ANY NEED — ANY TASK

THE 9LV CONCEPT: COMPLETE CONTROL FOR ALL WEAPONS, SENSORS AND COMMUNICATIONS
Saab's 9LV family offers complete C4I for all types of naval platforms, including frigates, patrol vessels, larger vessels and submarines. 9LV provides the command team with outstanding operational capabilities, supporting all mission types from littorals to the open ocean.

Options range from FCS solutions to complex Combat Management Systems with large numbers of interfaces and vast responsive decision support. The whole family uses open standards, and Saab can integrate any subsystem with a 9LV solution.

Saab has more than 40 years of experience in naval weapon control systems. Our 9LV solutions have been provided to leading navies around the world, with deliveries being completed to more than 230 ships. Many of the Fire Control Systems we delivered 25-30 years ago are still in operation.
The 9LV FCS is Trusted To Deliver When It’s Needed The Most. It provides rapid, reliable defence against any threat in any environment, including advanced sea-skimming missiles and asymmetric surface threats.

The core of the system is the director. Both options, the CEROS 200 and EOS 500, are combat-proven and renowned for outstanding accuracy. This works in combination with the other parts of the system to provide a sensor-to-shooter cycle which is extremely fast and accurate.

As well as being fully capable for naval gun support and Surface Defence Coordination, the system provides advanced air defence capability. The ability to deal with the demands of multiple incoming targets and tight time constraints sets the 9LV FCS apart from the competition.

The system is compact, easy to use and easy to integrate. It is in operation in all environments and performs in all conditions. Perfectly suited for all vessels, it provides outstanding capabilities for defending own unit as well as protecting high-value assets.

Make Every Shot Count
OPERATIONAL CAPABILITIES

THE KILL CHAIN
The director is at the heart of the sensor-to-shooter cycle. Using the CEROS 200 and EOS 500 directors, along with any combination of surveillance radar and weapon, 9LV FCS customers have confidence that the director will perform. From designation to elimination of the threat, the 9LV FCS is faster and more accurate than competitor systems. It has a short reaction time, including 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 MFC 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 difficult situations.
9LV FCS > OPERATIONAL CAPABILITIES

**REACTIoN TIME**
The 9LV FCS can designate, track and be ready to fire within less than a second. Using smart filtering, target acquisition and engagement can start 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**
The 9LV FCS can be configured to provide a range of more than 100 km, exceeding the needs of almost any surface-to-air weapon.

Saab’s parallel filtering gives you fast and stable tracking in less than a second.

The CEROS director exceeds the range requirements to control your preferred weapon system.
Air Defence Coordination (ADC) provides a range of configuration options, from manual to fully automatic. This optimises reaction times and weapon and sensor usage for effective ship defence.

ADC goes beyond the capability of traditional TEWA. It considers all available weapons and ammunition to calculate and recalculate optimal kill probability, assigning the right weapon to the right target, every time.

ADC reduces the operator's workload in critical conditions by automating the following tasks:

- **Threat evaluation**: finding and prioritising threats, largely based on performance as well as ETA, using all known characteristics from the CMS intelligence library
- **Engagement planning**: evaluating weapon deployment alternatives and selecting the optimised solution. This is performed cyclically, adapting quickly to rapidly-changing situations
- **Execute control**: sending engagement requests to the director and the weapon, and sending ship heading recommendations to avoid blind sectors, supporting integration of softkill measures

**FEATURES:**

- Coordinates all sensors and weapons (hardkill and softkill)
- Probability-based evaluation
- Cyclic re-evaluation and feedback loop
- Quick response to scenario changes
- Manual/semi-auto/full auto options

“THE DIRECTOR HASN’T FAILED ONCE TO FIND AND TRACK THE ADC-SCHEDULED TARGETS DURING THE VISBY TRIALS.”

Test Leader,
ADC/CEROS 200
Trials for Visby
The 9LV FCS provides a wide range of flexible, customised integration options. FCS software components benefit from open architecture standards, and hardware components are low weight, compact and have minimal power demands. These factors make integration as straightforward as possible.

Saab has proven its integration ability with the Evolved Sea Sparrow Missile, as well as with almost all types of naval guns. 9LV architecture is scalable and modular and complies with true open standards, meaning that 9LV solutions can be provided in a large variety of configurations.

Saab can also supply specialised, high-performance modules, either in part or in full, as subsystems for integration with another vendor’s Command and Control system.

Smaller subsystem solutions could comprise a CEROS 200 director and an associated module for director control, as well as a module for gun or missile fire control if required.
The Weapon Control System configuration, equipped with either the CEROS 200 or the EOS 500, is a fully competent, world-class solution. It focuses on multiple and asymmetric threat scenarios where high accuracy and direct hit results are required. The configuration can comprise several directors, electro-optical tracking systems, gun fire control modules and missile control modules, allowing dynamic allocation of any combination of tracker and weapon. This facilitates flexible handling of multiple threats. For optimum performance, the 9LV Defence Coordination Suite makes it possible to deal with all incoming threats.

