



MOBILE FIREPOWER

OERLIKON SKYRANGER® MOBILE AIR DEFENCE SYSTEM

PASSION FOR TECHNOLOGY.

 RHEINMETALL

INTRODUCTION

The Oerlikon Skyranger® family offers mobile defence against all current and future battlefield air threats. The Skyranger combines superior firepower, active and passive sensors and the dynamics needed to engage the most demanding targets performing loiter, pop-up or dive attacks. The use of best-in-class cannon systems means that the Skyranger can stand its ground against swarming attacks and its mobility means that it can be deployed alongside ground forces or for stationary vital-asset protection. The Skyranger can independently generate its own local air picture whilst its command and control architecture (Skymaster), IFF and data link mean that it can be seamlessly integrated into the battle order and command structure.

Depending on the tactical needs and the required target spectrum, the Skyranger can be equipped with a 35 mm x 228 KDG revolver cannon or a 30 mm x 173 KCE revolver cannon. Both cannons are characterised by a high rate of fire, excellent precision and airburst ammunition. The 35 mm calibre offers C-RAM capability and an effective range of up to 4,000 m. The 30 mm calibre has an effective range of up to 3,000 m and the gun turret is designed to also mount short-range air defence missiles.

The highly modular design approach chosen allows customized active or passive sensor configurations. These include AESA radars, passive panoview systems and optronic packages. Advanced algorithms are used to fuse the sensor data together, classify the targets and support the operators in their decision making. As the threats evolve, so does the Skyranger. Integration of a high-energy laser or vertically launched C-PGM missiles is being explored.

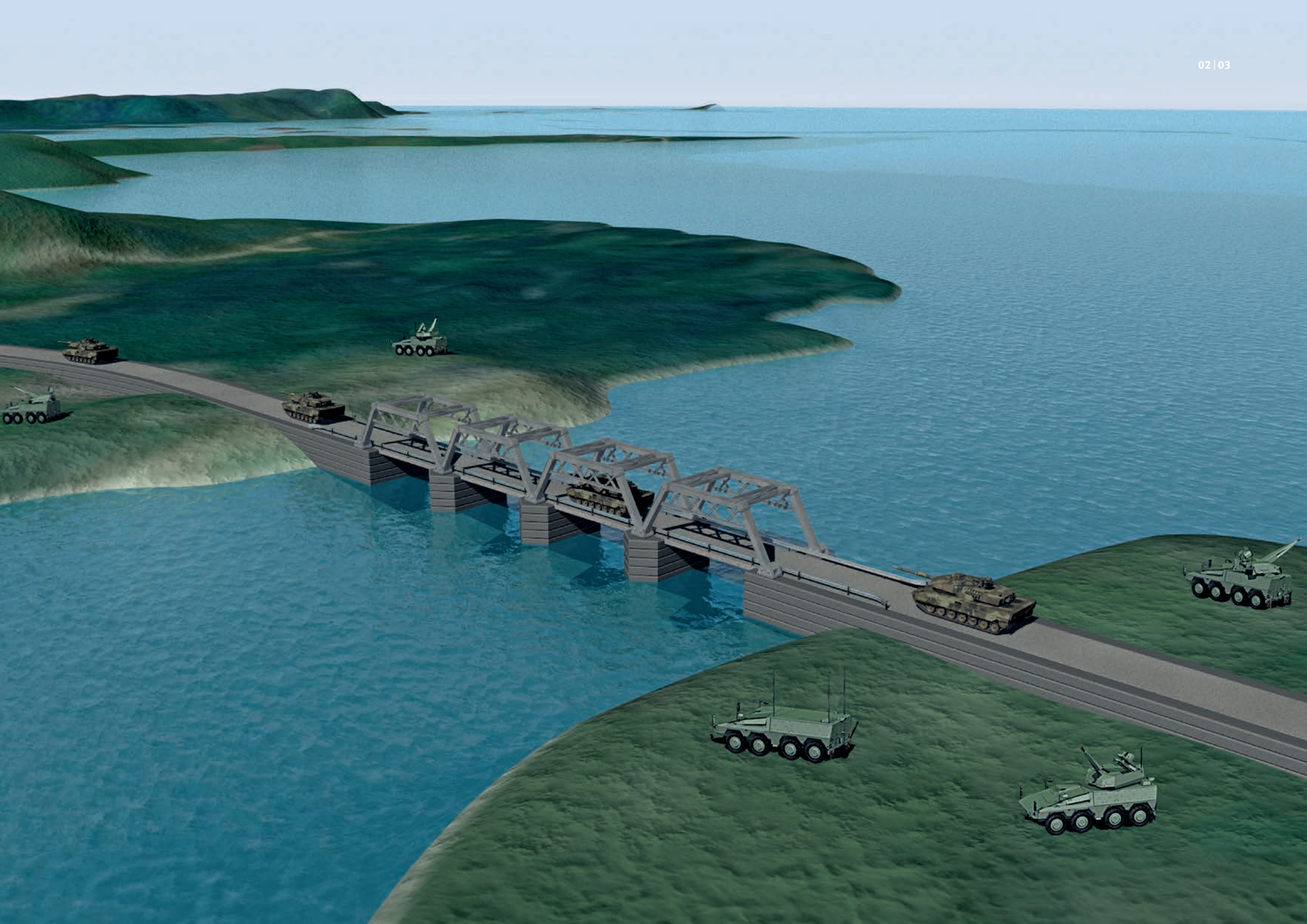
Skyranger: the mobile all-in-one-solution for today's pressing needs.

