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MILITARY HELICOPTERS

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COVER: Two HH-60G Pave Hawk helicopters assigned to the 34th Weapons Squadron perform helicopter aerial refuelling over the Nevada Test and Training Range in December 2018. (Photo: USAF) **ABOVE:** The Brazilian Navy took delivery of the first of five Exocet-capable H225M (UH-15B) Super Cougars during 2018 as part of the H-XBR programme. (Photo: Helibras)



FEATURE PIECE

MILITARY HELICOPTER MARKET ANALYSIS

In a comprehensive market overview, *Shephard* examines the maritime subsector of the defence rotary-wing industry, focusing on regional developments and how major players are positioning themselves for ongoing and future programmes.

ABOVE: An MH-60S Seahawk with Helicopter Sea Combat Squadron 21 prepares to land during routine training as part of the Boxer Amphibious Ready Group in the eastern Pacific Ocean. (Photo: USMC)

MARKET ANALYSIS

Welcome to the 2019 edition of the *Military Helicopter Handbook*. Last year was a busy one for *Shephard* as we invested in and improved our reference content. As a result, we have now introduced this new market report section to our handbooks.

Drawing on data regarding orders, deliveries and unit costs that we've added to *Shephard Plus*, alongside our in-depth reporting throughout the year, each overview aims to provide a more detailed account of the relevant industry sector, covering major procurement programmes across the globe and providing insight into which companies are leading the market.

For the 2019 edition of the *Military Helicopter Handbook*, we are focusing on maritime platforms. Although this segment seems to be dominated by one OEM, there are major emerging requirements that could alter the balance of the sector.

This report is broken down into two main sections: a short overview of the global market covering in-production rotorcraft and then a summary of major procurement programmes by region.

MARKET OVERVIEW

The majority market share for helicopters currently on order

is owned by Sikorsky, whose CH-53K and UH-60M models account for 50% of total orders. European rivals Airbus and Leonardo comprise a further 34% through their own platforms and the jointly owned NHIndustries, which is delivering the NH90. Russian Helicopters has around 14%, the majority of which is for the Russian market, and Korea Aerospace Industries (KAI) has around 3%, again due to a large national programme for a marinised variant of the Surion.

Sikorsky's success is largely down to its MH-60R, which is relatively low-cost compared to other platforms. Furthermore, there are a substantial number of users of the previous-generation S-70B Seahawk that have previous experience of operating the platform through the US FMS process.

The market is continuing to evolve, however, and new requirements are emerging, particularly in Asia-Pacific where there are a number of programmes.

MARKET FOCUS: NORTH AMERICA

By far the largest programme for the US in terms of cost concerns the Boeing CH-53K King Stallion, a marinised heavy-lift helicopter that will replace the CH-53E in USMC

service, which was introduced in 1980. According to the marine corps, the project is worth nearly \$24 billion, and each rotorcraft currently has a flyaway cost of \$120 million, although this is expected to reduce to around \$100 million across the life of the programme.

A total of 194 aircraft are planned for procurement, although there are firms orders for just eight low-rate initial production (LRIP) examples. Once full-rate production is approved, this number will increase substantially – the service's budget shows quantities rising to 19 aircraft annually by 2022. The programme began LRIP in FY2017.

Sikorsky's MH-60R also continues to win orders. The type was first deployed in 2009, and 278 aircraft had been delivered by the end of 2018. After receiving its 278th example, the USN reached its acquisition objective, but in November last year, the OEM secured another \$382 million contract for an additional eight helicopters for the service, with delivery expected by 2020. This will extend the life of the production line, which was previously expected to close in 2019 if no more orders were placed.

In the longer term, the navy will also look to begin a replacement programme

was cancelled in mid-2018 on cost grounds.

Lastly, under a \$50 million contract that was signed in 2016, four of Peru's five SH-2G(NZ) Seasprites are being remanufactured and upgraded by Kaman to SH-2G(P2) standard. The fifth aircraft is being used for training.

The helicopters have served with the Royal Australian Navy, Royal New Zealand Air Force and USN, and have been rebuilt several times. Delivery of the first upgraded Seasprite was expected to occur in July 2018.

MARKET FOCUS: EUROPE

The dominant maritime helicopter programme in Europe is for the NH90 NFH (NATO Frigate Helicopter). Developed as a multinational programme between France, Germany, Italy and the Netherlands, the European NH90 was designed to meet NATO requirements for multirole capability from a common rotorcraft. The type was originally offered in two variants – the Tactical Transport Helicopter (TTH) and NFH – but a hybrid version is now entering service, known as the Maritime Tactical Transport (MTT).

France, Belgium, the Netherlands and Sweden

have received all of their NFH examples. Deliveries are ongoing for Germany, Italy and Norway.

