SAAB

9LV NAVAL COMBAT SYSTEMS

Striking performance

Striking performance

The 9LV was originally created for operations in the Baltic Sea. Tactically demanding surroundings where you are constantly challenged by a high clutter environment and a military geography that generates large variations and highly compressed tactical cycles. This means that the 9LV is fast and agile, and provides unique capabilities that meet – and often exceed – the needs and requirements of modern naval warfare.

Saab's 9LV offers complete C4I for every type of naval platform, ranging from combat and patrol boats, frigates and large through-deck ships to submarines and vessels for anti-piracy, security and surveillance.

Designed to excel in combat, 9LV provides outstanding operational capabilities and supports all mission types. From the extreme littorals to the open ocean, in all warfare dimensions, manned as well as unmanned.

9LV addresses all resources efficiently. Whether it relates to economy, availability or operational capabilities, you can rely on 9LV to deliver enhanced awareness, faster reaction times and the striking performance required for turning the odds in your favour.

Making sure you stay ahead of the opposition – today and well into the future.

9LV NAVAL COMBAT SYSTEMS

9LV in brief

Saab's 9LV offer comprises everything from complete combat system deliveries to provision of systems and sub-systems, as well as components and services. All operationally proven, reliable and ready for the future, with exceptionally low life cycle costs and designed to suit your needs as well as your platform:

9LV CS – Combat System

As Combat System Prime, Saab will manage all project and engineering disciplines to deliver all required capabilities and to mitigate 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 you as the customer to select best-of-breed products and components regardless of provider – enabling complete freedom of choice.

9LV CMS – Combat Management System

The 9LV CMS is the command and control centre of many advanced surface vessels and submarines. Saab can take full responsibility for the CMS and thanks to the open architecture of 9LV, Saab can provide subsets of the CMS modules in partnerships. A full 9LV CMS configuration includes the Fire Control System (FCS).

9LV FCS – Fire Control System

Saab can provide the 9LV Fire Control System, including kill chain components, to any CMS. The FCS configurations range from a single EO director and a naval gun to a full multi-dimension weapon control system for an advanced surface combatant. This includes a combination of guns, missiles and decoys with full automation support.

9LV NAVAL COMBAT SYSTEMS

9LV CS – a complete Combat System capability

Simplifying complexity

9LV comprises some of the world's most advanced systems and technologies. Saab makes this complexity work on board ships, in crowded and confined areas, where people are under high pressure and where things can go from dead calm to dead serious in less than a blink of an eye. Needless to say, it is an immense challenge, but this is where Saab makes a difference.

With more than 250 combat system deliveries to over 20 navies worldwide, we understand the true needs of the modern navy and have become a trusted partner and systems provider to navies and naval shipbuilding industries around the world.

Upgrade or new-build

Saab is your delivery partner for new and upgraded surface warship and submarine platforms. With our knowledge, skills and professionalism, we can assist you in a variety of ways through your product's entire lifecycle – from contributing as a subsystem supplier and integrator to being the Combat System Prime or Prime Contractor.

Providing engineering expertise

9LV is always tailored according to customer requirements to ensure that the correct and necessary engineering expertise is provided during the development and modification of the system.

Skills and experience

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 all disciplines that are required for the successful delivery of combat systems.

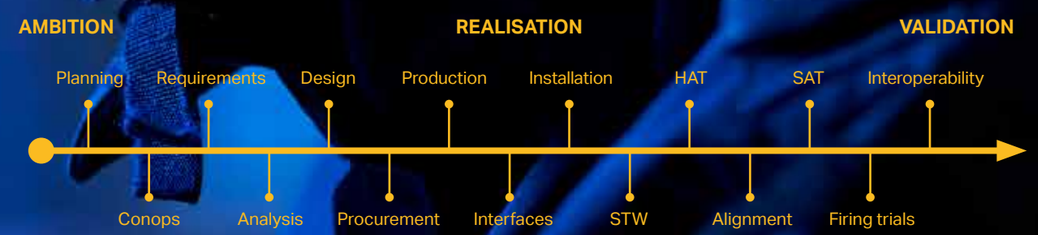
Collaborative approach

All 9LV systems are built on a common, independent technology platform used also for other Saab systems products.

The platform provides a powerful virtual development environment with integrated build, test and deployment tools to make the entire development process faster, safer, more secure and cost-effective. The platform also comprises the security and run-time services that ensure efficient management of hardware, software and cyber security throughout the lifetime of the system. Providing the platform allows for an effective, long-term technology transfer involving customer nation resources in joint development, maintenance and security of supply.

Our engineering competence includes:

- **Risk management**
- **Combat system design**
- **Subsystem acquisition**
- **System safety**
- **Performance engineering**
- **Logistics Engineering (RAMT – Reliability-Availability-Maintainability-Testability)**
- **Life Cycle Cost (LCC) Analysis**
- **Top deck design**
- **Combat Information Centre design**
- **Interface engineering**
- **Platform integration services**
- **System integration**
- **EMI/EMC services**
- **Acceptance testing**



Risk management – bringing the pieces together

The key to a successful delivery of a combat system on time and within budget is risk management. Saab has vast knowledge and experience in risk management processes.