THE THREAT

Today's aerial threats are cunning, swift and relentless. To effectively engage these threats it is imperative to have a well-balanced air defence system that can detect, track and engage even the smallest aerial threats at treetop level by itself. These threats can also be expected to perform steep dives or pop-up manoeuvres, using the natural terrain to their best advantage.

Both classical threats, such as ground-attack aircraft and helicopters, as well as more modern threats such as loitering ammunition and UAS, pose a significant risk to ground troops and installations. Units on the move or engaged in combat must be able to rely on effective protection against threats from above. They cannot always expect that air superiority can be achieved or maintained.

Here, the Skyranger makes the difference. Thanks to its mobility, its situational awareness and its effectors, it can defend ground units on the move and in battle. The use of airburst ammunition allows the successful engagement of standoff weapons and loitering ammunition, as well as overly aggressive ground-attack aircraft that venture too near. With the 35 mm calibre, even RAM targets such as mortar rounds and artillery rockets can be countered. The immediate readiness and the lack of minimum engagement distance make the cannon an ideal close-range effector.



SYSTEM LAYOUT

Tactical unit

The basic Skyranger system configuration is a tactical unit commanded by an Oerlikon Skyranger® Control Node 1 (Skyranger CN1). The sensor/effector vehicles are aligned automatically and are ready for operation in a few minutes after powering on. The connection to higher-echelon command takes place via CN1 direct or via CN2.

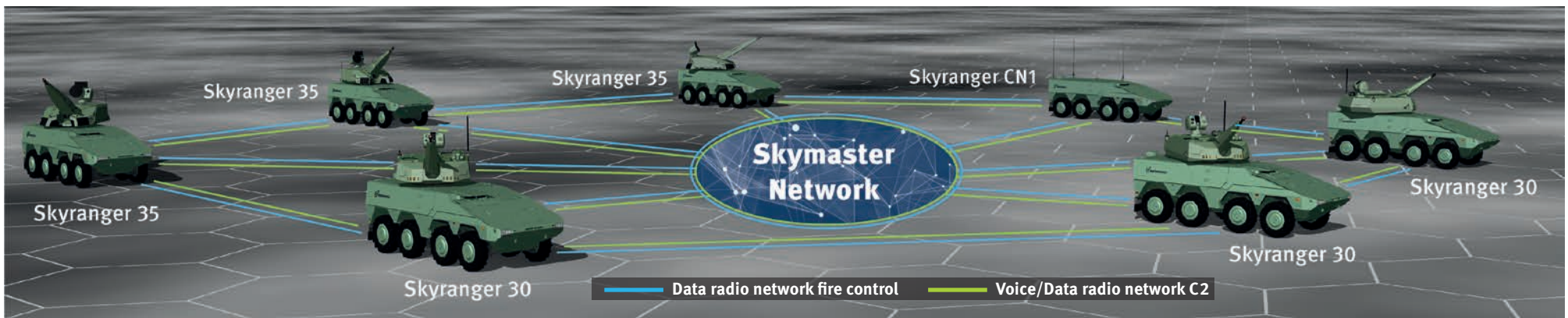
Skyranger Control Node 1

The Control Node 1 enables command and control of the tactical unit. It provides the operators with the command and control functionalities required to conduct air defence missions. This includes the command of connected sensors/ effectors, targeting, weapon supervision and, if applicable, engagement control (fire distribution). The goal is to provide a comprehensive local air and ground picture and to coordinate target engagements. The CN1 is installed in an armoured vehicle (e.g. ARTEC Boxer *) which is equipped with three generic operator consoles.

