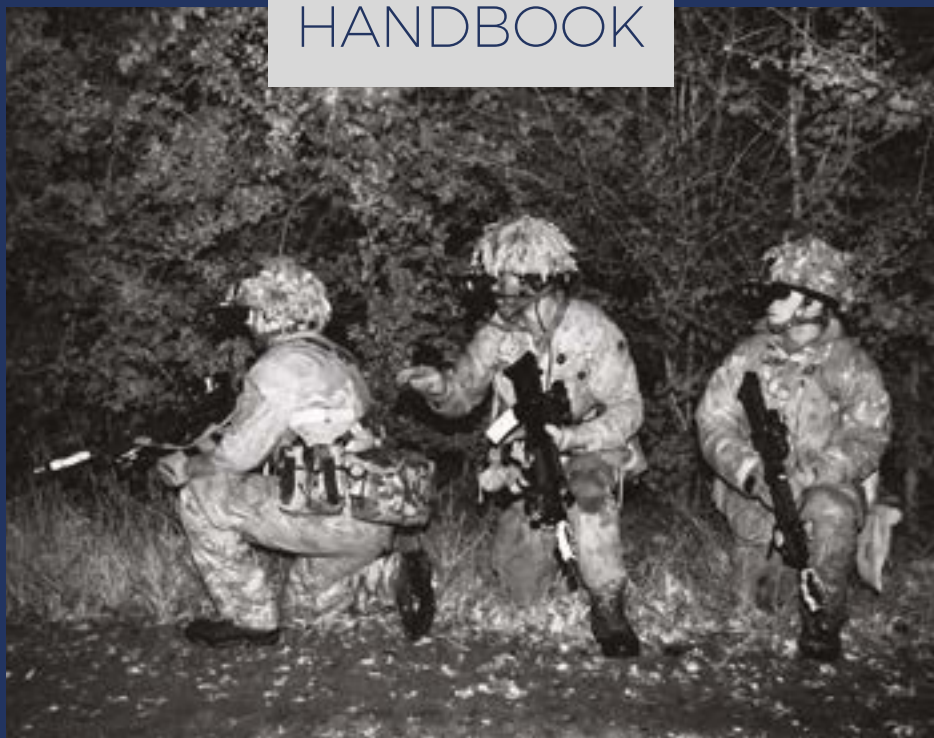


 **SHEPARD**

ISSUE 17

HANDBOOK



PUBLISHED MAY 2018

THE CONCISE GLOBAL INDUSTRY GUIDE

NIGHT VISION AND OPTICS

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WARRIOR SENSOR SYSTEMS

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COVER: British soldiers use head-mounted night vision systems during Exercise Iron Scout 3. (Photo: UK MoD) **ABOVE:** Night vision weapon sights are becoming more compact and lightweight, such as the Mepro Hunter 4X. (Photo: Meprolight)

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 **PLUS**



EQUIPMENT

AIRBORNE SYSTEMS

This section contains basic data on a selection of NV and EO systems used for pilotage, navigation, surveillance, targeting and fire control in fixed-wing aircraft and helicopters.

- NVGs
- integrated helmets
- NVG-compatible lighting
- aircraft EO pods

The equipment is listed alphabetically by manufacturer within the above subsections.

If you produce equipment that you believe should be listed in this section, please contact the team at reference@shephardmedia.com to ensure your system appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: A 36th Airlift Squadron C-130J pilot wears NVGs during a training mission above Yokota Air Base, Japan, in March 2018.
(Photo: USAF)

NVGS

AERO DYNAMIX

NVG for Aircrew

Aero Dynamix is an approved repair/service centre for L3 and ITT NVGs. Its technicians are certified to provide maintenance and inspections, and adhere to all necessary requirements to test, inspect and evaluate NVGs in accordance with the manufacturer's procedures. ADI offers 180-day NVG recertification and repair for L3 M949 AN/AVS-9 and ITT's F4210 and F949 series.

AEROTEC GROUP

Hela Mk 2

The Hela Mk 2 is an NVG for helicopter and transport pilots, featuring a wide-aperture objective lens. Constant resolution of the image is kept even when a polluting bright light source enters the FOV, claims Aerotec. This feature is useful when flying over urban environments or landing in brightly lit areas. The Hela Mk 2 is compatible with ANVIS-type helmets. The optical system is optimised to operate with European Gen II autogated tubes with 80lp/mm resolution, French Gen II B&W; tubes with enhanced contrast, or Gen III tubes. Though the basic version has no filter, Class A, B, and C filters can be fitted (internal or removable). Hela NVGs are provided with four lens protection caps, operator's manual, cleaning kit and carrying bag. Aerotec also offers users a control unit VT1 for Hela Mk 2 NVGs in order to check, before take-off, that the performance level of the equipment is still complying with their operational standards. Exit pupil/eye relief on axis: 25mm Objective lens aperture: F/0.95

AVIATION SPECIALTIES UNLIMITED

AN/AVS-9 White Phosphor

ASU's third generation White Phosphor night vision goggles provide high image quality with high resolution and diminished halo. White phosphor provides a black-and-white moving image to the user as opposed to the black and green images generated by green phosphor-based NVGs. Designed for enhanced image clarity and depth perception, the AN/AVS-9 White phosphor provides high-light performance due to auto-gating, improved low-light performance and increased FOM. The AN/AVS-9 is fully compatible with aircraft NVIS lighting systems, features mounting systems for a variety of flight helmets and is FAA and EASA certified. The system is fully compliant with RTCA DO-275 that stipulates the minimum operational performance standards for integrated night vision imaging systems, and ASU offer a 180-day service and repair period. Length: 116mm Width: 13mm Height: 89mm Power: 4xAA batteries FOV: 40° Helmet compatibility/interfaces: multiple Magnification: 1x Objective lens aperture: 27mm Interpupil adjustment: 25-72cm Exit pupil/eye relief on axis: 25mm Dioptre adjustment: +2 to -6

FENN NIGHT VISION

NG2000A

Lightweight, low-profile NVG designed for used by rotary- and fixed-wing pilots during extended mission

profiles. Power: 2x ½ AA size lithium Weight: 590g (inc mount) FOV: 47.5° at 30mm eye relief Magnification: unity Spectral response – visible: to 0.09µm (IR) Dioptre adjustment: +2/-4 Tilt adjustment: 8° min Resolution: 1cy/mr min Brightness gain: 6.500fL/FL typical Interpupil adjustment: 52-72mm independent Fore and aft adjustment: 20mm range

NG700+ System

The Fenn NG700+ System includes a lightweight NVG and a helmet-mounted power pack. Features include: lightweight design, fast F/1 objective lens, integrated low-level battery warning light, no single point of power failure, can be fitted with Gen 2 or Gen 3 I2 tubes, available with class A, B, C and UK645 Blue filters, DNVG-compatible, designed for rotary-wing aircraft, designed and manufactured within the EU, no ITR, ergonomically designed. Power: 4x AA batteries Weight: 600g (inc mount) FOV: 47.5° at 30mm eye relief Fore and aft adjustment: 20mm range Dioptre adjustment: +2/-4 Magnification: unity Spectral response – visible: to 0.9µm (IR) Weight of goggles only: 531g Tilt adjustment: 8° min Resolution: 1cy/mr min Brightness gain: 6.500fL/FL typical Interpupil adjustment: 52-72mm independent Operating temperature range: -32/+52°C

HARRIS COMMUNICATION SYSTEMS

AN/AVS-6 (F4210 series)

The AN/AVS-6 (F4210 series) NVG is used by US Army helicopter aircrew and has been sold to allied nations. The lightweight binocular can be mounted to a variety of aviator helmets, including the SPH-4B, HGU-56P, and Alpha. A clip-on power source is available as an optional accessory, enabling hand-held operation. Gen III gated pinnacle tubes provide performance under various light levels encountered during night flying operations. The 'minus-blue' objective lens filter screens reduce glare from cockpit instrument lighting. Other features include flip-up stowage and a durable, 'soft-sided' carrying case. Power: 2x AA size alkaline FOV: 40° Fore and aft adjustment: 27mm range Dioptre adjustment: +2/-6 Operating endurance: 30hr nominal under standard conditions Automatic breakaway: 11-15g Magnification: unity Exit pupil/eye relief on axis: 14mm at 25mm distance Spectral response – visible: to 0.9µm (IR) Tilt adjustment: 10° min Brightness gain: 5.500fL/FL min Resolution: 1.3cy/mr min Interpupil adjustment: 52-72mm Full field: 6mm at 25mm distance

AN/AVS-9 (F4949 series)

The AN/AVS-9 (F4949 series) is the standard night flying system for USAF and USN aircrew. Over 26,000 F4949 systems are in service in 34 nations. The Exelis F4949 series of aviator's night vision systems is available in over 40 different configurations, determined by the type of aircraft and type of helmet being used. Rotary-wing versions of the F4949 feature a rear-mounted, low-profile battery pack, which provides more than 50 hours operation. Power is provided by a cable extending from the battery pack, over the helmet, and into a connector in the mount. Fixed-wing versions feature a front-mounted battery pack, which provides more than 16 hours operation. An optional battery pack adapter enables connection of the fixed-wing F4949 to the rear-mounted battery pack, providing the same operational time as the rotary-wing versions when ejection is not a

1x Resolution: >1.36cy/mrad Weight of goggles only:
590g Exit pupil/eye relief on axis: 20mm eye relief
Cockpit compatibility: internal filters (coating) available
Tubes: Gen 3, XD-4, XR-5 or XH-72

THALES ANGENIEUX

HELIE

The Helicopter Light Intensifier Equipment (HELIE) NVG is designed for airborne operations at low light levels. HELIE is said to collect 60% more light than traditional goggles and its optical performance allows Level 5 (very dark) night flying. The compact lightweight design is based on aspherical lenses which boost the I2 tube performances. HELIE is compliant with multiple types of cockpit lighting due to removable external filters (A, B, C class or 645nm) and is compliant with standard ANVIS flight helmets. In 2009 Thales Angénieux received a contract from the French MoD to supply 1,500 NVGs for use by the helicopter pilots of the army, air force, navy, Gendarmerie, Sécurité Civile and customs. Power: 2x 1.5V AA batteries; 24hr life Weight: 560g FOV: 51° Operating temperature range: -32/+52°C; -46/+71°C (storage) Dioptre adjustment: -6/+2 Helmet compatibility/interfaces: ANVIS standard Tubes: Gen II or III Filters: removable A, B, C class and 645nm Magnification: 1x Exit pupil/eye relief on axis: 25mm eye relief Tilt adjustment: 20° Resolution: 64lp/mm Interpupil adjustment: 51-76mm Objective lens aperture: F/0.95

