition to further advance C2 capabilities supporting battlefield command and control.

GAO Cites $2.1 Billion 3 DELRR Program

In March 2012, the GAO estimated 3DELRR Total Program Cost at $2.1 billion, including $754.6 million for RDT&E and $1,369.4 million for procurement, for 35 USAF systems.

RDT&E Plans

In March 2014, plans were for FY14 to see completion of the Pre-EMD period of the TD phase for 3DELRR. The EMD phase will begin after an MS B decision in FY14.

Acquisition activities for the EMD phase within the FY14 timeframe include, but are not limited to; MS B preparation, MS B decision, EMD contract award, Integrated Baseline Review (IBR), Critical Design Review (CDR), test planning/preparation and fabrication/test of system components.

A CDR will be conducted during this timeframe to ensure the program has properly matured the system design and is postured for successful development of three Production Representative Units (PRUs). Activities also include studies and analyses to support both current program planning and execution and future program planning.

Raytheon Wins 3DELRR EMD

In October 2014, USAF awarded Raytheon a $19.5 million contract for 3DELRR EMD. The total contract, including all options, is estimated at $71.8 million and includes procurement of an additional three radar systems, for a total of six radar systems and product support.

Raytheon's 3DELRR system is a C-band gallium nitride (GaN)-based radar. Raytheon reports it was able to affordably increase the radar's range, sensitivity and search capabilities by using GaN. C-band reportedly offers the military increased flexibility because that portion of the spectrum is relatively uncongested.

Northrop and Lockheed Protest…

Later in October 2014, Northrop Grumman issued a protest with the USAF against the 3DELRR award to Raytheon. The next day, Lockheed Martin claimed they would also file a protest. The protests will likely stop EMD initiation for up to 100 days or more.

Protest Upheld… Two Year EMD Delay… Award Soon…

In October 2015, Raytheon was finally denied its counter-appeal to stop the Air Force re-evaluating 3DELLR EMD bids, following appeals by Northrop Grumman and Lockheed Martin. Lockheed and Northrop have successfully argued that they were unaware the USAF was allowing recovery of internal 3DELLR research and development costs. Raytheon was earlier notified of this by the Air Force and had reduced its EMD bid cost accordingly.

By February 2016, the Air Force finally announced it was, "currently engaged in additional evaluation activities, the details of which are source-selection sensitive. However, we anticipate an award in late second quarter fiscal year 2016."

Acquisition Strategy

In February 2016, the USAF FY17 budget announced the 3DELRR acquisition strategy as a single step acquisition approach for full capability to develop, produce, and field a highly capable and sustainable, expeditionary long-range radar. A limited competition was conducted among the three contractors that participated in the Pre-Engineering and Manufacturing Development (EMD) phase. The EMD contract will be awarded to a single developer to complete the final design, build, integration, and test of the 3DELRR system with options to produce Low Rate Initial Production (LRIP) units, and conduct Interim Contractor Support (ICS). A follow-on sole source contract will be awarded to the EMD and LRIP contractor for Full Rate Production (FRP) following the FRP Decision Review.

Air Force Program Executive Officer (PEO) for Battle Management (AFPEO BM) is the PEO for 3DELRR. Air Force Life Cycle Management Center (AFLCMC) is the Contracting Authority for the 3DELRR program and provides contracts, legal, and comptroller support. The Office of the Under Secretary of Defense for Acquisition, Technology, and Logistics [OUSD (AT&L)] is the program's Milestone Decision Authority (MDA).

The primary contract type for EMD is a Fixed Price Incentive Fee (FPIF) contract which includes an FPIF option to execute LRIP as well as a Cost Plus Fixed Fee (CPFF) option for Interim Contract Support (ICS). Upon MDA approval at MS C, the Procuring Contracting Officer (PCO) will exercise the LRIP option. A CPFF option is planned for ICS due to the uncertainty of the quantity and the exact nature of the work. The primary contract type for FRP is Firm Fixed Price (FFP) due to stable requirements and low risk of changes in scope.

The contract will deliver 3 Production Representative Units (PRUs) during EMD and 3 refurbished PRUs during LRIP for a total of 6 systems at Initial Operational Capability (IOC). The follow-on FRP contract will deliver 29 total systems.