** ARTEC GmbH is a Joint Venture of Rheinmetall Landysteme GmbH, Rheinmetall Defence Nederland B.V. and Krauss-Maffei Wegmann GmbH & Co. KG*

The CN1 performs the following key functions:

- Mission preparation
- Force operations for subordinate vehicles
- Monitoring of subordinate weapon system status
- Air picture compilation and distribution
- Tactical control of subordinated Skyranger systems
- Weapon control orders
- Air threat warnings
- Weapon assignment (fire distribution)
- Friend protection
- Sensor emission control
- Communication with higher echelon
- Voice communication with subordinated vehicles
- Optional voice communication with protected assets

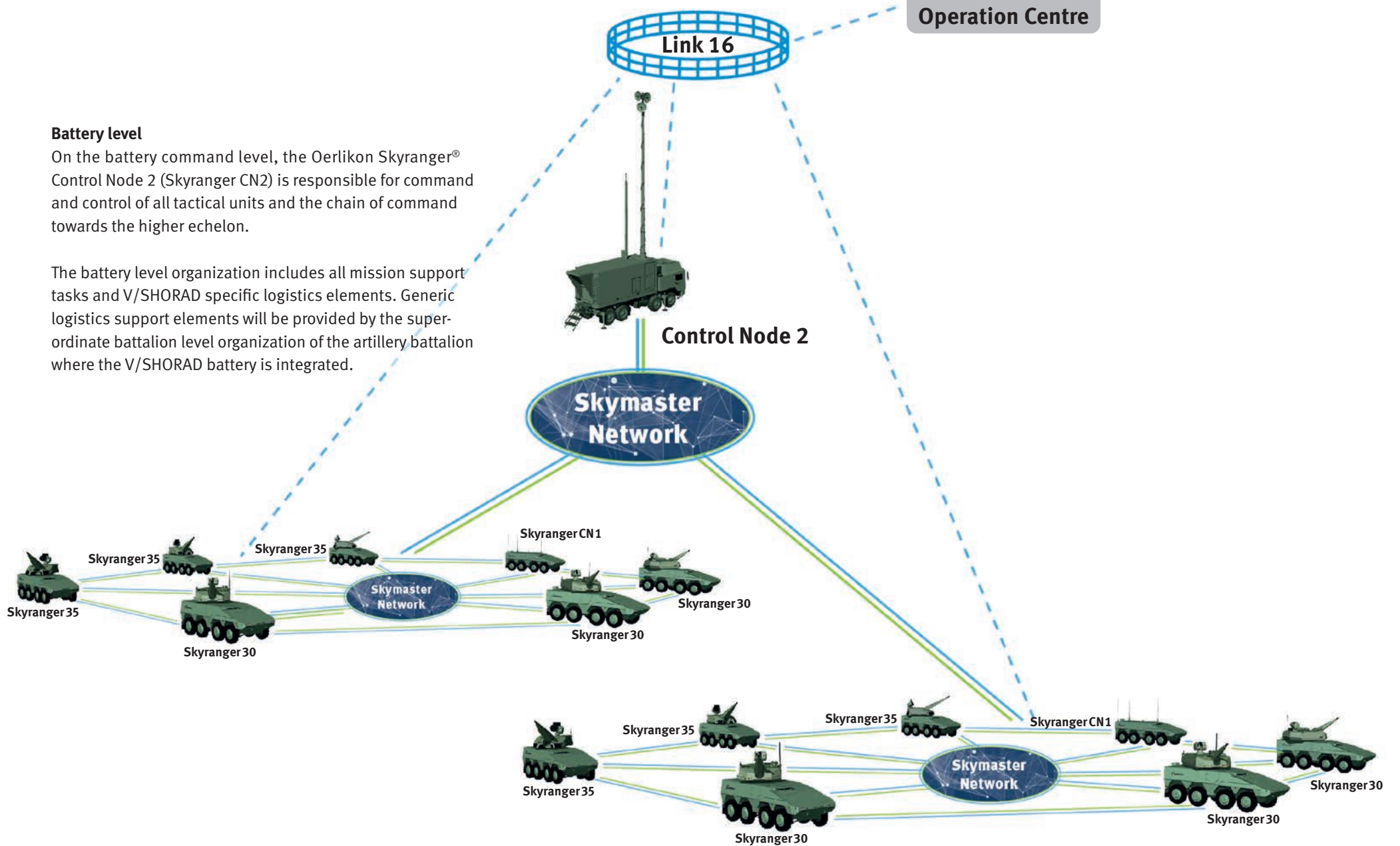


**Air Defence
Operation Centre**

Battery level

On the battery command level, the Oerlikon Skyranger® Control Node 2 (Skyranger CN2) is responsible for command and control of all tactical units and the chain of command towards the higher echelon.