Larger subsystem options include air warfare subsystems controlling multiple CEROS 200 directors, an EOS 500 director, guns, the Evolved Sea Sparrow Missile, and a multi-function radar.
HYBRID 9LV SOLUTIONS

9LV solutions can be readily integrated with systems from other providers and tailored to meet customer requirements. This diagram shows one example of how 9LV functionality can be combined in a hybrid system.
ONBOARD TRAINING AND SIMULATION

The components of the 9LV FCS include the option to provide realistic onboard training and simulation, fully preparing crew for live operations.

The CEROS 200 simulation agent reads the CMS training environment and simulates all sensors, using advanced models to make sure their internal states and detection capabilities are as realistic as possible.

Target filter and internal software functions behave in an identical manner to when actual hardware is used.

A simulated video can be provided to support and enhance both test and training purposes.

OPEN ARCHITECTURE

Saab employs the principles of Naval Open Architecture (NOA) for the 9LV family. This increases opportunities for innovation and competition, as well as reducing burdens of cost and risk through life.

NOA involves creating modular, interoperable systems that adopt open standards and have published interfaces.

The benefits of this approach include:

**Reduction of system and lifecycle cost:**
- Reduces development cycle time
- Enables reuse of components
- Reduces maintenance constraints

**Encourages innovation:**
- Facilitates rapid technology insertion
- Allows continued access to cutting-edge technologies from multiple suppliers, creating best-of-breed solutions

**Mitigates risks, avoiding:**
- Technology obsolescence
- Unwanted ties with proprietary or vendor-unique technology
- Reliance on a single source of supply
The CEROS 200 is a fully stabilised radar and optronic tracking system, purpose-built for use on 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 targets, in any weather conditions. It provides these capabilities over long distances as well as extremely close to the ship.

The system features options for tracking multiple targets, including the facility for the operator to seamlessly switch designation of the primary target.

It is available in a CWI configuration with the 9LV ESSM Missile Control Module. It provides an X-band channel for CWI illumination of a target, for 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.

The CEROS 200 provides reliable performance even in cluttered environments and is highly resistant to the latest jamming technology.

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
- Extremely high availability
- Patented CHASE algorithm
- Proven performance
- Unique capabilities
- Long range
- Extremely wide bandwidth (2 GHz)
- Low weight
- Low lifecycle cost
- Inherent growth potential
The CEROS 200 comprises multiple sensors, including EO, IR, TV and Laser. In addition, it has an advanced video tracker to enable simultaneous TV and IR tracking.

The radar director pedestal is of two-axis, elevation over azimuth type, and incorporates direct-drive hydraulic motors with built-in hydrostatic bearings.

The freedom of motion in azimuth is unlimited and all electrical signals are transferred via slip rings. In elevation the motion is controlled both by electrical and mechanical end stops.

For stabilisation against ship motion and angular rate measurements of the pedestal, a two-axis measurement gyro is used. The gyro features high performance and reliability. At turn-off, the director is automatically slewed to parking position and secured with hydraulic locking pins.

A key feature is its high ability when tracking with low angular speed.

The CEROS 200 has a hydraulically-driven pedestal with a much higher Mean Time Between Failure compared with alternative approaches such as electro-driven systems.

**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 nullify this problem, ensuring target tracking keeps working even when interference is present.

**BENEFITS:**

- Accurate low-altitude tracking
- Enables efficient firing with less rounds
- No need for an additional radar
- No reliance on EO sensors
- No need to switch to another sensor when about to fire

---

**CW1 VERSION**

**STEALTH VERSION**
The EOS 500 is a smart sensor system capable of performing high-accuracy 3D-tracking and surveillance. It is well suited to identifying ships and tracking air targets, as well as to supporting search and rescue operations.

It consists of some of the most capable sensors the market can offer. It also comprises one observation TV and one thermal imager, both of which are suitable for target tracking, as well as an 8 Hz laser rangefinder, well suited to locking on and tracking air targets, which performs up to four times better than competitor systems. The system also features the ability to switch quickly between targets.

The EOS 500 includes the same advanced video tracker as the CEROS 200, which includes a number of automatic functions to reduce the operator’s workload. The electrically-stabilised pedestal houses all of the system’s sensors.

Its low weight (120 kg) makes it easy to integrate on a wide range of platforms and its design enables straightforward future sensor upgrades.

Combined with the 9LV Gun Fire Control module, the EOS 500 provides precision anti-air and anti-surface engagement for any naval gun.

Features:
- Exceptional stabilisation performance
- Low weight
- Low profile
- Easy maintenance

Its low weight (120 kg) makes it easy to integrate on a wide range of platforms and its design enables straightforward future sensor upgrades.