Germany is procuring 18 NH90 Sea Lion NFHs to replace its in-service Sea King. The aircraft were ordered in 2013 through the NATO Support and Procurement Agency, and the maiden flight of the first helicopter took place in December 2016. The primary role of the new model will be SAR, although other missions could include reconnaissance, general transport duties and insertion and extraction of SF. The first three rotorcraft are set to be delivered in October 2019, and the rest will follow by 2022.

The Italian Navy has ordered 56 NH90s, of which 46 are in the NFH configuration. In January 2017, Leonardo delivered the first of ten NH90s configured to the MITT (Maritime – Italian Navy Tactical Transport) standard.

Norway's acquisition of a 14-strong NFH fleet has proven controversial as delays have led to criticism of the programme by the Office of the Auditor General. The last example will be delivered in 2022, 14 years later than was originally planned. Nevertheless, Norway is committed to operating the NH90 and

has ruled out any plans for an alternative procurement.

Elsewhere in the European market, Denmark's acquisition of nine MH-60R helicopters was completed in the summer of 2018.

For the UK, the primary focus is on upgrading its Leonardo Mk3/3A Merlin helicopters to Mk4/4A standard. The programme was signed in 2014 and is based on modifications to RAF Mk3/3A airframes. Structural and equipment changes include a new automated folding tail and main rotor as well as new avionics, a fast-rope system, roof-mounted chaff dispensers and a strengthened undercarriage to increase maritime durability.

The programme will also see the integration of a mission computer derived from the Leonardo AW159 Wildcat tactical processor and a communications suite based on the Merlin Mk2 communications control and intercom system that incorporates Mk4 radios and Mk2 navigation equipment. At full capacity, the Mk4/4A aircraft will be able to accommodate 24 mission-equipped troops or up to 16 stretchers.

The programme was initially scheduled for completion by December 2020, but this has been



SPECIFICATIONS

ROTORCRAFT

This section describes the main rotorcraft in military service, under development or on offer to military customers. Each aircraft is illustrated with a photograph and specifications including a description of current usage as well as technical data.

Entries appear alphabetically under the principal manufacturer holding design authority, unless otherwise stated.

- **Gross weight:** maximum all-up weight including internal load
- **Empty weight:** weight without fuel, crew, payload or weapons
- **Length:** normally fuselage length, occasionally with rotors running ('overall')
- **Payload:** maximum load either internal or external
- **Max speed:** VNE at sea level
- **Range:** typical sortie, still air
- **HIGE:** hover in ground effect
- **HOGE:** hover outside ground effect

If you think your product should be listed, please contact the team at reference@shephardmedia.com to ensure it appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: The active Mi-8MT/MTV fleet of the Ukrainian Army Aviation comprises 25-30 helicopters. (Photo: Ukrainian MoD)

Airbus Helicopters ▶ AS365 N3+ Dauphin

Airbus Helicopters developed the AS365 N3+ from the Dauphin series of medium, twin-turboshaft rotorcraft. The AS365 N3+ was launched at the 2009 Paris Air Show and was certified in 2010. It is the current production model for the AS365 family of helicopters. **Length:** 13.73m **Width:** 3.25m **Rotor diameter:** 11.94m **MTOW:** 4.3t **Empty weight:** 2.37t **Max load on sling:** 1,890kg **Max speed:** 155kt **Cruise speed:** 145kt **Range:** 792km **HOGE:** 3,773ft **HIGE:** 8,596ft **Crew:** 2 **Passengers:** 11



Airbus Helicopters ▶ AS565 Panther

The AS565 Panther is a medium-size, twin-engine helicopter that incorporates technologies derived from Airbus Helicopters' experience with the AS365 Dauphin family. It is an all-weather, multirole rotorcraft designed for operation in severe environments, including hot-and-high conditions, and ship-borne operations, including ASW and anti-surface warfare. The latest version is the AS565 MBe, which features an increased payload, folding main rotors and tail fin, Arriel 2N engines and new avionics. **Length:** 11.63m **Fuselage width:** 3.21m **Height:** 3.97m **Rotor diameter:** 11.94m **MTOW:** 4.5t **Empty weight:** 2.4t **Max speed:** 160kt **Cruise speed:** 143kt **Range:** 796km **Service ceiling:** 12,100ft **HOGE:** 8,200ft **HIGE:** 8,530ft **Crew:** 2 **Passengers:** 10



Airbus Helicopters ▶ H125M

The H125M (formerly the AS550 B3e Fennec) is a military version of the civil H125. The H125M is the latest evolution of the AS550 Fennec armed aerial scout family. The helicopter has a reduced radar signature through the use of composite materials and low IR-reflective paint. It is tailored for locating and attacking targets of opportunity, with hot-and-high capabilities. **Length:** 10.93m **Fuselage width:** 1.8m **Height:** 3.34m **Rotor diameter:** 10.69m **MTOW:** 2.25t **Empty weight:** 1.265t **Max load on sling:** 1.4t **Max speed:** 155kt **Cruise speed:** 134kt **Range:** 600km **Service ceiling:** 23,000ft **HOGE:** 11,000ft **HIGE:** 16,400ft **Crew:** 1 **Passengers:** 4