EMD Finally Awarded… to Raytheon

In May 2017, the Air Force Life Cycle Management Center, Hanscom Air Force Base, MA, awarded Raytheon, Integrated Defense Systems, Woburn, MA, a $52.7 million fixed-price-incentive-firm engineering and manufacturing development (EMD) contract for 3DELRR, to include EMD of three 3DELRR production representative units. Work will be performed at Andover, MA, and is expected to be complete by November 2020. This award is the result of a competitive acquisition with two offers received (FA8730-17-C-0018).

The start of EMD was delayed due to contractor protests and continued source selection activities, following a two-and-a-half-year fight between Raytheon and its competitors, Northrop Grumman and Lockheed Martin. Raytheon was initially selected to develop 3DELRR in October 2014, but Northrop and Lockheed protested the decision with the Government Accountability Office (GAO). Just before the protest window ended, the Air Force voluntarily announced it would re-evaluate the contract award, which many saw as a sign that the Air Force expected the GAO to favor one of the protesting companies. Raytheon then lodged a suit against the USAF, which was eventually rejected by a US court. The Air Force then relaunched the competition, now won again by Raytheon.

Acquisition Strategy

In February 2018 in the FY19 budget, the USAF's acquisition strategy was a single step acquisition approach for full capability to develop, produce and field a highly capable and sustainable, expeditionary long-range radar. A limited competition was conducted for the Engineering and Manufacturing Development (EMD) contract among the multiple contractors that participated in two Technology Maturation and Risk Reduction (TMRR) phases.

The EMD contract was awarded in May 2017 to a single developer to complete the final design, build, integration and test of the 3DELRR system; with options to produce Low Rate Initial Production (LRIP) units, conduct Interim Contractor Support (ICS), and produce Full Rate Production (FRP) units. The primary contract type for EMD is a Fixed Price Incentive Firm (FPIF). The contract also includes a FPIF option to execute LRIP, Cost Plus Fixed Fee (CPFF) options for ICS and Firm Fixed Price (FFP) options for FRP. A CPFF option is planned for ICS due to the uncertainty of the quantity and the exact nature of the work. An FFP option is planned for FRP due to stable requirements and low risk of changes in scope. The program office will exercise the LRIP option upon Milestone Decision Authority (MDA) approval at MS C. The program office will also seek MDA approval to exercise ICS options (as necessary) and FRP options.

The EMD prime contractor will deliver three (3) EMD units, which will be the primary assets used for Contractor Developmental Test and Evaluation (CDT&E) and Government Developmental Test and Evaluation (DT&E). The LRIP option provides scope for the retrofit of these three (3) EMD units to production quality specifications, which will be used for Government operational testing. The LRIP option also enables the delivery of three (3) additional production quality units for a total of six (6) units at Initial Operational Capability (IOC). Program office will request MDA approval to use procurement funds prior to MS C to procure early Low Rate Initial Production (LRIP) materials to reduce schedule risk. The FRP options will deliver an additional twenty-nine (29) units for a total of thirty-five (35) units at Full Operational Capability (FOC).

The LRIP phase is planned to run from 1QFY22-1QFY24, with the FRP phase running from 1QFY23-1QFY29.

The MDA for the 3DELRR program is the Assistant Secretary of the Air Force (Acquisition). The Air Force Program Executive Officer (PEO) for Battle Management (AFPEO BM) located at Hanscom AFB, MA is the PEO for 3DELRR. The Air Force Life Cycle Management Center (AFLCMC) located at Wright-Patterson AFB, OH is the contracting authority for the 3DELRR program, as AFLCMC provides contracting, legal, comptroller, programmatic, engineering, test and logistics support.

Unique Financial Performance Requirements

In February 2018 in the FY19 budget, the USAF states that 3DELRR is to be evaluated against traditional Research and Development (R&D) program expenditure benchmarks. Unlike many traditional R&D programs, however, the 3DELRR EMD contract is a FPIF contract with progress payments. 20 percent of incurred costs are withheld until the end of the contract, when they are liquidated. Mandatory funding obligations and progress payment withholds will cause the program to lag traditional expenditure benchmarks, painting an inaccurate portrait of overall program health.