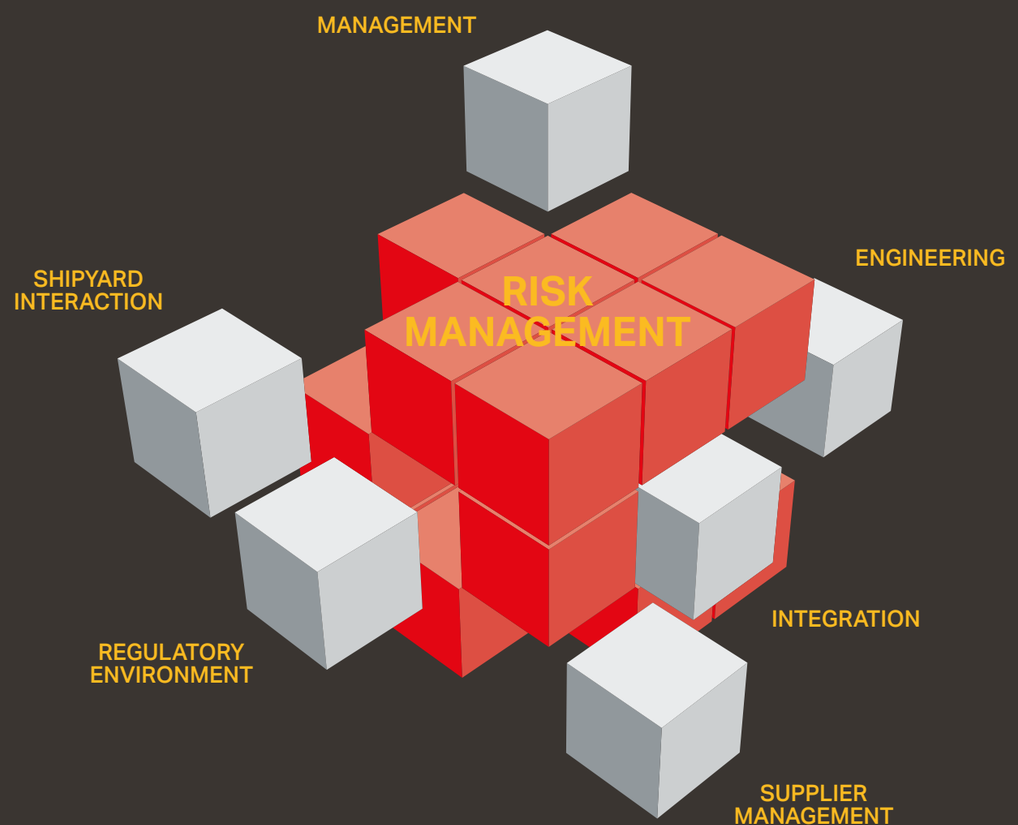
Reliable and efficient process

The 9LV CS process captures this know-how 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 yourself as a customer.

Experienced management teams

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 project management services such as information management, configuration management, quality assurance, work definition, 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)
- Customer assistance with establishing the maintenance concept and operational profile for the system
- Interpretation and analysis of customer needs and lifecycle plan (costs, future capabilities, etc.)
- Allocation of requirements into verifiable system and sub-system 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 time-scales, 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

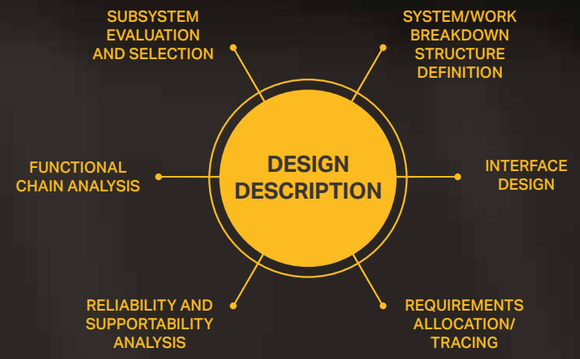
Combat System Engineering

Combat System Engineering takes customer requirements and transforms them into a realistic and optimised 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

Combat system design is about making the platform, products and selected subsystems work optimally together and with optimal reliability, availability, maintainability and testability characteristics. This is achieved by systematic definition, subsystem selection/proposal, interface engineering and verification.



Subsystem selection

With 9LV CS, customers can select best-of-breed products to suit their needs. 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.

Extensive supplier collaboration experience

Saab has worked with suppliers from many countries and has personnel with the experience that enables them to support the programme or project in the acquisition of, for example, sonar systems, radar systems, FCS, guns, missile systems and UxVs. 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 project or programme – from initial supplier evaluation to post-delivery warranty and support.

These 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, required for direct system interfaces**
- **Verification of the supplier deliveries for technical and contractual completeness**

System safety

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 life.

Cyber security – information security beyond IT

Modern cyber space has made it evident – software contains vulnerabilities just waiting to be exploited. Why risk cheap, effective and non-attributable attacks on your valuable assets? At Saab, we continuously develop our cyber security capabilities to support customers and partners in identifying, understanding and mitigating vulnerabilities throughout the entire system life cycle, from early design to operational systems management to decommissioning.

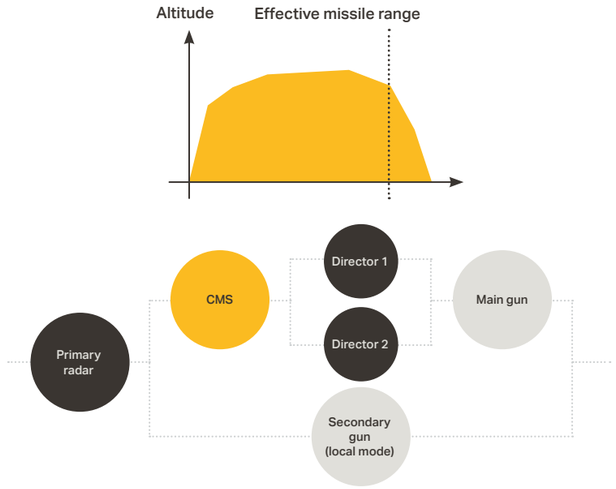
A chain of automated tools help finding vulnerabilities and preventing attacks, from the development environment and integration, into the operational 9LV system, and the same rigorous governance is applied at Saab as in the operational context.

As expected, Saab continues the tradition of striking performance and balanced solutions all the way into the cyber battlefield.

Performance engineering

Producing a combat system requires many different types of performance engineering, such as calculating performance for radar, sonar, communication and weapon systems. Engineering analysis includes system and sub-system RAMT and LCC.

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.

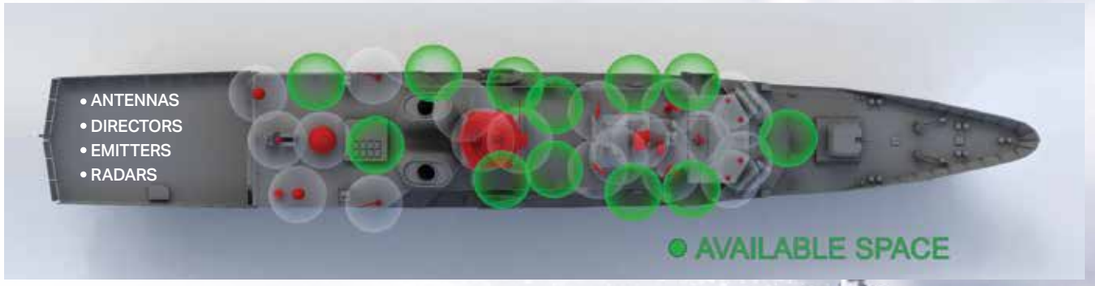
Examples of previously integrated equipment:

- **Radar systems including 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/UxV 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 our 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.