TROYA TECH DEFENSE

Strix

The Strix Aviator Night Vision Imaging System is designed to be compatible with existing AV/AVS-9 or AV/AVS-6 adapters and accessories, and with most aviation helmets. In order to facilitate depth perception and comfortable viewing, the Strix is equipped with dual optical channels (objective lens and eyepiece) and adjustable focus. The Strix is fitted with an 18mm I2 tube and features a low battery indicator. The Strix comes equipped with a soft carrying pouch, helmet mount, two batteries, a rear battery pack, user manual, neck cord and cleaning microfibre cloth. Power: 2x 1.5V AA batteries Weight: 650g FOV: 40° Operating temperature range: -51°/+45°C Options: hard carrying case, demist shield, sacrificial window, daytime practice shield

VISION SYSTEMS INTERNATIONAL

NVCD ANVIS

Vision Systems International has developed NV options to provide cueing symbology for night missions. NV Cueing and Display (NVCD) expands the capability of the Joint Helmet-Mounted Cueing System by providing the user with image-intensified NV merged with standard HMD symbology and LoS tracking. NVCD ANVIS inserts cueing symbology into standard 40° FOV ANVIS-9/F4949 NVGs. Company HMD users who already own ANVIS-9/F4949 goggles can modify their existing NVGs in less than one hour with a kit. This modification

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adds head-tracked NV cueing and display capability without modification to the HMD electronics or aircraft systems, it is claimed. FOV: 40°

INTEGRATED HELMETS

BAE SYSTEMS

Q-Sight

The Q-Sight is a helmet-mounted display device, designed for 'plug-and-play' integration, which makes use of patented holographic waveguide technology. It projects digital video and data onto a monochrome, see-through display located within the user's LOS. This provides the ability to superimpose geo-referenced situation awareness data and imagery onto the user's real-world vision. The Q-Sight is compatible with NVGs and a large exit pupil is designed to ease the transition between day and night during flight. With the inclusion of an optical tracker camera, sensors and weapons can be slewed to follow the direct LOS. The Q-Sight is low mass and has no bulky projection optics, reducing neck strain and CG issues, says the company. Its modular design allows extra capabilities to be added. It is compatible with 'any' cockpit and optical helmet tracking capability can be added by fixing tracking pads to the helmet. The Q-Sight provides advisory flight information and warning symbology which allows pilots to operate head-up and eyes-out. Helmet tracking enables conformal terrain symbology for 360° awareness and obstacle warning capability. Door gunners can manoeuvre the weapon over a wide targeting field as it is not restricted to their range of head movement. The Q-Sight can be integrated with a thermal weapon sight to provide day and night targeting capability and has the ability to share threat-warning and sensor imagery between the cockpit crew and the door gunner. For an aircraft commander, the Q-Sight can be integrated into current data and video systems to relay critical safety, battle mission update and warning messages displayed directly into the user's vision. Applications: helicopter aircrew Power: <20W FOV: >30° circular Exit pupil:

The Q-Sight is a helmet-mounted display device, designed for 'plug-and-play' integration. (Photo: BAE Systems)



>18mm circular Altitude: 0-25,000ft Eye relief: 20mm Head supported mass: <390g

Striker

Striker is a visor-projected, 24-hour HMD for fixed- and rotary-wing applications. The fixed-wing variant is in service on Eurofighter Typhoon and Saab Gripen aircraft, while the rotary-wing variant has generic applications across a range of platforms. The Striker HMD aids situation awareness by providing a wide-FOV visor-projected display of both symbolic information and cues, plus high-resolution video. Picture-in-picture capability allows pilots to identify targets, potential landing zones and other information. The fixed-wing variant has been qualified to 600kt ejection, while the helicopter variant meets US DoD rotary-wing requirements for safety and comfort. Both provide an accurate optical head tracking system for low-latency head LOS. Applications: fixed- and rotary-wing aircrew

Striker II

The platform-agnostic Striker II HMD builds upon BAE Systems' current Striker HMD (see separate entry). It is a digital solution based on a two-part helmet design with an integrated NV camera in a 'cyclops' configuration for increased comfort in g-level manoeuvres. Day/night situation awareness is delivered through visor-projected imagery augmented with symbology. The Striker II is compatible with aircraft that have analogue display drive electronics via a low-latency conversion device and has a digital interface for aircraft with digital display drives. It also offers a 'plug-and-play' solution for aircraft equipped with current-generation Striker HMDs. The Striker II tracking system, with hybrid opto-inertial tracker technology, creates a 'head motion box', eliminating any delay in determining where the pilot is looking, according to the company. The systems can therefore position symbology onto the visor, even if optical tracking is lost. The Striker II features an independent channel for each eye, offering display of stereoscopic and 3D imagery. At the Paris Air Show 2017, BAE Systems unveiled a modified version of the HMD which includes enhancements that had been set out by rotary-wing pilots. This includes two night vision cameras, one mounted on either side of the helmet, next to the eyes. This configuration differs from the 'cyclops' camera which is placed on the front of the helmet. The new placement allows for greater depth perception when flying at low altitudes. Also integrated into the Striker II is Terma's 3D-Audio/Active Noise Reduction technology which tackles airborne or acoustically transmitted noise present in aircraft, in order to reduce hearing loss and fatigue among pilots and improve speech intelligibility. FOV: 40° NV display: 1,600x1,200px; 60Hz update rate HMD display: 1,280x1,024px

ELBIT SYSTEMS

Brightnite

The Brightnite 'any night, all night' DVE/LVL system is an NV pilotage solution designed for low, stealth and operational night flights in DVE conditions, extreme weather, harsh environments, hostile territory and total darkness. The system comprises a radome containing eight uncooled FLIR sensors housed in a turret carried beneath the helicopter's nose. The Brightnite transmits



EQUIPMENT

GROUND SYSTEMS

This section contains data on a selection of NV and EO systems in the following categories:

- handheld day observation, surveillance and targeting
- handheld NV devices
- infantry weapon sights for day use
- infantry weapon sights for night use (image intensifiers)
- infantry weapon sights for night use (thermal imagers)
- long-range observation, surveillance and targeting
- NVGs
- unattended ground sensors
- vehicle driver aids
- vehicle surveillance and target acquisition

The equipment is listed alphabetically by manufacturer within the above subsections.

If you produce equipment that you believe should be listed in this section, please contact the team at reference@shephardmedia.com to ensure your system appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: US Army personnel use a Lightweight Laser Designator Rangefinder 2 to provide fire support, target acquisition and reconnaissance during training. (Photo: US Army Reserve)

HANDHELD DAY OBSERVATION, SURVEILLANCE AND TARGETING SYSTEMS

ASELSAN

Scout

The Scout handheld integrated EO sensor system incorporates a thermal camera, LRF, DMC, GPS receiver and laser pointer. The system provides target acquisition at extended ranges. The rugged and lightweight design provides TI for day/night observation. Target co-ordinates can be determined and transferred via communication devices to fire support units. The Scout can either be used handheld or mounted on a tripod. The Scout has a functions menu, binocular eyepiece and shuttered eyecups. For situational awareness, the TI has wide and narrow FOVs, and high magnification can be selected for further target analysis. Imaging capabilities include automatic image optimisation, image freeze, polarity change, gain/level adjustment, focus adjustment, dioptr/eye-pupil distance adjustment and image transfer to HUD. Applications: observation and target location

Viper

The Viper is a lightweight ground laser target designator and locator. It can be carried and used on a tripod, stationary or mobile. Remote-control capability and a thermal camera interface are provided for stationary and day/night usage. Besides designation, the Viper can also measure the range of the target, automatically calculate target location and capture digital photographs. It includes built-in GPS, DMC and digital still camera. The Viper can operate at all Band I and II PRF codes of NATO STANAG 3733, hence it is compatible with NATO laser-guided munitions with semi-active laser seekers, such as Copperhead, Hellfire and Paveway. Applications: observation, target location/designation Length: 28.2cm Width: 26.8cm Height: 11.7cm Power: rechargeable battery or 18-32V DC external supply Weight: <6kg FOV: 3°; +/4 dioptr adjustment Minimum range: 5km (tank), 10km (building) designation range Zoom - optical zoom: 10x Measuring accuracy: ±5m Certifications/MIL Standards: MIL-STD-810G Accessories: tripod with angulation head, remote firing switch, optional see-spot thermal camera, optional digital goniometer Targeting range: 300m-20km

DEFENCE VISION SYSTEMS

STAS24

The Surveillance Target Acquisition System Multi Spectral 24 (STAS24) can be used in handheld mode or mounted on a tripod to provide 24-hour surveillance capability from daylight down to starlight. A 1.550nm LRF allows the user to view the laser spot on the designated target. The STAS24 offers vision over a range from 400-1.700nm and includes range data, GPS data and heading using an electronic compass. Applications: observation and target location Length: 340mm Width: 270mm Height: 140mm Power: Li-poly batteries Weight: 3.5kg Zoom - digital/electronic zoom: 11-44x

ELBIT SYSTEMS INTELLIGENCE AND ELECTRO-OPTICS - ELOP

PLDR-II

The Portable Lightweight Designator/Rangefinder (PLDR) II incorporates a built-in laser see-spot camera and video display. The system has a built-in electronic compass, GPS and a tactical computer for target location calculations. An optional add-on thermal camera with laser see-spot is available for night-time observation. The main modules of the PLDR-II are a designator head, pan and tilt head, tripod, battery pack, remote firing switch and remote tactical computer. Applications: CAS designation and marking missions, forward observers Weight: 6.7kg (designator head weight)

PLDR-III

The Portable Lightweight Designator/Rangefinder (PLDR) III is intended for use with laser-guided munitions. Main features: based on diode-pumped technology, built-in electronic compass/GPS/tactical computer for target location, single soldier-portable system, extended duty cycle capability, data link to thermal sight/remote data transmission/test equipment. Applications: target designation

Rattler GX

The Rattler GX is a dismounted handheld, miniature coded designator/marker equipped with built-in LRF and DMC. The low SWaP makes it body-wearable (in a pouch) and accessible for use during CAS missions. Its internal direct-view optic, integrated IR pointer and laser beam makes this configuration suitable for troops in contact. JFOs and JTACs. Applications: target designation Power: 1x rechargeable CR123 battery Weight: 3.1kg Laser pointer/illuminator - power: 0.8W Zoom - optical zoom: 5.5x Mountings: Picatinny rail Laser pointer/illuminator - wavelength: 0.83µm

Rattler-H

The Rattler-H is a dismounted miniature code designator/marker used for CAS target engagement and surface-to-surface laser-guided munitions target engagement. The lightweight Rattler-H is body-wearable (with a pouch attachment) or can be weapon- and tripod-mounted, so is suitable for troops in contact and JTACs. The designator has a visible pointer and the designation codes are selectable. The system provides positive targeting for a pilot from a distance and reduced sensor-shooter loop time and possibility of collateral damage. Applications: handheld and weapon-mounted target designation Power: 1x CR123 battery Weight: 1.3kg Laser pointer/illuminator - wavelength: 0.63µm Display: OLED; user-friendly interface Accessories: external power cable, battery pack, operator manual, carrying case Targeting range: 3km (NATO-size target); 5km (building-size target) Visible pointer: 0.63µm/3mW Laser pointer/illuminator - power: 3mW Mountings: tripod interface 1/4-20 UNC; Picatinny rail MIL-STD-1913

FLIR SYSTEMS

Armasight 8x36/8x30c/7x50

The Armasight Daytime Binocular series, consisting of the 8x36, 8x30c and 7x50 offers magnification, waterproof construction and built-in rangefinder reticle.



