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FPS-124(V) - Archived 7/98

Outlook

- A total of 39 units produced for the joint US-Canadian North Warning System
- Production is complete; no new sales expected
- Thanks to their built-in high reliability factor, little need for spare parts
- Expected to be in operation well into the next century
- This report will be dropped next year

10 Year Unit Production Forecast
1997 - 2006



Orientation

Description. Short Range, unattended surveillance radar.

Sponsor

US Air Force
Electronic Systems Center
ESC/PAM
Joint Program Office
Hanscom AFB, Massachusetts (MA) 01731-5000
USA
Tel: +1 617 377 5191

HQ Canadian Forces
NWS Program Office
Ottawa, ONT, Canada

Contractors

Lockheed Martin Corp
Tactical Systems
6801 Rockledge Drive
Bethesda, Maryland (MD) 20817
USA
Tel: +1 301 897 6711
Fax: +1 301 897 6800

Status. In service, in-production, on-going logistics support.

Total Produced. A total of 39 units have been produced.

Application. Gap filler radar for the North Warning System.

Price Range. Estimated unit cost is US\$9.0 million.

Technical Data

Dimensions	<u>Metric</u>	<u>US</u>
Antenna/transmitter array		
Height:	3.7 meters	12 feet
Diameter:	1.5 meters	5 feet
Characteristics		
Coverage		
Range:	3.2 to 113 km	2 to 70 mi
Azimuth:	360°	
Elevation:	-10° to +20°	
Altitude:	4.6 km	15,000 feet
	10,000 ft (@ 2 - 30 nm)	
	15,000 ft (@ 30 - 70 nm)	
Frequency:	1218 to 1398 MHz at six assigned frequencies	
Blank Tx/Rx:	2 sectors up to 180°	
Target/ECM Reports Targets:	Range	
	Azimuth	
	Age of data	
	Speed	
ECM:	Heading	
	Jammers	
	Azimuth	
Target reporting:	200 credible/frame	
ECM Processing:	10 ECM strobes	
	90% detection	
Clutter cancellation:	60 dB	
STC:	Eight profiles, clutter adaptive	
Credible target:	40 to 240 kt ground speed threshold	
Cross section area:	1 m ²	
Frame time:	6 sec	
False reports:	< 15 per frame (by spec)	
	frame (by performance)	
Target Resolution:	300 ft separation for equal size targets	
	600 ft with 20 dB size differential	
MTBF:	>4000 hrs	
Availability:	0.9983 demonstrated	
MTTR:	< 1/2 hr demonstrated	

Design Features. The FPS-124(V) unattended radar is a high-reliability, easily maintained short-range radar designed to operate in conjunction with the FPS-117 long-range surveillance radars in the upgraded North Warning System. The system was optimized for the detection of small radar cross-section, low-altitude targets with false alarm control in any clutter environment.

The transmitter/antenna system uses a unique combination of stripline elements configured in a fixed 12 x 15-foot cylinder protected by a radome. Stripline elements are a series of dipole elements sandwiched between a dielectric and sealed off with an aluminum housing. Only the radiating end of the dipole element is exposed. The

electronics for the transmitter/controller are located inside the cylindrical assembly.

These dipole elements are scanned electronically so there is no mechanical rotation of the antenna. Selective excitation of the dipoles forms and steers the radar beam around the horizon. This improves reliability and makes adaptive target dwell-and-revisit time possible. Long and short-range beams and modes are possible, as is an azimuth monopulse technique for tracking.

The advanced receiver uses adaptive CFAR/point clutter sensor maps to reduce the chance of false alarms being processed. Signal processing uses a pulse compression technique, 16 Doppler filters, and adaptive residual clutter

normalization to enhance signal processing. Zero-Doppler detection, threshold control, and self-generated clutter breakout/bird-sensor mapping eliminates the Arctic problem created by migratory birds and summer ice floes. The system also has a multiple time-around clutter cancellation mode to further clean up the data processed.