3DELRR Funding Cut – USAF Looking at [US+International] Systems

In 2019, the US Air Force conducted a radar market survey and identified multiple [US and international] production-ready alternatives capable of meeting or exceeding 3DELRR requirements at this time.

In FY20, the Air Force re-designated 3DELRR as a Middle-Tier Acquisition rapid prototyping effort to demonstrate in FY20 the performance of production-ready systems for meeting 3DELRR requirements.

Based upon the new strategy, the Air Force removed all 3DELRR program funding from fiscal years FY22-FY25 in the FY21 budget released in February 2020 and planned

to use the FY20 prototype capability demonstration results to inform the FY22 budget request to be released in early 2021.

In February 2020, the 3DELRR effort was in Budget Activity 4, Advanced Component Development and Prototypes (ACD&P), because efforts are necessary to evaluate integrated technologies, representative modes, or prototype systems in a high fidelity and realistic operating environment.

Current Developments

3DELRR Acquisition Strategy: Raytheon Axed

In February 2020, the USAF FY21 budget discussed the previous 3DELRR strategy, a single-step acquisition approach for full capability to develop, produce, and field a highly capable and sustainable expeditionary long-range radar. A limited competition was conducted for the Engineering and Manufacturing Development (EMD) contract, from among the multiple contractors that participated in two Technology Maturation and Risk Reduction (TMRR) phases. The EMD contract was awarded in May 2017 to a single developer (Raytheon) to complete the final design, build, integration and test of the 3DELRR system.

"Due to chronic technical challenges rooted in the current EMD contractor's proposed TPS-81 design, and subsequent schedule delays," the USAF began conclusion of the current EMD contract in January 2020. The Milestone Decision Authority (MDA) directed a Middle-Tier Acquisition rapid-prototyping approach to accelerate capability delivery, pursuant to FY16 NDAA Section 804 guidance.

The current 3DELRR strategy is to implement rapid-prototyping, conduct operational assessment demonstrations of viable production-ready alternatives in FY20, and select the best solution that meets 3DELRR requirements in order to make the initial production decision in FY21. This strategy has the potential to deliver capability to the field no later than FY24.

Test activities planned for FY21 include but are not limited to rapid-prototyping, demonstration, and tailored Developmental Integration Test.

The MDA for the 3DELRR program is the Assistant Secretary of the Air Force (Acquisition). The PEO for 3DELRR is the Air Force Program Executive Officer (PEO) for Battle Management (AFPEO BM) located at Hanscom AFB, MA. The contracting authority for the 3DELRR program is the Air Force Life Cycle Management Center (AFLCMC) located at Wright-Patterson AFB, OH. AFLCMC provides contracting, legal, comptroller, programmatic, engineering, test, and logistics support.

"SpeedDealer" Rapid Prototyping Contracts Awarded

Also in February 2020, Lt. Col. Matthew Judge, materiel leader of the 3DELRR program, spoke to approximately 30 companies attending the "SpeedDealer" industry day. Judge stated that with the new SpeedDealer COTS option, the USAF was planning for initial 3DELRR production units to be fielded in FY22, with FOC by the end of FY27.

In April 2020, SpeedDealer bids were due. 3DELRR procurement was expected to cost at least $750 million.

In May 2020, the Air Force awarded Lockheed Martin, Northrop Grumman, and Australian firm CEA Technologies $500,000 contracts for the 3DELRR rapid prototyping effort (SpeedDealer). According to a USAF statement, "Each award provides $500,000 for the companies to demonstrate their radar system's capabilities, maintenance concepts, and radar performance against operationally relevant targets and conditions, no later than the end of September [2020]."

By the end of 2020, the USAF will determine whether a prototype is ready for integration and production and will potentially award additional contracts. IOC of a production-ready radar is hoped for by FY24.

According to Col. Michael Harm, 3DELRR's senior materiel leader, "We are not starting over; this is not a new development contract…. Through the information presented during our industry day and received in the companies' response to the solicitation, we were able to confirm that production-ready systems can be demonstrated this year."