The AN 10x50 M22 incorporates BAK-4 Porro prisms and multi-coated lenses, with non-slip UV-resistant rubber armouring. (Photo: Newcon Optik)

The multi-coated optics are designed to enhance the resolution and contrast of an image in bright conditions. A built-in universal rangefinder allows for accurate target measurements and range estimates, with the 8x30c model including a compass. FOV: 7-8° Zoom - optical zoom: 7x (7x50 model) or 8x (8x36, 8x30c)

GTD

Sentinel S30 and S40

Sentinel S30 and S40 are handheld counter-surveillance tools which determine location, distance and position of opposing optical devices such as rifle scopes, binoculars, spotting scopes, camera lenses, NVDs and other optical reflectors. Sentinel emits a controlled pattern of IR radiation and reflected light from targets within range are captured and shown on the connected display. Applications: counter-sniper/observer Measuring accuracy: clutter rejection integrated Communications interfaces: PC connection Navigation options: compass, inclinometer and GPS positioning

LEONARDO LAND & NAVAL DEFENCE ELECTRONICS

LINX

LINX is a multifunctional, day/night handheld target locator housed in a lightweight unit designed for use by dismounted soldiers and special forces. It includes an uncooled TI for all-weather observation and detection, two FOV colour TV channels for HD observation and detection during daylight conditions, an eye-safe laser rangefinder, GPS and a digital compass. LINX performs target acquisition through a target data record that provides a target marker, azimuth, elevation, distance, global positioning and a target snapshot of the scene in both IR and TV modes. The target data record is transmitted to the C2 by wireless or wired technology. LINX is self-powered using Li-ion military rechargeable battery, AA lithium battery (+1.5V) or an auxiliary power connector for an external DC source. Applications: observation and target location

MEPROLIGHT

Mepro LHP 2000

The Mepro LHP 2000 is a lightweight handheld periscope, designed for observation, surveillance and reconnaissance from concealed positions. Mepro LHP 2000 can be rapidly deployed from its folded position in tactical situations. Mepro LHP 2000 is used for over-the-wall and around-the-corner sighting with a WFOV and 3x magnification zoom for long-distance observation in varying tactical environments. Reaching more than 0.5m in deployment position, the periscope allows situation awareness while keeping the advantage of an elevated position. The Mepro LHP 2000 is ready for operation within less than two seconds. Built-in mounts and optional accessories can be provided. The latter include NV adaptor, video or still camera recorder, laser pointer, LRF, tripod, flashlight and anti-glare filter. Applications: observation from cover

NEWCON OPTIK

AN-Series Binoculars

AN-series binoculars incorporate BAK-4 roof prisms and multi-coated lenses for light transmission and resolution. Non-slip, UV-resistant rubber armouring makes these binoculars comfortable to operate even in cold weather, claims the company. AN binoculars are waterproof, shockproof and nitrogen-filled. The binoculars have a military reticle and adhere to current military standards. The series includes: AN 8x30 M22 - Mil-Spec 8x30, M22 reticle, individual focus; AN 7x50 MC - Mil-Spec 7x50, M22 reticle, built-in illuminated compass, centre focus; AN 7x50 M22 - Mil-Spec 7x50, M22 reticle, individual focus; AN 10x50 M22 - Mil-Spec 10x50, M22 reticle, individual focus. Applications: Observation

LAS 1000

The LAS 1000 is designed to detect snipers and other forward observers before they fire a shot. This system is suitable for border and perimeter security as well as VIP protection details. The LAS 1000 functions on optical principles with the aim of pinpointing the location of a threat before it has a chance to act. Using an eye-safe laser scanner, the LAS 1000 detects lenses and reflectors in its LoS even if these objects are covered behind bushes, windows or windshields. The detector can be handheld or mounted on a tripod and when an optical reflector of any kind is detected, its position is marked. For added situation awareness, an audio signal can also be set to automatically activate upon the detection of a threat. The LAS 1000 now has in-built GPS to determine the co-ordinates of detected threats. Applications: Sniper/observer detection

LRB 12K

The LRB 12K is a handheld LRF binocular. The unit has a 12,000m (NATO target) measuring range, built-in digital magnetic compass, built-in GPS receiver and LED display. Through USB and RS232 interfaces, the LRB 12K can be operated remotely, have its stored data exported and communicate with external GPS systems and ballistic computers. The LRB 12K has been upgraded in 2015 to enable communication with Android-based smartphones and tablets, allowing users to map and record target data for sharing or future use. Applications: Observation and target location Targeting range: 12,000m

LRB 3000PRO

The LRB 3000PRO combines 7x40 binocular optics with a 3,000m (NATO target) ranging capability. A built-in DMC provides azimuth, inclination and target speed readings. With a matte black housing, rubberised body and scratch-resistant optical surfaces, the LRB 3000PRO is built to perform in harsh environments. The LRB 3000PRO is available with an optional HD OLED display. Applications: Observation, targeting

LRB 4000CI/6000CI

LRB 4000CI and LRB 6000CI 7x50 binoculars provide distance, azimuth, inclination and speed measurements out to maximum distances of 4,000m and 6,000m respectively (NATO standard target). Both are tripod-mountable, compatible with NV monocular systems and built to stand up to conditions on the battlefield. They are equipped with a computer output that allows data acquisition by any system with an RS232 interface, including various GPS models and ballistic computers. Applications: Observation and target location Targeting range: 4,000m for LRB 4000CI, 6,000m for LRB 6000CI

LRB 20,000C

The LRB 20,000C is an LRF binocular designed for ground surveillance, target observation and distance measurement out to 20,000m. It employs a TDFA algorithm for accuracy and a single strong impulse to minimise exposure time. With an optional angular mount, it can measure horizontal angles and magnetic azimuth as well as vertical angles. The result of distance measurements is displayed through the eyepiece and can be transferred for processing via computer output. The unit can be remotely triggered via RS232. Applications: Observation, targeting Targeting range: 20km

LRM 1500M/1800S/2200SI

LRF monoculars combine laser measurement, optics and controls. The LRM 1500M is for users requiring basic functionality. It has a measurement range of 1,500m (NATO target) and can recall ten measurements from device memory. The LRM 1800S has a measurement range of 1,800m (NATO standard target) and performs speed measurement. The LRM 2200SI has a measurement range of 2,200m (NATO standard target) and can be used in most weather conditions. The built-in compass and inclinometer enable speed, elevation and azimuth measurements. Applications: Observation and target location

LRM 3500M

Like the LRB 12K series (see separate entries), the LRM 3500M LRF has an in-built GPS receiver, allowing users to acquire their own and the target's GPS co-ordinates. Its eye-safe 1,550nm laser cannot be detected by enemy NVDs, according to the company, and it can measure distance to a NATO-standard target up to 3,500m. The LRM 3500M has a Mil-Spec design and in addition to its measuring range it has a DMC, inclinometer and OLED display. The data output port enables communication with peripheral devices including smartphones and tablets running an Android-based application. Applications: Handheld LRF

SIB 16x40WP

SIB 16x40WP binoculars incorporate coated optics and gyroscopic image-stabilisation technology that

enables the user to observe distant objects from moving platforms without image resolution degradation caused by mechanical vibration or natural hand tremor, according to the company. Applications: Observation

Spotter M

The Spotter M is a lightweight tactical spotting scope that brings targets into focus at short, mid and long ranges. The Spotter M has an M22 ranging reticle and 8x42 optics and is nitrogen-filled, waterproof and dustproof.

**NOVOSIBIRSK
INSTRUMENT-MAKING PLANT****1N10**

The 1N10 is a monocular for observation at up to 6km with 4-20x zoom magnification. There is a removable light filter for contrast boost in reduced illumination or fog conditions. The reticle has range and angle-measure scales. The 1N10 is equipped with a holder for mounting on a suitable support. Exit pupil: 1.4-7mm Eye relief: 15mm. Applications: observation Length: 265mm Width: 42mm Height: 190mm Weight: 0.45kg FOV: 1.5-8.5°

SENOP OPTRONICS**Senop Lilly**

Unveiled at the September 2017 DSEI exhibition, Lilly is a handheld multipurpose observation, surveillance and targeting system developed on the basis of Senop's proven Lisa system. Weighing less than 1.5kg, Lilly is designed for urban operations and for use by special forces and reconnaissance units. Lilly incorporates an uncooled thermal imager, direct view optical channel, image fusion, a full colour OLED display, a laser rangefinder, a laser pointer, a digital magnetic compass and navigation systems (NAVSTAR GPS C/A code, GLONASS, Galileo, SAASM). The direct-view day channel, which is equipped with a high-resolution camera to take both video and still images, does not require an energy source to operate and can be used in power-off mode. The system can be connected to external power sources such as a vehicle's battery, solar panels and fuel cells. Lilly's internal memory can store more than 100,000 images and several hours of video. To facilitate situational awareness sharing, Lilly can be connected to different C4I systems using either a cable or wireless connection. Lilly is free of ITAR restrictions. Length: 210mm Width: 180mm Height: 80mm Power: 6x CR123A batteries Weight: <1.5kg FOV: 8 x 5.9° Image resolution: 640x480 Battery life: >5h Band: 8-12µm Zoom - digital/electronic zoom: 5x Communications interfaces: cable, wireless Targeting range: 6km

STEINER DEFENSE**Cyclops**

Cyclops is a lightweight handheld NIR laser pointer/illuminator for front-line troops and JTACs to mark targets for air or ground fire support, with 1.5W of optical power. The beam is adjustable from a collimated spot size divergence from <0.5MRAD to a 6.3° flood and can be operated in CW and pulse modes. This permits Cyclops to point out targets during day or night at ranges of over 45km or function as a long-range IR illuminator that extends the effective range of NVDs. Cyclops' ergonomic



EQUIPMENT

MARITIME SYSTEMS

This section contains basic data on a selection of NV and EO systems used in surface vessels and submarines:

- optronic masts and periscopes
- ship surveillance and fire control systems

The equipment is listed alphabetically by manufacturer within the above subsections.