The battery level organization includes all mission support tasks and V/SHORAD specific logistics elements. Generic logistics support elements will be provided by the super-ordinate battalion level organization of the artillery battalion where the V/SHORAD battery is integrated.



SKYRANGER 35

The Skyranger35 consists of a remote-controlled 35 mm gun turret with an integrated sensor suite as well as operating consoles and additional modules (e.g. power supply, electrical distribution, accessories) in the vehicle. The entire system is designed to be very modular and therefore allows simple integration into different carrier vehicles. The gun turret is designed as a complete, compact and modular air defence system. It provides a powerful remote-controlled 35 mm revolver gun with a high rate of fire of up to 1,000 rpm and is equipped with a link-less feed system containing 252 rounds. Reloading is carried out via the loading gate at the back of the turret or optionally from inside the vehicle. The sensor unit at the rear of the turret is equipped with multiple sensors allowing the precise tracking of air or ground targets. The sensor unit combines active and passive sensors. The XTR20 tracking radar is optimized for small targets and all-weather performance. The electro-optical sensors (IR camera, HDTV camera, two laser range finders) allow passive target tracking and identification.

PERFORMANCE OF REVOLVER CANNON KDG

Rate of fire	up to 1,000 rds/min
Muzzle velocity	1,050 m/s
Muzzle power	~7 MW

CHARACTERISTICS

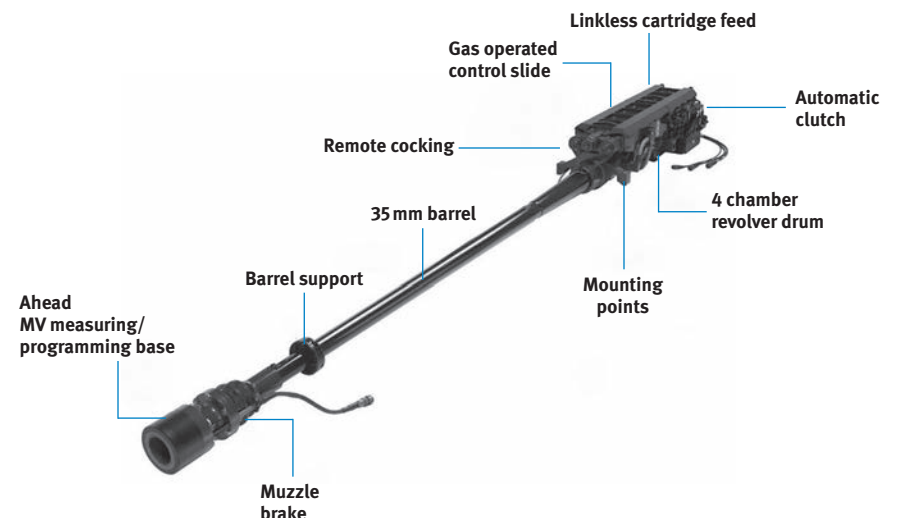
Mass	405 kg
Length (total)	4,110 mm
Recoil force (mean)	15,000 N
Recoil movement	20 mm

The Skyranger35 is operated with two consoles inside the vehicle; one C2/commander console and one target operator/gunner console. The commander console provides the local air picture and the link to the Skyranger Control Node 1. The target engagements and the operational status of the gun turret are controlled from the gunner console. The two consoles are redundant and allow operation of the complete Skyranger35 from a single console in case of emergency. For improved situational awareness, the complete ground picture can be displayed to the crew on additional screens. The operation of the system is highly automated and intuitive.

Due to its modularity, the 35 mm gun turret and additional system modules can easily be integrated into different types of wheeled or tracked vehicles. Air targets are engaged while the vehicle is stopped. Ground targets can be engaged on the move.

MAIN FEATURES

- Mobile 35 mm air defence gun
- Effective combat range: up to 4,000 m
- 35 mm Oerlikon Revolver Cannon® KDG
- Nominal rate of fire: 1,000 rds/min.
- Rapid single-shot mode: 200 rds/min.
- Ahead airburst ammunition
- Ready-to-fire ammunition: 252 rounds
- Remote charge and discharge function
- Ku-band tracking radar
- Fully stabilized electro-optical sensor unit
- Automatic target handover and tracking
- Two redundant operator consoles in vehicle
- Integrated navigation system
- Multi-purpose missions
- Simple handling and maintenance
- Integrated AESA search radar





SKYRANGER 30

This highly mobile air defence system with integrated active and passive search and tracking sensors is a powerful, autonomous shooter with both gun and missiles. It is capable of engaging modern battlefield threats with a special focus on small unmanned aerial targets. It combines superior firepower with the dynamics and elevation needed to successfully engage highly agile single or swarming targets performing loiter, pop-up or dive attacks. The Skyranger30 continuously monitors the surrounding air space with active (3D AESA radar) and passive infrared sensors (FIRST). In addition to its own air picture, targets from external search radars or higher-order control systems are received and processed. The integrated, fully stabilized electro-optical sensor unit with high resolution allows reliable target tracking and visual identification. The high level of automation makes the Skyranger30 easy to use. The integrated 30 mm x 173 Oerlikon Revolver Cannon® KCE-ABM provides best-in-class firepower and accuracy.