Canada to Retire Northrop AN/TPS-70 Air Defense Radars

In June 2021, the Canadian defense ministry awarded Thales Canada Inc. a C$186 million contract for procurement and support of three new transportable Tactical Control Radars (TCR), to allow the Royal Canadian Air Force (RCAF) to detect, identify, and direct fighter intercepts of potential threats in Canadian and North American aerospace. The order includes a contract for acquisition of the radars, sub-systems, and associated equipment, and a second contract for in-service support for an initial work period of five years.

Two TCRs will replace existing Northrop Grumman AN/TPS-70 radars at 4 Wing Cold Lake, Alberta, and at 3 Wing Bagotville, Quebec. The third TCR will, "be used as needed, based on Canadian Armed Forces operational requirements," including international deployments to support operations and training exercises for the RCAF.

The TPS-70 is very similar to the US Air Force's AN/TPS-43E/75 radars used for air defense (being replaced by 3DELRR).

Initial TCR deliveries are expected in 2023, with the radars

expected to be fully operational by the end of 2024.

Unconfirmed reports indicate the TCRs will be delivered by Thales Canada but manufactured by Lockheed Martin – if so, there may be great similarities between the TCR and either Lockheed's AN/TPS-77 (likely; see report) or the new TPY-4 3DELRR (less likely).

Lockheed Martin Chosen as New 3DELRR Production Contractor

In February 2022, the Air Force chose Lockheed Martin as the AN/TPY-4 3DELRR production contractor.

3DELRR Initial Production

In April 2022, Program Executive Office Digital executed the Lot 1 initial production option for Lockheed Martin to produce two units, designated IP1 and IP2. The Air Force plans to start government developmental testing on IP1 in 2QFY24 and IP2 in 3QFY24. The Air Force planned for dedicated IOT&E in 3QFY24 to support an initial operational capability of six fielded TPY-4s in FY25.

The total cost of the 3DELRR Rapid Prototyping Middle Tier of Acquisition effort is planned as $299 million, including RDT&E and procurement of prototype units. In April 2022, the 3DELRR was fully funded across the Future Years Defense Program (FYDP).

3DELRR Testing

There was no 3DELRR government test activity in FY22. The Air Force plans to conduct an early operational assessment on Lockheed Martin's Production Representative Unit radar at Eglin AFB in 4QFY23.

The Air Force plans to utilize integrated testing at every opportunity after developmental testing starts in 2QFY24 and plans to start dedicated IOT&E in 3QFY24.

The DOT&E will assess operational effectiveness, suitability and survivability in the FY24 DOT&E report, if testing is initiated as planned in 4QFY23.

Lockheed Martin Awarded Production Option for Four More 3DELRR Radars

In January 2023, the Air Force Life Cycle Management Center, Hanscom AFB, MA awarded Lockheed Martin Rotary and Mission Systems, Liverpool, NY a $84.9 million modification (P00015) to previously awarded contract FA8730-21-C-0022 for 3DELRR systems. The modification exercise options for four (4) 3DELRR radars, associated production management, travel and other direct costs, and data under the basic contract. The modification brings the total cumulative face value of the contract to $183.0 million. Work will be conducted in Liverpool, NY and is expected to be completed by January 2025. FY23 other procurement funds in the amount of $84.9 million were being obligated at the time of the award.

3DELRR FY24 Development Plans

In March 2023 in the FY24 budget, US Air Force RDT&E funding will support continued capability development for the 3DELRR system. Development of the system will consist of electronic protection (EP) techniques, classification and clutter algorithms, and enhanced radar capabilities across various operating environments.

FY24 funds will also support integration of the 3DELRR system with the United States Army using the Integrated Fire Control Network (IFCN) interface and the United States Navy & Marine Corps using Cooperative Engagement Capability/Composite Tracker Network (CEC/CTC) interfaces.

Test and evaluation will also continue with FY24 funding to support development of the TPY-4 radar to include cybersecurity and performance assessments, mobility, evaluations, and initial maintenance demonstrations.