If you produce equipment that you believe should be listed in this section, please contact the team at reference@shephardmedia.com to ensure your system appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: A USN officer scans the horizon for ships or aircraft from aboard guided missile destroyer USS *Stockdale*. (Photo: USN)

OPTRONIC MASTS AND PERISCOPES

ASELSAN

Periscope HSA

Aselsan's Periscope Head Sensor Assembly (HSA) is a TI with a 2D 640x512 staring array, operating in the 3-5µm (MW) band. The HSA features continuous zoom and autofocus functionality. It has LVDS and CAN bus external communication capability. Applications: submarine periscope

HENSOLDT OPTRONICS

OMS 100

The OMS 100 is a non-hull-penetrating optronic mast designed to offer shipbuilders more freedom in positioning the operations center. A rotating sensor head is housed inside the tower on a hoisting device. Fast sequences run automatically, relieving and supporting the user. Main features: TV camera for daylight observation with zoom optics, IR camera with two FOVs for observation by day and night, two-axis LOS stabilisation of targeting line, passive range determination on monitor, azimuth motor drive, connection to control panel, digital interfaces, heated head window (daylight), hoisting device, image processing. The OMS 100 is installed in USN *Virginia*-class nuclear attack submarines and South African Navy *Heroine*-class submarines. Platforms: *Virginia*, *Heroine*-class submarines Options: LRF, antennas (ESM-omni/ESM-DF/GPS/comms), RAM coating, video recorder

OMS 110

The OMS 110 features prominently in our line of successful submarine periscope systems. The rotatable sensor head of the OMS 110 can be raised above the bridge fin of a submarine using a streamlined, hoistable mast. The periscope system breaks the water's surface in just a few seconds enabling an initial topside sweep, including the airspace. It automatically scans the entire surroundings in a single panoramic image taking just three seconds. The OMS 110 can be remote-controlled from a multifunctional combat system console via its serial interfaces. The system is suitable for new-build and retrofit applications. In combination with a SERO 400 periscope, the OMS 110 provides 'the ultimate' in navigation and observation performance, according to Airbus DS Optronics. Its remarkably modular design streamlines logistics and makes maintenance so much easier. Applications: 360° QLR Height: 1.95m w/o antenna Diameter: sensor diameter 395mm FOV: 23.6 x 13.4 to 3.0 x 1.7° camera, with IR NFOV 4.1 x 3.3, WFOV 12.4 x 9.9° Functional modes: automodes, panoramic view Video formats: HDTV, linked via fibre optic cables LOS stabilisation: 2 axis line of sight stabilisation IR Sensor Type: Midwave IR 3-5µm Detection ranges: 1.54µm class 1 eyesafe laser Camera types: HD TV, MWIR, optional LWIR or SWIR LOS azimuth: 360° Rotation: 360° Zoom/ magnification: 8x continuous camera, IR is 2-stage changer Remote control types: fully integrated into combat management system Resolution: 1920x1080px camera, IR is 1280x960px

OMS 200

Airbus DS Optronics (now Hensoldt) unveiled the OMS 200 at the September 2013 DSEI exhibition. It combines the capabilities of the OMS 110 with intelligent target acquisition and tracking functions, enabling it to be used in a search and an attack role. The paired optical and IR sensors automatically acquire targets and track their trajectory. The optronic mast system's powerful sensors can penetrate fog and rain with the newest SWIR technology; combined with an IR sensor it can also be used by absolute darkness. The target coordinates are relayed continuously and the submarine's fire control systems are able to access these data. Airbus DS Optronics provided an OMS 200 to the USN for trials aboard a *Virginia*-class nuclear attack submarine in 2014. Applications: Enhanced stealth rangefinder FOV: 4x3 NFOV, 12x9 WFOV Zoom/ magnification: 8-14x Rotation: 360°

SERO 14/15

SERO 14/15 periscopes were developed on behalf of Germany's Federal Office for Defence Technology and Procurement. Used in Norwegian ULA plus German and Italian Type 212A submarines. Main features: two-axis LOS stabilisation, data display in oculars, optical rangefinder, LRF, heated head window (daylight sight), various optical filters, binocular observation, magnification changer (1.5/6x or 1.5/6/12x zoom), IR camera, azimuth motor drive, microphone, digital interfaces, monitor, video recorder, hoisting device with fairing. Platforms: ULA, Type 212A submarines Options: TV camera, photo camera, monitor, antennas (ESM-omni, ESM-DF, GPS), RAM coating

SERO 40/40 STAB/400

The SERO 40/40 STAB/400 system comprises one attack and one observation scope with high component commonality but independent operation. The optical quality of the periscopes enables observation and recognition of objects by means of high-contrast images under difficult lighting conditions. Main features: two-axis LOS stabilisation, data display in oculars, optical rangefinder, heated head window, various optical filters, binocular observation, magnification changer (1.5/6x), azimuth motor drive, digital interfaces. Options: TV camera, photo camera monitor, video recorder, antennas (ESM-omni, ESM-DF, GPS), RAM coating, hoisting device with fairing. Modernised versions will be designated SERO 400 and include: enhanced interface for more efficient new antennas, magnification steps (1.5/6/12x), laser integration, stabilisation with higher precision, connection to control panels with remote-control capability, enhanced camera integration, brushless servo drives.

SERO 250

The SERO 250 is a compact submarine periscope that can be installed in both new-build and upgraded boats. Little or no structural modifications are required for installation. It makes use of existing hoisting mechanisms, bearings and seals. The SERO 250 can be used for observation during the day and is equipped with an IR camera for night vision. It serves to monitor surface and air activity, collect navigational data, and detect and identify targets. The system provides video signals for parallel observation on combat system monitors. The periscope can be retrofitted with 'minimal' modifications to the vessel. Lighter and smaller than its predecessor model, it is ITAR-free. Applications: naval surveillance/



The SERO 250 is a compact submarine periscope that can be used for observation during the day and is equipped with an IR camera for night vision. (Photo: Hensoldt Optonics)

observation and targeting system for submarines Height: 1.1m, boat-specific adaptation possible Diameter: 180 or 190.5mm Platforms: Turkish *Atilay*-class Type 209/1200, Colombian Type 209/1200 submarines Field of regard – pitch: $-15/+45^\circ$ Rotation: nx360°

SERO 400

The SERO 400 submarine periscope provides a panoramic view of the surroundings on the water's surface and in the airspace above without exposing or comprising the vessel. Integrated optics, optical cameras, Gen III TI and LRF enable the user to determine the heading and distance to observed objects. The cameras also take pictures for documentation and subsequent analysis. Able to conduct 360-degree QLR in three seconds. The SERO 400 is integrated into the submarine's weapon systems. Its main purposes are observation and target acquisition. All sensors are stabilised and engineered for use at sea. The final pair of the German Navy's six Type 212A submarines are equipped with SERO 400, as are Portugal's two U209PN boats. Applications: naval surveillance/observation and targeting system for submarines Diameter: 190.5mm FOV: 360° QLR Video formats: LLL, HDTV, DigStill (CCD) LOS elevation: $-15/+75^\circ$ range LOS stabilisation: 2-axis Resolution: 750x580, 2000x2000, IR 640x480 TV type: HD Options: GPS, 1.2-1.8GHz IR Sensor Type: 3-5µm IR wavelength (MWIR standard) Platforms: Type 212A, U209PN submarines LOS elevation – IR: 4x3 NFOV, 12x9 WFOV Detection ranges: 1.54µm class 1 eyesafe laser Zoom/magnification: 8x Camera types: MWIR, HD TV, LLL TV, direct view, optional SWIR Rotation: 36x28, 9x7, 4.2x3.4° Functional modes: automodes, remote-controlled Remote control types: full remote control within MFC submarine weapon system

KENT PERISCOPES

Sabre Ti

The Sabre Thermal image (Ti) was developed as a gunner and/or commander's sight for small to medium turret systems with an optional LRF, allowing the user enhanced surveillance and target acquisition by night and day. The system was unveiled at DSEI 2013. The sight employs a 640x480 Thermoteknix MicroCAM 2 long-wave thermal imaging core with XTI Shutterless Technology

capable of detecting a tank at 5.4km. It is combined with a 6x zoom day channel enabling recognition of a tank at 4km. Products using MicroCAM are not subject to US ITAR control. As with other variants, Sabre Ti is designed to fit within a compact space. The sight input lever arm connects to the armament via the turret link and incorporates adjustment for elevation boresight corrections. This link arm can be fitted in any orientation to the left or right of the sight body, depending on turret configuration, with a selection of reticules available to the gunner. Thermal imaging type: 640x480 17µm pitch Detection ranges: 5.4km by night, 4km in daylight Daylight sight: 6x Laser rangefinder: optional

L3 CINCINNATI ELECTRONICS

Optronic Masts and Periscopes

The company's MWIR imagers have been selected to provide new TI modules for the non-hull-penetrating Model 90 Universal Modular (optronic) masts for USN Virginia-class SSNs. L3 has also been specified to retrofit the Type 8 periscopes of last-generation USN Los Angeles-class SSNs with modern IR technology. The same modules will be installed on the optronic masts of the UK RN's *Astute*-class SSNs. The new technology provides night surveillance and image resolution in hazy or foggy conditions. Images can be stored digitally for later display and analysis. It provides long-range, high-resolution imagery with a 360° WFOV for target acquisition. This permits installation of the IR module directly on the non-penetrating optronic mast, eliminating the need for a periscope. The technology is intended to facilitate faster, safer running near the surface for reconnaissance, not always possible with a conventional periscope. Platforms: US *Virginia*- and *Los Angeles*-class, UK *Astute*-class submarines