Airbus Helicopters ► H135M

The H135M (formerly known as the EC635) is a light utility variant of the EC135 twin-engine, multipurpose 3t helicopter. In addition to two pilots, the platform has seats for up to six passengers. The H135M can be equipped with Safran Helicopter Engines or Pratt & Whitney Canada powerplants – both are FADEC-controlled. **Length:** 10.2m **Fuselage width:** 1.56m **Height:** 3.62m **Rotor diameter:** 10.2m **MTOW:** 2.95t **Empty weight:** 1.53t **Max speed:** 140kt **Cruise speed:** 137kt **Range:** 650km **Service ceiling:** 20,000ft **HOGE:** 7,200ft **HIGE:** 10,000ft **Crew:** 2 **Passengers:** 6



Airbus Helicopters ► H145M

The H145M (formerly known as the EC645 T2) is the military version of the H145 medium-sized (3.7t) helicopter. It is marketed as a multirole platform for military forces, capable of performing special operations, airlift, SAR, casevac/medevac as well as armed scout and light attack missions. **Length:** 11m **Fuselage width:** 1.85m **Height:** 3.96m **Rotor diameter:** 11m **MTOW:** 3.7t **Empty weight:** 1.9t **Max load on sling:** 1.6t **Max speed:** 143kt **Cruise speed:** 130kt **Range:** 638km **Service ceiling:** 20,000ft **HOGE:** 16,800ft **HIGE:** 18,000ft **Crew:** 2 **Passengers:** 10



Airbus Helicopters ► H160

Airbus Helicopters unveiled a full-scale model of the H160 medium twin rotorcraft on 3 March 2015 at Heli-Expo. The utility helicopter, the first to be developed under the Airbus Helicopters identity, is being developed as a successor to the company's Dauphin family. First customer deliveries of the H160 are anticipated for 2019. In March 2017, the French MoD announced its intention to incorporate the H160 platform into the forefront of its modernisation programme. **Length:** 14m **Fuselage width:** 3.79m **Height:** 4m **Rotor diameter:** 12m **MTOW:** 5.67t **Max load on sling:** 1.6t **Max speed:** 175kt **Cruise speed:** 155kt **Range:** 850km **Service ceiling:** 19,350ft **HOGE:** 9,000ft **Crew:** 2 **Passengers:** 12



Leonardo Helicopters ▶ AW101

The AW101 – an evolution of the EH101 – is a three-engine, heavy helicopter that meets both military and civil mission requirements. The AW101 is equipped with a low-workload, NVG-compatible glass cockpit and fully integrated communications, navigation, avionics and flight and mission management systems. With the largest cabin in its class, the AW101 is able to carry up to 30 passengers and can be arranged in a variety of configurations to meet customer requirements. **Length:** 22.8m **Fuselage width:** 4.61m **Height:** 6.66m **Rotor diameter:** 18.6m **MTOW:** 15.6t **Empty weight:** 10.25t **Max speed:** 167kt **Cruise speed:** 150kt **Range:** 1,500km **Service ceiling:** 15,000ft **HOGE:** 4,800ft **HIGE:** 10,850ft **Crew:** 4 **Passengers:** 25



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EQUIPMENT

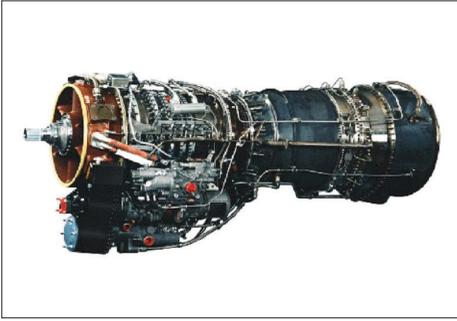
ENGINES

The following section provides data on a selection of powerplants produced for rotary-wing aircraft. Entries are shown in alphabetical order by manufacturer and engine model.

The specifications listed here are intended to provide a handy, at-a-glance reference of the engines produced by each manufacturer and the aircraft they are used on. It is by no means exhaustive given the large number of re-engining programmes currently under way by third-party companies. Manufacturers and agents can supply more information on request.