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.

9LV NAVAL COMBAT SYSTEMS

Combat System Integration

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.

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 the different elements of a combat system can be performed in many ways and at several locations simultaneously.

Integration 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 you with the different activities involved in ensuring that the combat system equipment is compatible with the ship platform.

Platform integration services

Prime for upgrade or new-build

Saab can provide platform integration services in prime 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 them 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 you on the required scope and nature of these refurbishments.

Work space design

Work environments for operators are an important consideration in the combat system integration. Saab can assist in the design of working spaces to ensure optimum environmental conditions for operators.

Combat System harbour and sea acceptance testing

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 a prime in planning, scheduling, preparing, orchestrating and executing harbour and sea acceptance testing. Tasks include compiling 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.

Standard Engineering services

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.

TASK	Basic CSE/CSI	Extended CSE/CSI	STW, HAT, SAT	Subsystems
	ENGINEERING SERVICES			
CS project management	●			
Operational concepts		●		
CS requirements	●			
CS architecture/design	●			
Performance engineering, including logistics engineering	●			
Interface engineering	●			
System safety	●			
System acquisition				●
Factory acceptance testing (FAT)				●
System integration service	●			
Platform integration services	●			
Support with top deck design		●		
Support with compartment layout		●		
EMI/EMC services		●		
STW planning coordination			●	
Harbour and sea acceptance testing (HAT/SAT)			●	
ILS coordination		●		
CS technology transfer		●		

KEY

- ● Standard task
- ● Standard task, variable scope
- ● Independent option

9LV NAVAL COMBAT SYSTEMS

9LV CMS – The Combat Management System

Unfailing readiness

The 9LV combat management system delivers the means you need for carrying out missions successfully and all the way to completion. Designed to cope with extremely heavy workloads and multiple tasking, it ensures unfailing readiness and provides the striking performance you need for empowering your naval platform and maritime mission.

Reducing operator workload – enhancing effectiveness

Saab's 9LV CMS will increase your mission capability and enable more flexible and effective operations by utilising a smart and easy-to-use interface with tailored configurations and highly automated routines that ensures reduced operator workload and greater focus on the most vital tasks at hand.

Built-in support functions

The 9LV CMS is a well proven and reliable product with developed support functions as operational and technical logging, onboard training (OBT) and built-in-tests (BIT).
The CMS is able to present operating status on all connected subsystems.

Open architecture

The systems' open architecture enables faster, more affordable upgrades, as well as the easy integration of any third-party module. The systems' flexibility also allows any 9LV module to be integrated with equipment from other providers – giving you complete freedom of choice.

The adaptable design of 9LV CMS means hardware and software can be adapted to meet your specific needs and requirements.

» We are constantly pushing technological boundaries to create new capabilities.

9LV CMS – core capabilities

The 9LV CMS technology comprises a range of software and hardware components that are designed to fit together in different configurations to meet the needs of your Navy. All 9LV equipped ships contain a core of components for the I/O interconnections to external equipment, the network and computer infrastructure, including the operator interactive devices and HMI.

A common situational picture

In any 9LV CMS, a core feature is to provide a common situational picture. Operators are presented with a single, clear image of the naval domain, graphically presented with chart or map information and tactical overlays.

AAW and ASuW

Saab is a leading provider of AAW and ASuW solutions. These range from small electro-optical systems controlling a light or medium-calibre naval gun, to large configurations with multiple guns and missile systems. Enabling rapid reaction times, automated responses, and high precision engagements, Saab provides naval ships with outstanding and high end engagement chains.

The 9LV CMS comprises the 9LV FCS capabilities and reduces the operator's workload in critical conditions by automating threat evaluation, engagement planning and weapon control during engagements.

Features:

- **Coordinates all sensors and weapons**
- **Probability-based evaluation**
- **Cyclic re-evaluation and feedback loop**
- **Quick response to scenario changes**
- **Manual/semi-automatic/fully-automatic options**

Surface warfare

A surface to surface missile system, like the RBS 15, is a standard addition to 9LV on ships from fast attack craft to frigates. The 9LV system provides the Combat Information Centre (CIC) crew with information from all available sources to prepare and execute missile assignments.

The 9LV situational picture visualises the terrain in littoral environments to assist the operators in finding tactical advantages.

ASW surface operations

9LV easily integrates functionality and capabilities to participate in or lead anti-submarine operations.

For a small vessel, a subset of sensor or weapon capabilities can be selected, including links for information exchange with other units.

Larger ships benefit from the full 9LV suite of solutions for ASW through a collaborating force of surface, sub-surface and air units.

Decision support

By establishing and maintaining a coherent maritime picture, the 9LV CMS provides a basis for the operator to make informed situation assessments and tactical judgements, based on readiness and priority. The system achieves this through an integrated data fusion process.

Secure communication

The 9LV integrates to any preferred communication system controlling all your communication technologies regardless of radioband frequency or hardware, reducing risk and increasing operational speed.

One option is the Saab TactiCall communication system giving a robust and highly survivable system with no single point of failure, which enables voice and data communication to be controlled from a single user interface. It also allows information to be monitored and shared within multi-level security.

Automated tasks

The 9LV CMS generates a picture from both internal and external data inputs. It allows the operator to interact through a selection of modes as well as to directly intervene with and override commands. The operator is supported by a situation and anomaly detection function. This automates tasks to allow the operator to focus on tactical decisions.

Secure system environment

The modern architecture includes cyber security solutions and provides support for streaming large amounts of video and recording large amounts of data. It also handles weapon system safety requirements and supports the real-time requirements of a critical fire control chain.

Scalable to precise needs

Saab scales each solution to match your vessel's size and capabilities. For example, the 9LV's architecture and hardware infrastructure means it can handle the demands of a complex frigate or destroyer. Alternatively, it can be scaled to much smaller ships that require special consideration due to size, weight and crew limitations.