L3 KEO

AN/BVS-1 Photonics Mast Programme

The AN/BVS-1 is the sensor mast system for USN *Virginia*-class attack submarines, the first of which entered service in 2004. It is the first class of US submarine to be equipped with photonic masts. Features: colour TV, monochrome HDTV, TI, eyesafe LRF, ESM, omnidirectional DF (monopulse), comms/GPS, 'patch' antenna, VPA (receive), sleeve antenna. FOV: 24x32°, 9x12°, 3x4°, 1.5x2° Rotation: rotary seal, pressure compensation LOS elevation: $-15/+74^\circ$ Platforms: *Virginia*-class submarines LOS azimuth: nx360° Signature control: de-plumer, RAS, thermal LOS stabilisation: 2-axis LOS elevation – IR: $-15/+55^\circ$ LOS elevation – visual: $-15/+74^\circ$

Model 76

The Model 76 system consists of an attack and a search periscope with many components in common, which can interface with a variety of combat systems. Operational flexibility is provided through local visual and remote TV display and control units. Common features: high light transmission, binocular viewing piece, eyepiece data display, range, relative/true bearing, LOS stabilisation, heated head window, fail-safe elevation, optical stadimeter (rangefinder), 35mm camera, mechanical bearing dials, microphone, integral electronic torque rotation drive, digital combat system interface. Search periscope specifications: diameter

190mm, LOS elevation -10/+60° (+76° detection), FOV 32/8/4°. Search periscope options: TI camera (3-5 or 8-12µm), Gen II or III I2, CCD or LLL TV camera, 2-18GHz ESM antenna, remote control with video rangefinder, voltage probe antenna (comms), RAM, GPS antenna. Attack periscope specifications: LOS elevation -10/+74° (+90° detection), FOV 32/8/4°, diameter 190mm (180mm optional). Attack periscope options: Gen II or III I2, CCD or LLL TV camera, ESM early warning system, remote control with video rangefinder, eyesafe LRF, RAM.

Model 86

The Model 86 is described as the first series of non-hull-penetrating submarine masts which is capable of combining viewing sensors, as well as ESM, GPS and communication antennas. Features: TV/TI, eyesafe LRF, quick lookaround with panoramic display, multiple modes (programming automatic scans, e-zoom, data recording and retrieval), simplified functional HMI, handgrip LOS control, real-time image enhancement, X-Windows display formats, comms/GPS/ESM antennas.

Model 90

The major functions of the Model 90 submarine periscope include: direct visual observation, TI, TV, photography, rangefinding (optical, video, laser) and data transmission. Features: split-beam binocular viewing with eyepiece data display, operable from remote control console or through combat system, 'quick look' and programmed automatic modes, capability for adding e-zoom and image enhancement, data recording and retrieval functionality, choice of ESM/comms/GPS capabilities. Ranging: stadimetric (optical and video), Film photography: 35mm, FOV: 32/8/4/2.5° (visual), 10/4/4° (IR) LOS elevation - visual: -10/+74° Antenna types: ESM early warning IR Sensor Type: MW (3-5µm) or LW (8-12µm). Options: ELRF, GPS, VPA, DF LOS azimuth: electric drive (360° continuous) Zoom/magnification: 1.5/6/18x (visual) LOS stabilisation: two-axis/35mrad RMS TV type: B&W CCD LOS elevation - IR: 10/4/4°

Type 8 Mod 3

The Type 8 Mod 3 is an updated version of the Type 8 series periscopes. The Type 8B/J Mod 3 provides EHF low-data-rate communications capability for USN *Los Angeles*- and *Seawolf*-class SSNs and Trident-armed SSBNs. The systems are currently being fitted with a TI capability. Features: multiple levels of optical magnification, power-assisted train operation, day and night viewing, operationally proven. Can be integrated into a submarine's combat system. Communications: EHF SATCOM. Staring detector array: 640x512 with closed-cycle cooling, WFOV 8°, NFOV 2.3°, elevation -10°/+45° LOS. Eyepiece and remote monitor display(s). FOV: 1.5x32°, 6x8° LOS depression: -10° Platforms: *Los Angeles*- and *Seawolf*-class SSNs, Trident-armed SSBNs Zoom/magnification: 1.5/6x Optical length: 10.9m (Type 8B), 14m (Type 8J) Spectral band: 3-5µm LOS elevation: +60°

Type 18

The Type 18 periscope was designed to provide USN *Los Angeles*- and *Seawolf*-class submarines with a broad spectrum of optical, EO, RF intercept and targeting capability. Features: multiple levels of optical magnification, power-assisted train operation, single-axis stabilisation, digital photography, LLL image intensification, colour TV. Perivu: Sony XC999 colour TV camera, Nikon D1

digital frame camera, workstation with image processing and 20in flat panel display. FOV: 1.5x32°, 6x8°, 12x4°, 24x2° LOS elevation: +60° LOS depression: -10° Platforms: *Los Angeles*- and *Seawolf*-class submarines Zoom/magnification: 1.5/6/12/24x Functional modes: day, night, visual, TV/visual, gyro Optical length: 10.9m (Type 18B), 12.6m (Type 18D), 13.1m (Type 18H) Exit pupil: 7mm at 6x

SAFRAN ELECTRONICS & DEFENSE

Iris

Iris is a TI designed for multiple applications, including ship optronic masts. Claimed detection/recognition ranges with two FOV: soldier 13/5km, tank 16/6.7km, helicopter 18.5/8.5km, fast jet 26/14km. Video output: CCIR or RS-170 or 8- and 12-bit digital. Synchronisation: internal or external. BiTE dedicated maintenance link: RS-422. Weight: <10kg in 2-FOV configuration Sensitivity NETP: <0.02°C Detector type: 8-12µm Interfaces - control: RS-422 Cooldown time: <5min Resolution: 576x746px

Series 20 APS

The Series 20 APS attack periscope system has been designed by Safran for all types of modern submarines. It is capable of carrying out above water surveillance and attack tasks. These include navigation safety, intelligence gathering and EW self-protection. The system combines a direct optical channel with four magnifications, optronic sensors including low light level TV anti-blooming camera and HDTV colour camera. It also supports GPS and early warning ESM antennas. The periscope system includes 1-axis (optional 3-axis) line of sight stabilisation, stadimetric range measurement, true and relative bearing output to weapon system, hoisting system control and remote control from CMS. The system is also capable of digital video and snapshot recording. Diameter: 190.5mm IR Sensor type: IR camera LOS stabilisation: 1-axis (optional 3-axis) Antenna types: GPS and early warning ESM Remote control types: remote control from CMS Platforms: classic or nuclear submarines TV type: low light level TV anti-blooming camera

Series 30 AOM

The Series 30 AOM's design is based on the Series 30 SOM. It is a discreet non-penetrating attack optronic mast suited to all types of submarines and integrates optronic sensors and electronic warfare in a single, compact unit. The system can simultaneously combine up to four optronic sensors and an ESM/GPS antenna. The Series 30 AOM has a small volume above surface water to provide it with a low signature. The AOM is compatible with the Series 30 SOM in terms of mechanical, electronic and software interfaces. The two systems share the same interfaces, including hoisting system, cable loops, PHP, internal wiring and electronic unit. The same cabinet and cables can be used with both sensor pods, enabling navies to select the optimal configuration for a specific mission. The system features a lightweight pod with no air/water cooling requirement which supports GPS, early warning ESM and direction-finding ESM antennas. Three operational modes are available: fast quick look direction, optronic air threat early warning and direction finding, and digital video and snapshot recording and relay. Applications: intelligence gathering and attack Antenna types: GPS, early warning ESM and direction-finding ESM IR Sensor Type: 3rd gen 3-5µm thermal imager Video formats: digital video and snapshot recording and replay



EQUIPMENT

CORE SYSTEMS

This section lists a selection of cameras, IR detectors and image intensifiers used as the core sensors for a range of systems.

If your company produces sensors which you believe should be listed in this section, please contact the team at reference@shephardmedia.com to ensure your system appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: US marines try out new night optics equipment during *Advanced Naval Technology Exercise 2018* at Camp Pendleton, California, in March 2018. (Photo: USMC)

CAMERAS AND IR DETECTORS

ASELSAN

ASIR

The ASIR 288x4 FPA thermal surveillance system operates in the LWIR band. The ASIR thermal camera has high sensitivity that enables long-range target detection with low temperature difference to its environment. In addition to accuracy in good weather conditions by day and night, ASIR discriminates targets in adverse weather with limited atmospheric energy transmission due to natural effects like fog, haze, smoke, dust, fire and other battlefield conditions. The ASIR thermal camera has narrow/wide FOV selection, focus adjustment, reticle on/off and intensity adjustment, auto/manual image optimisation, brightness adjustment, contrast adjustment, polarity selection (white hot/black hot), e-zoom and image freeze. It is operated by an ergonomically designed control unit. Applications: surveillance and reconnaissance Power: 21-30V DC Weight: <15kg FOV - wide: 9x6.75° Electronic zoom: 2x Data control interfaces: RS-422/RS-232 Options: HEKOS target acquisition system, motorised pan/tilt, tripod, remote control unit, LCD monitor, video recorder Spectral IR band: 8-12µm Video output format: CCIR FOV - narrow: 3x2.25°

BAE SYSTEMS

MIM500 Series

Developed to meet the performance requirements of military programmes, the MIM500 series of uncooled IR camera cores is based on BAE Systems' 640x480 MicroIR technology. It is designed for applications requiring high resolution to meet range and/or pixel-on-target requirements. For less demanding applications, the company offers the MIM500H with 320x240 resolution. Features such as gen-lock synchronisation and support of customisation boards mean that the MIM500 series can be configured for specific applications. Gen-lock enables pixel timing to be synchronised to the system clock of third-party hardware. The expandable back-end board stack allows customisation boards to be integrated into the stack without the need for cables or connectors. The MIM500's open architecture with MIPS process and WindRiver Vx-Works real-time OS generates a standard feature set and accommodates application-specific software. A flex cable between the front-end card and back-end electronics provides the end user with the flexibility to adjust the camera core layout to meet packaging constraints. A universal optical mounting plate with integral shutter assembly allows the end user to configure the MIM500 series core with the optics required to meet specific OEM/integrator requirements.

PMC300

Based on BAE Systems' 640x480 MicroIR technology, the PMC300 fixed-mount IR camera generates high-resolution thermal imagery claimed to meet mission detection requirements at standoff distances once limited to cooled IR cameras. It is based on an environmentally qualified, modular design providing the end user with the flexibility to tailor the unit to meet specific performance requirements and be deployed in

operational environments. A family of interchangeable, single- and dual-FOV optics permit solutions to be configured to meet specific short-, medium- and long-range requirements. A mounting bracket, coupled with an RS-422 interface for control of camera functions, allows integration with third-party positioning equipment, control hardware and complementary sensors.