Teal Group Evaluation

Legacy Radars

Northrop Grumman's AN/TPS-43E and AN/TPS-75 remain the principal US Air Force tactical air surveillance radars, although they have become very difficult to service and upgrade due to their age. The role of these radars has changed, however, with the now unquestioned superiority of airborne surveillance aircraft such as the E-3 AWACS. Ground-based air surveillance radars have increasingly been converted to air traffic control as well as a point-defense anti-missile role, as with the US Marine Corps AN/TPS-59 HAWK tactical missile point defense upgrade and the missile tracking upgrade for the TPS-75.

Three-Dimensional Expeditionary Long-Range Radar (3DELRR)

But the Air Force has had definite plans for the past decade to replace the TPS-75 with the phased array ***Three-Dimensional Expeditionary Long-Range Radar (3DELRR)***, now designated ***AN/TPY-4***. In mid-2009, the USAF chose two contractor teams to develop prototypes for the 20-month Technology Development (TD) phase, to be followed by a 4-year development program. By February 2011, the planned EMD contract award date had slid out to 3QFY13, to continue through 4QFY16. By early 2012, EMD was planned to begin in 2QFY14, and by March 2014 had only slid slightly right, to 3QFY14.

Substantial continuing RDT&E funding was already in place, with a new 3DELRR Program of Record PE# from FY14 on. Procurement had

been planned to begin in FY18, and the planned EMD date had held firm for FY14 over a couple of years, indicating the Air Force continued to be serious about the 3DELRR – with a $2.1 billion total program cost earlier planned.

Then in October 2014, the USAF awarded 3DELLR EMD to Raytheon, relatively on schedule, for a C-band gallium nitride (GaN)-based radar (later designated AN/TPS-81). But almost immediately, Northrop Grumman and Lockheed Martin both filed protests with the Air Force.

A year later, in October 2015, the USAF finally denied Raytheon's counter-appeal to stop the Air Force re-evaluating 3DELLR EMD bids. By February 2016, the Air Force announced it anticipated a new EMD award in 2QFY16 – now almost four years late, compared to original plans. Eventual full-rate production was to deliver 29 total systems.

In May 2017, the Air Force Life Cycle Management Center, Hanscom Air Force Base, MA, finally re-awarded Raytheon, Integrated Defense Systems, Woburn, MA, a $52.7 million fixed-price-incentive-firm EMD contract for 3DELRR, to include EMD of three 3DELRR production representative units. Work was expected to be complete by November 2020.

Eventual full-rate production was to deliver at least 29 USAF systems, with a total USAF acquisition goal of 35 units at Full Operational Capability (FOC). LRIP was scheduled to begin in 1QFY22 and FRP was to continue through FY29.

Teal Group did not expect such a long protest, but the Air Force continued to be serious about the relatively urgent need for 3DELRR. With Russian and Chinese long-range SAMs threatening Boeing 707 AWACS and JSTARS aircraft, and the recent US practice of depending on unprotected manned and unmanned aircraft for most forms of ISR, the Air Force realized that ground-based air defense radars might become a vital component again in a near-peer land war. US ground radars almost across the board were old and out of date by the 2010s.

We suspected development might have continued to stretch somewhat as abilities were added to a system that might serve for another 20-30+ years – 3DELRR is needed not only to replace the old and unsupportable TPS-75 for maintenance and cost reasons, but new-generation radar and C4I capabilities may determine life and death, defeat or victory, in a near-peer land war.

10 Years Later Becomes… SpeedDealer?

Well… ten years after program beginnings, with no radar close to being ready… in 2019, the US Air Force conducted a radar market survey and, "identified multiple US and international production-ready alternatives capable of meeting or exceeding 3DELRR requirements at this time."

In FY20, the Air Force re-designated 3DELRR as a Middle-Tier Acquisition rapid prototyping effort to demonstrate in FY20 the performance of production-ready systems for meeting 3DELRR requirements. Based upon the new strategy, the Air Force removed all 3DELRR program funding from fiscal years FY22-FY25 in the FY21 budget released in February 2020, and will use the FY20 prototype capability demonstration results, "to inform the FY22 budget request to be released in early 2021."

In February 2020, the USAF budget stated that, "Due to chronic technical challenges rooted in the current EMD contractor's proposed TPS-81 design, and subsequent schedule delays," the USAF began conclusion of Raytheon's EMD contract in January 2020.