Future secured

Saab's experience in combining functional modularity with modern computer technology has led to the creation of flexible, scalable solutions with built-in capacity for upgrades and extensions during the entire lifecycle of the ship.

9LV CMS
– extended capabilities

Mine Counter Measure (MCM)

The Mine Counter Measure function within the 9LV CMS supports planning, control, analysis and documentation of all MCM-related tasks. Together with the 9LV CMS core functionalities, it provides a comprehensive tool for decision support, command and control. Known information from databases is combined with own sensors or information provided by a task group, through links or other means.

The 9LV CMS will integrate any chosen MCM sub-system regardless of provider, manned or unmanned. Self-defence capabilities like AAW or defence against small surface vessels or drones is easily added as these are included in the 9LV core capabilities.

» 9LV ensures greater focus on delivering a striking performance.

Subsurface situation awareness

Operations focusing on the subsurface environment can be particularly challenging and require additional support from a CMS. The 9LV features advanced data fusion and situation presentation functionalities for ASW and other subsurface operations. Tools are provided to support operators in detection, tactical decisions and engagements in real operations as well as in planning and training modes.

Enhanced video situation awareness

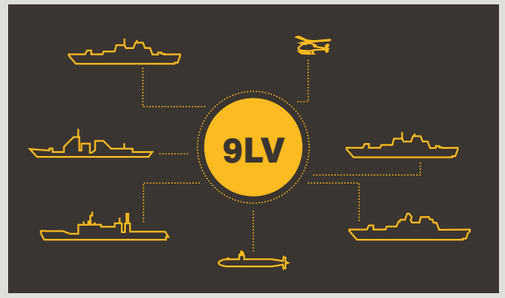
9LV features a video infrastructure that merges and stores input from all IR and TV sensors on-board continuously. Any operator can independently access any part of the video stream at any time. With the right sensors a ship can receive total video coverage, where operators get a stabilized panoramic presentation and the opportunity to zoom in multiple directions simultaneously. Combined with an augmented reality where tactical data is overlaid, the situation awareness will be further enhanced.

Force networks

Communications are key for task group or task force multipliers. 9LV integrates all standard data links and national derivatives and will make best use of the available data flow.

Force functionalities adapt to the information at hand, providing services from data fusion of external sources to collaborative weapon engagements.

The 9LV open architecture enables full usage of future improvements of available communications.



Submarine operations

9LV's advanced sensor and weapon integration ensures optimal performance and subsurface situational awareness to modern submarines and their weapon systems. The 9LV CMS has hardware and software tailored specifically for submarine environments and operational requirements.

UxV control

Unmanned vehicles such as drones, ROVs or USVs can be integrated at various levels depending on tactical needs, safety and security.

9LV supports full integration for command and control of both vehicles and their sensors as well as thin integration of commercial non-military graded equipment. Management and coordination of multiple unmanned vehicles can also be supported.

9LV CMS – configurations

The flexibility of the 9LV system makes it possible for you to pick and choose the exact configuration best suited to the vessel. Saab has also created pre-packaged configurations for your convenience. However, these are not stovepipe solutions, and Saab will customise the system to your exact requirements.

Surface combatants

9LV technology is able to interface many subsystems and its architecture readily scales to corvettes, frigates or destroyer-type vessels. These solutions will typically support a large number of Multi-Function Consoles (MFCs). They meet the demanding needs of battle resilience through extensive redundancy and physical separation of critical assets. Medium-sized configurations often focus on one type of mission, such as anti-submarine warfare (ASW) or anti-surface warfare (ASuW) using surface-to-surface missiles (SSM).

Larger configurations provide a wide range of capabilities and typically include multiple tactical data links and highly automated tactical responses to a range of simultaneous threats, above and below the surface. They also integrate with command support systems to provide the ship with complete C4I capability.

Patrol vessels

The patrol vessel configuration combines full capability with a small footprint. The mix of Multi-Function Consoles (MFCs) and smaller interactive devices is based on the ship's size and operational needs. The communication suite links the ship to any manned or unmanned asset and the recording capabilities are extended to handle the data collected by the ship's sensors. The 9LV's core functionality has also been extended to include fire control capabilities. A typical set-up, depending on the size of the vessel, is a small or medium-calibre gun integrated with the 9LV. It can be controlled remotely and utilised for both air and surface targets.

A standard configuration includes MSI Seahawk DS30B, Oto Melara Single 40L70 or BAE Systems Bofors 40 mm MK4. The EOS 500 is the tracking source, providing high accuracy tracking data for ballistic computations and gun-laying for air, surface and littoral land targets. The CEROS 200 features world-class acquisition speed and tracking precision. It has the ability to track any low-altitude target, including supersonic missiles and surface threats in any weather conditions over long and short distances. The surveillance radar can also be used as the solo tracking source for surface engagements. An interface for designation to a Remote Weapon Station with a dedicated console (Saab's Trackfire RWS) can also be provided.

Coast Guard, Auxiliaries & Inshore Units

The 9LV is engineered to meet the demands of smaller platforms, providing powerful capability with a small footprint. It delivers fully integrated situational awareness along with weapon control and C2 capabilities normally restricted to larger, more expensive systems. For the benefit of smaller vessels, Saab has introduced new hardware for operator interaction and a system infrastructure that can be adapted to the available space, without loss of capability. It is low weight, easy to integrate and cost-efficient throughout its lifecycle.

At its core, 9LV CMS contains hardware that provides the functionality needed for maritime security missions, while it is also uniquely scalable due to full compatibility with all 9LV technology. Communication solutions, video surveillance and designation of threats to a remote weapon station are a few examples of mission requirements.

Submarines

Through our work with 9LV technology and our acquisition of naval platforms specialist Kockums, Saab has vast experience in submarine solutions.

Several generations of 9LV technology have been used for submarine CMS and weapon control configurations. 9LV technology has also been used as the platform for advanced integrated sonar systems with multiple operators and sensors.

