

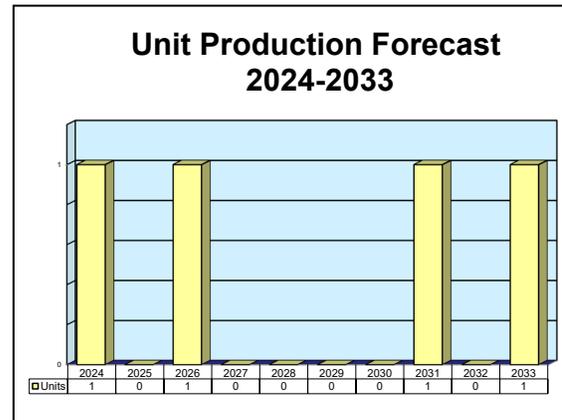
ARCHIVED REPORT

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Submarine Command System (SMCS)

Outlook

- Production of ACMS version will parallel Astute submarine production
- Dreadnought SSBN(R) submarine will likely be equipped with the ACMS-upgraded variant – the Common Combat System



Orientation

Description. The Submarine Command System (SMCS) is a command and control system optimized for submarine use. It is an integrated system capable of coordinating communications, sensors, and weapons systems on U.K. Royal Navy submarines. The system has several variants that fulfill specific requirements for individual submarine classes.

Sponsor

U.K. Ministry of Defence (MoD)
 Defence Equipment and Support (DE&S)
 Maple 0a, #2043
 MoD Abbey Wood
 Bristol
 BS34 8JH
 United Kingdom

Status. In production and operational service. The U.K. Royal Navy's Vanguard and Trafalgar classes of submarines have been upgraded to the SMCS NG configuration, as have three shore-based trainers.

The Astute class submarines of the U.K. Royal Navy are being equipped with the Astute Combat

Management System (ACMS), which evolved from the SMCS.

Application. The coordination of communications, sensors, and weapons systems on U.K. Royal Navy submarines.

Price Range. Analysis of a 1994 contract yielded an estimated cost for each Vanguard/Trafalgar class SMCS of \$15.6 million, which when adjusted for inflation equals \$33.52 million in June 2024 U.S. dollars.

The cost of a single SMCS NG upgrade kit was estimated at \$5.5 million in 2004, or \$9.33 million in June 2024 inflation-adjusted dollars. The cost of a full-system SMCS NG was originally estimated to be \$22.66 million based on cost averaging of a 2004 contract, which equates to approximately \$38.34 million in June 2024 when adjusted for inflation.

The ACMS model and the SMCS NG are believed to have similar costs.

Submarine Command System (SMCS)

Contractors

Prime

BAE Systems, Defence Information, Training & Services (DITS)	http://www.baesystems.com, Victory Point, Lyon Way, Frimley, Surrey, United Kingdom, Tel: + 44 1276 603000, Fax: + 44 1276 603001, Prime
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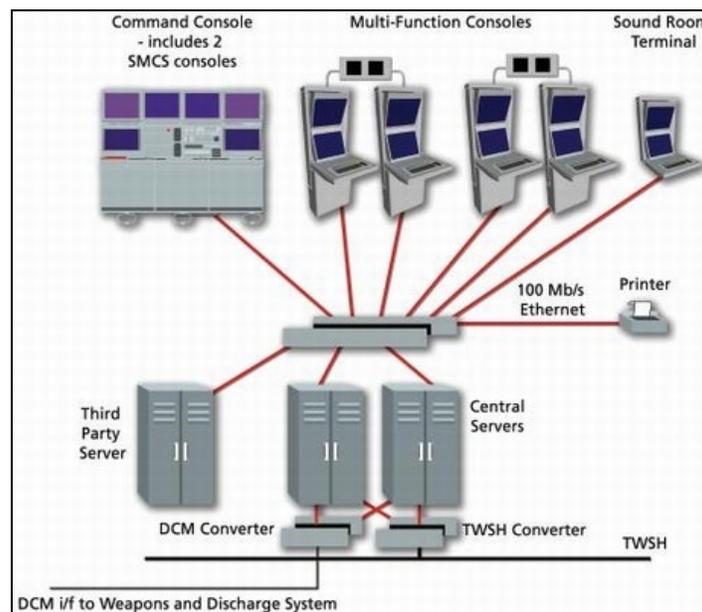
Contractors are invited to submit updated information to Editor, International Contractors, Forecast International, 75 Glen Road, Suite 302, Sandy Hook, CT 06482, USA; rich.pettibone@forecast1.com

