9LV CS
COMBAT SYSTEM
Saab’s 9LV naval combat system solutions offer complete C4I for every type of naval platform, ranging from combat boats and patrol boats, to frigates and aircraft carriers, as well as submarines and vessels for anti-piracy, security and surveillance.

Our 9LV solutions provide naval forces with outstanding operational capabilities, supporting all mission types, from littorals to the open ocean.

Saab’s 9LV naval combat system solutions consist of three different packages to fit your needs and your platform:

**9LV COMBAT SYSTEM (9LV CS)**
As the Lead Systems Integrator (LSI) of the complete combat system, Saab will manage the through-life process and reduce any risk. We can also take the role of Prime Contractor (PC), supplying the platform and a fully integrated combat system. The flexibility of 9LV CS allows customers to select best-of-breed products and components regardless of provider – enabling complete freedom of choice.

**9LV COMBAT MANAGEMENT SYSTEM (9LV CMS)**
The 9LV CMS is the command and control centre of many advanced surface vessels and submarines. Saab can take full responsibility for the CMS solution, and due to the open architecture of 9LV, can provide subsets of the CMS solution in partnership configurations. A full 9LV CMS configuration includes the Fire Control System (FCS).

**9LV FIRE CONTROL SYSTEM (9LV FCS)**
Saab can act as sub-supplier of the FCS, including kill chain components to other onboard CMS. The Saab Fire Control System configurations range from a single EO director connected to a naval gun, to the full anti-air warfare (AAW) and anti-surface warfare (ASuW) self-defence suite for a frigate or destroyer. This includes a combination of guns, missiles and decoys with full automation support.
THE COMBAT SYSTEM CONCEPT

Saab is your delivery partner for new and upgraded surface warship and submarine platforms. With our knowledge, skills and professionalism, we will manage your product’s entire lifecycle with you and manage the risks. Saab can assist in a variety of ways: from contributing as a subsystem supplier and integrator, to being the combat system LSI or platform PC. Saab can provide through-life support solutions that range from specifically tailored support services to full availability contracts, as well as ongoing technology upgrades required to maintain your operational capability. Saab has skills and experience in various disciplines that are required for the successful delivery of combat systems. 9LV is tailored according to customer requirements. This ensures that the correct and necessary support and services are provided during the development and modification of the system. Our thinking edge ensures that we can deliver innovative combat system solutions to support you in meeting your goals and aspirations.

Support and services include:

- Risk management
- Combat system design
- Subsystem acquisition
- System safety
- Performance engineering
- Top deck design
- Combat Information Centre design
- Interface engineering
- Platform integration services
- EMI/EMC services
- Acceptance testing

SAAB HAS MORE THAN 50 YEARS OF EXPERIENCE IN NAVAL COMBAT SYSTEMS. OUR 9LV SOLUTIONS HAVE BEEN PROVIDED TO LEADING NAVIES AROUND THE WORLD, WITH DELIVERIES TO MORE THAN 240 VESSELS.
The key to a successful delivery of a combat system on time and within budget is risk management. Saab has vast experience in risk management processes.

The 9LV CS process captures this experience and applies it to each specific project. Risk management requires prior experience and an understanding of the customer’s environment. These are essential for the development of a trusted relationship between Saab and the customer.

Managing the development of a combat system for a ship is a significant undertaking. It is, however, much simpler if it is done frequently and builds upon previous programmes or projects.

Saab initiates several programmes every year and has multiple ongoing projects. We are able to provide experienced programme/project management teams for work at various levels including platform level modernisation, combat system supply and CMS supply.

The management team oversees the initiation and control of the project. The support provided by the management team will scale with the size of the project.