9LV NAVAL COMBAT SYSTEMS

9LV FCS
– The Fire Control System

Targeting perfection

In mission critical situations there is no room for error. And that is where the 9LV FCS gives real advantage. With highly accurate tracking of air and surface targets and automated threat evaluation it creates an unmatched situational picture, enables faster reaction times, ensures high-precision striking performance and the ability to aim for perfection.

Proven precision

The 9LV FCS is an innovative combat system solution that provides rapid, reliable response against any threat in any environment, including advanced sea-skimming missiles and asymmetric surface threats.

The core components of the system are the directors – the combat proven CEROS 200 and the operationally proven EOS 500. Renowned for outstanding precision, both directors work in combination with the other parts of the system to provide a fast and accurate sensor-to-shooter cycle.

Advanced air defence capability

As well as being fully capable of naval gunfire support and surface defence coordination, the 9LV FCS provides advanced air defence capability. Its ability to deal with the demands of multiple incoming targets and tight time constraints is what sets the system apart from the competition. The 9LV FCS is compact, easy to use and easy to integrate.

Reliable performance

Proven to perform in all environments and conditions, the system is perfectly suited to any vessel – providing outstanding capabilities for defending its own unit as well as delivering effect in a volume defined by the weapon systems at hand.

The 9LV FCS also provides well-developed and built-in support functions with good fault separation (BIT). This means it is always prepared and ready for action.

9LV FCS – core capabilities

The response cycle

The CEROS 200 and EOS 500 directors are at the heart of the sensor-to-shooter cycle and can be used with any combination of surveillance radar and weapons.

The 9LV FCS is market leading in terms of accuracy and engagement speed with a short reaction time during the designation, search and acquisition phases. Its accurate sensors, pedestal, servo and filtering provide excellent firing performance.

The system is easy to operate using either Saab's proven 9LV Multi-Function Console or any third-party console.

Accuracy

Both the CEROS 200 and EOS 500 directors provide highly accurate 3D tracking. This enables the operator to deal with advanced air and surface threats. Using modern ammunition, every round is a hit, even in complex conditions.

Multiple targets

The 9LV FCS features a range of manual, automatic and semi-automatic modes for controlling sensors and weapons. Along with advanced tracking capability, this allows effective handling of high-pressure, multiple target scenarios.

Track-while-scan surface engagements

This capability enables gun firing at surface targets using the ship's surveillance radar as the tracking source. A B-scope picture is used to monitor the engagements and observe firing as well as provide fire corrections.

Naval gunfire support (NGS)

The NGS support function can be used against land targets that are identified by the coordinates in the graphical situational picture. The function supports interaction with a forward observer and provides data for fire corrections.

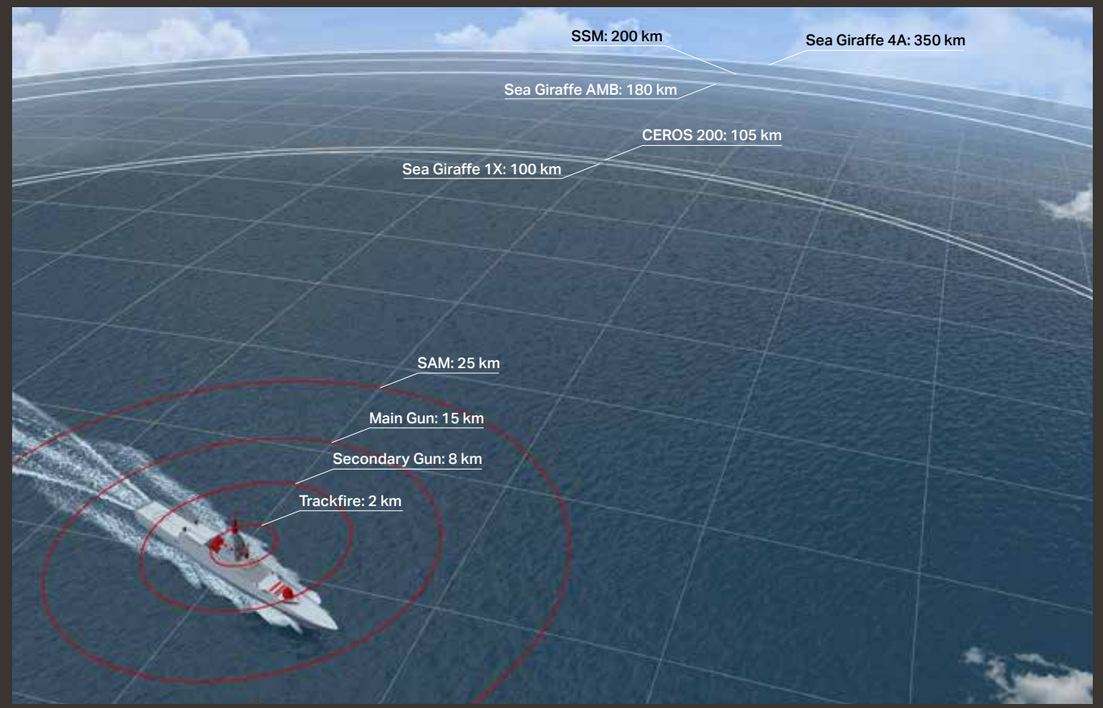
Reaction time

Both the CEROS and the EOS director will, after designation, track and deliver a firing solution within a very short timeframe. With the use of the built-in system speed, precision and smart filtering, target acquisition and engagement can begin without delay.

Range

The 9LV FCS configurations are designed to meet the requirements of short to long range engagements using a combination of decoys, guns and missiles. The radar director can be used for tracking and target illumination at distances over 100 km.

9LV NAVAL COMBAT SYSTEMS



Air and Surface Defence Coordination (ADC & SDC)

An AAW situation can be challenging when there are multiple incoming targets against a ship or escorted units. Air Defence Coordination (ADC) provides solutions that automate and accelerate an optimal response using a ship's AAW self-defence assets. Saab has provided a range of configuration options, from one CEROS director with a medium calibre gun to full optimisation of the ship's guns, SAMs and decoys.

ADC goes beyond traditional threat evaluation and weapon assignment. It considers all available weapons and ammunition in order to calculate and recalculate optimal kill probability, allocating the right weapon to the right target, every time.

In fully automatic mode, ADC can initiate firing in under a second, only requiring fire permission confirmation from the operators. Along with advanced tracking capability, this allows effective handling of high-pressure, multiple target scenarios.

