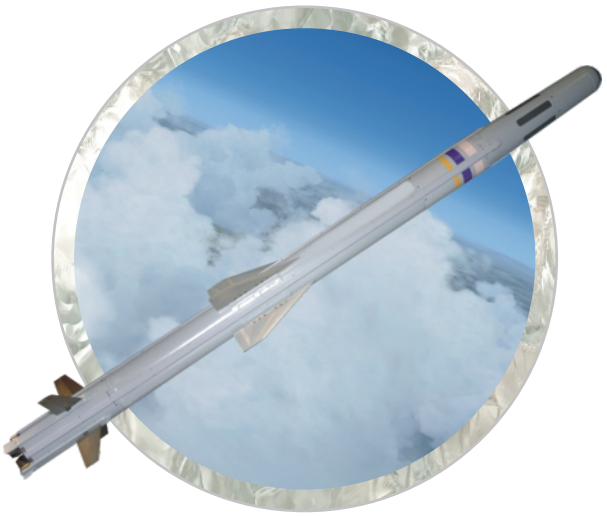

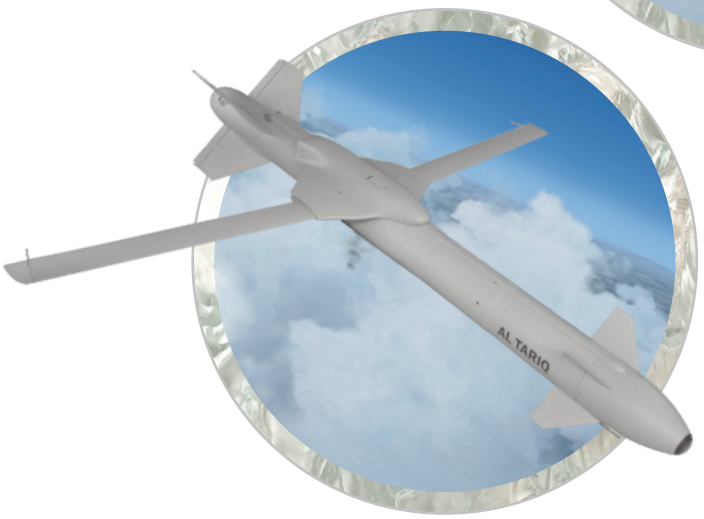

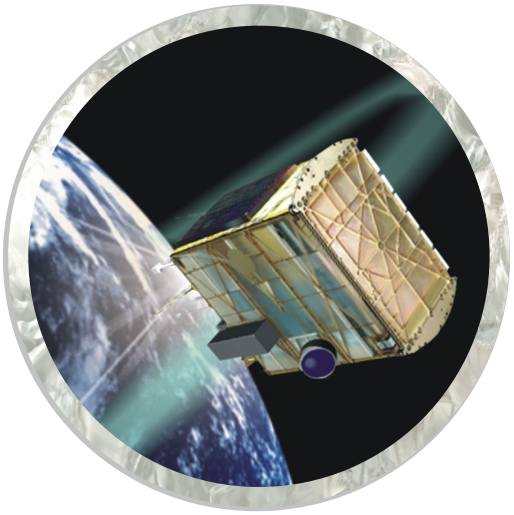

DENEL

DENEL DYNAMICS

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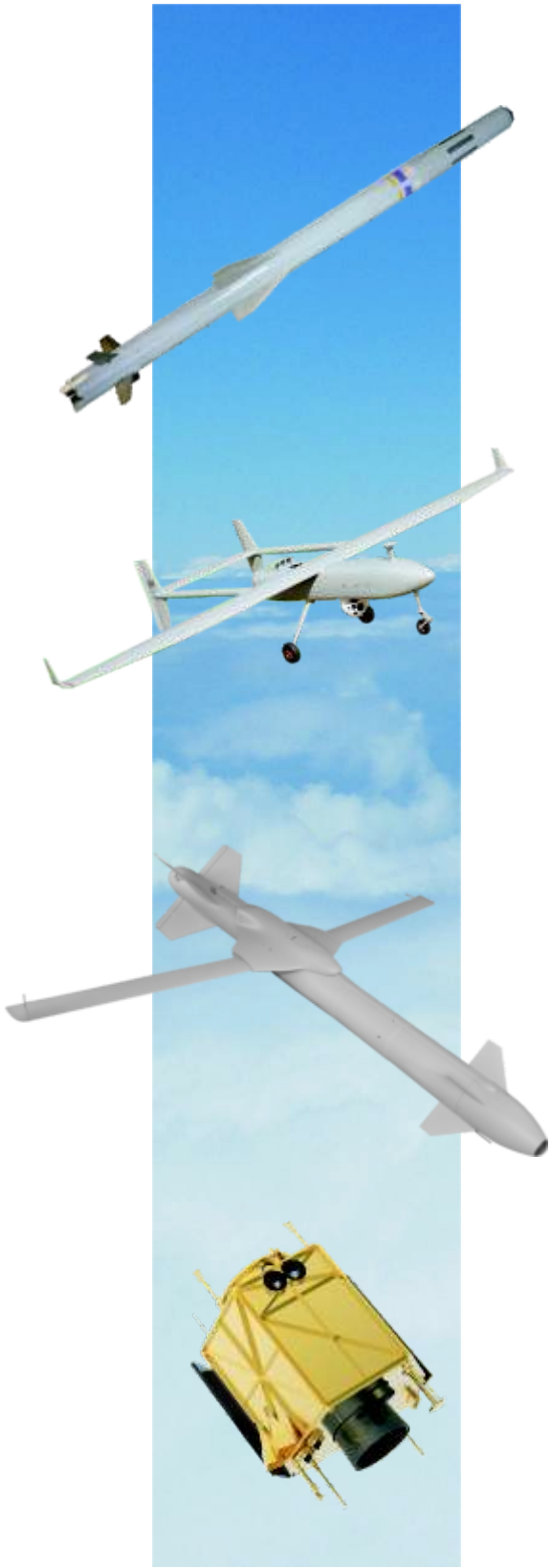
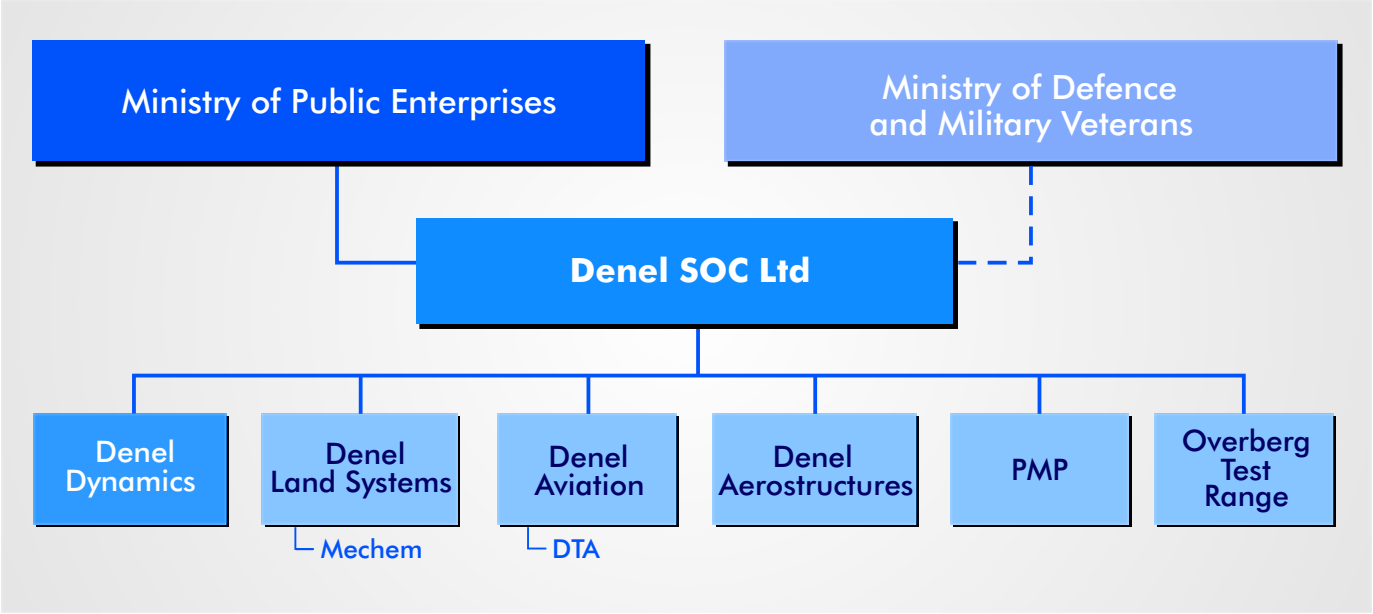