If you think your product should be listed, please contact the team at reference@shephardmedia.com to ensure it appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: The crew chief from a Black Hawk conducts final preflight checks as the crew prepares to fly the helicopter to northern Michigan following a severe winter storm. (Photo: Michigan National Guard)



The T64 is a turboshaft/turboprop engine that has now accumulated over 11 million flight hours of operation. (Photo: GE Aviation)

LTS101

The LTS101 was first certified in 1975. Since then, over 2,100 engines have been delivered to customers worldwide, logging over 11 million service hours. The engine underwent a redesign in 2001 with over \$30 million invested in upgrades. According to Honeywell, the LTS101 turboshaft engine's benefits include a potential 18% increase in helicopter value, 22% increase in OEI power meeting EASA standards and increased shaft horsepower. Length: 80.2cm Width: 63cm

T53

The T53 is a turboshaft engine, designed for use on helicopters and fixed-wing aircraft. More than 19,000 T53-series engines have been produced to date, powering an extensive list of military and commercial helicopters. After 60 years of service, the engine has achieved more than 62 million flight hours. Length: 121cm Width: 61cm Height: 61cm Weight: 247kg Cruise power: 1,800 mechanical hp

T55

The T55-GA-7 14A is a turboshaft in the 13kg/s airflow size class. Honeywell has produced more than 6,000 T55-series engines for military and civil use, and the type has accumulated more than 12 million service hours. Length: 120cm Width: 61.4cm Height: 61.7cm Weight: 376kg Cruise power: 4,800 mechanical hp

LHTEC – LIGHT HELICOPTER TURBINE ENGINE COMPANY

CTS800

The CTS800, the result of the LHTEC partnership between Honeywell and Rolls-Royce, provides power across a range of military and civil aircraft, including several versions of the Lynx family of helicopters, the AW159 Wildcat, the T625 and the T129 Atak attack helicopter. Additionally, the engine family has powered the Sikorsky X-2 Technology Demonstrator to its world record speed and has been installed in a number of light- and medium-utility, scout and attack platforms. Specifications for the CTS-800-4N. Length: 122.2cm Width: 60cm Height: 72.9cm Weight: 185.1kg Cruise power: 1,280 mechanical hp

LYCOMING ENGINES

HIO-390-series- HIO-390-A1A

The Lycoming HIO-390-series engines are six-cylinder, direct-drive, horizontally opposed, air-cooled models. Length: 79.66cm Width: 87cm Height: 50.73cm Weight: 134kg Cruise power: 158 mechanical hp

O-360 Series

The Lycoming O-360-series engines are four-cylinder, direct-drive, horizontally opposed, air-cooled models. There are 167 different models within the O-360 series. The power of the engine series ranges from 109kW to 168kW, with the basic O-360 operating at 134kW. The O-360-J2A variant has been installed on the Robinson R22 and has lightweight cylinders and a reduced power rating, making it suitable for installation on rotorcraft. Length: 75.72cm Width: 84.43cm Height: 58.4cm Weight: 132kg Cruise power: 225 mechanical hp

O-540 Series

The Lycoming O-540-series engines are six-cylinder, direct-drive, horizontally opposed, air-cooled models. The engine is the six-cylinder version of the four-cylinder Lycoming O-360 series. The O-540 engines have been installed on a range of aircraft, including the Piper PA-31 Navajo and the Robinson R44 helicopter. Variants included in the O-540 series include the O-540-F1B5 and the IO-540-AE1A5. Length: 98.1cm Width: 87cm Height: 49.79cm Weight: 203kg Cruise power: 175 mechanical hp

MITSUBISHI HEAVY INDUSTRIES

TS1

The TS1-M-10 is a 900shp-class turboshaft engine which powers the Kawasaki OH-1 light observation helicopter used by the Japanese Ground Self-Defense Force. MHI was the prime contractor for the design and manufacture of the TS1-M-10. Development began in 1991, with the first flight in August 1996 and the first production engine certified by the Japan Defence Agency in 1999. Length: 149.9cm Width: 60.9cm Height: 151kg Cruise power: 940 mechanical hp

MOTOR SICH

D-136/D-136 series 1

The D-136 and D-136 series 1 turboshaft engines are used to power the Mi-26 and Mi-26T 'Halo' twin-engine transport helicopters, the world's largest rotorcraft. The engine's main features include low fuel consumption, high reliability, high power, easy maintenance and good maintainability. Length: 371.5cm Width: 112.4cm Height: 138.2cm Weight: 1,077kg Cruise power: 8,382 mechanical hp

MTU AERO ENGINES

MTR 390

Jointly developed by MTU, Rolls-Royce and Safran Helicopter Engines, the MTR 390-2C powers the Tiger attack helicopter. ITP joined the programme for the development of the MTR 390 Enhanced. The

engine is based on a modular architecture (gearbox, gas generator, power turbine) and is the first engine with full condition-based maintenance. The two versions feature dual-channel FADEC and One Engine Inoperative 30-second emergency ratings. Overall, approximately 450 MTR390 series engines of both variants have been ordered. Collectively, these engines have achieved more than 180,000 flight hours. The specifications listed are for the MTR390-E. Length: 107.8cm Width: 44.2cm Height: 68.2cm Weight: 179kg Cruise power: 1,341 mechanical hp