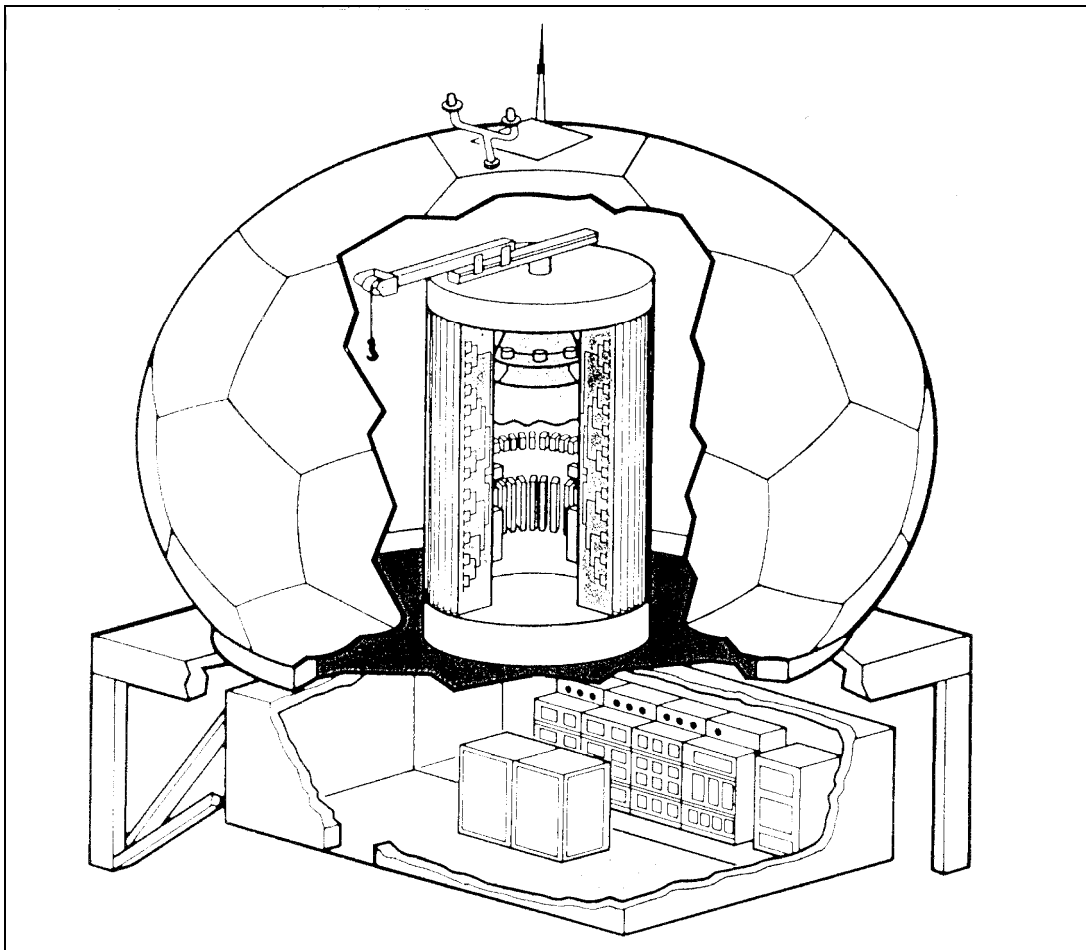
Target correlation can be on a burst-to-burst, beam-to-beam, and scan-to-scan correlation basis. Kalman filter tracking of up to 200 targets is possible. Frequency, PRF, and waveform are selectable by remote control. Remote operators can adjust velocity reporting thresholds and sensor zones, as well as call up enhanced high data rate search sectors.

End-to-end fault isolation, combined with a remote reconfiguration capability, boosts the MTBF of the radar and its processors. The design MTBF of greater than 4,000 hours allows for nearly six months between critical failures, drastically reducing the need for maintenance visits to the radar sites. Overall operating and life cycle costs are less than for the older, smaller DEW Line Radars.