Saab can provide much-needed support services such as information management, configuration management, quality assurance, work definition and planning and scheduling.
The keys to the successful delivery of a combat system on time and within budget are:

**MANAGEMENT**
- Establishment of a plan for the entire programme
- Development of a credible time schedule
- Management of the programme in accordance with the scope of the plan and schedule requirements

**ENGINEERING**
- Customer assistance with establishing concept of operation (if required)
- Interpretation and analysis of customer needs
- Allocation of requirements into verifiable system and subsystem requirements for future tests and verification

**INTEGRATION**
- Established experience in integration of a wide variety of sensors, weapon systems and communications systems (including tactical data links) with 9LV CMS, 9LV FCS and the platform itself to create the optimum solution for customer requirements
- Understanding of integration timescales, processes and trade-offs

**SUPPLIER MANAGEMENT**
- Contracting experience with a wide variety of suppliers from many countries including the USA
- Understanding of supplier-specific issues and the legal environment of the supplier

**REGULATORY ENVIRONMENT**
- Experience in working with various regulatory regimes and requirements
- Understanding of timescales associated with establishment of legal agreements in the regulatory environment

**SHIPYARD INTERACTION**
- Experience with diverse shipyard processes and procedures
- Understanding of the requirements for information transfer between Saab and the shipyard
Combat System Engineering takes customer requirements and transforms them into an optimised, realistic design ready for implementation on the target platform.

The production data pack includes purchase specifications for the various elements of the combat system, shipyard manufacturing data packs for mechanical installation and cabling, and test instructions for subsequent system integration and acceptance testing.

Combat system design is about making the platform, products and selected subsystems work optimally together. This is achieved by systematic definition, interface engineering and verification.
With 9LV CS, customers can select best-of-breed products to suit their system. Every combat system project has many suppliers at different tiers that need to be managed during selection, acquisition and production, as well as throughout the integration and testing stages. Saab has worked with suppliers from many countries and has personnel with the experience to permit them to support the programme or project in the acquisition of, for example, sonar systems, radar systems, FCS, guns, missile systems and UAVs.

Specific attention is paid to the requirements of the main supply contract and the analysis, flow down and management of these requirements on the selected subcontractors.

Close monitoring of supplier performance is required throughout the complete supply lifecycle, from initial supplier evaluation to post-delivery warranty and support. Activities typically involve:

- Selection of subsystem suppliers
- Trade-off analysis
- Management of the supply process from initial evaluation to final delivery and acceptance
- Management of supplier interaction, which is required for direct system interfaces
- Verification of the supplier deliveries for technical and contractual completeness

Saab performs system safety tasks according to international (MIL-STD-882) or national standards. Safety assurance on a combat system level will include the management and coordination of underlying safety protocols, radiation hazard (RADHAZ) analysis, weapons safety, as well as any other hazards posing risks to humans.
Producing a combat system requires many different types of performance engineering, such as calculating performance for radar, system availability, sonar, communication and weapon systems. Saab has specific expertise in kill chain analysis, with experience in pairing a wide variety of sensors and effectors.

**INTERFACE ENGINEERING**

Interface engineering involves obtaining and establishing all interface documents and drawings needed for problem-free integration of individual systems into a proven, working combat system for a specific ship. Saab has interfaced most types of sensors and weapons used by any combat systems.

Examples of previously integrated equipment:

- Radar systems such as multi-function radars
- EW suites (ESM/ECM)
- IFF
- Decoy launching systems
- Laser warning systems
- Electro-optical systems
- Tracking devices
- Missile launchers
- Surface-to-surface missiles
- Surface-to-air missiles
- Large and small calibre guns
- Sonar systems
- Torpedo launching systems
- Tactical data links
- Sensor/UAV links
- Navigation equipment
- Communications equipment and systems
**TOP DECK DESIGN**

Combat systems typically comprise high power emitters, sensitive sensors and complex weapon systems. Fitting different combat system equipment into the limited space available on top of a naval ship, without causing subsystem mutual interference, requires careful analysis.

In cooperation with its partners, Saab can offer analysis and measurements supporting the top deck design effort. EMI/EMC analysis of radio frequency emitters and receivers placed above deck is usually a part of the top deck design effort, as are lightning protection measures.

- **ANTENNAS**
- **DIRECTORS**
- **EMITTERS**
- **RADARS**

**AVAILABLE SPACE**

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**COMBAT INFORMATION CENTRE DESIGN**

An important aspect of the usability of a combat system is the design and layout of the heart of a ship, the Combat Information Centre (CIC).