SCC500 Series

The SCC500 series are uncooled IR camera cores aimed at the commercial and military OEM markets. Based on BAE Systems' MicroIR technology, SCC500 series cores are designed to generate image quality over an extended operating temperature range with a wide dynamic range (14bit) and real-time 60Hz frame rate in a small package. A common electronics package and mechanical interfaces are shared by all three camera cores, enabling OEMs to develop a family of systems differentiated by resolution. A flex cable between the front-end card/lens assembly and the back-end electronics provides the OEM with the flexibility to adjust the camera core layout to meet packaging constraints. Frame rates: 60Hz

TIM1500

Designed for RWS and weapon targeting systems, TIM1500 is an uncooled TI used for long-range surveillance and target acquisition. TIM1500 is designed around a modular common MicroIR sensor architecture. It does not require cryocoolers or optical scanners, thus reducing SWaP. Features: silent image in less than 30s; dual optical FOV; user-specific adjustable reticules and alphanumeric to simplify platform- and weapon-specific integration. Applications: RCWS/weapon RSTA MTBF: >10,000h Electronic zoom: 2/3/4x

CHELTEK DEFENCE

Cylindrical Camera

Cheltek Defence unveiled its thermal helmet camera, the Cylindrical Camera, at DSEI 2017. The miniature camera is fitted with a FLIR thermal core and is designed for surveillance applications. It is compact and lightweight, housed in anodised aluminium, and outputs composite video. Enclosed within a 26mm diameter housing, the Cylindrical Camera is ideally suited to helmet mounting, allowing for hands-free operation. Various mounts can be supplied, including Picatinny rail mounts. The system can be powered from either 3.3V, 5V (USB) or 12V DC and is supplied with an inline quick release connector which will disengage when the helmet is removed. The camera has been designed to integrate with the latest IP Mesh radios system and is normally supplied with a USB connector for power and a BNC connector for video. It can be modified to other connectors if required. Length: 62mm Weight: 100g Resolution: 320x256 Operating temperature range: -40° to +80°C

CHESS DYNAMICS

Piranha LRTV

The Piranha LRTV is a long-range colour CCD camera designed for long-term external deployment in exposed environments, suitable for land and maritime applications. The camera is able to withstand dust, heat and moisture due to its rugged design. Power: 15-36V DC; <25W consumption Weight: 14kg Detection range:

vision enhancement. Applications: air, land EO systems
Length: 50mm Width: 50mm Height: 82mm Power: 12V
DC Weight: 282g Spectral IR band: 0.9-1.7 or 0.4-1.7µm
Operating temperature range: -40/+75°C Video output
format: 14-bit CameraLink Frame rates: 25, 30, 50, 60Hz
Resolution: 320x256 Detector type: Alcatel-Thales III-V
Lab, InGaAs PIN-Photodiode Pixel pitch: 30-30µm

RAYTHEON VISION SYSTEMS

Custom Detection and Imaging Solutions

Raytheon Vision Systems develops and produces detection and imaging devices for applications in the X-ray, visible, IR, terahertz and millimetre-wave regions of the EM spectrum. Over 450,000 devices have been delivered to date, for use in military, scientific and commercial sensing systems. This includes over 25,000 Javelin ATGW detector assembly devices. Recent product developments include uncooled microbolometer camera engines, large-format 2x2K SWIR and MWIR arrays, 1,280x720 dual-band arrays and a number of custom staring and scanning arrays for military and civil space applications.

Owl IR-640-25

The Owl IR-640-25 camera core uses uncooled VOx microbolometer technology to obtain clear images for detection, navigation and surveillance needs. It is a large-format camera engine designed for use in LWIR imaging applications and comprises a Raytheon 640x480 uncooled FPA, a heat sink and mixed signal electronics. It comes calibrated for a wide environmental temperature range and, at an ambient temperature of 20°C, can achieve an intra-scene dynamic range of greater than 100°C. The Owl IR-640-25 is designed to be small, lightweight and low-power. The uncooled FPA interfaces to the electronics via an application-specific cable, providing flexibility in conforming to user O&M constraints. Applications: LWIR imaging

U320-25

The U320-25 is a quarter-VGA format, 25µm uncooled detector designed for LWIR imaging applications. Two

models are currently available: a commercial version and a military-grade version that is Mil-Spec conforming. The detector consists of a high-transmission germanium window, a 320x240 VOx microbolometer array and a thermal electric cooler (TEC), sealed in a long-life metal-ceramic vacuum enclosure. The U320-25 is designed to be small, lightweight and low-power, with the use of the TEC being optional. Electrical interface to the U320 package is either through a conventional gold dot interface, or a SAMTEC ASP-62876-02 connector. Applications: LWIR imaging

U640-25

The U640-25 is a VGA-format, 25µm uncooled detector designed for high-resolution LWIR imaging applications. Two models are currently available: a commercial version and a military-grade version that is Mil-Spec conforming. The detector consists of a high-transmission germanium window, a 640x480 VOx microbolometer array and a thermal electric cooler (TEC), sealed in a long-life metal-ceramic vacuum enclosure. The U640-25 is designed to be small, lightweight and low-power, with use of the TEC being optional. Electrical interface to the U640 package is through a conventional gold dot interface or a SAMTEC ASP-62876-02 connector. Applications: LWIR imaging

SAFRAN ELECTRONICS & DEFENSE


Matis XM

Matis Extended Magnification (XM) is a cooled, long-range IR imager, featuring an 18x continuous optical zoom. It is intended for zone surveillance networks and high-performance weapon systems. Applications: long-range IR imager

SOFRADIR

Cactus 320 SW

The Cactus 320 SW is a compact, high-sensitivity FPA assembly designed for low-flux imaging applications from 0.9-1.7µm. It can be used for a range of applications such as NV, surveillance, airborne gimbals and various





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- Motorized and zoom IR lenses
- Lenses for SWIR, MWIR and LWIR cameras
- IR components: aspheric, diffractive and spherical lenses, mirrors, windows and prisms


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www.ophiropt.com/infrared-optics, MKTG@ophiropt.com



The Pluton LW scanning array operates in the LWIR 8-12µm band.
(Photo: Sofradir)

industrial and scientific tasks. Applications: land, air, maritime Pixel pitch: 30x30µm Storage temperature range: -40/+71°C Frame rates: 15KHz Camera wavelength/waveband: 0.9-1.7µm; 0.4-1.7µm optional

Cactus 640 SW

Cactus 640 SW is a high-sensitivity, high-resolution FPA assembly designed for low-flux imaging applications from 0.9-1.7µm. Cactus 640 SW can be used for a range of applications such as NV, surveillance, airborne gimbals and various industrial and scientific tasks. Applications: land, air, maritime Pixel pitch: 25x25µm Camera wavelength/waveband: 0.9-1.7µm

Epsilon MW

The Epsilon MW is a compact detector built for optimised SWaP MWIR (3-5µm) applications. This IDCA can operate at FPA temperatures greater than 110°K, which responds to demands for acoustic stealth. Power: 12V FPA operating temperature: 100-110°K Pixel pitch: 15x15µm Material spectral response: 0.8-5µm Operating temperature range: -30/+71°C Detector spectral response: 3.4-4.8µm (cold filter) Frame rates: 140Hz

Jupiter MW

Jupiter MW is an MWIR SXGA IDCA. FPA operating temperature: <90°K Pixel pitch: 15x15µm Material spectral response: 0.5-5.3µm Detector spectral response: 3.7-4.8µm Frame rates: 120Hz

Leo MW

Leo MW is a compact detector designed for optimised SWaP MWIR (3-5µm) applications. Features: digital output camera link. Pixel pitch: 15x15µm Detector spectral response: 3.7-4.8µm (cold filter)

Mars LW

Mars LW, which has been manufactured in large quantities, is an LWIR (8-10µm) staring array. Applications: land FPA operating temperature: 77°K for 9.5µm, 70°K for 11µm Pixel pitch: 30x30µm Material spectral response: 0.8-9.5 or 0.8-11µm Detector spectral response: 7.7µm up to material cut-off (high-pass cold filter)

Mars MW

Sofradir has produced the Mars MWIR 320x256 detector for over ten years. This IDCA is battlefield-proven and in operational systems all over the world, and is also used for commercial and space applications. FPA operating temperature: up to 110°K (Stirling cycle coolers), 80 or 90°K (Joule-Thomson cooler) Pixel pitch: 30x30µm Material spectral response: 0.8-5µm Detector spectral response: 3.7-4.8µm (cold filter)

Mercury LW

Mercury LW, manufactured in large quantities, is a high-resolution LWIR (8-12µm) scanning array. This IDCA is battlefield-proven and has been chosen by several armies around the world. Features: format 480 lines with TDI on six elements, detector pitch (cross-scan/inscan) 49.8x25.4µm, detector size (cross-scan/inscan) 38x28µm. FPA operating temperature: 77-90°K Material spectral response: 0.8-10.3µm Detector spectral response: 7.7µm up to material cut-off (high-pass cold filter)

Neptune SW

Neptune SW is an IDCA that enables imaging from 0.9-2.5µm. It is adapted to low flux in this wavelength range and the line-by-line gain selection function makes it suitable for hyperspectral imaging. FPA operating temperature: up to 200°K Pixel pitch: 30x30µm Detector spectral response: 0.8-2.5µm (cold filter)

Pluton LW

Sofradir has produced more than 25,000 Pluton LWIR (8-12µm) scanning arrays. Array features: format 288 lines with TDI on four elements, detector pitch (cross-scan/inscan) 28x43µm, detector size (cross-scan/inscan) 28x25µm. FPA operating temperature: 77-90°K Material spectral response: 0.8-10.3µm Detector spectral response: 7.7µm up to material cut-off (high-pass cold filter)

Saturn SW

Saturn SW is a high-resolution IDCA that enables imaging from 0.8-2.5µm. It is adapted to low flux in this wavelength range and the line-by-line gain selection function makes it suitable for hyperspectral imaging. Format: 1,000x256px. FPA operating temperature: 200°K Pixel pitch: 30x30µm Detector spectral response: 0.8-2.5µm

Scorpio LW

Scorpio LW is a compact high-resolution LWIR IDCA with low power consumption. It offers high-speed operation for detecting fast-moving targets or improving sensitivity. It is optimised for long-range applications. Applications: land Weight: 0.55kg FPA operating temperature: 90°K Pixel pitch: 15x15µm Material spectral response: 0.8-5µm Detector spectral response: 7.7-9.3µm Frame rates: 210Hz Detector type: 640x512

Scorpio MW

Scorpio MW is a VGA 15µm pitch MWIR IDCA detector which has been developed to replace the MWIR QVGA format in military systems. Scorpio MW is also ruggedised for harsh environments. FPA operating temperature: up to 110°K, 90°K typical with Stirling-cycle cooler Pixel pitch: 15x15µm Material spectral response: 0.8-5µm Detector spectral response: 3.7-4.8µm



PRODUCTS

GUIDE TO SUPPLIERS

This section lists key companies supplying goods, services and equipment to the night vision and optics industry worldwide.