Surface Defence Coordination (SDC) provides an automated defence against directly attacking surface threats, e.g. a swarm attack by high-speed craft. SDC models the ADC way of working, applying automated support to the surface dimension. It allocates the appropriate weapon to a surface target at the right time – making it the most efficient way to counter a direct multiple surface threat attack at short notice.

Operator workload is reduced through automation of the following tasks:

- **Generation and maintenance of a coherent operational picture**
- **Semi-automatic or automatic fusion of available information sources, local or networked**
- **Keeping track of available ADC and SDC onboard and task group resources**
- **Threat evaluation: finding and prioritising threats using all known threat characteristics**
- **Engagement planning: evaluating weapon deployment alternatives and selecting the optimised solution. This is performed cyclically for immediate adaptation to rapidly-changing situations**
- **Execution control: sending engagement requests to directors, guns, launchers and decoys, as well as sending ship heading recommendations to avoid blind sectors**
- **Task group defence coordination**

9LV FCS – Configurations

Saab is a leading provider of AAW and ASuW solutions. Our offering ranges from small electro-optical systems controlling a light or medium-calibre naval gun, to large configurations with multiple guns, decoys and missiles. Enabling rapid reaction times, automated responses and high precision engagements, Saab provides naval ships with their entire critical self-defence chain.

Electro-Optical

The Saab EOS 500 Electro-Optical Director with a 30–40 mm naval gun is an ideal solution for surveying a threat environment. The director is used for surveillance, classification and identification purposes, as well as for high precision tracking of surface threats, local aircraft and UAVs.

Radar and Electro-Optical

The next configuration uses the CEROS 200 Radar and Electro-Optical Director to control a 57 mm or 76 mm naval gun. CEROS enables all-weather capability through its advanced tracking radar. The proximity-fused ammunition of the guns, in combination with the unique precision of the Saab FCS, provides optimum self-defence capabilities, even against incoming sea-skimming missiles.

For larger ships it is common to fit more than one director and gun to achieve coverage from all directions.

Multi-channel weapon control

Multi-role ships with surface to air missile systems benefit from the 9LV architecture allowing tracking data from all available sensors or links. Decoys, guns, and missiles will be utilised together based on the best probability of effect and advanced automatic defence functionality is provided and integrated with the ESM and ECM capabilities of the ship.

The 9LV Weapon Control System is capable of handling short range SAMs together with longer range area defence SAMs, all of which are supervised and controlled by the 9LV, optimising the engagements for the tasks at hand.

Sub-systems and products

CEROS 200

The CEROS 200 is a stabilised radar and optronic system providing all-weather target tracking for naval ships. Working in combination with missile and gun systems it provides excellent defence against any threat, including advanced sea-skimming missiles and asymmetric surface threats in littoral environments.

The CEROS 200 features world-class acquisition speed and tracking precision. It has the ability to track any target, including supersonic missiles and surface threats, in any weather conditions over long and short distances. The system features options for tracking multiple targets as well as the ability to seamlessly switch designation of the primary target. The CEROS 200 is available in a CWI configuration with the 9LV ESSM Missile Control Module. It provides an X-band channel for CWI target illumination enabling guidance of the semi-active surface-to-air missile.

The system has a top weight of 630–750 kg, much lighter than comparable systems. This makes it easy to integrate with all platform types. Highly resistant to the latest jamming technology, the CEROS 200 provides reliable performance even in cluttered environments. The system can also be combined with the 9LV Gun Fire Control and SAM modules, providing precision control for any naval gun or a semi-active SAM missile system.

Key strengths:

- **Extremely high accuracy**
- **Fast reaction**
- **High availability**
- **Patented CHASE algorithm**

Patented CHASE algorithm

Low-altitude threats such as sea-skimming missiles are traditionally hard to detect and track due to multipath interference. The CEROS 200 uses the CHASE algorithm to eliminate this problem, ensuring target tracking even when there is interference.

Benefits:

- **Accurate low-altitude tracking**
- **Enables efficient firing with fewer rounds**
- **No need for an additional radar**
- **No reliance on EO sensors**

Sub-systems and products

EOS 500

The EOS 500 is a smart sensor system capable of performing high-accuracy 3D tracking and surveillance. The system is well suited to identifying ships, tracking air targets and supporting search and rescue operations. It uses a number of automatic functions to reduce the operator's workload.

The EOS 500 features some of the most capable sensors on the market, housed within an electrically-stabilised pedestal. It comprises one TV and one thermal imager, as well as a high pulse repetition frequency (PRF) laser range finder. The EOS 500 can lock onto and track air targets, with the capability to switch quickly between them.

Combined with the 9LV Gun Fire Control Module, the EOS 500 provides precise anti-air and anti-surface engagement for any naval gun. Weighing only 120 kg, the EOS 500 is easy to integrate into a wide range of platforms, with an open design that enables straightforward future sensor upgrades.

Key strengths:

- **Exceptional stabilisation performance**
- **Low weight**
- **Low profile**
- **Easy maintenance**

Target Designator

No matter how robust your combat systems are, it is vital to have comprehensive redundancy functionality to ensure the security of your forces and assets.

For this reason, Saab's 9LV FCS includes **target designators**, used by lookouts for direct optical designation of targets. By using two designators, one for starboard and one for port, the installations are not restricted to those few areas on board where 360 degrees of free sight is possible.

The target designators are suitable for use during the day or night and are equipped with an Aimpoint device for red dot targeting. An optional image intensifier enhances night capability. The designators feature two push buttons, the first of which is used for designation in bearing and elevation to the FCS. The second button allows the lookout to take immediate control of the director, starting an acquisition process.

Sub-systems and products

Multi-Function Console (MFC)

The Saab 9LV MFC has been developed with the operator in focus resulting in both ergonomic and operational excellence. Thanks to the ultra-high resolution wide screen display it provides an extremely clear and distinct presentation of the tactical picture. This together with the quick and logical human computer interaction concept makes it most suitable for all types of naval applications.