DENEL GROUP



DENEL VALUES

PERFORMANCE
WE EMBRACE OPERATIONAL EXCELLENCE

INTEGRITY
WE ARE HONEST, TRUTHFUL AND ETHICAL

INNOVATION
WE CREATE SUSTAINABLE INNOVATIVE SOLUTIONS

CARING
WE CARE FOR OUR PEOPLE, CUSTOMERS, COMMUNITIES, NATIONS AND THE ENVIRONMENT

ACCOUNTABILITY
WE TAKE RESPONSIBILITY FOR ALL OUR ACTIONS

COMPANY OVERVIEW

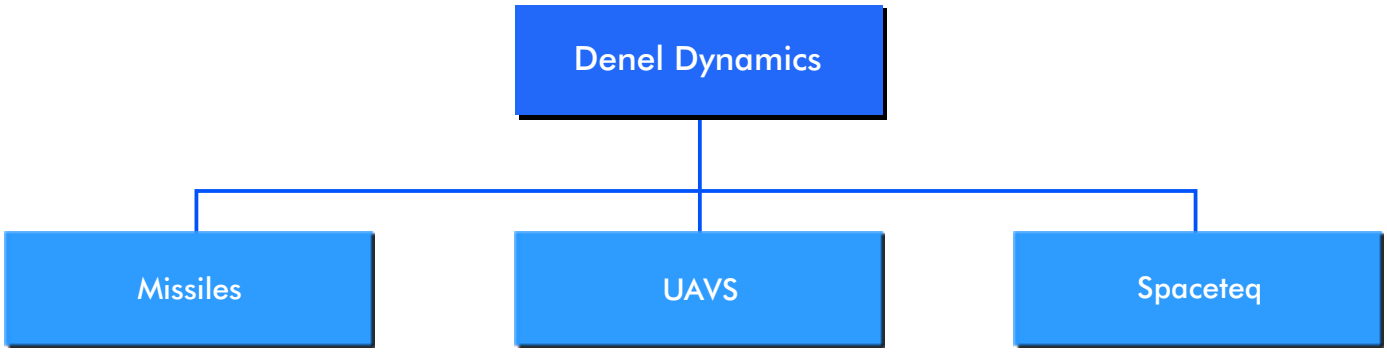
Denel Dynamics, a division of Denel SOC Ltd, is an innovative leader in advanced systems technology. Its core business include tactical missiles, precision guided weapons, unmanned aerial vehicle systems and space solutions. Our products are designed, developed and manufactured in South Africa. Denel Dynamics is a strategic partner of the South African National Defence Force. The company also promotes collaboration and partnerships with other developing nations such as Brazil, UAE and others.

Denel Dynamic's products are in service with other defence forces in Africa, Middle East, Europe, Asia and South America.

As South Africa's top engineering intellectuals work for Denel Dynamics, local and international partnerships with educational institutions have been established to create exciting opportunities in the fields of maths, science, engineering and technology. Quality skills transfer, mentoring and bursaries are of key importance to enable retention of South Africa's pool of talent while transforming our business and people. Our aim is to build upon our world-class expertise and to keep passing on our intellectual property.

The true character of Denel Dynamics business is advanced technology prowess and the evolution of innovative ideas into high-quality, reliable, and robust products and systems for end-users.

Company Structure



The family of missile systems include the Umkhonto air defence system; Ingwe and Mokopa anti-armour missiles; A-Darter air-to-air system. Precision guided weapons, Long-range Raptor and the Umbani strap-on bomb kit, which is also known as the Al Tariq in the United Arab Emirates, where it is manufactured in partnership with Tawazun Dynamics.

The family of Unmanned Aerial Systems (UAS), include the Seeker 200 tactical ISR System, Seeker 400 Multi-mission, multi-role ISR, the Hungwe UAV and the Skua high-speed target drone.

Spaceteq, a new business unit in Denel Dynamics, commenced operations on the first of July 2013. It is using the intellectual property from DST, the ex-Sunspace personnel, and the heritage from work previously done by Houwteq, as a solid foundation on which to build an organisation that will develop satellite systems for the South African Government and International Clients.

UMKHONTO

Surface-to-air Missile

Umkhonto (Spear) Missile is an indigenous product, designed, development and manufactured in South Africa. The design of Umkhonto was inspired by the Zulu military commander "King Shaka" who introduced to his warriors amongst other things, the short Spear, the cow horn formation and the element of surprise. Similarly the Umkhonto missile design includes Stealth (passive IR seeker and low smoke rocket motor) and flexibility (multi target engagement and ability to launch from any position).

The Umkhonto vertical launch Surface to Air Missile (SAM) was developed for the SA Navy's Meko A200 class frigates, and has been in service since 2001. Other Navies have also acquired the Umkhonto system, this include amongst others the Finnish Navy.

The missile is high-velocity and infrared homing, providing all-round defence against simultaneous attacks from missiles and aircrafts. Although, this is a surface to air missile, it is also capable of taking out stationery surface targets. The Umkhonto was designed with a 23 kg warhead for High-kill probability, unlike other SAM missile systems in its class.

System Features

- Multiple-target engagement (up to four targets)
- Ease of integration
- High-kill probability (23 kg warhead)
- Countermeasure resistance
- Absence of line-of-sight limitations
- Ease of maintenance (high BIT coverage)
- All-round (360°) coverage (with vertical launch)

System Operation

- Target is acquired and tracked by 3D target acquisition radar
- Missile is launched and flies to a lock-on point, using an on-board inertial navigation subsystem
- IR seeker locks on and missile intercepts target under seeker control
- Continuous updating of target course from surface radar during missile flight, via a telecommand link, to enable engagement of manoeuvring targets

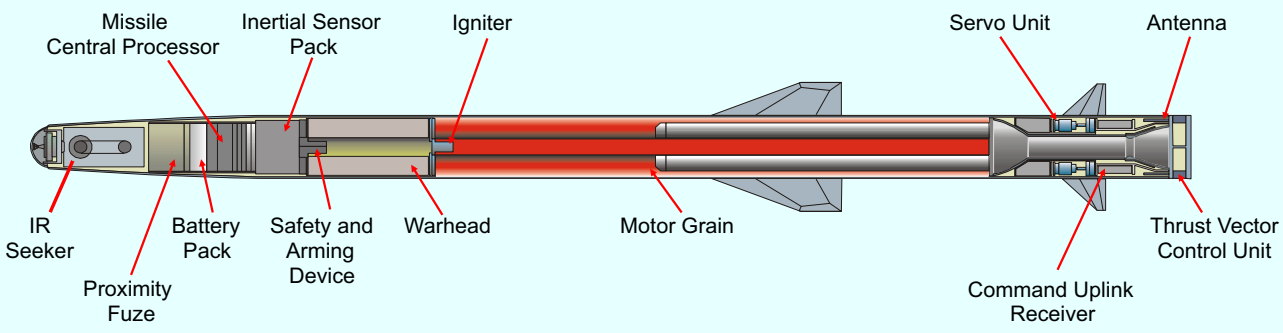
System Specifications

Physical Characteristics

- Missile length : 3 320 mm
- Missile diameter : 180 mm
- Wingspan : 500 mm
- Launch mass : 135 kg
- Canister length : 3 800 mm
- Canister maximum diameter: 650 mm

Performance Characteristics

- Range : Max 20 000 m
- Ceiling : 8 000 m
- Maximum Mach No. : 2
- Time of flight to 8 km : 18 s



UMKHONTO

Ground-based Launcher System: Land Application

Umkhonto Ground-based Launcher (GBL) is a versatile, compact and mobile surface-to-air missile vertical launching system providing all-round defence against simultaneous air attacks from missiles and aircrafts. The GBL concept is similar to the naval application. It operates autonomously for extended periods without significant replenishment requirement. It is specifically designed to launch the well-known Umkhonto range of missiles using the designated homing principle.

The GBL is supplied as a stand-alone effector system for easy integration into bigger ground-based and naval air defence systems or it can be deployed on a vehicle. It is transportable by land, sea and air (C130 and helicopter lifting).

System Features

- Multiple simultaneous target engagement.
- Ease of integration with next level Command and Control Systems.
- Absence of line-of-sight limitations.
- ISO 668 Lock and STANAG 2413 hook-lift compliant.
- Transportable by land, sea and air (C130 and helicopter lifting).
- All-round (360°) coverage (with vertical launch).
- Rapid encampment/decampment possible due to highly mobile and autonomous features.
- Design allows for rapid reloading.
- Deployment on vehicle or stand-alone.
- Surface attack mode

System Operation

- The GBL can be deployed either on a vehicle or stand-alone, and is connected to the Command and Control centre via radio, hard-wired or fibre-optic links.
- The GBL can be deployed on various ISO and STANAG 2413 compliant vehicles.
- The GBL operates autonomously for extended periods without significant replenishment requirements.
- The GBL is specifically designed to launch the well-known Umkhonto range of missiles using the designated homing principle.