MWFLY ENGINES

B22

The B22 is a four-cylinder, liquid-cooled, fuel-injected engine that has been developed specifically for light aircraft. The B22 is available in three variants (100hp, 122hp and 135hp) and are also available in two different displacements (2,200cc or 2,549cc). Standard equipment of the B22 includes an integrated oil tank, dual ignition, thermostat, coolant expansion tank and an electric starter with relay, alternator and rubber mount elements. Length: 56.8cm Width: 75.8cm Height: 45.1cm Weight: 83.6kg Cruise power: 135 mechanical hp

PBS VELKÁ BÍTEŠ

TS100

The PBS TS100 is a turboshaft engine designed for light helicopters and UAVs. It has a maximum continuous power mode of 160kW, and the engine can be operated in cold temperatures below -30 °C without preheating. Length: 82.9cm Width: 33cm Height: 39.8cm Weight: 56.7kg Cruise power: 215 mechanical hp

PRATT & WHITNEY

JTFD12-4A

The Pratt & Whitney JTFD12-4A is a turboshaft engine that was used to power the Sikorsky S-64E Skycrane helicopter. The JTFD12-4A is the civil variant of the T73-P-1 military engine. The JTFD12A-5A (which had an increase in power) was used for the Sikorsky Skycrane S-64F and was the civil equivalent of T73-P-700. Length: 271.78cm Weight: 417.3kg Cruise power: 4,500 mechanical hp

PRATT & WHITNEY CANADA

PT6B family

The initial models in the PT6B series were derived directly from the PT6T TwinPac engine. The PT6B-37A has automatic fuel control and an electronic power turbine governor with a manual back-up – a feature claimed to be unique for single-engine operations. The 1,000shp-class single-engine configuration has been produced in six models. More than 697 PT6B engines power aircraft in service with 160 operators in 41 countries, having accumulated more than 2.31 million flying hours in applications such as HEMS, business and utility operations. Length: 150.4cm Width: 49.5cm Height: 89cm Weight: 172.36kg Cruise power: 900 mechanical hp

PT6C family

The PT6C family is designed for the new generation medium-class helicopters and tiltrotors. This 1,300-2,000shp-class engine series has been produced in four models and is utilised for a range of applications including oil exploration, HEMS, maritime patrol, business and utility operations. In May 2017, P&WC delivered its 2,000th PT6C-67C to Leonardo Helicopters. The PT6C-67E engine, which powers the Airbus H175, is currently flown by eight operators in five countries, and the fleet leader has some 2,200 hours of flight. There have been no in-flight shut downs or basic unscheduled removals reported for the engine. Specifications shown are for the PT6C-67A. Length: 165.1cm Width: 63.5cm Height: 55.9cm Weight: 270kg Cruise power: 1,940 mechanical hp

PT6T family

The PT6T TwinPac engine has powered medium-class helicopters for four decades. The 1,800-2,000shp class twin-power engines have been produced in 11 models, and power aircraft in service with 360 operators in 99 countries. More than 7,260 PT6T engines have been produced since the family entered service in the 1970s, accumulating more than 43.7 million flying hours in applications such as oil exploration, EMS, maritime patrol and utility operations. Length: 167.64cm Width: 110.49cm Height: 82.8cm Weight: 308kg Cruise power: 1,875 mechanical hp

PW200 Family

The PW200 series are 500-700shp-class engines designed for light twin helicopters. The series includes 12 models that have been applied to a wide range of applications. PW200 engines power aircraft in service with 821 operators in 82 countries with more than 5,300 engines produced since the family entered service in the 1990s. The engines have accumulated more than 11.5 million flying hours in EMS, utility, law enforcement, business and other operations. Specifications shown are for the PW206C. Length: 91.186cm Width: 55.88cm Height: 55.88cm Weight: 107.501kg Cruise power: 560 mechanical hp

PW207K

The PW207K is a turboshaft engine, designed by Pratt & Whitney. In June 2001, it was announced that Pratt & Whitney Canada had sold 20 PW207K engines to Kazan Helicopters for installation on the new Ansat light twin-engine helicopter. Kazan Helicopters reportedly selected the PW207K engine, a growth derivative of the PW206C engine, for the Ansat because of its efficiency, reliability and cost-effectiveness. Length: 160cm Width: 75cm Height: 62cm Weight: 107.5kg Cruise power: 646 mechanical hp

PW210 family

The PW210, P&WC's 1,000shp-class engine family, is designed for single and twin-engine helicopters with improved fuel burn, power-to-weight ratio, environmental emissions and operating economics, whilst being durable and reliable. The PW210 is flown by 59 operators in 22 countries. The PW210S powers the Sikorsky S76D helicopter, while the PW210A powers the AW169 helicopter from Leonardo. Length: 111cm Width: 50.038cm Height: 59.69cm Weight: 162.4kg Cruise power: 900 mechanical hp



EQUIPMENT

INTEGRATED MISSION SYSTEMS

A selection of offerings from the major companies that integrate military mission systems into rotorcraft. Helicopter manufacturers are capable of completing this kind of work, but are increasingly partnering with outside systems houses such as those listed here. The entries in this section include examples of their work, which is tailored to the requirements of individual customers.