Combined with the 9LV Gun Fire Control module, the EOS 500 provides precision anti-air and anti-surface engagement for any naval gun.

Features:
- Exceptional stabilisation performance
- Low weight
- Low profile
- Easy maintenance
VIDEO TRACKER

The video tracker is common to both the CEROS 200 and the EOS 500. It simultaneously uses the input from both the TV-camera and the IR-camera in an automatic fusion process.

The system provides functions for acquisition and tracking of up to four simultaneous targets.

To enhance visibility of the target, the video tracker uses background suppression which provides more reliable tracking in high contrast clutter environments.

Features:
- Automatic Target Detection (ATD)
- Automatic Target Acquisition (ATA)
- Automatic Target Tracking (ATT)
- Manual selection of tracking point
- Roll stabilisation of sensor image
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 installation is not restricted to those few areas onboard where 360 degrees of free sight is possible.

The target designators are capable day and night and are equipped with an Aim Point device for Red Dot aiming. An optional image intensifier enhances night capability. They 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.
The 9LV FCS is designed to provide optimum performance throughout its lifecycle. This makes it a low-cost, high-value investment for our customers around the world.

The CEROS 200 features a lower lifecycle cost and higher operational Mean Time Between Failure than any comparable director, electro-driven or hydraulic.

Comprehensive training and publication packages mean that operational procedures and first-level maintenance are easy to perform.

**THROUGH-LIFE SUPPORT CONCEPT**

Cutting-edge systems need to be supported by equally competent and well-crafted support packages. Saab offers complete, highly customised through-life support programmes for the 9LV FCS, ensuring maximum availability and cost-efficiency over the entire lifecycle.

We are well-known for our long-term customer commitments and we currently support more than 200 systems around the world, including some that have been in service for over 30 years.

Our proven support concept consists of several elements:

- **On-site support**: emergency or scheduled assistance on a global basis
- **Factory support**: major overhauls and upgrades
- **Logistical support**: spares supply, end-of-life handling and in-country support capability

These options are tailored into packages which meet the unique needs of each individual customer.
Since its conception the 9LV FCS has entered operational service with over 230 ships, all around the world. With the latest release of the system being at Mk4, new 9LV customers benefit from over 40 years of experience, development and innovation.
SAAB’S NAVAL OFFER

9LV is an integral part of Saab’s naval offer. Our capabilities cover all dimensions of the domain, including air, surface and sub-surface. We work with naval and civil security organisations around the globe to make the maritime domain safer and more secure.

INVESTOR GROUP

Saab is a core part of Investor AB. The group features major corporations from sectors including finance, telecoms and pharmaceuticals. Our position in the group not only provides Saab with robust financial stability – it also allows us to partner with a wide range of prestigious organisations to provide outstanding offset and Industrial Cooperation offers.
## TECHNICAL DATA

### CEROS 200

**Sensors**
- Radar: K-band
- TV camera: Colour/black & white
- IR camera: MWIR/LWIR
- Laser range finder: Eye-safe
- High PRF (10 Hz)

**Antenna**
- Type: Cassegrain, monopulse
- Diameter: 1 metre
- Gain: 41 dBi
- X-band (CWI version)

**Transmitter**
- Type: TWT
- Frequency: 16.5 GHz band
- Band width: 12 %

**Receiver**
- Type: Digital
- Instrumented range: > 100 km

**Director**
- Bearing coverage: Unlimited
- Elevation coverage: -30° to +85°
- Top deck weight: 120 kg
- Can be extended
- Stabilisation accuracy: < 50 μrad RMS

### EOS 500

**Sensors: basic package**
- TV camera: Colour/black & white
- Several FOVs
- IR camera: MWIR/LWIR
- 3rd generation
- Laser range finder: Eye-safe
- 3 Hz continuously, 8 Hz burst

**Director**
- Bearing coverage: Unlimited
- Elevation coverage: -30° to +85°
- Top deck weight: 120 kg
- Can be extended
- Stabilisation accuracy: < 50 μrad RMS

**Top deck weight**
- 630-750 kg
- (depending on version)
The 9LV FCS combines combat-proven history with cutting-edge innovation. It performs in all environments and scenarios. It is quick and accurate. It provides outstanding value and availability throughout its lifecycle.

“SAAB’S NAVAL GUNFIRE SUPPORT CAPABILITY PROVIDES EXTREME ACCURACY, ENABLING US TO USE A LOW NUMBER OF ROUNDS TO GREAT EFFECT. ITS HIGHLY ACCURATE SPOTTERS POSITION INDIVIDUAL ROUNDS, REDUCING BOTH FIRE FOR EFFECT AND OVERALL AMMUNITION USAGE.”

Frigate Commander