Launcher Specifications

Physical Characteristics

- Length : 6 058 mm
- Width : 2 438 mm
- Height : 2 000 mm
- Mass : < 4 500 kg (empty)
- Mass : < 7 100 kg (including eight IR missiles)
- ISO 668 Lock and STANAG 2413 hook-lift compliant

INGWE

Precision-guided Missile

Ingwe ('leopard') missile is a laser guided, therefore jam-resistant, beam-rider missile with a tandem warhead that will penetrate up to 1000 mm of Rolled Homogeneous Armour (RHA) after a single layer of reactive armour. The warhead ensures effective target neutralisation. The missile automatically determines its own position in the laser beam and manoeuvres onto the line of sight. It has crossfire capability from adjacent platforms with high-speed launch from helicopter platforms and fire-on-the-move from land platforms.

The system is designed to ensure that it can be installed easily on most aircrafts in either standard two-or-four-missile configuration. Electrical integration with aircraft avionics is achieved with standard serial communication interfaces.

System Features

- Multi-purpose missile for use by infantry, armoured or helicopter forces against modern threats
- Crossfire capability from adjacent platforms
- High-speed launch from helicopter platforms
- Fire-on-the-move from land platforms
- High countermeasure resistance
- High-accuracy laser beam-riding guidance
- Short- and long-range application (250 m to 5 000 m)
- Easy to use, with automatic target tracking
- Low maintenance cost

Principle of Operation

Ingwe uses laser beam-riding guidance. The missile automatically determines its own position in the laser beam and manoeuvres onto the line of sight. The missile follows the line-of-sight until the target is hit. The warhead ensures effective target neutralisation.

The sighting system can vary from a non-stabilised optical sight for light vehicles to a more complex and integrated stabilised day/night sight for moving platforms such as helicopters. Automatic target- tracking modules can be added to ensure fully automatic missile guidance after target lock-on by the operator.

System Description

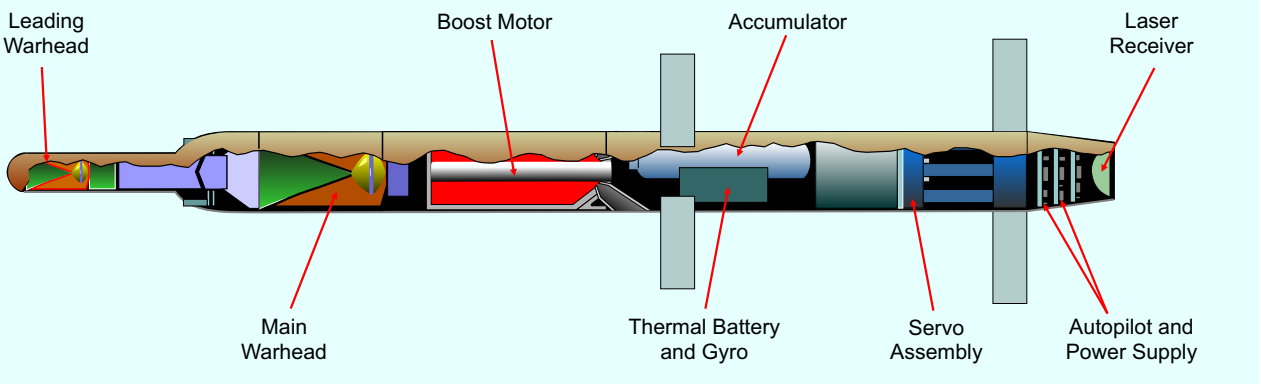
The system is designed to ensure that it can be installed easily on most aircrafts in either standard two- or four-missile configuration.

Electrical integration with aircraft avionics is achieved with standard serial communication interfaces.

Other platform options include heavy IFV turrets fitted with stabilised sighting systems, to light vehicle- and even tripod-mounted solutions.

Technical Data

- Missile mass : 28.5 kg
- Missile diameter : 127 mm
- Missile length : 1 750 mm
- Penetration: up to 1 000 mm in RHA (with ERA)
- Range : 250 m to beyond 5 000 m



IPLS INGWE

Ingwe Portable Launch System (IPLS)

Ingwe Portable Launch System (IPLS) is a manually operated, cost-effective, portable single missile launch system. The IPLS brings further flexibility to the already operational capability of the highly effective Ingwe anti-armour missile. It offers flexible integration on Light Utility Vehicles (LUV) and is dismountable onto a tripod.

System Features

- Manual operation with day view optical (dvo) telescope
- Crew portable in tripod configuration
- Easy to use with low maintenance
- High accuracy with advanced countermeasure resistance
- Upgrade options:
  - Thermal imager for night capability
  - Servo driven remote control
  - Two missile launcher
  - Auto tracker
  - Laser Range Finder (LRF)

Principle of Operation

Ingwe uses laser beam-riding guidance. The missile automatically determines its own position in the laser beam and manoeuvres onto the line of sight. The missile follows the line-of-sight until the target is hit. The warhead ensures effective target neutralisation.

The sighting system can vary from a non-stabilised optical sight for light vehicles to a more complex day/night sight. Automatic target- tracking modules can be added to ensure fully automatic missile guidance after target lock-on by the operator if a thermal imager is fitted.

System Description

The IPLS is a manually operated system adding to the operational effectiveness of the Ingwe anti-armour missile.

The IPLS is a cost-effective, portable single missile launch system. It offers flexible integration on light vehicles and is dismountable onto a tripod.

Technical Data

- Mass: LRUs are manportable
- Dimensions: Swept circle diameter: 1 770 mm
- Elevation angles: -20° to 20°
- Sight performance: DVO: 12 x magnification
- 24 V Electrical interface
- Adaptable to two missiles

ALRRT-4M INGWE

Armed, Long-range, Reconnaissance Turret (Alert)

Armed, Long-range, Reconnaissance Turret, ALRRT (Alert) adds to the operational effectiveness of the highly lethal Ingwe anti-armour missile. Available in a variety of configurations (four missiles, two missiles with a 7.62 mm calibre machine gun, etc.), the turret can be integrated on a wide range of vehicles from Light Utility Vehicles (LUV) to heavy Infantry Fighting Vehicle (IFV).

System Features

- Stabilised for reconnaissance and fire-on-the-move capability
- Remote-controlled from inside or outside the vehicle
- Lightweight and unmanned (non-intrusive), allowing integration on a wide range of vehicles
- Full day and night capability coupled to automatic target-tracking
- Advanced state-of-the-art man-machine interface with colour displays
- Easy to use, with low maintenance cost
- High accuracy and advanced countermeasure resistance

Principle of Operation

Ingwe uses laser beam-riding guidance. The missile automatically determines its own position in the laser beam and manoeuvres onto the line of sight. The missile follows the line of sight until the target is hit. The warhead ensures effective target neutralisation.

The sighting system can vary from a non-stabilised optical sight to a more complex and integrated stabilised day/night sight for moving platforms. Automatic target-tracking modules can be added to ensure fully automatic missile guidance after target lock-on by the operator.

Technical Data

- Mass:
  Turret only : 290 kg
  Turret armed (four missiles) : 400 kg
- Dimensions:
  Height : 668 mm
  Turret swept circle diameter : 1 630 mm
  Launcher swept circle diameter : 2 600 mm
  Ring gear diameter : 960 mm
- Elevation angles : -10° to +25°
- Sight Performance:
  Recognition
  (target: tank, visibility > 23 km) :
  3 x TV fields of view:
  - WFOV (12°) : 950 m
  - IFOV (4°) : 2 700 m
  - NFOV (1.2°) : 6 300 m

  2 x TIS fields of view:
  - WFOV (6.25°)
  - NFOV (1.3°) : 7 350 m
- Integrated Auto-tracker
- 24 V Electrical interface
- Adaptable to two missiles and light machine gun configuration (2M-MG) turret

MOKOPA

Long-range Precision-guided Missile

Mokopa (Black mamba) is a long-range, precision-guided missile that utilises the semi-active laser guidance concept. Its high performance, large-calibre tandem warhead will destroy any foreseen armoured threat. It may also be used effectively against other high value ground, air or naval targets from a variety of launch platforms such as land vehicles, shore battery installations, naval vessels and fixed wing aircraft. The modular design of the missile allows for different warheads (e.g. penetration, fragmentation or anti-armour), optimised for the type of target. Furthermore, the modularity of the missile system facilitates pre planned upgrades, such as mmW and IIR seekers, ensuring a continued presence in the market.