The section is separated into two listings, by product then by supplier.

Products are listed alphabetically with suppliers and their location under each.

Supplier listings from p162 are shown alphabetically and include:

- Company address
- Email and website addresses
- Telephone and fax numbers
- Contact names

Highlighted listings also include the company's logo and a summary of activity.

To update a listing or submit new information, email the team at reference@shephardmedia.com.

ABOVE: US and French marines use rifle combat optics mounted on sniper rifles aboard the French ship *Dixmude*. (Photo: USMC)

PRODUCTS

Airborne EOS

Advanced Coherent Technologies (USA)
 Advanced Defense Systems, Inc (ADS) (USA)
 Aero Optical (UK)
 Airbus Defence & Space (Germany) (GERMANY)
 BAE Systems (UK)
 BAE Systems Electronic Systems (USA)
 Ball Aerospace (USA)
 BE Meyers (USA)
 Bodkin Design & Engineering (USA)
 CANVS (USA)
 CohuHD Costar (USA)
 Controp Precision Technologies (ISRAEL)
 Dassault Aviation (FRANCE)
 Defence Vision Systems (UK)
 DO Systems (UK)
 DRS Advanced ISR (USA)
 e2v (UK)
 Elbit Systems EW & SIGINT - Elisra (ISRAEL)
 Elbit Systems Intelligence and Electro-optics - Elop (ISRAEL)
 EMX (USA)
 Esterline CMC Electronics (CANADA)
 Field Aviation (CANADA)
 FLIR Systems (USA)
 FLIR Systems (UK) (UK)
 Hanwha Systems (SOUTH KOREA)
 Hanwha Techwin (SOUTH KOREA)
 Headwall Photonics (USA)
 HeliMedia (UK)
 Hensoldt Optronics (Pty) Ltd (SOUTH AFRICA)
 Hensoldt Sensors (GERMANY)
 IAI North America (USA)
 IAI Tamam (ISRAEL)
 IMEC Integration (SOUTH AFRICA)
 ING Robotic Aviation (CANADA)
 Intevac Photonics (USA)
 ISP Optics (USA)
 ISP Optics Europe (LATVIA)
 JAI (USA)
 L3 Wescam (CANADA)
 Leonardo (ITALY)
 Leonardo UK (UK)
 LFD (UK)
 LightPath Technologies (USA)
 LKD Aerospace (USA)
 Lockheed Martin Missiles and Fire Control (USA)
 Lockheed Martin UK (UK)
 Logos Technologies (USA)

Mann Aviation Group Engineering (UK)
 Max-Viz (USA)
 Miltrade Technologies (SINGAPORE)
 NSE (FRANCE)
 Obzerv (CANADA)
 OIP Sensor Systems (BELGIUM)
 Opgal Optron Industries (ISRAEL)
 Ophir Optics LLC (USA)
 Ophir Optics SRL (ROMANIA)
 Ophir Optronics Solutions (ISRAEL)
 Optikos (USA)
 Own the Night (Lceo LLC) (USA)
 Page Aerospace (UK)
 QinetiQ (UK)
 Rafael Advanced Defense Systems (ISRAEL)
 Raytheon Space & Airborne Systems (USA)
 Rheinmetall Defence Electronics (GERMANY)
 Rockwell Collins (USA)
 S.M. Engineering (SOUTH KOREA)
 Saab (SWEDEN)
 Safran Electronics & Defense (FRANCE)
 SCD - Semiconductor Devices (ISRAEL)
 Sofradir (FRANCE)
 Teledyne Imaging Sensors - Scientific & Tactical Camera Products (USA)
 Terma (DENMARK)
 Thales (FRANCE)
 Thermal Beacon (ISRAEL)
 TNO (NETHERLANDS)
 Top I Vision (ISRAEL)
 UAV Vision (AUSTRALIA)
 UTC Aerospace Systems - ISR Systems (USA)
 Vision Systems International (USA)
 Xenics (BELGIUM)
 Yunnan Olightek Opto-Electronic Technology (CHINA)

Associations

AFCEA International (USA)
 National Defense Industrial Association (USA)

Aviator goggles

Adams Industries (USA)
 Aero Dynamix (USA)
 AM Vision (UK)
 AMST Systemtechnik (AUSTRIA)
 Aselsan (TURKEY)
 Aspect Technology & Equipment (USA)
 Atlas Telecom (UAE)
 ATN (USA)

Aviation Specialties Unlimited (USA)
 BAE Systems (UK)
 BAE Systems Electronic Systems (USA)
 BCB International (UK)
 Beck Optron Solutions (UK)
 Britannia 2000 (UK)
 CAE UK (UK)
 CANVS (USA)
 Consolite Technology (UK)
 DO Systems (UK)
 Elbit Systems (ISRAEL)
 Elbit Systems of America (USA)
 eMagin (USA)
 Everett Aviation (KENYA)
 Fenn Night Vision (UK)
 Flight Helmets Australia (AUSTRALIA)
 Forth Dimension Displays (UK)
 Glomex Military Supplies (CZECH REPUBLIC)
 Headset Services (UK)
 IMEC Integration (SOUTH AFRICA)
 InterSense (USA)
 Jenoptec (FRANCE)
 Kanematsu Aerospace (JAPAN)
 LOMO America (USA)
 Luminator Aerospace (USA)
 Nakao International (USA)
 NAVAIR Expeditionary Airfield Team (USA)
 Night Flight Concepts (USA)
 Night Optics USA (USA)
 Night Vision (Australia) (AUSTRALIA)
 Night Vision Experts (USA)
 Night Vision Gear UK (UK)
 Nightline (USA)
 Nivisys (USA)
 Northrop Grumman (USA)
 Northrop Grumman (UK)
 OIP Sensor Systems (BELGIUM)
 Ophir Optics LLC (USA)
 Ophir Optics SRL (ROMANIA)
 Ophir Optronics Solutions (ISRAEL)
 Optikos (USA)
 Optix (BULGARIA)
 Own the Night (Lceo LLC) (USA)
 PCO (POLAND)
 Photonis France (FRANCE)
 Photonis Netherlands (NETHERLANDS)
 Photonis USA (USA)
 REB Technologies (USA)
 Rheinmetall Defence Electronics (GERMANY)
 Safran Electronics & Defense (FRANCE)
 Scandinavian Avionics (DENMARK)

SCHOTT Government Services (USA)
 SCB Enterprises (USA)
 Thales (FRANCE)
 Thales Angénieux (FRANCE)
 Thales Optronique (FRANCE)
 TNO (NETHERLANDS)
 Transaero (USA)
 Troya Tech Defense (ISRAEL)
 United Rotorcraft (USA)
 US Cavalry (USA)
 US Night Vision (USA)
 Valpak (GREECE)
 Viriyakit (THAILAND)
 Vision Systems International (USA)
 Wilco International (FRANCE)

Components, accessories

AeroComputers (USA)
 ACM Container Controls (USA)
 Akzo Nobel Aerospace Coatings (USA)
 Andor Technology (UK)
 Applied Infrared Sensing (AUSTRALIA)
 Armstrong Optical (UK)
 BAE Systems Rokar (ISRAEL)
 Barco Fredrikstad (NORWAY)
 Barum & Dewar (UK)
 Brandywine Photonics (USA)
 Brownell (UK)
 Cubic Global Defense (USA)
 Curtiss-Wright Defense Solutions (USA)
 Curtiss-Wright Defense Solutions UK (UK)
 Edmund Optics (UK)
 Elbit Systems Intelligence and Electro-optics - Elop (ISRAEL)
 Eltek USA, Inc. (USA)
 Emergency Beacon (USA)
 ER Precision Optical (USA)
 Exotic Electro-Optics (USA)
 Gentex (USA)
 GMK Tactical Products (UK)
 Gooch & Housego (UK)
 Hardin Optical (USA)
 Headwall Photonics (USA)
 Helmet Integrated Systems (UK)
 II-VI Infrared (USA)
 Intro Precision (UK)
 Interactive Safety Products (USA)
 IRCAM (GERMANY)
 IRnova (SWEDEN)
 Janos Technology (USA)
 Jenoptik Advanced Systems (USA)
 Jenoptik Optical Systems GmbH (GERMANY)

Laser Lines (UK)
 Leonardo DRS (USA)
 Liteye Systems (USA)
 Materion Precision Optics (USA)
 Measuring Instruments Technology (SOUTH AFRICA)
 Metax (UK)
 Militrans (ISRAEL)
 Millog (FINLAND)
 MSA Gallet (FRANCE)
 New Imaging Technologies (NIT) (FRANCE)
 North Guangwei Technology Inc (CHINA)
 NVLS (SPAIN)
 Obzerv (CANADA)
 Ophir Optics LLC (USA)
 Ophir Optics SRL (ROMANIA)
 Ophir Optronics Solutions (ISRAEL)
 OptoCom Group (MALAYSIA)
 Oshino Lamps (UK)
 Photonis France (FRANCE)
 Photonis Netherlands (NETHERLANDS)
 Photonis USA (USA)
 Power Technology (USA)
 PRP Optoelectronics (UK)
 QWIP Technologies (USA)
 Rafael Advanced Defense Systems (ISRAEL)
 Raytheon Vision Systems (USA)
 Sandel Avionics (USA)
 Sofradir EC (USA)
 Stemmer Imaging (UK)
 Target Group (TURKEY)
 Techno Sourcing (BRAZIL)
 Teledyne Imaging Sensors - Scientific & Tactical Camera Products (USA)
 Trex Enterprises (USA)
 Vincent Associates (USA)
 Wilcox Industries (USA)
 Xactra Technologies (USA)
 Xenics (BELGIUM)
 Yunnan Olightek Opto-Electronic Technology (CHINA)