Moving quickly, in May 2020 the Air Force awarded Lockheed Martin, Northrop Grumman, and Australian firm CEA Technologies $500,000 contracts for the 3DELRR rapid prototyping effort, which may include COTS technologies (briefly called "***SpeedDealer***"). The 3DELRR strategy was to select the best solution that meets 3DELRR requirements in order to make the initial production decision in FY21, with the potential to deliver capability to the field no later than FY22-24, with FOC by the end of FY27.

In February 2022, the Air Force chose Lockheed Martin as the AN/TPY-4 3DELRR production contractor.

In April 2022, Program Executive Office Digital executed the Lot 1 initial production option for Lockheed Martin to produce two units, designated IP1 and IP2. The Air Force plans to start government developmental testing on IP1 in 2QFY24 and IP2 in 3QFY24. The Air Force planned for dedicated IOT&E in 3QFY24 to support an initial operational capability of six fielded TPY-4s in FY25.

In early 2023, the 3DELRR program is operating as a Rapid Fielding Middle Tier of Acquisition program, which the Air Force is planning to transition to a Major Capability Acquisition program by December 2023.

AN/TPY-4 Production Begins

Our earlier 3DELRR forecast had been for only moderate delays to recent (FY19) Air Force plans for this vital, major program. We also expected continuing production for the US and international services through the 2020s at least.

Again… well… at least one can say the USAF did step in quickly in 2019 when it realized the 3DELRR program was slipping again. With SpeedDealer, the Air Force claimed there were multiple off-the-shelf options to satisfy its 3DELRR requirements.

In May 2020, the USAF awarded three $500,000 "rapid prototyping" contracts to three companies (not Raytheon), including Lockheed Martin and Northrop Grumman.

In late 2020, Teal Group forecast continuing delays, but the results

have so far been good, and quicker than expected.

In February 2022, the Air Force chose Lockheed Martin as the re-designated AN/TPY-4 3DELRR production contractor.

In April 2022, the USAF executed the Lot 1 initial production option for Lockheed Martin to produce two units, designated IP1 and IP2, with plans for dedicated IOT&E in 3QFY24 to support an initial operational capability of six fielded TPY-4s in FY25.

And in January 2023, the Air Force awarded Lockheed Martin a $84.9 million contract modification option for four more 3DELRR radars, with production to be completed by January 2025.

Teal Group Forecast

Our forecast is for USAF 3DELRR production to now remain relatively on-schedule.

The original USAF plan was for eventual full-rate production of at least 29 systems, with a total USAF acquisition goal of 35 units at Full Operational Capability (FOC).

By early 2023, all nine planned Initial Production radars were contracted and funded to Lockheed Martin, with all due to be complete and delivered by 2025.

After the first nine systems, USAF funding is in place for about four radars per year through our forecast period – worth about $1.1 billion in total.

But Teal Group expects production will ramp up soon after 2025 and we have included a more front-loaded USAF production run in our forecast, with a total number of at least 45 radar systems procured.

We have also included the beginnings of a substantial undetermined 3DELRR production forecast – especially for FMS and international sales – which we expect to continue through the next decade.

Total funding forecast in this report includes $2.5 billion for production, RDT&E, and support of Lockheed Martin's TPY-4 3DELRR and near-term variants.

Funding Forecast

RDT&E (FY22$ Millions)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
All RDT&E										
3DELRR	22.0	26.0	24.0	36.0	38.0	34.0	28.0	30.0	26.0	32.0

Procurement (FY22$ Millions)	FY22	FY23	FY24	FY25	FY26	FY27	FY28	FY29	FY30	FY31
All Production and Upgrade & Support										
3DELRR	94.0	94.0	94.0	112.0	176.0	234.0	280.0	346.0	372.0	190.0

Production Forecast

User (Platform)	Through 2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031	Total
3DELRR												
USAF (Initial Prod Units)	—	—	—	5	4	—	—	—	—	—	—	9
USAF	—	—	—	—	—	6	8	6	8	6	6	40
Undetermined	—	—	—	—	—	—	—	2	2	4	4	12
Total	**—**	**—**	**—**	**5**	**4**	**6**	**8**	**8**	**10**	**4**	**4**	**61**