MUSS®
Multifunctional Self-Protection System
Active Integrated Protection System
Presently the protection of armoured fighting vehicles is based on traditional protection made of steel or composite materials. The level of protection has mainly been improved by providing thicker armour with the consequence of increasing weight. The requirement of the weight budget for the Puma Armoured Infantry Fighting Vehicle (AIFV) is very limited. Under such conditions, the level of protection cannot be achieved when using only passive armour.

It is only possible to improve the level of an Armoured Infantry Fighting Vehicle’s protection within the given weight limitations by using an active protection system approach. Hits from hostile ATGM threats can be avoided by combining warning sensors, which detect the missile and laser threats, and activate the appropriate countermeasures.

**MUSS®**

**MUSS Sensor Head**
The MUSS warning system is based on four MUSS hybrid sensor heads (passive sensors) and includes missile- and laser warning sensor in a single housing. The data is transmitted to the MUSS Central Electronics were the final processing is performed.

**Anti-Tank Guided Missile Warning Sensor**
The missile warning sensor operates in the solar-blind part of the UV spectrum and continuously observes the surrounding area. The missile signature generated by UV missile plume irradiance will be pre-processed in the missile warner and then transmitted to the MUSS Central Electronics for further processing.

**Laser Warning Sensor**
The laser warner includes a special integrated detector element with a high sensitivity and angle resolution. It communicates with a bus and transfers all alarms to the MUSS Central Electronics.

**MUSS Central Electronics**
The MUSS Central Electronics is the link between the sensor heads. It receives all transferred data and controls the final processing of the missile warner. It also controls and activates the IR Jammer and initiates the adjustable smoke screen dispenser.

**MUSS Countermeasure IR-Jammer**
The IR Jammer is effective against most in service wire guided optically tracked (non-jam-resistant) missiles. It can now jam the missile launcher and provides wrong missile location to the firing post. Consequently it can be used as many times as necessary. The IR Jammer is based on two parts, the turnable MUSS IR Jammer head and the separate MUSS IR Jammer electronics. The MUSS IR Jammer head provides 360° azimuth coverage and an advanced elevation. Alignment and activating of the MUSS IR Jammer head will be by the MUSS Central Electronics according to the threat determination. The radiation emitted by the MUSS IR Jammer head is neither observed in the visible spectrum nor in the IR spectrum therefore it cannot be observed by the thermal imager of a missile launcher either.
**MUSS System Components**

**MUSS Smoke Electronics**
It includes the control of the adjustable smoke screen dispenser and the ignition module of the pyrotechnic ammunition.

**Adjustable Smoke Dispenser**
The adjustable smoke dispenser will be aligned by the MUSS Smoke Electronics to the direction of the threat. For tactical reasons deployment of smoke can be activated manually by the crew.

**MUSS Pyrotechnic Ammunition**
It is optimized for a fast generation of a smoke screen which is effective in the visible up to the IR spectral range, disturbing IR guided or seeker head based missiles.

**Key features**

- Configured to effectively protect armoured fighting vehicles against guided ammunition such as:
  - Missiles
  - Laser guided munitions

- IR Jammer countermeasure is effective against:
  - Wire guided optically tracked non-jam-resistant missiles
  - It is non consumable, so it becomes re-usable

- Pyrotechnic munition countermeasure effective against:
  - Jam-resistant second generation missiles
  - Third generation missiles (e.g. guided by IR-Seeker)
  - Laser Target Designator guided missiles
  - Laser Target Designator guided munitions

- No significant influence on vehicle radiation
  - Passive sensors (UV-MWS and LWS)
  - IR Jammer short activation time, not detectable either in visible or in thermal image spectrum

- Multi threat capability
- No collateral damage (as with hard kill DAS)
System Architecture
The MUSS is based on the sub-assemblies MUSS Central Electronics, MUSS Sensor Heads (4 per system), MUSS Jammer Head, MUSS Jammer Electronics, MUSS Smoke Electronics and 2 adjustable smoke screen dispensers with MUSS specific pyrotechnic ammunition.

Principle of System Operation
The MUSS system is designed to counter threats caused by ATGM (anti-tank guided-missiles) and laser guided ammunition in six steps:
1. The scenario is continuously monitored by the MUSS passive sensor heads. It recognizes threats with their emitting radiations through the warning sensors.
2. Based on the threat messages which include direction of attack and other parameters, this is then displayed to the vehicle crew.
3. The movement information of the vehicle and the head sensors is collected by the IMU and provided to the MCE.
4. The appropriate type of countermeasures will be automatically selected. The countermeasures are initiated automatically or semi-automatically as selected by the vehicle crew.
5. The Jammer is able to disrupt the guidance of most of the jammable ATGMs which are currently in service. This function influences the missile in such a way that it does not reach its target, either hitting the ground or flying away.
6. A further countermeasure is the deployment of a special smoke grenade activated by the turnable smoke screen dispenser.