System Features

- Multi-purpose, precision-guided missile may be used against a variety of targets and launched from various platforms
- Semi-active laser guidance
- Excellent price/performance ratios
- Multiple warhead capability, tandem warhead (1 350 mm penetration)

Description

Mokopa is a state-of-the-art, long-range, precision-guided, anti-armour missile. It may also be used effectively against other high-value ground, air or naval targets from a variety of launch platforms such as land vehicles, shore battery installations, naval vessels and fixed-wing aircraft. The modular design of the missile allows for different warheads (e.g. penetration, fragmentation or anti-armour), optimised for the type of target. Furthermore, the modularity of the missile system facilitates pre-planned upgrades, such as mmW and IIR seekers, ensuring a continued presence in the market.

System Operation (SAL Version)

Prior to launch, target information must be supplied via the on-board sighting system or from an external source. After launch, the missile flies towards the target area, using the selected trajectory and fly-out method. During the terminal phase, the target must be illuminated by the on-board sighting system or a remote designator.

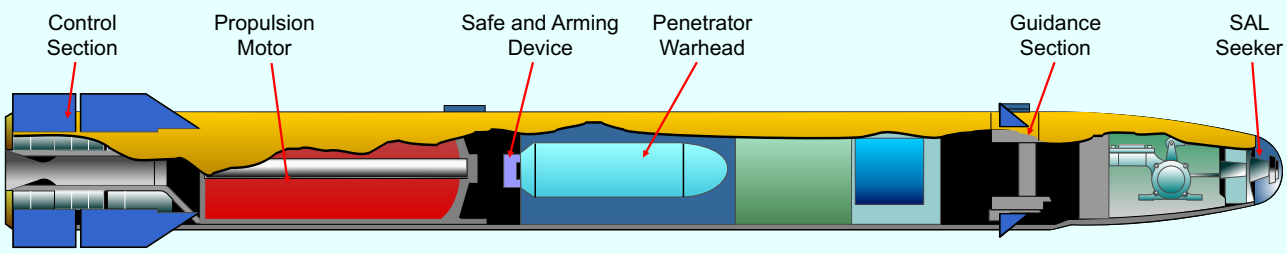
System Description

The Mokopa system consists of the following major components:

- 178 mm missile
- Launcher (two or four missiles)
- Support equipment

Technical Data

- Missile mass : 49.8 kg
- Missile diameter : 178 mm
- Missile length : 1 995 mm
- Seeker : Semi-active laser homing
- Warhead : Tandem HEAT
- Penetration : > 1 350 mm RHA
- Range : 10 000 m



Multi-purpose Penetrator Warhead

A-DARTER

Fifth-generation Air-to-air Missile System

A-Darter is a leading wingtip fifth-generation Imaging Infrared (IIR) SRAAM air-to-air missile system. It has a lock-on after launch and memory tracking with the latest processing capabilities. The A-Darter may be designated to a target by using the aircraft's radar, a helmet sight or the missile's very effective autonomous scan feature if radar silence is required. The seeker's large look-angles and the airframe's agility enable high off-bore sight helmet-designated firings. Long-range intercepts beyond IR detection range are also possible with the lock-on after launch capability of the A-Darter.

The missile can be integrated on the latest and older generation aircraft platforms. It has already been integrated on the JAS-23 Gripen and integration on the Hawk Mk 120 is under way.

System Features

- A-Darter is a leading wingtip fifth-generation Imaging Infrared (IIR) SRAAM that will enhance your platform's lethality
- Designed by Denel Dynamics (co-funded by Brazil), utilising its 50 years of air-to-air missile experience
- High agility (thrust vector controlled) to handle the closest of close combats
- A two-colour thermal imaging seeker with high sensitivity and a multi-mode ECCM suite
- Advanced digital processing capability ensures improved performance in terms of image detection, false target rejection, ECCM, guidance and control
- Lock-on after launch and memory tracking capabilities

Principle of Operation

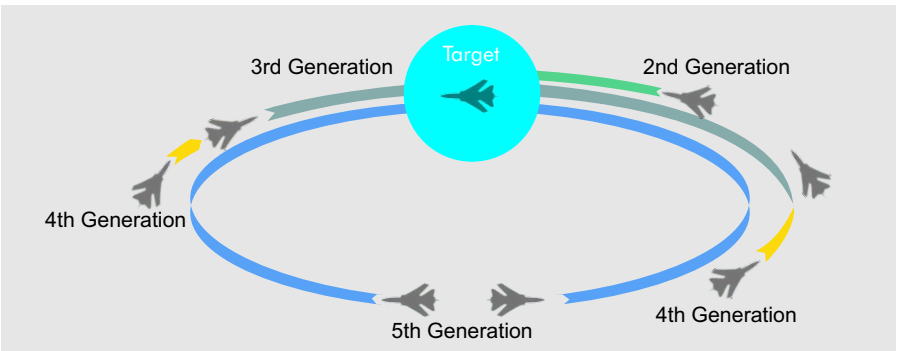
The A-Darter may be designated to a target by using the aircraft's radar, a helmet sight or the missile's very effective autonomous scan feature if radar silence is required. The seeker's large look-angles and the airframe's agility enable high off-boresight helmet-designated firings. Long-range intercepts beyond IR detection range are also possible with the lock-on after launch capability of the A-Darter.

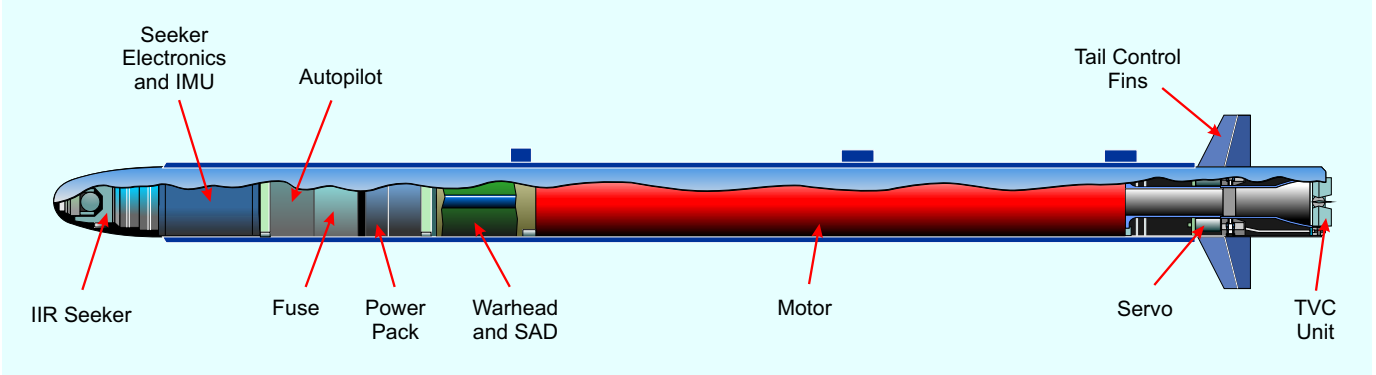
Aircraft Integration

The A-Darter missile can be integrated on the latest and older generation aircraft platforms. It has already been integrated on the JAS-39 Gripen. Integration on the Hawk Mk 120 is under way.

Technical Data

- Length : 2 980 mm
- Diameter : 166 mm
- Mass : 93 kg





RAPTOR II

Long-range, High-precision Guided Weapon

Raptor II is a long-range, high-precision guided weapon that can be launched from a variety of aircraft to achieve pinpoint accuracy for the destruction of high-value targets.

The modularity of the system ensures mission flexibility for optimum launch aircraft survival and target destruction.

Various system upgrades such as improved stand-off range and alternative seeker types are in progress.

System Features

- Extreme high precision
- Modularity allows for mission flexibility
- Heavy calibre warheads (600 kg)
  - Fragmentation (with airburst capability)
  - Penetration
- Multiple simultaneous target engagement
- Variety of seekers:
  - GNSS/INS
  - LLTV
  - IIR (with ATR)
- All-weather attack capability
- Ease of integration with older (strap-on) and new generation aircraft
- Enhanced robustness against GNSS jamming and spoofing
- In-flight target re-programming capability

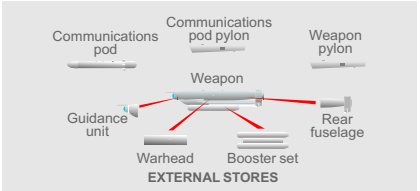
System Description

The Raptor II system flies autonomously to the target and is then designated on the intended point of impact by the operator. The Communications Pod is mounted on the launch aircraft or on a second aircraft, which allows for the control of the weapon over a separation distance of up to 200 km.

A set of cockpit display symbology indicates weapon and mission status.

The weapon allows for two methods of operation, depending on the Seeker used:

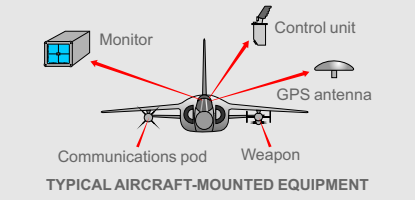
- MITL – The weapon will fly autonomously to the target. The operator designates the precise point of impact by means of an advanced auto-tracker.
- Fire-and-forget – GNSS/INS aided navigation.