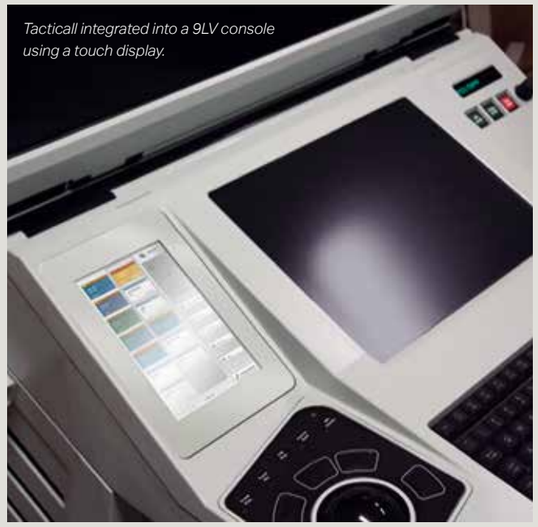
The MFC can display any combination of tactical information e.g. TV/IR-video, sonar video, overlaid pictures and satellite images as well as S57 charts and overlaid raw radar, both in 2D and in 3D.

The MFC is part of the 9LV modular suite of solutions for Command and Control in Naval Environments and aligned with Open Architecture compliant Combat Management Systems. The modularity of the 9LV system allows the MFC to be provided as an optimally integrated part of the 9LV Combat Management Systems, or as a stand-alone product with optional 9LV software modules.

Key strengths:

- **Excellent ergonomics**
- **Modular design**
- **Based on COTS**
- **Quick access with Touch Input Display (TID)**

TactiCall integrated communication



Tacticall integrated into a 9LV console using a touch display.

TactiCall interconnects all your communication technologies regardless of radioband, frequency and hardware, reduces effort, reduces risk and increases tempo. The system is scalable from one to several operator positions or communication interfaces and makes up the centrepiece in remote controlled setups from single radio to complete operations.

TactiCall will allow you to put together the functionality needed to support your operational requirements spot on and integrate seamlessly with third party equipment, legacy as well as new. The intuitive user interface will guarantee secure and reliable operations within every operational setup, be it within international or joint coalitions, own force squadrons or single ship operations.

TactiCall is a robust and highly survivable system with no single point of failure, which will let you handle voice- and data communication, red as well as black, in a fast and efficient manner.

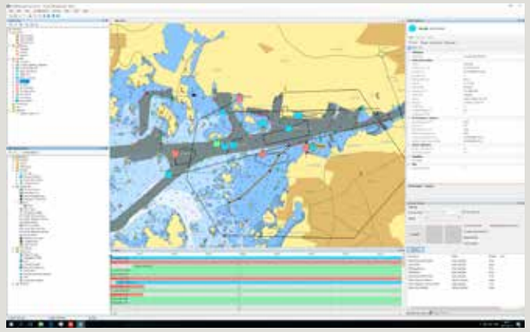
Training for mission success

At Saab, we believe in supporting forces and units with simulation and training expertise throughout the training life cycle. Our focus is on delivering realistic and efficient training solutions that create true training value.

Saab has a set of applications for training of different roles at the Combat Management System as well as the Fire Control System– from the individual operator to complete team training and all the way to joint training operations. Multiple teams can create realistic training scenarios – to train as you fight – by connecting several Combat Information Centres or teams.

Our training applications are embedded onboard or stand-alone in a land-based facility. They may be combined in different ways using Saab's integrated training environment and managed through our joint game management applications. The onboard applications can be utilised in parallel with ship operations thanks to a separate simulation network.

Saab is able to deliver all necessary equipment, tools and knowledge required for providing a complete naval training service.



Training applications

Ship Protection Training

A full Live training capability with weapon and RHIB instrumentation – may also be combined with virtual or constructive solutions for full-scale training.

C4 Training

Training command & control methodology without the need of a full-scale operational Combat Management System.

CMS Training

Realistic training at the Combat Management System that features a built-in simulation function that supports command team training and provides an experience almost identical to live operations.

FCS Training

Authentic training at the Fire Control System where sensors and weapons are simulated to provide an experience almost identical to live operations – from detection to engagement.

Weapons Training

Realistic live instrumented training as well as virtual training on desktops or mock-ups.

Sonar Training

Training for the sonar operator in realistic environments.

Comms Training

Training in the use of COMMS in a synthetic environment and linking it with other operational environments.

Nav Training

A complete bridge simulator.

Long-term support

Supporting excellence

Our support services have one clear goal – to make sure your 9LV system provides unparalleled availability. With services tailored for every stage of the system's lifecycle, you ensure operational excellence and create the confidence that comes from knowing that whatever lies ahead, your 9LV system is ready to act and deliver the striking performance required.

Defining a Support Agreement

The main purpose with an agreement is to establish a mechanism between the customer and Saab for maintaining system performance as well as system knowledge within the customer organisation or according to customer maintenance philosophy. Usually, an agreement comes into force by the time for expiry of the warranty and is valid up to decommissioning of the vessel.

A Support Agreement within long-term support is defined by customer specific operational requirements, system availability and existing maintenance organisation.
An agreement outlines the parameters for long-term support and is an efficient channel for an interaction between the customer and Saab.

A Support Agreement normally includes the following services:

Help desk support

The Saab help desk function provides technical and operational support and is coordinated by an assigned Project Manager who handles any upcoming question or inquiry.

Customer conferences

Depending on the number of 9LV systems or vessels in operation, recurrent yearly meetings between the assigned Saab team and the customer will take place where information and experiences will be exchanged.

System plans

In order to keep the 9LV system up-to-date over time, Saab will periodically notify the customer about any available hardware or software upgrades. Logistic Engineering calculations will be made accordingly in order to verify the actual requirement of spare parts, reflecting the current system configuration.

Provision of spare parts and repairs service

Naval systems are continuously exposed to harsh weather, temperature, humidity and physical strain which inevitably lead to the need for Spare Parts. Provision of Spare Parts, identical with the system delivery or equivalents, will be provided during the entire system lifetime. Equally important is provision of swift and effective repair services. Saab will repair faulty parts at our own premises or can organise a subcontractor under the supervision of our quality assurance organisation. In parallel, Saab will establish and maintain a fault history archive in order to capture usage, failure and corrective action data: information that is shared with the customer by providing a yearly failure report.