Entries are arranged alphabetically by company name.

If you think your product should be listed, please contact the team at reference@shephardmedia.com to ensure it appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: A US Army pilot prepares to fly an AH-64 Apache helicopter for aerial gunnery qualification on Schofield Barracks, Hawaii, in November 2018. (Photo: US Army)

AERONAUTICS

LRS

The Launch and Recovery Station (LRS) is a compact, transportable UAV GCS used to operate the aircraft during opening and closing stages of a mission. Together with the main GCS and UAV itself, the LRS forms an integral part of the system. The LRS is usually deployed close to the runway to maintain line-of-sight radio and visual contact with the aircraft.

AIRBUS DEFENCE & SPACE (GERMANY)

Sferion

As a pilot assistance system, Sferion is designed to raise awareness of the current situation and supports decisions relevant to the flight. This is especially in extreme conditions with poor visibility such as darkness, fog, brownout and whiteout. Sferion offers mission and navigation support, as well as reliable obstacle detection in real time, and pilot assistance during all flight phases. The possibility to record, transfer and analyse flight and mission data completes the Sferion portfolio.

ASTRONAUTICS CORPORATION OF AMERICA

Tactix

Tactix is a modular tactical mission system for airborne applications. It provides full situational awareness and combined presentation of route, threats avoidance zone targets, terrain-related information, and full airborne tactical view of the combat arena, based on ship sensors and data-linked information.

BAE SYSTEMS

ISTAR UAV Ground Station

ISTAR UAV Ground Station is a UAV mission management system that enables force management needs from individual sorties to larger, collaborative operations.

COLLINS AEROSPACE

Flight2

The Flight2 integrated flight and mission management system provides increased situational awareness that enables reduced pilot workload, while enhancing flight safety and improving mission effectiveness. This fielded and combat-proven suite provides an integrated primary flight display, engine indicating and crew alerting system, flight management, communications management, vehicle management and mission management. Mission management capabilities include integrated EO/IR sensor, digital maps, data link and self-defence systems.

CONTROP PRECISION TECHNOLOGIES

FPD-1

The FPD-1 is a ruggedised, flat-panel colour TV display with high brightness, developed for rotary- and fixed-wing aircraft. The Super VGA display comes in LCD active matrix (TFT) screen sizes and is compatible to operate at altitudes of up to 20,000ft. Length: 30cm Width: 23cm Height: 10cm Weight: 5.3kg

FPD-2

Larger than the FPD-1, the FPD-2 is also a ruggedised, high-brightness, flat-panel colour TV display developed for rotary- and fixed-wing aircraft. The FPD-2 is also suitable for other applications. The flat-panel monitor is for use with air, land and naval platforms and applications. The Super VGA display comes in LCD active matrix (TFT) screen sizes that are capable of operating at altitudes of up to 20,000ft. Length: 14.8cm Width: 22cm Height: 16.5cm Weight: 3.7kg

CURTISS-WRIGHT DEFENSE SOLUTIONS

Mission Displays Family

The Mission Displays Family offers a wide range of multifunction rugged LCD displays for rotary- and fixed-wing aircraft. The HD displays are designed for use with FLIR and long-range daylight video cameras, moving maps, computers and radar. All avionics displays offer high quality functionality. This includes multiple video inputs, VGA inputs, picture-in-picture facility, video freeze frame, digital zoom and internal NVG filters that eliminate the need for external NVG filters.

MPMC-9105

The MPMC-9105 Mission Computer is one of the smallest members of Curtiss-Wright's integrated subsystems family of application-ready COTS systems. It is designed for avionics requirements, providing a set of ten, coupled to Intel dual and quad-core processors alongside up to four SSDs. Packaged in a compact form factor, the MPMC-9105 integrated system is suitable for both low-power systems and high-performance computing.

MPMC-9335 Mission Computer

The MPMC-9335 rugged mission computer system uses packaging techniques, to provide the processing power of the latest quad-core Intel-based SBC and Nvidia Fermi GPU in a rugged enclosure that measures 250in. The MPMC-9335-0001 3U OpenVPX three-slot baseplate-cooled COTS product, is a flexible processing system that can be configured to meet the needs of any military or aerospace requirements. From benign laboratory to harsh deployed airborne vehicle environments.