Technical Data

Design Features. The Submarine Command System (SMCS) links multifunctional consoles in the operations room with the computer room through a dual fiber-optic local area network. The fiber-optic LAN has considerable built-in extra capacity; only 30 percent of its data transmission capacity is utilized at the usual level of traffic. In the computer room, dual input/output nodes and dual common service nodes link the SMCS to the sensors and weapons systems and take care of the processing. The input/output nodes provide the interface between the raw data generated by the ship's sensor systems, while the common service nodes and their related storage devices provide the system's master database and higher processing functions. Local data and processing are distributed throughout the system.

A bulk store unit supports the four nodes. In a typical SMCS processing configuration, 150 Intel-386 32-bit processor chips are incorporated.

The SMCS, which uses high-resolution color graphics and built-in plasmas, is reportedly the first British naval command system to have multifunctional common consoles with color displays. The individual consoles display the overall tactical situation or further process the data to provide specific information. The remote terminal facility provides an off-line capability for interrogating the system without interfering with the console operators. Software independence from hardware is a key feature of the design.



Submarine Command System (SMCS NG) Integration

Source: BAE Systems

Submarine Command System (SMCS)



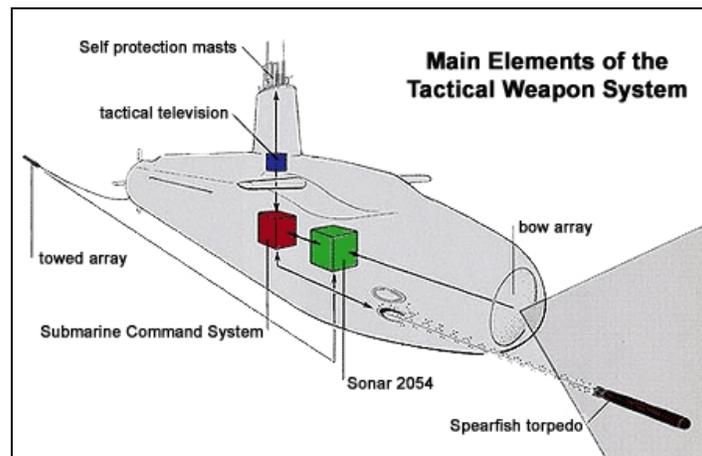
Submarine Command System (SMCS NG) Console

Source: BAE Systems



Astute Combat Management System (ACMS) Console

Source: BAE Systems



SMCS Submarine Platform Location

Source: U.K. Royal Navy

Submarine Command System (SMCS)

Variants/Upgrades

Successor. The Successor is an export-oriented command and control system intended for submarines and surface ships. Its technology provided the basis for both the Submarine Command System (SMCS) and the Surface Ship Command System (SSCS).

SMCS NG. The Submarine Command System Next Generation (SMCS NG) is the upgraded version of SMCS and uses both commercial off-the-shelf (COTS) hardware (personal computers) and software.

ACMS. The Astute Combat Management System is a submarine command system based on and evolved from the technology used in producing the SMCS. The ACMS is being installed on all Astute class submarines.

Common Combat System. Advanced ACMS that will eventually be installed on all Astute, Vanguard, and future Dreadnought (SSBN) class submarines.

Program Review

Background. The U.K. Royal Navy's Submarine Command System competition opened in 1984 and the first 14 sets were ordered in April 1986, accompanied by SMCS software deliveries. The initial sets outfitted the HMS *Vanguard*, *Victorious*, and *Vigilant*; seven Swiftsure and Trafalgar class SSN refits; the team trainer at Faslane; a hardware reference set; and a maintainer trainer.

The original SMCS contractor, Gresham-CAP, went through several name changes. Gresham was taken over by Dowty, and the company name was changed to Dowty-CAP. The CAP group then merged with Sema-Matra to form the Sema Group. Dowty-CAP started trading under the name Dowty-Sema on June 1, 1989. British Aerospace then formed a joint venture with Sema, making the group Dowty-BAE-Sema, although the Dowty-Sema name was retained in practice. Subsequently, Dowty was taken over by TI International, which sold its interest in the joint venture to BAE, and the group took the name BAESEMA. In 1999, British Aerospace and GEC-Marconi merged to form BAE Systems, the current SMCS contractor.