Combined with airburst technology, the gun achieves a high hit probability against the smallest targets. To achieve longer ranges, SHORAD missiles can be integrated. The remote-controlled gun turret has no turret basket and can easily be mounted on current in-service vehicles. It offers a level 4 protected hatch for easy access and maintenance.

PERFORMANCE OF REVOLVER CANNON KCE-ABM

Rate of fire	up to 1,200 rds/min
Muzzle velocity	1,050 m/s
Muzzle power	~4.2 MW

CHARACTERISTICS

Mass	142 kg
Length (total)	approx. 3,000 mm
Recoil force (mean)	12,000 N
Recoil movement	16 mm

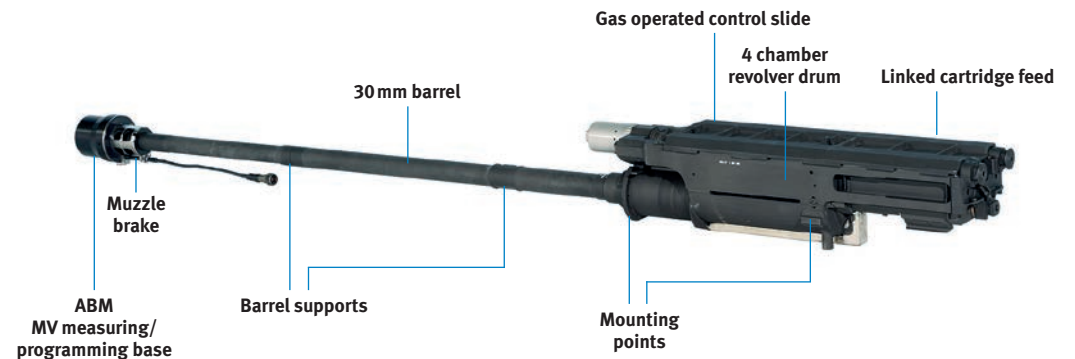
MAIN FEATURES

- Remote-controlled gun/missile turret
- Effective range: up to 3,000 m, with missile 6,000 m
- 30 mm Oerlikon Revolver Cannon® KCE-ABM
- 30 mm airburst ammunition
- Nominal rate of fire: 1,200 rds/min.
- Rapid single-shot mode: 200 rds/min.
- Integrated 7.62 mm CoAx machine gun
- Ready-to-fire ammunition: 252 x 30 mm, 1,000 x 7.62 mm
- Two integrated SHORAD missiles (option)
- Integrated 360° AESA search radar
- Integrated 360° fast infrared scanner FIRST (optional)
- Fully stabilized electro-optical sensor unit
- Ku-band tracking radar (optional)
- Ballistic protection: up to level 4 (STANAG 4569)
- 2x 9 ROSY smoke grenade launchers
- Two operator consoles in vehicle (commander/gunner)
- Simple handling and maintenance

ALL IN ONE SOLUTION FOR MOBILE APPLICATION IN 2 CALIBRES

Successful engagement

- 1 Search
 - 360° AMMR radar
- 2 Track and identify
 - EO package with optional tracking radar
- 3 Engage
 - 30 mm x 173
 - 35 mm x 228
 - Missiles optional
- 4 Communicate and share
 - Skymaster





OERLIKON AHEAD® AIR BURST TECHNOLOGY

The Skyranger system relies on the proven Oerlikon Ahead® Air Burst Technology to achieve the required kill performance for small air threats and in particular for RAM threats and drones. The Ahead ammunition carries a payload of sub-projectiles, which is ejected at a predetermined distance in front of the target, with the objective of achieving optimal sub-projectile density for maximum effectiveness.

The optimal ejection point is programmed into the time fuse of each shell. The fire control system calculates a fuse time corresponding to the required target intercept conditions, based on an assumed muzzle velocity.

The actual muzzle velocity of each round is measured by the Ahead measuring and programming base at the end of the gun barrel. The calculated fuse time is subsequently corrected to correspond to the measured actual muzzle velocity of each round. This value is then programmed into the Ahead round in real time by an inductive coil at the end of the Ahead measuring and programming base.