Software support

Provision of Software Support services can be provided, facilitating smooth modifications or changes within the operational software. Functionality upgrades, interface changes or cyber security are standard reasons for software modifications, as well as more customer specific requests. Software changes are provided using a reference system where the current software version is running and from where changes reflecting a new configuration are made. The reference system is used for an adequate verification once the implementation is made. Reference systems are normally situated at Saab's premises but can also be located at the customer's.

Technical support on site

Saab's responsibility for a solution does not end after a completed and approved installation. A Support Agreement normally includes several predefined visits of skilled support engineers or in-country support executed by a permanent residential engineer from Saab.

Obsolescence management

Obsolescence monitoring and management is an important undertaking within a Support Agreement. In the event of a component approaching obsolescence, Saab will notify the customer with a suggestion for component stockpiling and/or replacement.

Training and documentation

Saab provides secondary operational or maintenance training at the customer's premises, securing transfer of vital knowledge to new technicians and operators. Training can also be conducted as On-The-Job-Training (OTJT), which is more of "hands-on" training on-board, made by Saab's well-experienced service engineers. During any training, the system documentation is important and used to provide each user with the information they need to operate and maintain the system. Upon request, Saab can provide uniquely adapted documentation that reflects an individual customer's day-to-day use of the system.

SERVICES	SERVICE BLOCK	SERVICE LEVEL EXAMPLES 1	2	3	4
Management	Point of Contact	●	●		
	Service Management		●	●	●
Engineering	Configuration Management		●	●	●
	Obsolescence Monitoring		●		
	Contractor Obsolescence Management			●	●
	Engineering Investigations (PDS task)		●	●	●
	Service Desk		●	●	●
Maintenance	Accesses to Saab Spare Part Tool			●	●
	OEM Repairs (Depot level)		●	●	●
	On-Site support / Assistance		●	●	●
	Resources, means and infrastructure		●	●	●
Supply	Spare Part Supply		●	●	●
	Measures for requested lead times		●	●	●
Training	Training		●	●	●

KEY
- ● Always available
- ● According to support agreement
- ● Optional

Extending the lifecycle

Modern naval vessels have a life expectancy time exceeding 25 years. To ensure continuous development during this time, Saab provides long-term technical support. This includes the provision of spare parts and repairs on top of a variety of services in order to improve reliability, availability, maintainability and testability throughout the system's operational lifecycle.

Extending the system lifetime can be made through overhaul of an existing 9LV system, a complete replacement of a 9LV from the latest generation, or thirdly, a mixture of overhauling the current system and integrating 9LV parts from the latest generation. Recommissioning and reusing well-maintained 9LV parts on board new commissioned vessels is another option. The choice is yours!

Many of our systems are hardware independent, meaning parts can be easily interchanged, thus minimising end-of-life problems.

Saab's long-term support lasts throughout the system's lifetime.

9LV NAVAL COMBAT SYSTEMS

Track record – more than 250 vessels

Saab has a long history of providing 9LV Combat Systems and integrated platforms to satisfied customers around the world. Below are just some examples of our deliveries.

Anzac-class frigates – Australia

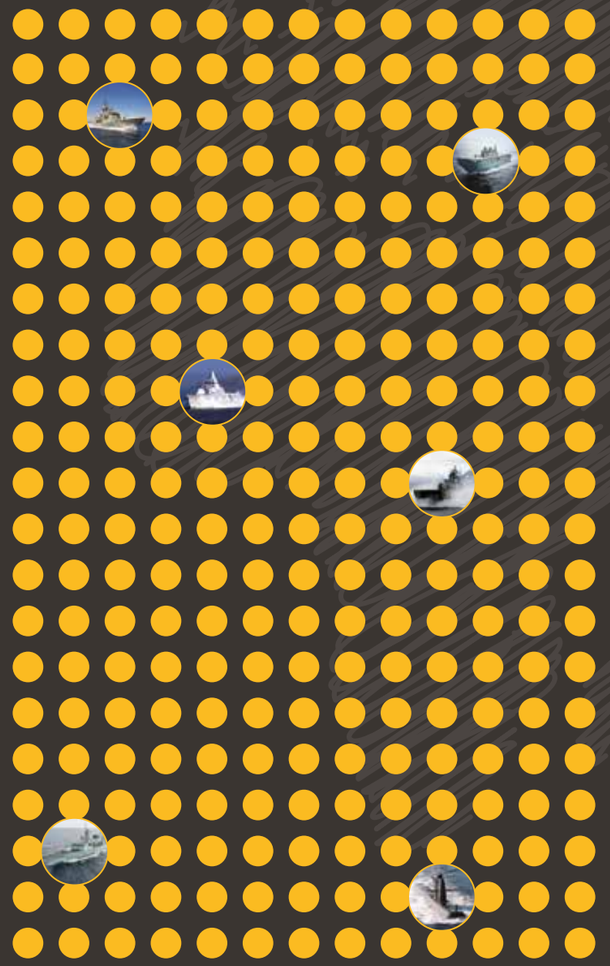
Saab is the combat system design and integration authority for the ANZAC class frigate and continuing RAN subsystem upgrades. Combat system based on 9LV CMS and FCS.

Visby-class corvettes – Sweden

Saab is CS integrator for the new-build and continuing upgrades. Combat system based on 9LV CMS and FCS.

Halifax-class frigates – Canada

This upgrade is an example of teamwork through global partnership using open architecture technology and modularity. Saab provided CMS modules and an advanced FCS based on CEROS 200 directors, ESSM missiles and a 57 mm gun.



Canberra-class landing helicopter dock – Australia

Saab is the combat system integrator for the new build. Combat system based on 9LV CMS and Sea Giraffe AMB.

Skjold-class high speed vessels – Norway

The Skjold class is equipped with a lightweight CEROS 200 fire control director.

Gotland Class submarines – Sweden

Saab is CS integrator for the Swedish submarines and continuing upgrades. Combat system based on 9LV CMS – integration of all sensors and weapons systems.

9LV NAVAL COMBAT SYSTEMS

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 Combat Systems 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 partnerships

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 supplier of naval combat systems.

You can rely on Saab's thinking edge to deliver innovative, effective products and solutions that enhance your capabilities and deliver smarter outcomes.

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