EXTERNAL STORES

Aircraft Integration

Raptor has been integrated on the Mirage III/V, Mirage F1, Cheetah and SU-24. The system can also be integrated with other suitable aircraft, e.g. MiG-29, SU-27/30, Mirage 2000 and Tornado.



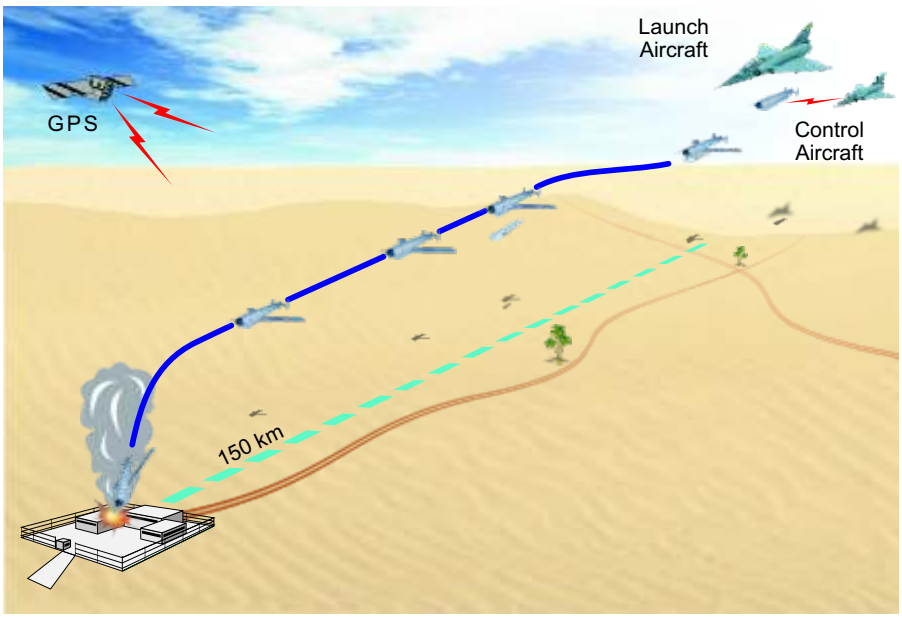
TYPICAL AIRCRAFT-MOUNTED EQUIPMENT

Simulation and Training

Mission planning is performed by means of the Ground-based System (GBS) utilising geographic maps and/or photo-strips.

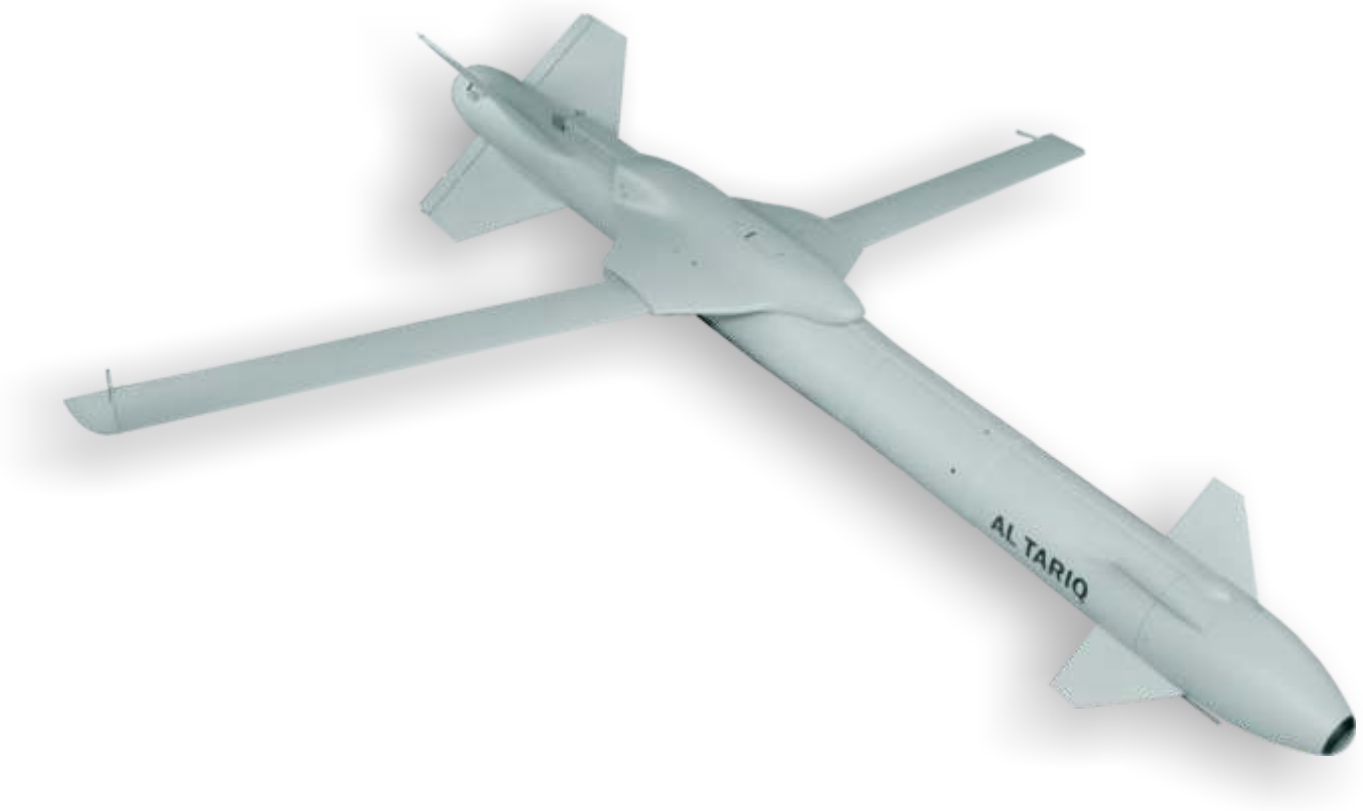
Operator training of the aircrew is also performed on the GBS, simulating the entire mission.

A low-cost multi-mission Airborne Trainer allows for cost-effective operator training. This trainer can be integrated on smaller light fighters for cost-effective operations.



AL TARIQ

Precision-guided Bomb Kit



Al Tariq is a family of strap-on bomb kit systems, used on Mk81 and Mk82 bombs. Al Tariq provides the user with all-weather, day or night operational capabilities, utilising GPS/INS guidance or Imaging Infrared (IIR) with complete Automatic Target Recognition (ATR) capability, or a Semi-active Laser (SAL) seeker. The system can also be fitted with an RF proximity fuse for area targeting, using a pre- fragmented warhead. It is autonomous target acquisition with stand-off range.

Description

Al Tariq is a family of strap-on bomb kit systems, used on Mk81 and Mk82 bombs. Al Tariq provides the user with all-weather, day or night operational capabilities, utilising GPS/INS guidance or Imaging Infrared (IIR) with complete Automatic Target Recognition (ATR) capability, or a Semi-active Laser (SAL) seeker. The system can also be fitted with an RF proximity fuze for area targeting, using a pre-fragmented warhead.

System Features

- Autonomous target acquisition with long stand-off range
- Wing kit or motors may be added to increase stand-off range and low-level (straight and level) launch capability
- Programmable attack angle up to 90° (straight from above)
- Different adaptations possible, including seekers, fuzes and warheads, utilising a common airframe