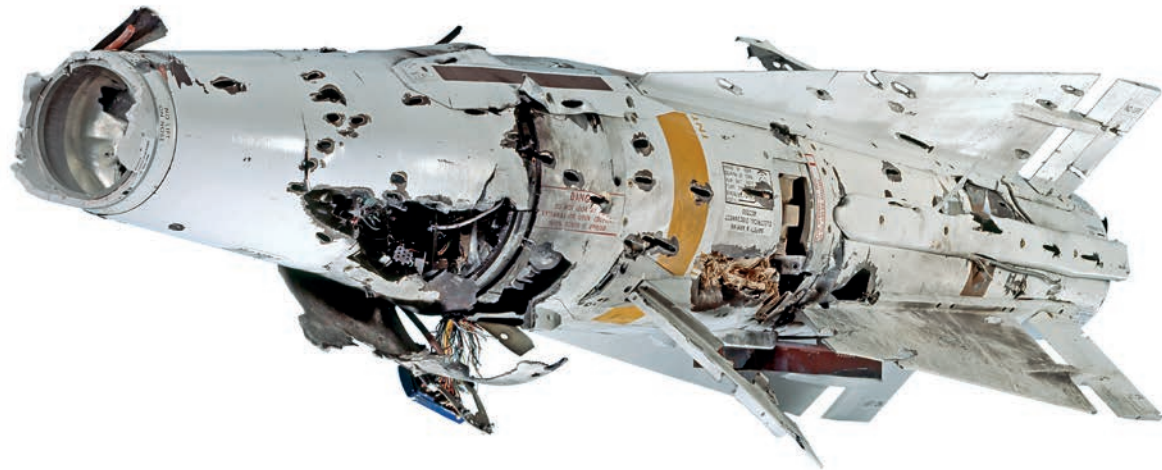
With the Ahead airburst ammunition, a cloud of sub-projectiles intercepts the attacking target. A short burst of Ahead rounds produces a high density of sub-projectiles ejected 10 to 40 metres in front of the attacking target, so that even the smallest target is hit with a sufficient number of sub-projectiles to achieve a mission kill.

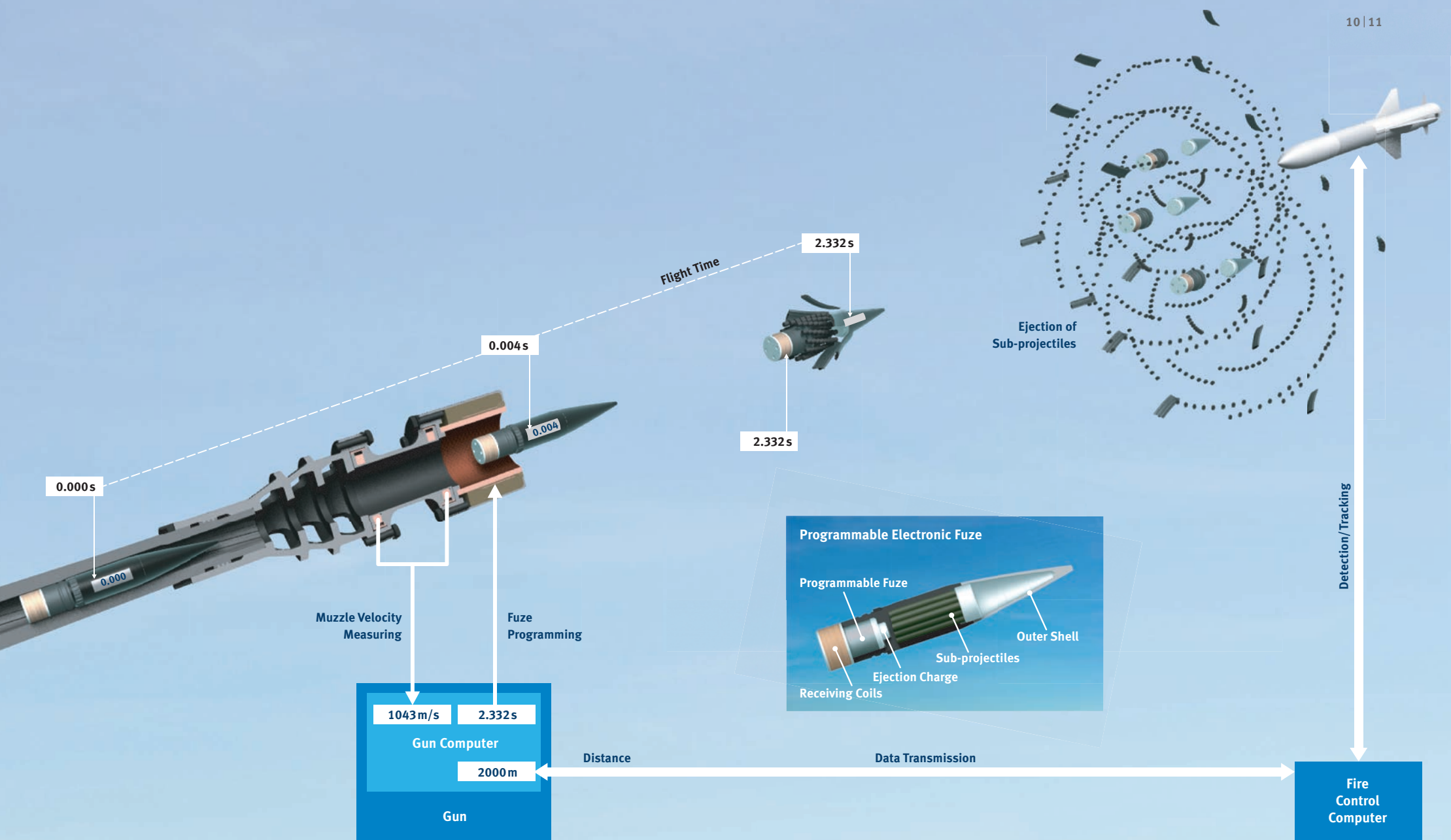
The spin-stabilized sub-projectiles penetrate the target – even at low impact angles – and inject a high level of kinetic energy into it. This will damage or destroy the target and thereby leads to a mission kill.

