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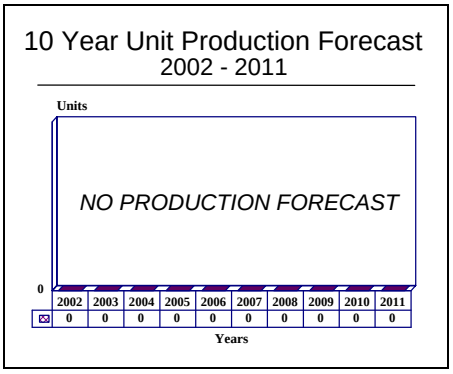
WM-20 Series FCS - Archived 3/2003

Outlook

- No recent contracts detected
- Limited, if any, activity expected
- Barring any new information, this report will be archived in the near future



Orientation

Description. I/J-band 2D radar(s) system.

Sponsor
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The Netherlands
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Contractors
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SaabTech Electronics
(Formerly CelsiusTech Electronics AB)
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Sweden
Tel: +46 8 580 840 00
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(Upgrade package for WM-20 family)

Licensee
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Status. In service.

Total Produced. More than 300 WM series radar systems are estimated to have been sold worldwide.

Application. Search, tracking, and surveillance for weapons control.

Platform. The WM-20 series fire-control radar systems are deployed on warships of frigate, corvette, fast attack and patrol craft size, and are configured for weapons ranging from 40 mm to 120 mm guns/Sea Sparrow and

Aspide missiles, as well as a 21-inch wire-guided torpedo.

Price Range. The current cost of a WM-20 series FCS is believed to be approximately US$6 million to US$8 million. Other members of the family vary widely in cost, starting at US$2 million, depending on the weapons configuration and the number of features available. The upgrade packages cost between US$600,000 and US$1.2 million depending on the version being modernized.

Technical Data

	Metric	US
Specifications		
Radome diameter:	2.39 m	7.9 ft
Radome height:	3.26 m	10.7 ft
Radome weight:	780 kg	1716 lb
Peak power:	1000 kW	

Design Features. WM-20 series fire-control systems are available in a wide variety of configurations, all of which include elements of the WM-20 series radars. The basic system uses a digital weapon control computer, the integration of sensors, combat information and weapon control, and the integration of the search and tracking radar antennas.

Typically, a WM-20 series fire-control system features a combined antenna comprising surveillance and tracking radars that operate in the I and J bands, respectively. With the exception of the WM-26, which is housed in a hemispheric radome and is for surface gunnery control only, all the other members of the WM-20 series are housed in a near-spherical radome. Within this radome, the tracking/illuminating antenna is mounted above the surveillance antenna, and elevation is effected by an autonomous servo-drive. A monopulse radar receiver is also configured with the tracking antenna.

In systems configured for compatibility with semi-active missile types, a Continuous Wave (CW) Illuminator can be incorporated (with a few component changes) into the upper antenna. A separate gimbal and stabilizing arrangement is featured between the upper (tracking) and lower (search) antennas. The search antenna is located on a horizontally stabilized platform using a common servo drive in azimuth. Newer systems feature the Local Attitude Reference System (LARS), which supersedes earlier WM-20 series radar stabilization facilities. The entire antenna group is mounted on anti-shock/vibration mounts, as high as can be managed on the craft concerned (typically on top of the wheelhouse on FACs). The search antenna features a circular polarization unit with a low noise amplifier for the search radar.

As in the wider range of Signaal fire control systems, the WM-20 series radars can operate with a single transmitter driving both search and tracking elements. Alternatively, a double transmitter arrangement is available for surveillance and air-target tracking. Both magnetron and Traveling Wave Tube (TWT) versions are in production.

Operational Characteristics. In operation, the surveillance radar carries out the air and surface search mission, as well as the tracking function in surface engagements. The tracking radar carries out tracking for aerial engagement only, including such targets as sea skimming missiles and very low airborne threats. WM-20 series fire-control systems are capable of engaging one air, two surface gun-control, and two torpedo engagements simultaneously.

WM-20 series fire-control systems have been configured with the following weapons:

- 40 mm L70 Bofors
- 40 mm L70 Breda Bofors twin
- 76 mm L62 Oto Melara compact
- 4.5 L45 twin Mk6
- 3.9 L55 MOD 1968/3
- Bofors 4.7 L50 single
- Bofors 120 mm L46 single
- General Dynamics Standard Missile
- Shorts Sea Cat
- Raytheon Sea Sparrow
- Alenia Aspide
- 21-inch wire-guided torpedo

Variants/Upgrades

The WM-20 series are configured to perform a wide variety of naval fire control missions. Broadly, these can be stated as follows:

Mk 92/94. Future orders for these licensed production WM-20 series fire control systems will be placed with Sperry in the US.