Operational Characteristics. The 39 unattended radars were dispersed between the long range FPS-117 surveillance radars. Siting is such that the FPS-124s fill in the coverage gaps caused by terrain and earth curvature masking. The radars can detect and track small radar cross section, low flying targets, and are to be particularly effective in detecting cruise missile penetration of US and Canadian airspace.

The receiver and processor system is especially effective in eliminating clutter caused by migratory birds and ice floes, particular problems in the Arctic summer that could render the older DEW Line radars completely ineffective. The FPS-124 discriminates among targets based on speed and size. Automatic mapping eliminates unwanted returns from operator displays.

Data from the radar is processed on site and transmitted via communication link to the Regional Operational Control Centers (ROCCs) at Elmendorf AFB, Alaska, and at North Bay, Canada.



FPS-124 RADAR AND PROTECTIVE RADOME

SOURCE: Forecast International

Variants/Upgrades

There are none.

Program Review

Background. In 1957, the original DEW (Distant Early Warning) Line was deployed to protect Canada and the continental United States from attack by high-altitude Soviet strategic bombers. Through the years, aircraft improvements and radar aging made this warning fence less and less capable of performing its intended mission and more and more expensive to maintain.

In the early 1980s, the United States decided to replace the DEW Line with a modernized system to be known as the North Warning System (NWS). The US Air Force Electronic Systems Division was given responsibility for designing and developing the system. General Electric was selected to provide the 15 long-range radars and Unisys was tapped to design, build, and deliver the 39 short-range gap-filler systems.

The US and Canada signed a Memorandum of Understanding in 1985 to combine efforts and share funding for building this radar fence across the top of the North American continent, a warning system which would give better coverage of ingress routes and be particularly able to detect and track low radar-cross-section targets such as low-flying cruise missiles. Each country agreed to be responsible for providing and operating the systems within its borders. The US would manage development and acquisition of the radars and Canada would provide the satellite communications links between the radar sites and command centers in the US and Canada.

The installation of the long-range FPS-117 radars was completed in 1989; but design delays on the short-range radar and adjustments for the joint program kept production of the FPS-124 gap-fillers from beginning until 1991. Three developmental systems had been in test operation for three years when the production contract was awarded. Successful testing against cruise missile-sized targets was completed in mid-1989.

In 1993, CINC NORAD revalidated the need for NWS. The FY93 budget supported the deployment, integration, and testing of 19 UAR systems (one more than scheduled) with funding of US\$1.6 million. A total of US\$0.9 million was allocated to support the construction of three sites in Alaska.

NWS production was completed in late 1994. Deployment and integration of Canadian and Alaskan systems continued, funded at US\$1.8 million.

FY95 plans provided US\$1.15 million in post-deployment activities, residuals, and contract deficiencies.

Funding for the radar upgrades are from the overall Distant Early Warning (DEW) Stations Program Element. In FY94, the Air Force spent its US\$2.5 million supporting the DEW program office efforts in engineering and program support, deployment and site integration, and activating a depot maintenance facility.

In FY95, the nearly \$ US2.0 million R&D funding continued supporting the program office, with the bulk of the funds (US\$1.3 million) going toward post-deployment activities, residuals, and settling contract deficiencies.

FY96 PE plans included studies which were planned to lead to system modernization and commercialization in order to prevent obsolescence. In FY97, the program office would continue the modernization/ commercialization studies and evaluate trade-offs and a final redesign of the multiple display and human interfaces in the MCF facilities in Alaska and Canada.