Saab can take complete responsibility for designing a CIC tailored to the intended missions and selected capabilities of the ship. Layout and fitting suggestions can also be provided for other types of spaces, such as those intended for combat system equipment.
Combat System Integration takes the installed combat system elements and integrates them into a system, where performance meets the required specifications and is ready for harbour and sea acceptance testing. Pre-delivery interface testing of the system’s elements, testing of the combat system integrated within a land-based test site, and performance verification of portions of the combat system can all be performed during the CSI phase.

Integration of the different elements of a combat system can be performed in many ways and at several locations simultaneously. Saab is experienced in setting up suitable tailored integration environments as well as planning, preparing, coordinating and executing integration tasks. The process can include the use of shore-based reference sites, land-based test sites, specialised test facilities and on-board ship integration.
Integration of all the different elements comprising a combat system with a ship platform is a complex task. It includes obtaining installation data, creating detailed compartment designs, reviewing installation procedures, performing installation checkouts and many other tasks. Saab can assist customers with the different activities involved in ensuring that combat system equipment is compatible with the ship platform.

Saab can provide platform integration services in LSI and PC roles to a shipyard for both upgrade and new-build platforms. Integrating a new combat system to an existing platform requires detailed knowledge of the platform’s capabilities and capacities, as well as the ability to match these capabilities with the platform services required by the new combat system.

Modifications to both platform capabilities and combat system design may be required to achieve cost-effective integration of a new combat system with an existing platform.

Upgrades to or refurbishment of some of the existing platform systems may also be required to ensure maximum performance from such systems. Saab can advise the customer on the required scope and nature of these refurbishments.

Work environments for operators are an important consideration in the combat system integration. Saab can assist in the design of working spaces to ensure acceptable environmental conditions for operators.
The harbour and sea acceptance testing of a combat system and its elements can be a significant part of the overall testing of the complete ship. Saab can provide support to a shipyard or PC in planning, scheduling, preparing, orchestrating and executing harbour and sea acceptance testing. Tasks include writing or reviewing acceptance test procedures and supervising or participating in testing. Dedicated teams are normally assembled for this task. Before acceptance testing, combat system equipment needs to be aligned and data entered into concerned systems. Saab has the processes and equipment for both static and dynamic alignment.
Saab has considerable experience from a number of past projects of various sizes and scope and is thus able to offer a number of standard service packages. These packages include typical CSE and CSI services as required for many new-build or upgrade projects. A high-level view of commonly used packages is given in the diagram below.

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<th>Extended CSE/CSI</th>
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<td>CS technology transfer</td>
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**KEY**
- ● Standard task
- ❁ Standard task, variable scope
- ▁ Independent option
LONG-TERM SUPPORT

DEFINING A COMBAT SYSTEM SUPPORT AGREEMENT

A long-term support agreement is defined by your specific operational requirements, system availability and existing maintenance organisation. The support agreement outlines the parameters for long-term support. As part of our long-term support commitment for 9LV CS, Saab can take full responsibility for all delivered systems after the system delivery warranty has expired. The undertaking will be governed by a long-term support agreement covering all the systems in the delivery. Saab will act as the main point of contact towards all subcontractors, thereby securing access to long-term support. Due to the variances in the scope of 9LV CS, the long-term support agreement will be tailored according to customer-specific requirements.

The agreement typically spans five years for the first operational vessel, and gives you a main point of contact at Saab for the entire combat system, including sub-suppliers, products and systems. The agreement normally includes the following:

HELP DESK SUPPORT
The Saab help desk function provides technical or operational support, and is coordinated by an assigned support engineer.

REPAIRS AND SPARE PARTS
Saab repairs faulty parts at our premises, or we can organise a subcontractor under the supervision of our quality assurance organisation.

SYSTEM PLANS
In order to keep the 9LV CS up-to-date over time, Saab will periodically notify the customer about any available hardware or software upgrades.

CUSTOMER CONFERENCES
Depending on the number of systems or vessels in operation, meetings between assigned Saab personnel and the customer will take place at least once a year.

TECHNICAL SUPPORT ON SITE
A support agreement will include several predefined visits by skilled support engineers.

FAILURE ANALYSES AND STATISTICS
Saab will establish and maintain a fault history archive in order to capture usage, failure and corrective action data.

OBsolescence MANAGEMENT
In the event of a component approaching obsolescence, Saab will notify the customer with a suggestion for component stockpiling and/or replacement.