Typical Missions and Targets

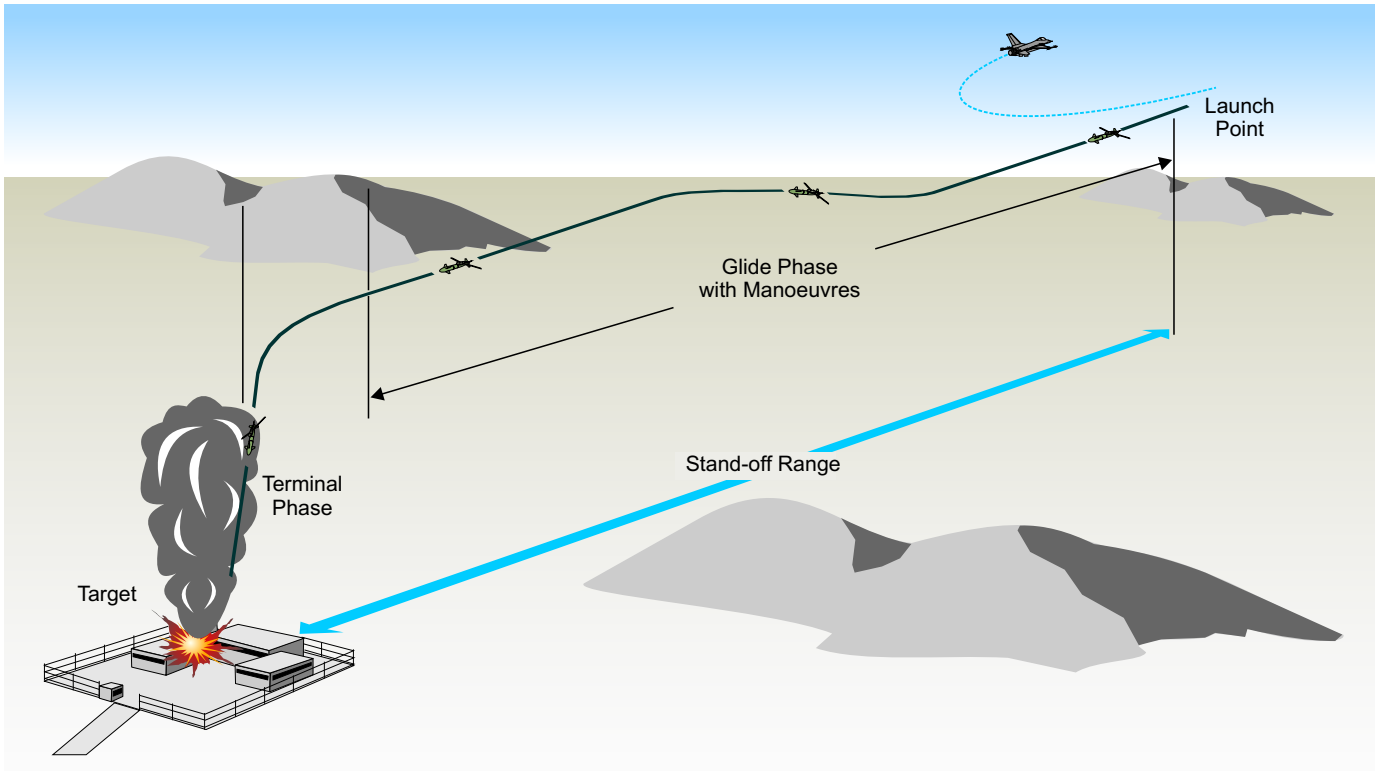
- Offensive counter-air, e.g. hardened aircraft shelters, runway cratering, runway denial, aircraft on tarmac
- Battlefield interdiction, e.g. air defence units, surface-to-air missile launchers, supply columns (trucks)
- Deep battlefield interdiction, e.g. buildings, bridges and refineries, industrial areas
- Close air support, e.g. troops, artillery

Characteristics

- Range over 100 km (depending on configuration)
- Accuracy as low as 3 m CEP (laser or IIR)
- Warhead: Mk81and Mk82 and variants
- Large launch envelope
- Wireless integration capability with the launch aircraft
- Fully autonomous operation once released
- Modular system
- Low maintenance and life-cycle cost
- Minimal logistics equipment
- Ease of use
- Extended Range (ER) module can increase range to 200 km

Al Tariq is manufactured in partnership with Tawazun Dynamics

توازن دايناميكس
TAWAZUN DYNAMICS



SEEKER 200 UAS

Tactical ISR System

The Seeker 200 tactical Unmanned Aerial System evolved from the battle-proven Seeker II system. This feature-packed derivative offers an engine with long service intervals (> 250 h), long endurance, low noise levels (<70 dB open throttle at 1 000 ft AGL), short take-off distance (~300 m ASL) and a rapid rate of climb (~750 ft/min).

Other key features include: Automatic Take-off and Landing (ATOL); state-of-the-art avionics (Autopilot and Integrated Navigation Unit including a power PC); electro-optical multi-sensor payload combining EO/IR (day and night) and equipped with a Laser Designator (LD) and Laser Range Finder (LRF); as well as numerous enhancements to the Ground Stations, Mission Control Unit and Tactical Ground Station (up to 16 waypoints, corridor flying capability, alternative loiter patterns, Digital Elevation Model (DEM)/Map datum, and video encryption).

The System

The Seeker 200 System operates at ranges of up to 250 km from base and provides:

- Real-time day and night reconnaissance
- Target location
- Artillery fire support
- Electronic intelligence (ELINT)
- Its reliable communication link, modular design, high mobility and self-contained support provide an advanced system that has passed the real test of operational use.

The system comprises:

- Four to six unmanned aerial vehicles (UAV)
- Tactical Ground Station (TGS)
- Payloads
- Field support equipment
- Optional MCU and TCU Units

System Features

Slant range surveillance:

- 250 km line-of-sight communication
- Redundant data links (two control links, one status and video link and one emergency link)
- Range and azimuth tracking for operation under GPS denial conditions
- Endurance: up to 10 h; 6 h over target at 250 km
- Service ceiling: up to 18 000 ft
- Multi-mission payload, excluding fuel: up to 40 kg
- Range extension capability via passing control of the UAV to a secondary TGS
- Deployment and flight preparation < 2.5 h

UAV

The Unmanned Aerial Vehicle (UAV) variants have an all-composite, low-drag airframe for optimum performance.

An on-board directional antenna gives high resistance to jamming and enables real-time communication up to maximum range.

TGS

The Tactical Ground Station (TGS) is compact UAV control station and it is a main interface between the mission control crew and the UAV. With its high mobility and low footprint, the TGS provides for:

- Mission planning
- UAV control and monitoring
- Communications control
- Payload control
- Mission simulation

Workstations have identical hardware, with dedicated software enabling specific functions.

As a force multiplier a secondary TGS can be deployed to extend the range of Seeker 200 with ground stations placed up to 400 km apart.

The secondary TGS also allows control of the Seeker 200 UAV and its payloads, providing total mission independence.

MCU (Optional)

Like the TGS the Mission Control Unit (MCU) is the main interface between the mission control crew and the UAV. It provides for similar functions to those of the TGS.

For long-term deployments the MCU and TCU ground segments are available as options to provide greater comfort to the crew.

Workstations have identical hardware, with dedicated software enabling specific functions.

TCU (Optional)

The Tracking and Communications Unit (TCU) contains the tracking and communications equipment that maintains contact with the UAV. It is an unmanned, separate unit that can be located up to 80 m from the MCU, enabling it to be positioned for optimum line-of-sight communication.

The stand-alone TCU has the additional benefit of providing safety to the crew in the event of an air-to-ground weapon strike onto the TCU.

Payloads

Several different payloads can be carried using 'plug and play' methodology.

Goshawk II HDT multi-sensor payload combining EO/IR (day and night) with integrated LD and LRF to 20 km, containing a single CCD with x 20 zoom, a 3rd generation 3 - 5 µm IR camera with continuous zoom lens, automatic video tracker, azimuth and elevation gimbal, < 20 µrad stabilisation. Histogram, edge, correlation and scene-based auto-trackers are available.

An ELINT Payload is available for radar emitter detection (0.5 to 18 GHz, 120-degree sector direction location, on-board emitter library). The man-machine interface is integrated into the ground control station.

To provide for multi-mission and multi-roles, optional COTS sensors and payloads like SAR, COMINT, SIGINT etc. can be integrated.

SEEKER 400 UAS

Multi-mission, Multi-role ISR System

Seeker 400 UAS, operates at direct line-of-sight (LOS) ranges of up to 250 km with more than 10 hrs over target and provides cruising speed of 150 km/h and up to 16hrs endurance with multiple sensor payload capability of up to 100 kg; high-definition video imagery; real-time data acquisition and transmission to remote receivers; autonomous take-off and landing capability; external wing hard points for carriage of external fuel tanks or other requirements; manual and autonomous capability (flight control and payload control); brake-assisted ground operation; separate or combined shelter configurations for the Mission Control Unit (MCU) and Tracking and Communications Unit (TCU).

The System

The Seeker 400 System operates at direct line-of-sight (LOS) ranges of up to 250 km from the base station and provides:

- Real-time day and night reconnaissance
- Target location and designation
- Artillery fire support
- ELINT and Electronic Support Measures (ESM)
- Border and Maritime patrol
- The system comprises:
- Four to six UAVs
- MCU and TCU units
- Payloads
- Field support equipment
- Optional secondary MCU and TCU

System Features

- Direct 250 km LOS control range with >10 h over target
- Range extension up to 700 km with passing control of UAV via the secondary MCU and TCU
- Up to 16 h endurance
- Up to 18 000 ft service ceiling
- 100 kg payload capability (excluding fuel but including optional emergency parachute)
- Dual links allow dual mission payloads
- Brake-assisted ground operation/taxing
- Piloted and autonomous flight capability
- Observer and autonomous payload control capability
- VHF and UHF FM Tactical Communications Radios Mode S Transponder and VHF AM radio for ATC interfacing. An IFF Transponder can be provided as alternative.
- MCU and TCU can also be supplied as a combined single shelter or housed in a building.
- System is air transportable in a single IL-76 or two C-130 aircraft.
- ATOL capability or external piloted take-off and landing.