WM-20 is designed to control torpedo and gunfire on small attack craft. It has one air and one surface gun-control channel and two torpedo fire control channels. WM-20 can track one air and three surface targets simultaneously.

WM-22 is a simpler gun-fire control system of the WM-20 for larger surface ships, capable of tracking one air target. It is intended for use with a long-range search radar and can control two guns against one air and one surface target simultaneously. A third gun channel can be added as an option.

WM-24 has one air and one surface gun control channel with an option for a third, plus an ASW control channel. It is the only member of the family with an ASW capability.

WM-25 is specifically for low-level air defense applications, applying an integrated system concept. It can control a semi-active surface-to-air missile by providing continuous-wave target illumination and has the capability to simultaneously track one air, one surface and one shore target or one air and two surface targets. Air targets are tracked by the pulse Doppler dish, while surface targets are tracked by the search antenna in TWS mode. The WM-25 is usually used with the Sea Sparrow missile system. The WM-25 is also fitted with anti-clutter and anti-jamming features.

WM-26 is a highly simplified anti-surface gunnery fire control system and navigation system. It is limited to controlling two single-purpose guns and uses only the search element of the WM-20 series radar. The WM-26 is designed to provide continuous air and surface surveillance, radar navigation, combat information, target designation, and weapon control.

WM-27 is a combined SSM, gun and anti-ship torpedo control system, which provides one surface gun channel, one surface-to-surface missile channel and two torpedo control channels. This and the WM-20 are the only members of the family with torpedo-control capability.

WM-28 can track one air and one surface target simultaneously while controlling one surface-to-air missile and two light or medium guns. WM-28 is license-built (in a modified form) in the US as the Mark 92 FCS.

WM-29 controls one command-guided surface-to-air missile and two surface gun channels. WM-29 is designed to include a Signaal LIOD optical director, which can be used as a secondary tracking channel.

In 1991, CelsiusTech Industries (now SaabTech Electronics) introduced a major upgrade applicable to all members of the WM-20 family. This upgrade reduces the number of printed circuit boards from 1300 to approximately 12 (the exact number depends on the version of the WM-20 being modernized). This modification greatly increases the availability of the system, while new prediction algorithms improve reaction time four to eight seconds. Angular resolution is also improved significantly.

This was quickly followed by an equivalent upgrade package from Signaal, which also uses modern electronics technology to improve the reliability of the system and enhance performance against low-altitude targets. The ability of the system to operate in severe clutter conditions and engage maneuvering targets was also upgraded. Reaction time was improved to three to five seconds. Overall angular resolution is improved to 0.8 mrad.

Program Review

Background. The design of the WM-20 series fire-control system stems from a development initiative dating back to the 1960s. Since then, successive improvements have been added to the system, including digital processing, TWT transmitters, and improvements to antenna stabilization. This has resulted in a steadily improving reaction time, greater resistance to ECM, and higher reliability. Ballistic computations have also been improved, while new filtering techniques and Fast Fourier Transform (FFT) processing give better detection and prediction against fast-maneuvering targets. WM-20 is the direct linear descendant of earlier M series of fire-control systems from Hollandse Signaalapparaten BV (now Thales Netherlands). US development of the WM-20 Series fire-control systems began in 1972.

In 1991, the CelsiusTech group in Sweden introduced a major upgrade and modernization package for the WM-20 family. This uses modern integrated-circuit technology to reduce the number of printed circuit boards from 1300 to approximately 12 and resolves the contact problems that had previously reduced the availability of the WM-20 family. The efficiency of the system has been greatly improved. New processing technology has also been employed to improve the reaction time of the system and upgrade its accuracy. CelsiusTech claims that the upgrade package costs between 15 and 30 percent of the cost of a new WM-20.

The CelsiusTech package was swiftly followed by the announcement of a similar upgrade package from Signaal. As could be anticipated, this offered the same range of improvements as the CelsiusTech package but claimed superior performance in the most significant areas. From late 1991 through 1993, a the two upgrade packages were in resolute competition.

By 1995, a total of some 90 Signaal-produced upgrade packages were being installed on warships of the Belgian, Egyptian, German, South Korean, Thai, and Dutch navies. In contrast, the CelsiusTech competitor has not received any publicly acknowledged sales, although it is possible that unannounced deliveries have been made.