Parvus DuraMAR 5915

The Parvus DuraMAR 5915 is a rugged COTS Cisco IOS-managed secure mobile network router. It integrates Cisco's 5915 Embedded Services Router (ESR) card in a rugged chassis suitable for harsh military and civil vehicle/aircraft installations. The 0X model series, MAR-5915-0X, is a standalone variant with a total of five Ethernet ports.

Parvus DuraNET 30-2020

The Parvus DuraNET 30-2020 is a rugged 19-port Cisco IOS-managed Layer 2 network switch. It integrates Cisco's ESS 2020 Embedded Services Switch technology with an isolated MIL-STD-1275/704 power supply in an IP67 dust/waterproof sealed aluminium chassis, with MIL-DTL-38999 connectors. Parvus DuraNET 30-2020 is designed for SWaP-sensitive harsh military and civil environments. The unit provides LAN switching capabilities with secure access and easy manageability.

VMS

The Video Management System (VMS) offers surveillance solutions for rotary- and fixed-wing aircraft. VMS includes

ugged displays, video distribution and recording equipment. According to the company, the system is scalable, interoperable and easy to install and reconfigure. VMS has been fielded in a range of applications, including SAR and border patrol.

ELBIT SYSTEMS

CNR-9000/9000HDR

The CNR-9000/9000 HDR is a multi-mode VHF/FM, COMSEC/ECCM radio system for voice and data communications. Capabilities include an extended communications range and error correction codes, along with automatic data rate adaptation. Equipped with MANET capability and IP-based communications, the HDR enables real-time video transmission as well as tactical e-mail, file transfer and Voice over IP (VoIP) services. The frequency-hopping radio also features a menu-driven MMI.

Helic³om

Helic³om is a fully digital, integrated C3 and mission management system designed to provide crew with data communications and accurate, real-time tactical pictures. The modular system was designed to grow as needs evolve from a single helicopter, to a formation, to an air force. Installed in a variety of platforms, Helic³om was developed by active pilots whose combat experience is incorporated into all facets of the system.

Helicopter Mission Systems

Elbit Systems' helicopter modernisation activities are focused on upgrading existing utility and attack platforms, supplying systems for latest-generation aircraft, converting utility and assault helicopters into multi-role platforms, and providing full maintenance and support. The company can act as a prime contractor, systems integrator, component supplier or as sub-contractor to local industry. The use of open-architecture technology is designed to increase modularity and upgrade paths.

LEAP

Elbit developed the Light Enhanced Armament Package (LEAP) to convert utility helicopters into multirole platforms capable of performing a variety of missions such as attack, close-support, self-defence, troop evacuation, CSAR and reconnaissance. According to Elbit, the ability to easily convert a helicopter from peacetime utility missions to armed missions provides a life-cycle cost saving.

ELBIT SYSTEMS EW & SIGINT - ELISRA

ASARS-C

The Airborne Search and Rescue System (ASARS) consists of the ARS-700G installed in CSAR aircraft. This communicates with personal survival radios (PSRs) such as the PRC-434 family, and is also compatible with the PRC-112 family and other NATO rescue systems, air, ground and naval. It offers range measurement from 360° DF capability and up to 200km range.

CQ1 Kneebord/Handheld Airborne CSAR Interrogator

The CQ1 is a compact, lightweight PLS based on a ruggedised tablet PC running Windows XP Professional OS, in a configuration optimised for rugged, wearable kneeboard requirements. The CQ1 interfaces to the

aircraft intercom system via the integral helmet connector, enabling the aircrew to locate survivors by means of GPS, geo-location data and text messages. This is processed by a dedicated modem and displayed on a moving map.

ETEP

DTMUX DVR

The DTMUX Digital Video Recorder (DVR) is designed for airborne video surveillance, including SAR or other video recording needs. It provides full HD 1080p, H.264 or MJPEG 2000 compression. The DTMUX DVR also allows users to simultaneously record and replay one HD, or record one to four HD video channels with post replay. Width: 14.5cm Height: 8.6cm Weight: 2kg

DTMUX M

The DTMUX M is a mission airborne data recorder designed for adding digital video, audio and data recording functionality in new and legacy airborne platforms. It offers easy plug-in integration in the cockpit side panel. DTMUX M also enables recording of a range of signals like video/audio channels (H.264 or JPEG 2000 Wavelet compression) in Full HD 1080p or lower (PAL/SECAM). Width: 12.7cm Height: 7.62cm Weight: 1.3kg

