9LV FCS
FIRE CONTROL 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, Saab 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 9LV FCS provides rapid, reliable defence 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 CEROS 200 and EOS 500. Both are combat-proven and renowned for outstanding precision. The directors work in combination with the other parts of the system to provide a fast and accurate sensor-to-shooter cycle.

As well as being fully capable for naval gun 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. 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 protecting high-value assets.

Our thinking edge ensures that we can deliver innovative combat system solutions to support you in meeting your goals and aspirations.
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 and SAM missiles. Enabling rapid reaction times, automated responses, and high precision engagements, Saab provides naval ships with their entire critical self-defence chain.

**OPV/CORVETTE CONFIGURATION**

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, provide 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.

**FRIGATE/DESTROYER CONFIGURATION**

Larger ships with self-defence SAM missiles benefit from the 9LV architecture, where tracking data for the missiles can come from either the surveillance radar or directors on board. Guns and SAM missiles can be used together, and advanced surface and air automatic self-defence functionality is provided and integrated with the ESM and ECM capabilities of the ship. For the largest ships, point defence SAM missiles are combined with longer range area defence SAM missiles, all of which are controlled by the 9LV system using the best combination of data available.

For patrol vessels, 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.
Core Capabilities

The Kill Chain

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.

Reaction Time

The 9LV FCS can designate, track and be ready to fire in under a second. The use of smart filtering, target acquisition and engagement can begin immediately after designation.

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.

Range

CEROS and EOS configurations are designed to meet the requirements of short, medium and long range defence using a combination of naval guns and surface-to-air missiles (SAM). The radar director can be used for tracking and target illumination at distances over 100 km.
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 speed up 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 crafts. SDC uses the same type of algorithms as ADC in order to allocate the appropriate weapon to a surface target at the right time – making it the most efficient way to stop a direct multiple surface threat attack at short notice.

Operator workload is reduced through automating the following tasks:

- Patrol and response, including interdiction, maritime patrol and anti-piracy
- Surface contact detection, identification and interception
- Surface warfare
- Border control and securing of economic interests
- Defence against unconventional attacks
- 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
EXTENDED CAPABILITIES

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 (NGFS)

The naval gun firing 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.

ONBOARD TRAINING

The 9LV FCS features a simulation function which supports onboard operator training. Sensors and weapons are simulated to provide realistic training for the whole chain, from detection to engagement. Operators can create and save sequences involving simulated aircraft, missiles and surface ships moving along pre-defined trajectories. These are observed by simulated own-ship sensors and are engaged by the simulated weapon systems. The simulation provides an experience which is almost identical to live operations, except in cases where this would put safety at risk.

LAND-BASED TRAINING

A range of system configurations have been delivered to support training, testing, experimentation and development at shore-based facilities. This includes fire control training systems that are part of full Combat Information Centre (CIC) installations to support immersive command team training, and single operator training. System configurations can use the ship's existing hardware, or cost-efficient office environment components that provide the same high-level training experience.
The Saab multi-function console has been designed with the most demanding fire control requirements in mind. It can be included in any configuration to provide a turn-key solution, including the proven and fielded Saab HMI for the FCS.

Saab also provides solutions to remotely control the FCS from a CMS other than 9LV, with or without HMI implementation from Saab.

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
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 remove 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

TARGET DESIGNATOR

No matter how robust your combat systems are, it’s 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 aiming. 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.
LONG-TERM SUPPORT

DEFINING A FIRE CONTROL 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 FCS, Saab can take full responsibility for the fire control system after the system delivery warranty has expired. The undertaking will be governed by a long-term support agreement covering the systems in the delivery. Due to the variances in the scope of 9LV FCS, the long-term support agreement will be tailored according to customer-specific requirements.

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 can organise a subcontractor under the supervision of our quality assurance organisation.

SYSTEM PLANS
In order to keep the 9LV FCS 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.

The agreement typically spans five years for the first operational vessel and gives you a main point of contact at Saab for the entire fire control system, including subsystems. The agreement normally includes the following:
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 FCS and integrated platforms to satisfied customers around the world. Below are just some examples of our most notable projects.

**Hämeenmaa-class Minelayers**

The Hämeenmaa-class upgrade includes an FCS configuration with CEROS 200 and a 57 mm gun.

**Absalon-class Flexible Support Ships**

The Absalon-class is a flexible support ship with the 9LV FCS with CEROS 200 and a 5 inch gun as well as two 35 mm guns.
The Visby-class corvettes contain a 9LV FCS for the sensor-to-shooter chain also comprising:
- Giraffe AMB
- CEROS 200
- Gun fire control for 57 mm gun

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

Saab provided an advanced FCS based on CEROS 200 directors, ESSM missiles and a 57 mm gun.
- Supplied the 9LV Mk4 FCS in control of the main gun, ESSM and CWI equipment
- Provided modules in CANACCS 9LV for data fusion, sensor interfaces and training
- Provided CEROS 200
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 FIRE CONTROL SYSTEMS.