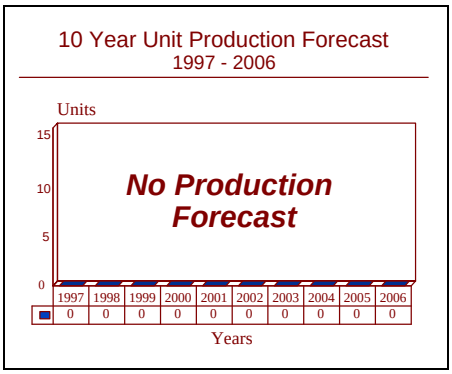
# SPS-40(V) - Archived 5/98

## Outlook

- Production complete
- Upgrades and spares support continue
- Multi-element upgrades will extend operational life into the next century




## Orientation

**Description.** Shipborne search radar.

**Sponsor**
US Navy
Naval Sea Systems Command (NAVSEA)
2531 Jefferson Davis Highway
Arlington, Virginia (VA) 22202
USA
Tel: +1 703 602 3381

**Contractors**
Northrop Grumman Corp
Electronic Sensors & Systems Division
10 Norden Place
Norwalk, Connecticut (CT) 06856
USA
Tel: +1 203 852 5000
Fax: +1 203 852 7698
[formerly Westinghouse Electronic Systems Group, Norden Systems]
(Prime: Development/Production)

Northrop Grumman Corp
Electronic Sensors & Systems Division
P.O. Box 17319
Baltimore, Maryland (MD) 21203-7319
USA
Tel: +1 410 765 1000
Fax: +1 410 993 8771
[formerly Westinghouse Electronic Systems Group]
(Solid-State Transmitter Upgrade)

**Status.** System production complete; upgrades and spares support.

**Total Produced.** Estimated total production was 156 systems. Modification production continues.

**Application.** Surface combatants.

**Price Range.** Undetermined.

## Technical Data

| | Metric | US |
|---|---|---|
| **Dimensions** | | |
| Antenna | | |
| Weight: | 785 kg | 1728 lb |

| | | |
|---|---|---|
| Dimensions: | 3 X 5.5 m | 18 X 9.75 ft |
| Below-decks equipment | | |
| Weight: | 1,576 kg | 3,474 lb |

**Characteristics**

| | |
|---|---|
| Frequency: | 400 to 450 MHz |
| Channels: | 10 |
| PRF: | 278 to 300 pps |
| Peak Power: | 125 to 225kW |
| Range: | 225 nm (max) |
| Pulse Width: | 3 µsec |
| | 60 µsec (compressed 60:1) |
| Antenna Beam Width: | 11° X 19° |
| Scan rate: | 7.5 or 15 rpm |
| Scan period: | 4 or 8 seconds |
| Clutter Improvement factor: | 54 dB |
| | 66 dB with Doppler Processor) |
| Track initiation: | Automatic |
| Track File Size: | 511 |
| MTBF: | 200 hr (SPS-40D/E) |

**Design Features.** The SPS-40 is a two-dimensional air search and surveillance radar used by surface ships to detect airborne targets at long and medium ranges. The system was specifically designed for long range surveillance and uses standard search radar operational techniques: MTI; frequency jitter; pulse compression; and several receiver and processor control techniques to enhance detection capabilities.

The most significant change to the radar has been the introduction of a Solid-State Transmitter (SSTx). This replaced the system's old tube-type transmitter, significantly enhancing reliability. The new system uses redundancy and interchangeability to insure maximum reliability and ease of maintenance. The SSTx was designed to degrade gradually and gracefully should components fail, insuring that the radar remains operational in spite of the problem and while repairs can be accomplished.

The SSTx can adjust the output power so Emission Control (EMCON) operations are possible; but it is capable of instantly resuming full power operation from the EMCON state on command of the operator. The transmitter can also adjust to high reflected energy caused by battle damage to the antenna or waveguide.

The system is available in a half-power version for ships involved in coastal operations that require shorter-range sensors. The Solid State Driver cabinets are combined with existing Power Amplifier cabinets to form a single-unit PA configured transmitter instead of two cabinets.

Other receiver, processor and antenna improvements are being considered to update the SPS-40 with new technology. The latest receiver upgrade includes an enhanced signal-to-noise ratio through optimum signal processing. The radar is equipped with interfaces to feed radar data into the ship's combat control system.

**Operational Characteristics.** Like the SPS-49, the SPS-40 is a standard air surveillance radar for the surface fleet. It is found on many older combatants and auxiliaries and supports long-range target detection and tracking, self-defense and fire control system designation. The radar will detect aircraft at long ranges in a variety of sea states, providing early warning of the approach of aircraft and has good range resolution to detect multiple missile raids.. It is IFF capable for air traffic control and threat identification operations.

The system detects, within limits, the approach of low-flying targets. The radar incorporates a variety of electronic counter-countermeasures to insure effective operation in hostile electronic environments. Frequency agility and side-lobe reduction are ECCM features under development. IT was designed to have a limited vulnerability to Anti-Radiation Missiles.

## Variants/Upgrades

**SPS-40B.** This version uses a 3 µsec pulse, 300 pps PRF, Digital MTI, low-flying-target detection mode (LFDM), automatic target detector and various ECCM improvements. Some systems had a Minimum Range Modification (MRM) that provided range and bearing

information on low-flying aircraft that were in the SPS-40 and SPS-40A blind spot.

**SPS-40C/D.** These solid-state variants add reliability enhancements and combine most of the earlier model features. The SPS-40C went into service in the early 1970s and included the LFDM modification. The SPS-40D was an improved version of the -C. Both exhibited a 40-percent improvement in reliability and maintainability over the earlier systems.