Ground EOS

Adams Industries (USA)
 Adimec Advanced Image Systems (NETHERLANDS)
 AM Vision (UK)
 Applied Infrared Sensing (AUSTRALIA)
 Aselsan (TURKEY)
 Aspect Technology & Equipment (USA)
 Atlas Telecom (UAE)
 ATN (USA)
 Aurora Tactical (USA)
 BAE Systems (UK)
 BAE Systems Electronic Systems (USA)
 Ball Aerospace (USA)
 BCB International (UK)
 BE Meyers (USA)
 Beck Optronic Solutions (UK)
 Beechwood Equipment (UK)
 Bharat Electronics (INDIA)
 Bodkin Design & Engineering (USA)
 Britannia 2000 (UK)
 Cantronic Systems (CANADA)
 CANVS (USA)
 Chess Dynamics (UK)
 CohuHD Costar (USA)
 Consolite Technology (UK)
 Controp Precision Technologies (ISRAEL)
 CSIR (SOUTH AFRICA)
 CVI Melles Griot (USA)
 Defence Vision Systems (UK)
 DO Systems (UK)
 e2v (UK)
 Elbit Security Systems (ELSEC) (ISRAEL)
 Elbit Systems (ISRAEL)
 Elbit Systems Intelligence and Electro-optics - Elop (ISRAEL)
 Elbit Systems of America (USA)
 Elbit Systems - ITL (ISRAEL)
 eMagin (USA)
 EMX (USA)
 Esterline Control & Communication Systems (USA)
 FFW Optical Systems (USA)
 FLIR Systems (USA)
 Forth Dimension Displays (UK)
 Fotona (SLOVENIA)
 Fraser Optics (USA)
 GE Intelligent Platforms (UK)
 GE-HA-TEC Optronics (GERMANY)
 General Dynamics Mission Systems (USA)
 Glomex Military Supplies (CZECH REPUBLIC)
 Graflex (USA)
 Harsh Environmental Applied Technologies (USA)
 Helylux Industries (FRANCE)
 Hensoldt Sensors (GERMANY)
 HGH Systems Infrarouges (FRANCE)
 IAI North America (USA)
 IAI Tamam (ISRAEL)
 IMEC Integration (SOUTH AFRICA)
 ING Robotic Aviation (CANADA)
 Innovative Sensor Developments (UK)
 INO (CANADA)

InterSense (USA)
 Intevac Photonics (USA)
 IRCAM (GERMANY)
 JAI (USA)
 Jenoptik Advanced Systems (USA)
 Jenoptik Optical Systems GmbH (GERMANY)
 Kalinka Optics (USA)
 KiLoLambda Technologies (ISRAEL)
 Kongsberg Maritime (NORWAY)
 L3 Advanced Laser Systems Technology (USA)
 L3 Brashear (USA)
 L3 Cincinnatti Electronics (USA)
 L3 Sonoma EO (USA)
 L3 Wescam (CANADA)
 Laser Lines (UK)
 Leonardo Land & Naval Defence Electronics (ITALY)
 Leonardo UK (UK)
 LFD (UK)
 LightPath Technologies (USA)
 Liteye Systems (USA)
 LKD Aerospace (USA)
 Meopta - optika (CZECH REPUBLIC)
 Military & Law Enforcement Technologies (AUSTRALIA)
 Militrans (ISRAEL)
 Miltrade Technologies (SINGAPORE)
 N-Vision Optics (USA)
 Newcon Optik (CANADA)
 Night Optics USA (USA)
 Night Vision Experts (USA)
 Night Vision Gear UK (UK)
 Nightline (USA)
 Nivisys (USA)
 Northrop Grumman (USA)
 Novosibirsk Instrument-Making Plant (RUSSIA)
 Obzerv (CANADA)
 OIP Sensor Systems (BELGIUM)
 Opgal Optronics Industries (ISRAEL)
 Ophir Optics LLC (USA)
 Ophir Optics SRL (ROMANIA)
 Ophir Optronics Solutions (ISRAEL)
 Optikos (USA)
 Optix (BULGARIA)
 Opto-Knowledge (USA)
 Own the Night (Lceo LLC) (USA)
 Oxley Group (UK)
 Page Aerospace (UK)
 PCO (POLAND)
 Photonic Optische Geräte (AUSTRIA)
 Photonis France (FRANCE)
 Photonis Netherlands (NETHERLANDS)

Photonis USA (USA)
 Pleora Technologies (CANADA)
 POG Precision Optics Gera (USA)
 Premier Electronics Ltd (UK)
 Pro Optica (ROMANIA)
 QinetiQ (UK)
 Qioptiq Singapore (SINGAPORE)
 Rafael Advanced Defense Systems (ISRAEL)
 Raptor Photonics (UK)
 Raytheon UK (UK)
 Remote Ocean Systems (USA)
 Rheinmetall Defence Electronics (GERMANY)
 Rheinmetall Nordic (NORWAY)
 Rockwell Collins (USA)
 Safran Electronics & Defense (FRANCE)
 Scandinavian Avionics (DENMARK)
 SCD - SemiConductor Devices (ISRAEL)
 SCHOTT Government Services (USA)
 Seraphim Optonics (ISRAEL)
 slnfrRed (SINGAPORE)
 SRI International (USA)
 Steiner Defense (USA)
 Synectics (UK)
 Target Group (TURKEY)
 Technical Consultants International (ISRAEL)
 Teledyne Imaging Sensors - Scientific & Tactical Camera Products (USA)
 Telops (CANADA)
 Theon Sensors (GREECE)
 Thermal Beacon (ISRAEL)
 TNO (NETHERLANDS)
 Vector Developments (UK)
 Vectronix (SWITZERLAND)
 Vistar Night Vision (UK)
 Wilco International (FRANCE)
 Xenics (BELGIUM)
 Yunnan Olightek Opto-Electronic Technology (CHINA)

Ground vehicle driver goggles

Adams Industries (USA)
 Allen-Vanguard UK (UK)
 Aselsan (TURKEY)
 Aspect Technology & Equipment (USA)
 ATN (USA)
 Aurora Tactical (USA)
 BAE Systems Electronic Systems (USA)
 Beck Optronic Solutions (UK)
 Bharat Electronics (INDIA)
 Britannia 2000 (UK)

SUPPLIERS

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Frank Kraft, Owner

AeroComputers

2889 West Fifth Street, Suite 111,
Oxnard, CA 93030, USA
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Tel: +1 805 985 3390 x107
Fax: 984 8782
Mike Thompson, East Coast/
Government Sales

Aeromaoz

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Tel: +972 3 609 5003
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Marc Steinberg, Mktg Mgr

Aeronautical & General Instruments

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sales@agilttd.co.uk
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Fax: 685 670
Mark Beisley, Bus Mgr Naval Avn

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www.aerospacedefenceproducts.com.au
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David Coleman, MD

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26120 Chabeuil, FRANCE
contact.direction@aerotecgroup.com
www.aerotecgroup.com
Tel: +33 4 75 852 992
Fax: 619 320
Paul Rossini, CEO

AFCEA International

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Fax: 631 6169

AGM Container Controls

3526 East Fort Lowell Road,
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agmwebsales@agmcontainer.com
www.agmcontainer.com
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Fax: 881 4983

AIM Infrarot-Module

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Fax: 6212 929
Herbert Korf, MD

Aimpoint AB

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213 75 Malmö, SWEDEN
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Jonas Ardemalm, Dir Sales & Mktg

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lothar.belz@airbus.com
http://airbusdefenceandspace.com
Tel: +49 89 3179 0
Lothar Belz, Hd Media Rel CIS

L3 Electrodynamics

3975 McMann Road,
Cincinnati, OH 45245, USA
edi.info@l-3com.com
www.2l-3com.com/edi
Tel: +1 513 943 2000 Fax: 943 2050

L3 Electron Tube Operations

1215 S 52nd Street,
Tempe, AZ 85281, USA
www.insighttechnology.com/ETO/
electron-tube-operations-eto
Tel: +1 480 968 4471

L3 EOTech

1201 E. Ellsworth,
Ann Arbor, MI 48108, USA
support.eotech@l-3com.com
www.eotechinc.com
Tel: +1 734 741 8868 Fax: 741 8221
Rod Coons, Dir US Sales

L3 Infrared Products

3414 Herrmann Drive,
Garland, TX 75041, USA
www.insighttechnology.com/IRP/irp-home
Tel: +1 972 840 5600

L3 Insight Technology

9 Akira Way, Londonderry,
NH 03053, USA
Service.Insight@L3T.com
www.insighttechnology.com
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Fax: 626 4888

L3 KEO

50 Prince Street,
Northampton, MA 01060, USA
keo.sales@L-3Com.com
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Tel: +1 413 586 2330
Fax: 586 1324
John Nixon, Dir Int'l Bus Dev

L3 Mission Integration

PO Box 6056, Greenville,
TX 75403-6056, USA
www.2l-3com.com/MID/index.htm
Tel: +1 903 455 3450
Fax: 457 4413
Lance Martin, Public Relations
Manager- Integrated Systems

L3 Sonoma EO

428 Aviation Boulevard, Santa
Rosa, CA 95403, USA
sales.sonomaeo@L3T.com
www.2l-3com.com/sonomaeo
Tel: +1 707 568 3000

L3 Unmanned Systems

6900 K Ave, Plano,
TX 75074-2527, USA
www.2l-3com.com/uas
Tel: +1 469 568 2376 Fax: 568 2100

L3 Warrior Sensor Systems

9 Akira Way, Londonderry,
NH 03053, USA
Service.Insight@L3T.com
www.L3T.com/warriorsensorsystems
Tel: +1 603 626 4800
Fax: 1 603 626 4888

**Warrior Sensor Systems**

L3 Warrior Sensor Systems is a global leader in the development and production of advanced night vision and electro-optical technology and systems for the US military, federal agencies, public safety and sporting communities, and international markets.

L3 Wescam

649 North Service Road West,
Burlington, ON, L7P 5B9, CANADA
sales.wescam@L-3com.com
www.wescam.com
Tel: +1 905 633 4000 Fax: 633 4100
Bill Swindall, Dir Intl Sales

Lambda Research

25 Porter Road,
Littleton, MA 01460, USA
www.lambdaresearch.com
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Michael Gauvin, VP Sales & Mktg

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AMOLED MICRODISPLAY

Technical parameters

Product Series	WVGA041(0.41inch)	SVGA050(0.5inch)	SVGA060(0.6inch)	SVGA097(0.97inch)	SXGA060(0.6inch)
Color Type	Full Color/Mono White/Mono Green				
Resolution	800 (×3) ×480	800 (×3) ×600			1280 (×3) ×1024
Operating Temperature	-40℃~+65℃				

Technical features

- Self-emitting
- Solid-state structure
- High brightness
- Wide temperature range
- High contrast ratio
- Low power consumption



WVGA041



SVGA050



SXGA060



SVGA060



SVGA097