The Ahead technology is available in both 30 and 35 mm calibre.

MAIN FEATURES

- High-precision programmable base fuse
- Tungsten sub-projectile payload
- All payload kinetic energy is projected towards the target
- Spin-stabilized sub-projectiles
- Self-destruction incorporated
- Unprogrammed anti-armour mode
- Qualified and in service
- Inherently safe round
- Embedded advanced ECCM functionality
- No special maintenance needed
- More than 400,000 rounds delivered





SKYRANGER SKYKNIGHT MISSILE LAUNCHER

Together with its partner company HALCON, Rheinmetall is currently developing a new type of short-range air defence missile in order to complete the effector mix. The SkyKnight missile is specifically designed to engage hard-cased targets such as precision-guided munitions and large artillery shells.

With a range of up to 6 km against hard-cased targets and its multi-launch capability, the Skyranger will deliver a significant performance increase against saturation attacks and enhance its target spectrum. One missile launcher unit containing up to 60 ready-to-fire missiles can launch up to five missiles per second at individually assigned targets.

With an engagement range of up to 10 km against soft-cased targets, the new missile significantly increases the combat radius of the Skyranger and truly contributes to the approach of a layered air defence system. The SkyKnight missile is planned to be operational in 2026.

MAIN FEATURES

- All-weather capability
- Stationary and mobile application
- 60 ready missiles per Missile Launcher Unit
- 360-degree coverage (vertical launch capability)
- Effective range up to 10 km (depending on target type)
- Effective against RAM, PGM, UAS, cruise missiles and fixed- and rotary-wing aircraft
- Launch of up to five missiles per second at individually assigned targets
- One Missile Launcher Unit can simultaneously guide up to 20 missiles to 20 different targets
- One Tactical Unit can manage up to 80 missiles in flight simultaneously (from four Missile Launcher Units)
- High saturation resistance
- On-the-move missile launch capability

SKYRANGER HIGH-ENERGY LASER

For many years, Rheinmetall has been working on new weapon technologies such as the high-energy laser system. Its scalable lethality, the low cost per engagement and the extended engagement range make it the ideal weapon against unmanned aerial systems, in particular drones and other low, slow and small targets that come in masses. Integrated into the Skyranger, the high-energy laser system certainly adds a first level of saturation resistance that is very much required with regard to future threat scenarios. In view of the current status of development, Rheinmetall expects its high-energy laser system to be ready and fully operational by 2025.

MAIN FEATURES

- Scalable performance 10kW – 60kW available
- Low cost per engagement at extended ranges
- Scalable lethality
- Effective against various target types such as drones, LSS, RAM and fixed- and rotary-wing aircraft
- 100kW power can be achieved by superimposing the HEL beams of two HEL guns
- Available with its own EO sensor package (TV, IR, LRF) and coarse tracking





Skyranger concept demonstrator with High-Energy Laser and 30 mm Revolver Gun KCE (SHORAD missile optional)