In June 1990, the first equipment successfully achieved its Naval Weapons Harbor Trial (Equipment) rating at the Trident Tactical Weapon System Shore Development Facility. Equipment was then accepted by the U.K. Ministry of Defence for delivery to HMS *Vanguard*, Britain's first Trident submarine.

After Sea Trials, SMCS a Go

HMS *Vanguard* sea trials began in 1993, culminating in the test-firing of a Trident ballistic missile. The SMCS proved successful during these trials and demonstrated substantially greater capability than anticipated.

In May 1994, the U.K. Ministry of Defence ordered nine more SMCS units; HMS *Sovereign* and HMS *Trafalgar* were the first two SSNs to receive

them. SSNs with modernized sensor and combat systems (under the SSN Update I program) received the SMCS Release 5 software, the same version being fitted to Vanguard class SSBNs. The Update I program, also known as the Initial Phase, involved six SSNs (believed to be *Sovereign*, *Trafalgar*, *Turbulent*, *Superb*, *Tireless*, and *Splendid*). The Release 5 upgrade included a modified SMCS to interface with sonar improvements, as well as featuring functional improvements and updated hardware.

In 1998, as the technology of SMCS began to evolve into an open system using COTS hardware, BAE Systems reportedly sought to export it to Australia and other Asia-Pacific markets. However, no sales outside the U.K. have been announced.

The HMS *Trafalgar* attack submarine, one of the first U.K. Royal Navy submarines to be outfitted with the SMCS, returned to its homeport in Plymouth, England, in May 2002, following a successful tour as part of Operation Enduring Freedom. Earlier that year, HMS *Trafalgar* test-launched its first Tomahawk land attack missile in the Gulf of Mexico while working out of the U.S. Air Force test range at Eglin in western Florida, using the U.S./U.K. version of the Advanced Tomahawk Weapon Control System software. This software, which uses the SMCS, enhances interoperability between the U.K. Royal Navy and the U.S. Navy.

In June 2004, the U.K. Defence Procurement Agency awarded Alenia Marconi Systems (AMS) a contract for the upgrade of Trafalgar class submarines to the SMCS NG configuration. The first unit was installed on HMS *Torbay* and a unit was later fitted on HMS *Talent*.

Following the successful installation on HMS *Torbay* in June 2005, the U.K. MoD awarded BAE Systems (AMS was disbanded in April 2005, see below) a new contract to outfit a combined total of 11 Vanguard,

Submarine Command System (SMCS)

Trafalgar, and Swiftsure class submarines with the SMCS NG, plus three shore-based trainers.

Vanguard Class HMS Vengeance Begins Long Overhaul

The U.K. House of Commons reported in March 2012 that the U.K. Ministry of Defence had signed a contract valued at GBP350 million (\$544.8 million) with Babcock Marine Ltd for the "Long Overhaul Period (Refueling) (LOP(R))" of HMS *Vengeance*, to take place at Devonport dockyard, Plymouth. HMS *Vengeance* is one of the four Vanguard class submarines carrying Trident missiles, which provide the U.K.'s strategic nuclear deterrent. The LOP(R) is essential to enabling HMS *Vengeance* to remain operational. This program, which was scheduled to last approximately three and a half years, would involve the installation of a new reactor core, the energy source that powers the 15,000-ton vessel. The new core would provide the submarine with sufficient fuel for the remainder of its planned service life. The LOP(R) would also involve the installation of improved strategic weapons system equipment and a tactical weapons submarine command system (SMCS NG). Finally, the LOP(R) would also enable HMS *Vengeance* to achieve safety recertification.

The award of this contract secured around 1,300 jobs in Devonport dockyard, plus a further 700 in the supply chain. The contract was awarded using an improved performance-based contracting strategy agreed upon as part of the Babcock Marine Terms of Business agreement, which aims to return savings of several hundred million pounds to the MoD over the 15-year duration of the agreement.

This is the last time the U.K. Royal Navy's submarines will require refueling, as newer classes of submarines are designed with sufficient fuel for their entire service life. Extended maintenance periods, however, will still be required to ensure the safe and effective operation of submarines, so the unique capability at Devonport to perform deep maintenance will remain vital.

Astute Class Takes Technology a Step Forward

Astute class submarines use the Astute Combat Management System, which appears to be heavily based on the technology used in the SMCS. An estimated eight ACMS units may be built: seven for the actual submarines and one for shore-based training.