SECONDARY TRAINING
Saab provides secondary training at the customer’s premises, securing transfer of vital knowledge to new technicians and operators. System documentation is configured to provide each user with the information they need to operate and maintain the system.
Modern naval vessels have a life expectancy exceeding 25 years. To ensure continuous development during this time, Saab provides long-term technical support. This includes the provision of spare parts and a variety of services in order to improve reliability, availability, maintainability and testability throughout the system’s operational lifecycle.

Saab’s solutions do not require expensive modifications part-way through their lifespan, as any upgrades can be made over time when necessary, without the need for additional testing and verification of the system. Many of our systems are hardware independent, meaning parts can be easily interchanged, thus minimising end-of-life problems. Saab’s long-term support is not limited to the acquisition phase, and lasts throughout the system’s lifetime.
Saab has a long history of providing 9LV CS and integrated platforms to satisfied customers around the world. Below are just some examples of our most notable projects.

**GOTLAND-CLASS SUBMARINES SWEDEN**

- Saab is CMS integrator for the new build submarine and continuing upgrades.
- Combat system based on 9LV CMS
- Integration of all sensor and weapon systems
- Post-build modernisation includes new generation of 9LV CMS
- Post-build integration of new WECDIS navigation system, new ESM system and of new active sonars
- Integration testing, harbour and sea acceptance testing
- Data fusion sonar tracking

**VISBY-CLASS CORVETTES SWEDEN**

- Saab is CMS integrator for the new build corvette and continuing upgrades.
- Combat system based on 9LV CMS and FCS
- Support to FMV for combat system integration
- Supplier of sensor and effector subsystems
- Tactical data links
ANZAC-CLASS FRIGATES AUSTRALIA

Saab is the combat system design and integration authority for the new frigate and continuing RAN subsystem upgrades.

- Combat system based on 9LV CMS and FCS
- Post-build capability enhancements include full integration of ESSM, Harpoon and Nulka active missile decoy
- Anti-ship missile defence
- Combat system capability modelling and analysis and validation in the virtual maritime systems architecture
- Integration of an active phased array radar and multi-channel phased array Continuous Wave Illuminator (CWI)
- Integration and conformance to standard certification of tactical data links
- Automatic performance-based engagement control of ESSM against supersonic missile targets

CANBERRA-CLASS LANDING HELICOPTER DOCK AUSTRALIA

Saab is the combat system integrator for the new build.

- Combat direction system based on 9LV CMS and Sea Giraffe AMB
- Link 11, Link 16 and VMF fully integrated with 9LV CMS
- Integrated IFF all modes including 5 and S
- Air space management including aircraft tasking, scheduling and precision approach
- Water craft management, landing craft tasking, tactical overlay and control
- Integrated multi-station self defence
WORKING WITH SAAB

THE TRUE NEEDS OF THE NAVY

Saab’s broad experience in the naval domain has made us a trusted partner for many navies around the world. Our customers benefit from a long-term relationship with support at every stage, from the early phases where ideas are captured, to the shaping of tailored solutions, through to maintenance and upgrade planning. As a solutions provider, Saab recognises that the key to long-term success is understanding the true needs of the end user.

A FLEXIBLE GLOBAL PARTNER

In order to provide the best possible solutions for our customers, Saab works with leading companies in the naval domain, often forming long-term relationships based on the supply of outstanding products.

Saab can take a leading role, or work as a sub-supplier, depending on the situation. Our products and business models are designed for partnership and lead to flexible teamwork options where both Saab and our partners become part of a winning team.

LOCAL PRESENCE LOCAL PARTNER

Saab recognises local presence as an increasingly crucial factor for success. This makes it important to be established locally, build local competence and understand local conditions. Today, Saab has a local presence in more than 30 countries and sales in over 100.

Saab cooperates with local industry and forms partnerships to better meet and understand local conditions. Our local partnership approach is tailored based on a balance of all contributing factors to form an optimal and sustainable solution that is successful during and after the initial project. Existing skills are incorporated and enhanced throughout projects where Saab addresses the needs of product adaptation and in-country support.
SAAB is a dedicated and trusted sub-supplier of naval combat systems.