UAV

The unmanned aerial vehicle (UAV) has a modular all-composite, low-drag design for optimum performance.

MCU

The Mission Control Unit (MCU) is the main interface between the mission control crew and the UAV. Its functions include:

- Mission planning and simulation
- UAV control and monitoring
- Communications control
- Dual Payload control
- Workstations have identical hardware, with dedicated software enabling specific functions.

TCU

The Tracking and Communications Unit (TCU) contains the dual redundant tracking and communications equipment that maintains contact with the UAV. It facilitates dual payload operation and transmission of high definition imagery. It is an unmanned, separate unit that can be located up to 200 m from the MCU, enabling it to be positioned for optimum LOS communication.

The stand-alone TCU has the additional benefit of providing safety to the crew in the event of an air-to-ground weapon strike onto the TCU.

Payloads

S400 is capable of carrying dual imaging EO/IR payloads with gimbal diameters of up to 530 mm. The images are transmitted to the MCU via the dual high definition video downlinks. The following sensor combinations are typically included:

- Colour daylight camera with zoom lens; IR thermal imager with step fields of view
- Day colour or monochrome spotter camera; Night spotter camera
- Laser illuminator and LRF
- An ELINT Payload is available for detection and location of radar emitters.
- To provide for multi-mission and multi-roles, optional COTS sensors and payloads like SAR, COMINT, SIGINT etc. can be integrated.

HUNGWE UAS

Compact and Mobile ISR System

This small UAV has an all-composite, low-drag blended wing design that ensures optimum performance. It is fitted with a day or night payload. The communications link on-board the UAV enables real-time communication up to 100 km from base.

The UAV is catapult-launched and skid-landed.

System Features

The UAV has an all-composite, low-drag design that ensures optimum performance. It is catapult-launched and skid-landed. Hungwe offers the following features:

- Wing span of 4 m
- MTOW of 35 kg
- Direct Line-of-sight range of 100 km
- Up to 6 h endurance
- Up to 12 000 ft service ceiling
- Up to 5 kg day and night mission payload (fuel excluded)
- Piloted and autonomous flight capability
- Secondary command link for redundancy and emergency operation
- The system comprises:
- Two Unmanned Aerial Vehicles (UAVs)
- One Ground Control Station (GCS)
- Two payloads
- A launcher
- Field support equipment

Logistics

The UAS:

- Can be operational within 30 minutes of arriving at the deployment site
- Is capable of being operated by a crew of two.
- Hungwe is transportable in one single commercial 4 x 4 vehicle
- Overall aircraft dimensions of 3.0 m wingspan, 2.0 m (L) and 0.45 m (H) ensures portability and a small footprint

Ground Control Station

The GCS is portable, quick to set up and easy to use. It consists of the following components:

- Flight Management System, used for:
  - Mission planning
  - UAV control
  - Payload control
  - Status monitoring
  - Video display
- Antenna tripod, used for:
  - Transmission and reception of the radio frequency signal
  - Tracking the UAV

The GCS can easily be installed into a vehicle according to operational requirements and to provide for high mobility of the system.

Application

A few applications of the Hungwe are:

- Border patrol
- Anti-piracy operations
- Game park surveillance
- Battlefield support
- Law enforcement
- Search and rescue
- Pipeline surveillance

SKUA

High-speed Target Drone

The Skua is a high-speed target drone designed to simulate high-speed attack aircraft during weapon development as well as land, sea and air combat training. The Skua has an all-composite, low-drag airframe with a wingspan of 3.57 m and length of 6 m. Wing hard-points are provided to carry up to 130 kg of tow-targets and signature augmentation equipment. An internal bay can house a payload of up to 30 kg.

The System

The system comprises:

- Four to eight target drones
- Launcher
- Mobile ground control station
- Ground support equipment

Drone

The Skua has an all-composite, low-drag airframe with a wingspan of 3.57 m and length of 6 m. Wing hard-points are provided to carry up to 130 kg of tow-targets and signature augmentation equipment. An internal bay can house a payload of up to 30 kg.

Launcher

The zero-length launcher is easily deployed. It includes self-loading and engine-starting facilities.

Ground Control Station

The mobile ground control station houses the control interfaces, telecommand and telemetry equipment required to control the drone. Tracking is done via position feedback from the drone's navigation system.

Performance

- Maximum speed:
  Mach 0.86 at 10 000 m
- Controllable range:
  200 km (line-of-sight)
- Altitude:
  150 m to 11 000 m
- Endurance:
  60 min at 6 000 m and
  Mach 0.7
- Manoeuvrability:
  5 g at 1 500 m

System Features

- Reliable communications link
- Easy deployment and recovery
- Large payload capacity
- Programmable missions
- Radar and infrared tow targets

Operation

Deployment

The system is easily transportable by land, sea and air, and can be deployed in less than a day. No sophisticated range equipment is required for system operation.

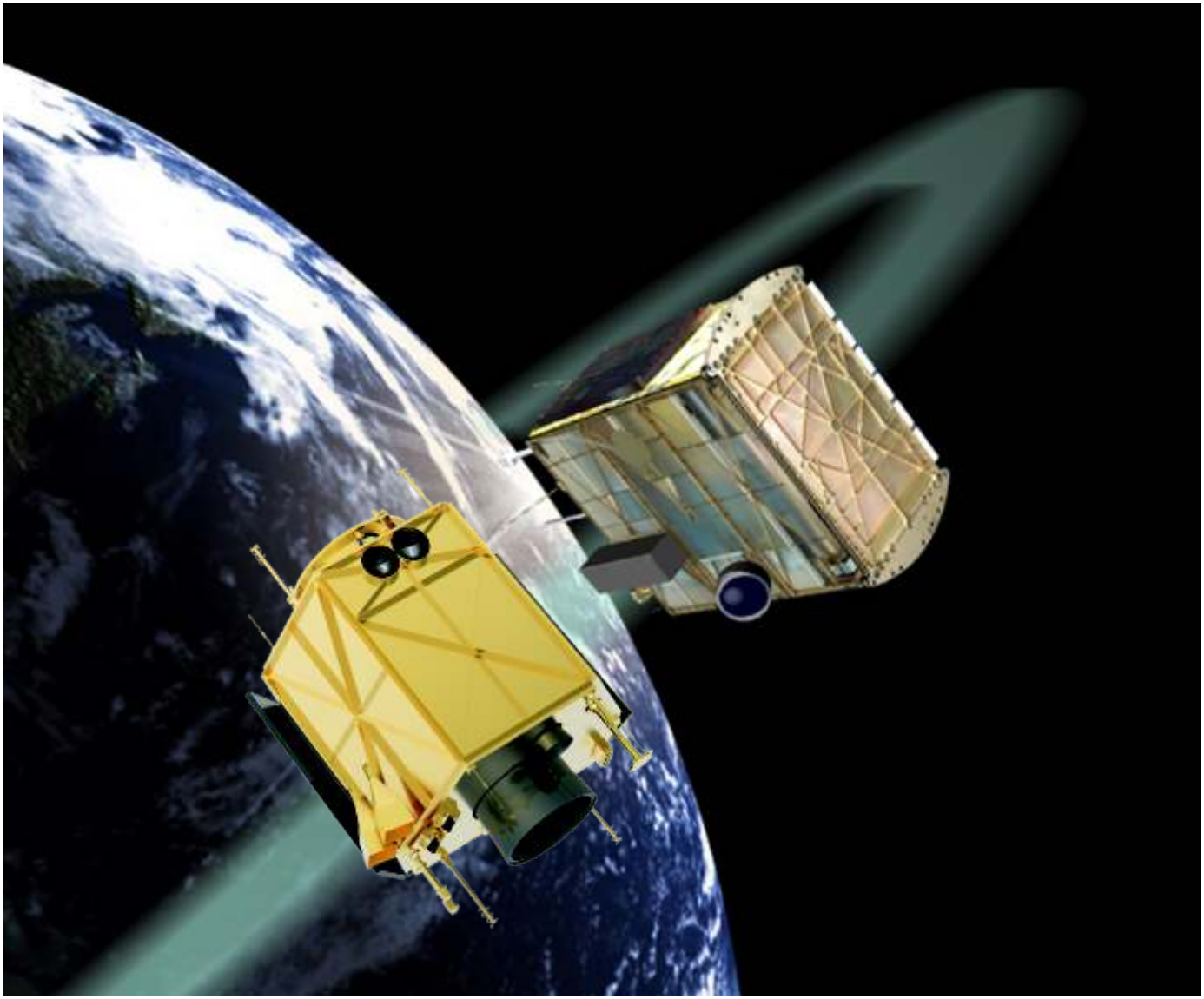
Flight Control

Following launch, all flight path and drone manoeuvres are controlled by a telecommand and telemetry link between the drone and ground station. The drone can also fly autonomously to a programmed mission plan.