Astute Class Production Will Influence Sales of ACMS

Production of the Astute class submarines has now stabilized and is on course. Any hope that an eighth Astute class submarine would be ordered has vanished. In February 2018, HMS *Audacious* successfully conducted its first test dive, putting it on schedule to complete acceptance trials and commission later in the year.

In May 2018 it was finally announced that the seventh submarine of the Astute class had been ordered and would be named HMS *Agincourt*.

Astute Class Faced Delays Even Before COVID-19

The Astute class submarine program has not been a happy experience for the U.K. Royal Navy or the British submarine industry in general. The submarines have come in far in excess of the planned costs and are more than a decade behind the original schedule. As a result of design and construction problems and excessive costs, and because other areas of investment were given priority, the SSN force level has fallen from 14 submarines to seven. This is barely adequate to support the SSBN fleet and leaves other areas of capability unaddressed.

Although the seventh Astute class submarine has been ordered, it has been several years since the last Astute class submarine was laid down. Thus, the supply and support network for additional construction has probably been dispersing. There is the additional problem that the Dreadnought class SSBN program, now in the construction phase, is absorbing the industrial infrastructure needed for another SSN.

There were reportedly growing doubts within the U.K. Royal Navy over some basic design choices made early in the Astute program. The adoption of the PWR-2 reactor was one example, with critics noting that the PWR-2 was designed to power a much larger submarine with a different operational profile. Allegedly, this reactor fed steam to turbines derived from the preceding Trafalgar class. Those turbines proved unable to absorb the extra power generated by the reactor. As a result, it was alleged that Astute failed to reach its intended speed. Since that speed is classified, the truth of these accusations is hard to gauge, although official statements assert that the Astute class has met its current speed targets.

The "official" 2024 completion date for HMS *Agincourt* proved unattainable and completion was pushed back to 2026. At this point, an additional delay to 2027 cannot be ruled out.

Submarine Command System (SMCS)

The first of four Dreadnought class submarines is likely to enter active service in 2031.

AMS Disbanded. Alenia Marconi Systems was created in 1999 as a joint venture company owned equally by BAE Systems of the U.K. and Finmeccanica of Italy. AMS operated within the domains of integrated air defense systems, naval mission systems, battlespace C4I, air traffic management and airport systems (ATMAS), simulation and synthetic

environments, systems integration, training solutions, and manufacturing. Within the ongoing restructuring of the European defense industry, BAE Systems and Finmeccanica completed the Eurosystems transaction agreement on April 29, 2005, resulting in the dissolution of the AMS JV. The U.K. operations of AMS Ltd (excluding ATMAS) returned to BAE Systems and the Italian operations of AMS SpA and all air traffic management activities returned to Finmeccanica (now Leonardo).

Contracts/Orders & Options

No recent contracts have been identified.

Worldwide Distribution/Inventories

U.K. The SMCS is installed aboard four Vanguard class ballistic nuclear (SSBN) submarines and the one remaining Trafalgar class nuclear-powered attack (SSN) submarine. The ACMS is being installed on seven Astute class SSNs (five active and two under construction). An upgraded variant of the ACMS is likely to be installed on the four Dreadnought class SSBNs.

Forecast Rationale

Through the use of commercial off-the-shelf (COTS) components, the Submarine Command System Next Generation (SMCS NG) offers cost savings that make it an attractive system.

The SMCS variant known as the Astute Combat Management System (ACMS) is designed primarily for the U.K. Royal Navy's Astute class submarines and is expected to perform just as well as the early SMCS

models. Production of the ACMS will parallel production of the seven Astute submarines. A unit or two may also be produced for shore-based training.

The Dreadnought class SSBN submarines will likely use an upgraded variant of the ACMS. The first Dreadnought class submarine is expected to enter service in 2031.

Ten-Year Outlook

ESTIMATED CALENDAR YEAR UNIT PRODUCTION												
Designation or Program	High Confidence					Good Confidence			Speculative			Total
	Thru 2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
BAE Systems (Prime)												
ACMS <> United Kingdom <> Navy <> Astute												
Note: Forecast numbers are based on Astute platform commission date.												
	5	1	0	1	0	0	0	0	0	0	0	2
ACMS <> United Kingdom <> Navy <> Dreadnought												
Note: Forecast numbers are based on Dreadnought platform commission date.												
	0	0	0	0	0	0	0	0	1	0	1	2
Subtotal	5	1	0	1	0	0	0	0	1	0	1	4
Total	5	1	0	1	0	0	0	0	1	0	1	4