In February 1996, the Air Force released a market survey of available radar interface units that would support the Region/Sector Operations Control Center (R/SOCC) modernization program. HQ ESC/ENS (PRISM) announced that it was seeking COTS/GOTS/NDI solutions to satisfy the requirement for providing a Radar Interface Unit for the R/SOCC. They anticipated that existing technologies and products could satisfy the need and would meet the open system architectures (e.g., UNIX, POSIX, etc.) requirement, emphasizing government and industry standards. The Radar Interface Unit would have to interface with a large variety of existing radars; including all Air Route Surveillance Radars (ARSR), Tethered Aerostat Radar System (TARS) radars, FPS-117, FPS-124, FPS-93, and others.

In another announcement, the Air Force advertised its market survey available Radar Tracker or Multi-Radar Trackers in support of the RSOCC modernization. This, too, would emphasize COTS/GOTS/NDI solutions. The requirement for the RSOCC to interface with 27-35 radars was expected to increase significantly.

Funding

	US FUNDING							
	FY94		FY95		FY96		FY97	
	QTY	AMT	QTY	AMT	QTY	AMT	QTY	AMT
RDT&E (USAF)								
PE0102412F								
DEW Radar Stations								
2710 North Warning								
System	-	2.5	-	2.0	-	1.0	-	0.0

NOTE: Funds support for the final deployment, installation, integration, and testing of both the Unattended Radars (FPS-124) and Minimally Attended Radars (FPS-117).

All US\$ are in millions.

Recent Contracts

(Contracts over US\$5 million.)

Contractor	Award (\$ millions)	Date/Description
Unisys	326.5	Oct 1990 — Follow-on firm fixed price contract for acquisition of 37 FPS-24 NWS unattended radars, ancillary equipment, four remote radar controllers, support hardware, and software. A special "Limitation on Payment of Profit or Fee" clause provided that no profit or fee was payable until ongoing "Ill Wind" investigations were resolved. Completed November 1994 (F19628-89-C-0058)
PMC/Frontec JV	25.2	May 1994 — FFP contract for operation, maintenance, and support services for 17 FPS-117 long range and 3 FPS-24 short range radars located throughout Alaska. Complete Sept 1999 (F65501-94-C-0015)

Timetable

	1957	Original DEW Line deployment
Mar	1985	US/Canada MoU signed
Jan	1989	Last FPS-117 long-range radar installed
	FY90	DT&E completed
Oct	1991	FPS-124 contract award, initial production deliveries, installations begin
	FY93	Requirement for NWS revalidated
4Q	1994	Production contract complete
late	FY94	FOC

Worldwide Distribution

This is a joint US/Canadian program.

Forecast Rationale

The North Warning System took advantage of new technology and developed very sensitive, operationally capable, reliable radars that could be operated and controlled from central locations. They replaced '50s-vintage equipment that was long past its prime and could not meet today's performance or reliability requirements. (This writer began his radar career maintaining these original Dew Line radars, and can relate to this evaluation.) The need for expensive manned sites was eliminated. Although the new North Warning System would be made up of nearly four times as many radars as the network it replaced, it would be less costly to operate and maintain and the data received are far more reliable and suitable for today's computer-intensive network environment.

The new radars take advantage of superior processing capabilities and incorporate the latest in electronic antenna scanning technology to minimize maintenance intensive mechanical systems. The unique antenna design has the potential for other applications. Since major ground-based

radar systems tend to be kept in operation for decades once developed, the FPS-124 and its follow-on sensors can be expected to be around well into the next century.

Because these radars were specifically designed for and installed in a singular system, there will be no more radars procured for NWS. The high reliability design limits the size of the repair and spare parts market for this system. The short-range but capable radar could be selected for other applications and there may be some interest from the Pacific Rim; but cost will limit the totals procured, and tactical radars are better suited for most Pacific Rim needs.

The radar is too large to be converted to tactical use, but its shorter range may make selected gap-filler or limited coverage applications feasible in the future. Once the company has an opportunity to investigate other markets, other interest could likely develop. But the total numbers would be small and it may not be cost effective to re-start production for a very small order.

Ten-Year Outlook

Production is complete. This report will be dropped next year.

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