**SPS-40E.** This is an SPS-40 with the Westinghouse SSTX modification. It has become the standard version of the SPS-40 for the Fleet.

# Program Review

**Background.** Originally developed by Lockheed Electronics, the SPS-40 was introduced into US Navy service in the early 1960s as a replacement for the SPS-31. It was designed for destroyers, but came to be used on numerous classes of ships. It has subsequently been fitted in ships of other navies from South America, Europe and the Middle East.

The Navy deployed ships with the Solid State Transmitter to the Persian Gulf and Red Sea during Operation Desert Storm. In this combat environment, operators reported superior reliability and performance stability from the systems. A hoped-for major retrofit of the SPS-40E to many ships was canceled due to lack of funding.

In February 1996, the Navy announced that it intended to issue a solicitation for integration of the SPS-48E radar with the SYS-2 Integrated Automatic Detection Tracking System (IADT) and for integrating the SPS-40E Radar with the SYS-2(V) (IADT). The specifications for the computer systems were: Motorola Power PC Model, MVME 1604-023, 133 MHz; CPU, MPC 604; Memory Dram, 32 Mb; Memory Flash, 1 Mb; Memory Cashe, 256 Kb; Ethernet Interface; SCSI Interface; Graphics Output; Four Serial I/O; and One Parallel I/O.

Acquisition of the Motorola brand name power personal computer systems was essential to the government's requirements, precluding consideration of a product manufactured by another company. The intended Motorola source has the only verified and validated hardware which could execute the existing tactical software. Therefore, the acquisition would be issued on a sole-source basis.

Generic Simulator Program. In March 1995, the Naval Sea Systems Command announced that they were conducting a market survey to identify sources to provide Generic Navy Stimulators/Simulators (GNSS). The GNSS is to be built to Open System Architecture (OSA) standards incorporating a functionally modular design using Non-Developmental Items and Commercial Off-The-Shelf products as well as industry-defined software and communication interface standards. An overall objective in the design and development of the GNSS is to provide the Navy with the most cost-effective system which makes maximum use of the inherent Battle Force Tactical (BFTT) System capabilities, while allowing as much flexibility as possible for future growth.

According to the *Commerce Business Daily* announcement, the government will solicit plans to develop, manufacture, install and maintain standardized radio frequency (RF) and intermediate frequency (IF) Stimulators and Digital Simulators for the Surface Navy, on a variety of surface platforms. The GNSS shall consist of a GNSS controller Versa Module Eurobus (VME) and a ship-specific number (1-6) of Radar Signal Generator enclosures capable of producing, either by stimulation or simulation, modeled radar return signals and/or video signals associated with the following radar sets: AIMS MK XII IFF; SPN-35; SPN-43; SPN-46; SPQ-9B; SPS-40 Series; SPS-48 Series; SPS-49 Series; SPS-55 Series; SPS-67 Series; TPX-42; UPX-29; UPX-30; UPX-36; MK 23 TAS; and MK 95 NSSMS.

The Navy anticipated issuing a final RFP in May 1996 with a Cost Plus Incentive Fee development and test contract award in Fall 1996. The contract would contain fixed price options for five subsequent years of production equipment. In addition, product improvement engineering and engineering support would be procured throughout the contract's period of performance.

# Funding

US FUNDING

| | FY96 | | FY97 | | FY98 (Req) | | FY99 (Req) | |
|---|---|---|---|---|---|---|---|---|
| | QTY | AMT | QTY | AMT | QTY | AMT | QTY | AMT |
| Procurement (USN) | | | | | | | | |
| SPS-40 | - | 0.0 | - | 7.5 | - | 0.7 | - | 0.0 |

All US$ are in millions.

## Recent Contracts

No contracts over US$5 million recorded.

## Timetable

| | | |
|---|---|---|
| Jun | 1961 | Initial systems delivered |
| | 1990 | US Navy initiated SPS-40 upgrade |
| | FY92 | Receiver modifications complete |
| | FY94 | SSTx transmitter deliveries, current contract complete |
| | FY96 | Antenna restoration program complete |

## Worldwide Distribution

In service with **Australia, Brazil, Germany, Greece, Japan, Pakistan, Turkey** and the **United States**.

## Forecast Rationale

Although the SPS-40 is an old system, upgrades, enhancements, and repairs have kept it operational and capable. Enhancements capitalized on newer technology to maintain radar performance at an acceptable level.

The Solid State Transmitter was one of the radar's most important upgrades. The transmitter of a high-powered radar is its weak link and the redesigned power amplifiers eliminate this source of trouble, making "fail-soft" the usual failure mode, instead of the sudden, complete failure typical of tube transmitters. In the "fail soft" mode, performance degrades gradually should one or more solid-state components fail. This prevents total loss of surveillance capability and allows the system to operate while repairs are being made.

The solid state components are more cost-effective and maintenance costs are lower. Because budget constraints make it necessary to maintain operations as long as possible with successful equipment, the SPS-40 can plan on a long life on the ships carrying it. Other enhancements and repairs, such as a series of receiver and data processing upgrades and the replacement of many antenna assemblies, are combining with the new transmitter to give the fielded SPS-40s a long life expectancy. Most should remain operational as long as the ship carrying it is active. The Navy continues to seek information on possible upgrades and improvements. Newer systems with more modern designs are available. These include the SPS-48(V) and SPS-49(V); but the Navy continues to deploy a sizable number of surface combatants equipped with the SPS-40C/D/E.

The Navy is involved in upgrade programs for the receiver, receiver signal processor and a solid state transceiver. Many antennas are being replaced. This will extend the operational life of the system. Support will continue for those systems at sea.

## Ten-Year Outlook

No more production expected.

* * *