Recovery

A two-stage parachute system is used to recover the drone. The drone lands in an inverted horizontal position on pneumatic landing bags. It can also be recovered over water.

SPACETEQ



Spaceteq, a new business unit in Denel Dynamics, commenced operation on the first of July 2013. It is using the intellectual property from DST, the ex-Sunspace personnel, and the heritage from work previously done by Houwteq, as a solid foundation on which to build an organisation that will develop satellite systems for the South African Government and International Clients. With this solid foundation, Spaceteq has the capability to supply multispectral Earth Observation Satellites and high quality, reliable satellite components and subsystems at cost competive prices. Furthermore, our business model emphasizes the "Win-Win" business philosophy. With this approach to business, Denel Dynamics has perfected the implementation of mutually beneficial co-operation programmes with a number of partners countries and the Spaceteq Business Unit is offering the same approach to its clients and partners.

Spaceteq is affiliated with the International Astronautical Federation (IAF) an international space advocacy organisation, and has been selected to present 3 technical papers at the 65th International Astronautical Congress (IAC) conference held in Canada.

GREENSAT - 1988

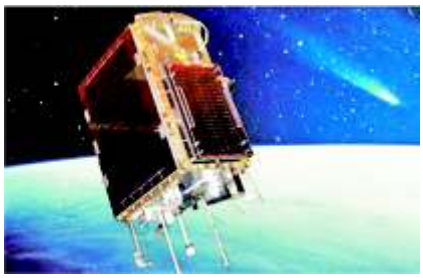
Houwteq, a Division of Denel, was established to develop a satellite-based reconnaissance system. This development included a dedicated Satellite Assembly, Integration and Test facility with clean environments for:

- Mass Property Determination
- Large anechoic chamber for EMC
- Thermal vacuum chamber
- Payload test benches
- 3-D Measurement
- Vibration
- Acoustic

SUNSAT - 1999

SunSpace had its origins in the SunSat satellite programme of the Stellenbosch University, a prime example of the role that an university can play, as a catalyst for economic growth.

- Sunsat was South Africa's first satellite developed completely by a team of South African engineers.
- In February 1999, SunSat was launched by NASA.
- The satellite operated successfully in space, fulfilling all mission objectives



SUMBANDILASAT - 2005

The project was awarded to SunSpace, in conjunction with the University of Stellenbosch, by the South African Department of Science and Technology.

- SumbandilaSat was designed and completed in record time.
- The main payload is a multi-spectral imager with 6 bands and a Ground Sampling Distance (GSD) of 6.25 m.
- Imaging is supported by 6 Gigabyte on-board storage with an additional 18 Gigabyte redundant capacity.

Imaging Payload

- Linescan imager : 6.25 m GSD
- Swath width : 52 km
- Special bands : 6 at VNIR
- Forward motion compensation: 4x
- Matrix imager : 8.4 m GSD
- Scene size : 8 x 10 km
- Storage capacity : 24 Gbyte

Mission

- Satellite mass : 82 kg
- Design lifetime : 3 years
- Orbital altitude : 500 km
- Orbit type : Sun-synchronous
- Data downlink : 72 months

EO SAT Next Generation - present

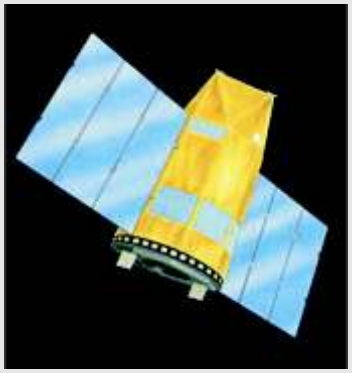
EO Sat NG is the next generation, high resolution multi-spectral imaging satellite, designed by Denel Dynamics Spaceteq in collaboration with the wider South African Space Industry. It is designed to meet the ARMC Space Segment Requirement. The EO Sat NG Satellite is designed to be cost competitive while meeting the mission life requirement of 5 years.

Development will be conducted by the newly formed Spaceteq, business unit in Denel, a State-owned Company, and in close cooperation with the RSA Space Industry and international suppliers.

EO Sat NG imaging data is optimised to respond to the ARMC application Requirements which are:

- Food security
- Urban planning and development
- Safety and security
- Support for disaster management

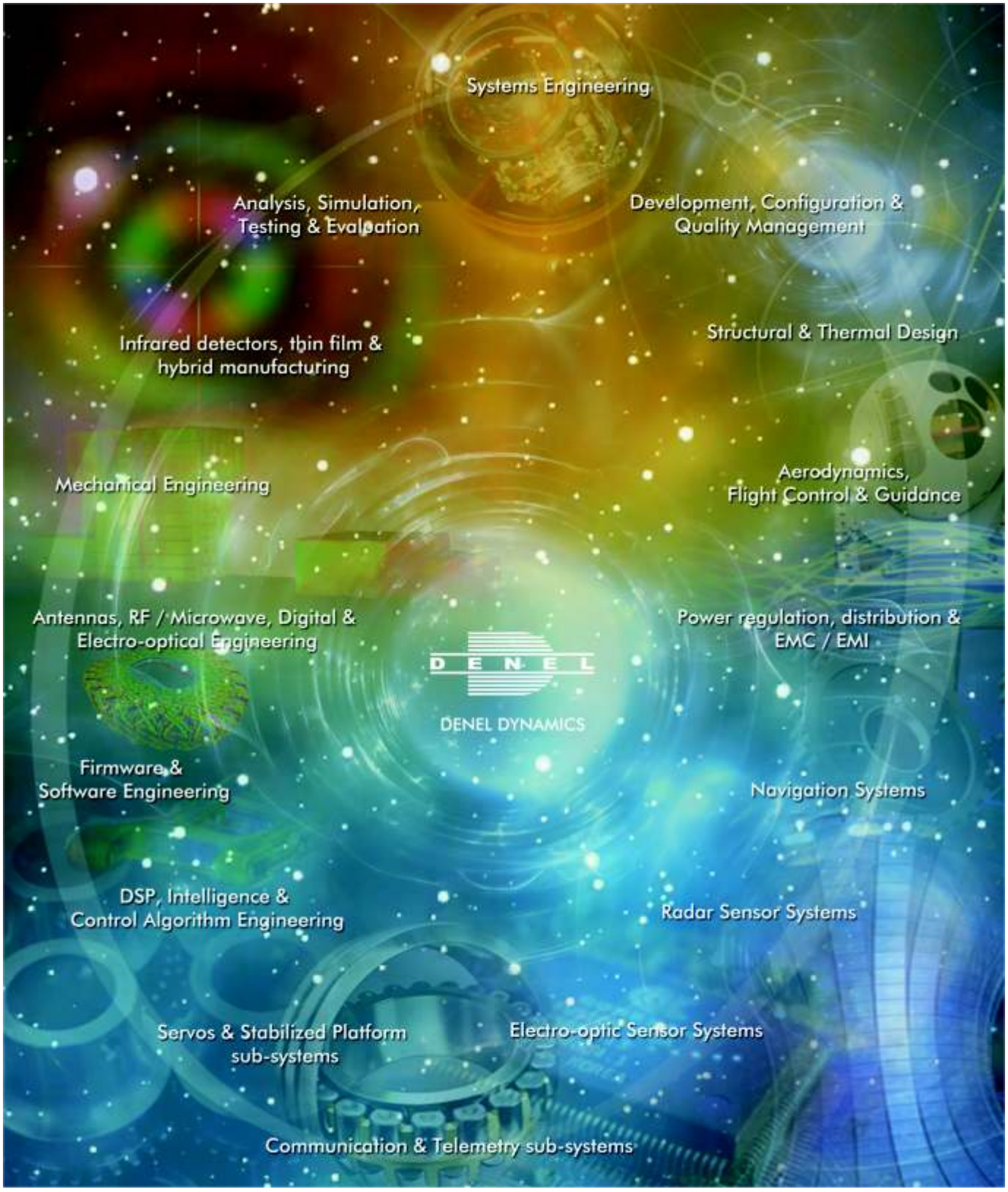
EO Sat NG will be based on the heritage from the development of SumbandilaSat.



ENGINEERING CORE COMPETENCIES

The true character of the business is advanced technology prowess and the evolution of innovative ideas into quality, reliable, robust products for end users. As a key supplier of defence requirements, one of Denel Dynamics' reputed core competencies both internationally and at home, is the fast turnaround of design and development.

Denel Dynamics has a depth of engineering specialisations as indicated below:



PRODUCTS


Seeker 400
INGWE
MOKOPA
A-DARTER
UMKHONTO
AL TARIQ
DENEL
DENEL DYNAMICS

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