FUTURE SENSORS AND EFFECTORS

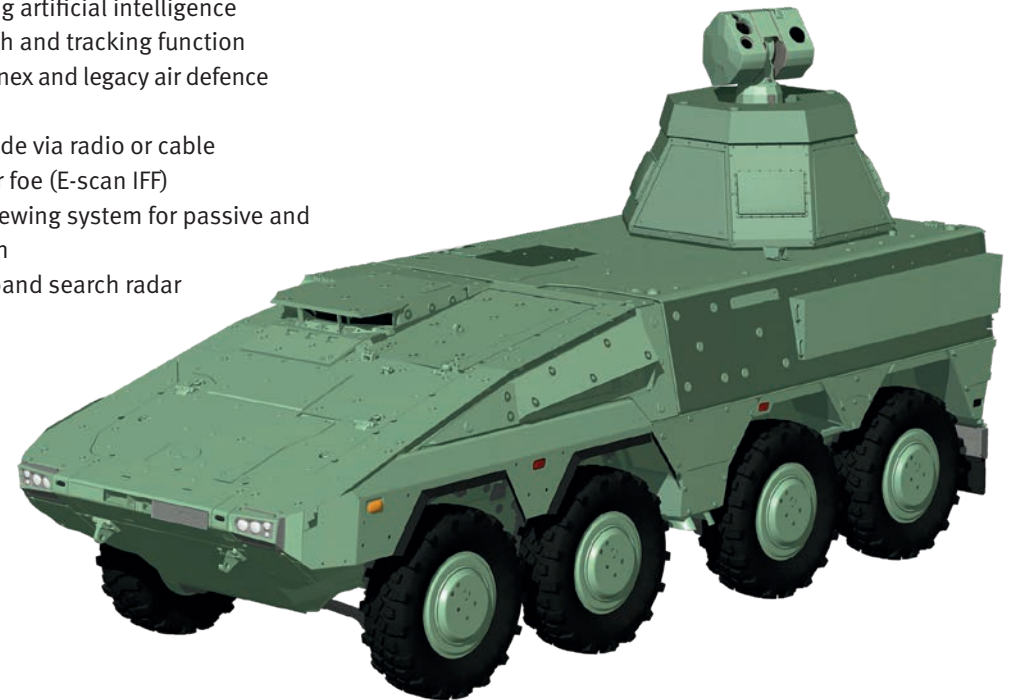
Skyranger Multi Sensor Unit S

The Skyranger Multi Sensor Unit (MSU) S is the next-generation sensor unit for ground-based air defence and can be installed on a wide range of platforms. The fully automated and unmanned MSU S is remotely controlled from inside the vehicle or the Skyranger Control Node 1. The non-rotating and software-defined 3D AESA Multi-Mission Radar (AMMR) enables superior awareness and mission flexibility. High robustness is achieved even in the most trying electronic warfare environment. To support the identification of friend or foe (IFF), an optional interrogator with non-rotating, passive, electronically scanning (E-scan) antenna is integrated. Once a target is detected, the electro-optical tracker is used to automatically verify and classify the threat.

The modular architecture of the MSU allows a flexible mix of active and passive sensors. It provides a superior air picture and total awareness at any time. It combines excellent performance for detection, acquisition and tracking of the most demanding targets, together with highly automated identification and classification capabilities. In an extended version, the MSU can also control SHORAD surface-to-air missiles (SAM).

MAIN FEATURES

- Fully remote-controlled and automated sensor unit
- All-weather, day- and night-capable
- Highly modular, flexible and scalable architecture
- Rapid deployment
- Full azimuth coverage with AMMR search radar
- Detection range higher than 20 km (1 m² RCS target)
- Reliable detection of small targets including micro UAS and RAM targets
- Advanced ECCM features and clutter mapping
- Advanced sensor data fusion (SDF) and target track generation
- EO tracking with HD cameras and laser rangefinders
- Target classification using artificial intelligence
- Active and passive search and tracking function
- Simple integration in Skynex and legacy air defence systems
- Connection to control node via radio or cable
- Identification of friend or foe (E-scan IFF)
- Option: EO panoramic viewing system for passive and low-level target detection
- Growth potential: Dual-band search radar



VEHICLE OPTIONS AND SYSTEM INTEGRATION

Both Skyranger turrets are vehicle agnostic. The Skyranger turret can be fitted on tracked or wheeled vehicles alike. The main general requirements are:

- Turret weight Skyranger35
3.8–4.7 t (depending on ballistic protection level)
- Turret weight Skyranger30
2.5–3.4 t (depending on ballistic protection level)

Only the slipring penetrates the deck, and the Skyranger30 furthermore offers the possibility of a hatch.

Around 0.7–1.2 t of equipment are stored in the vehicle.

This includes two operator consoles with the operators, the power supply, radios and miscellaneous equipment.

The two operator consoles can be placed side by side, facing the direction of travel.



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