Although a number of new potential platform orders and program initiations were announced by a variety of possible customers during 1994, none of these specified the WM-20 as the fire-control radar. Instead, the later Signaal STING radar appeared to be the preferred system for these applications.

Funding

The WM-20 series fire-control system has been developed by Hollandse Signaalapparaten BV (now Thales Netherlands) as a private corporate venture. The Mk 92/94 fire-control systems are license-produced by Sperry in the US, with separate development funded by the US DoD under PE#64301N Project SO179 and System Upgrade Project S-1783.

Recent Contracts

No contractual information has been made publicly available.

Timetable

Year	Major Development
1991	Order by the Philippines for FAC
1991	CelsiusTech upgrade package introduced
1991	Signaal upgrade package introduced

Worldwide Distribution

Argentina (4 WM-28 on Espora corvettes)
Australia (1 WM-22 on River class frigates, 6 WM-28 on Adelaide class frigates)
Belgium (3 WM-25 on Weilingen frigates)
Egypt (2 WM-28 on Descubierta class frigates)
Finland (2 WM-22 on Turunmaa corvettes)
Germany (8 WM-25 on Bremen frigates, 10 WM-27 on Type 143A FAC, 10 WM-27 on Type 143B FAC, 10 WM-22 on Type 343 minesweepers)
Greece (6 WM-25 on Elli frigates)
Indonesia (1 WM-28 on Hajar Dewantara frigate, 3 WM-28 on Fatahilah frigates, 4 WM-28 on Daggar FAC, 4 WM-22 on Signa large patrol craft)
Iran (10 WM-28 on Kaman FAC, 2 additional craft sunk by USN)
Japan (2 WM-25 on Shirane helicopter carriers)

South Korea (9 WM-28 on Ulsan frigates, 4 WM-28 on Donghae corvettes, 24 WM-28 on Po Hang corvettes)
Malaysia (2 WM-22 on Kasturi frigates, 1 WM-22 on Rahmat frigate)
Morocco (4 WM-25 on Lazaga FAC, 1 WM-25 on Modified Descubierta)
Netherlands (4 WM-25 on Kortenaer class frigates, 2 WM-25 on Tromp class frigates)
Nigeria (1 WM-25 on Aradu destroyer, 2 WM-24 on Erinomi frigates, 1 WM-28 on Ekpe FAC, 1 WM-24 on Mk 9 Vosper Thornycroft corvette)
Norway (8 WM-26 on Storm FAC)
Peru (1 WM-25 on cruiser Aguirre, 1 WM-25 on cruiser Almirante Grau)
Singapore (6 WM-28 on Sea Wolf FAC, 1 WM-26 on Sovereignty FAC (retired))
Spain (6 WM-25 on Descubierta frigates)
Thailand (1 WM-22 on Makut Rajakumarn frigate, 2 WM-25 on Tapi frigates, 2 WM-25 on Rattanakosin corvettes, 3 WM-25 on Ratcharit FAC, 3 WM-28 on Prabarapak FAC, 3 WM-22 on Chon Buri FAC)
Turkey (4 WM-25 on Yavuz frigates, 8 WM-28 on Dogan FAC)

Forecast Rationale

The Thales Netherland WM-20 series is a family of I/J band 2D fire-control radar systems designed for use on frigates, corvettes, fast-attack, and patrol crafts. Having been in service for over 30 years, the radar system has undergone several upgrades to enhance its performance. The WM-20 series is optimally configured for weapons ranging from 40 mm to 120 mm guns/Sea Sparrow, Aspide missiles, and the 21-inch wire-guided torpedo.

Since its development in the 1960s the WM-20 radar series has had considerable success on the international market. However, it appears that time has finally caught up the WM-20 radar series. Procurement for the WM-20 appears to have ceased. In spite of significant modernization, the WM-20 simply cannot compete with newer technologically advanced systems that offer modern open architectures. Many WM-20 systems are currently being replaced by the newer STIR and STING Systems.

Although it is highly unlikely that any more systems will be produced, there is still remains the possibility of upgrades for those customers who decide that it is not cost-effective to replace their WM-20s. Any activity for WM-20 over the next decade is expected to be very limited. Barring any new developments, this report will be archived in the near future.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR PRODUCTION

			High Confidence Level				Good Confidence Level			Speculative			
Designation	**Application**	**Thru 01**	**02**	**03**	**04**	**05**	**06**	**07**	**08**	**09**	**10**	**11**	**Total 02-11**
WM-20 FCS	Prior Prod'n:	393	0	0	0	0	0	0	0	0	0	0	0