DTMUX M2

The DTMUX M2 mission recorder is designed for cockpit installation with quick access to the memory cartridge for post-flight analysis. It is capable of recording HD video/audio, 720p/i or 1080p/i, or lower resolution PAL/NTSC. Additionally, it is able to record digital data bus (MIL-STD-1553, ARINC 429) and analogue data, such as strain gauges. The system features a lightweight, quick-access recorder, 8GB-256GB, full NVG/night/day compatibility, qualified MIL-SPEC for airborne use, panel mounted with DZUS fasteners and events marker. Width: 14.5cm Height: 8.32cm Weight: 1.4kg

DTMUX Nano

The DTMUX Nano is a small airborne data, voice and video recorder device with quick access from 4 to 256GB of solid-state disk memory. Mission purposes include surveillance and reconnaissance. The DTMUX Nano is capable of recording many parameters in reduced volume and record simultaneously analogue/digital, video and audio data. Width: 11.2cm Height: 6.85cm Weight: 1kg

NanoS2

The NanoS2 acquisition system combines a data concentrator and a compact flight test recorder, which provides modularity and permits stacking of 12 data acquisition modules by unit in the same device. A unit is comprised of a CPU module with a recording capacity of 8-256GB or a CPU module without storage function, and a power supply module. Length: 11cm Width: 11.2cm Height: 27.2cm Weight: 2.8kg

Sentinel - ED-155

The Sentinel is an integrated flight data recorder system for ED-155 standard requirements. It has the capability for data audio and airborne image recording in a single lightweight device for turbine aircraft weighing less than 5,700kg. Its specifications are two audio channels, two video channels, optional internal sensors for three-axis gyro, three-axis g sensor, air pressure sensor, aircraft data



EQUIPMENT

COMMUNICATIONS SYSTEMS

This section features a selection of voice and data communication systems optimised for use on helicopters.

Information has been supplied by the manufacturers.

If you think your product should be listed, please contact the team at reference@shephardmedia.com to ensure it appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: A special missions aviator from 41st Rescue Squadron takes notes on a radio interface system at Moody AFB, Georgia. (Photo: USAF)

EXTANT AEROSPACE

IDM

The Improved Data Modem (IDM) is described as a flight-proven, off-the-shelf system that provides an open-architecture, multipath approach to situation awareness in the cockpit. The system is designed to improve utility and service life on existing military radio equipment.

IDM-501/IDM Junior

Originally designed for UAV applications, the IDM-501 also fits into fighter/attack aircraft and helicopters. IDM-501 has the same capabilities as existing IDM systems. Its features include four channels of digital data communications, multiple protocols of AFAPD, TACFIRE and IDL, identical aircraft interfaces and the PRISM option for imagery. However, it is half the size, half the weight and generates less than half the heat.

FLIGHTCELL INTERNATIONAL

DZMx

The Flightcell DZMx is an all-in-one hybrid satellite and cellular system for global voice, data and aircraft tracking. The Mil-Spec device supports Iridium PTT, provides HF and features low-cost cellular tracking, according to the company. The interface is designed to be easy to use with a soft touch, backlit silicone keypad, mis-key prevention guard, convex keys for gloved operation and an LCD menu. Additionally, the keypad and LCD backlighting is NVIS A/B NVG-compliant. Length: 12cm Width: 12.5cm Height: 5.5cm Weight: 0.65kg

Iridium Cradle

The Flightcell Iridium Satellite Phone Cradle is a lightweight alloy frame, designed for the US military and rated to 16+G for military use. The cradles support 9505/9505A, 9555 satellite and extreme phones. Direct power source charges the handset and phones clip into place with a quick release mechanism. To enable network integration, they include an inbuilt antenna connector, data and power supply connections. Length: 6.5cm Width: 7.23cm Height: 22.2cm Weight: 0.795kg

HARRIS

Harris Airborne Multi-Channel Radio (HAMR)

The Harris Airborne Multichannel Radio (HAMR) is a two-channel wideband radio designed to deliver voice, high-speed IP-networked data and full-motion video. It uses VHF/UHF networks to provide air-to-air and air-to-ground communications. HAMR enables interoperable communications between multiple waveforms and radios, including the entire Harris Falcon family of radios. The HAMR solution repackages two Falcon III AN/PRC-152A radios into an airborne form factor in the same SWaP as a traditional, single-channel airborne radio. Weight: 5kg

HARRIS COMMUNICATION SYSTEMS

ADRA Bowman VHF/Centaur

The Advanced Digital Radio Airborne (ADRA) provides a Bowman VHF radio capability to helicopters and fixed-wing aircraft. It is fully compatible with the Bowman VHF ground radio (advanced digital radio ADRA+ - see separate



Part of the E-Lynx family, the tactical networking MCTR-7200 Military IP Radio delivers high-speed broadband data communication to the battlefield. (Photo: Elbit Systems)

entry) and the Bowman VHF portable transceiver. The system also provides secure anti-jam voice and data facilities, as well as operates in a shared voice/data environment using carrier sense multiple access techniques. Length: 10cm Width: 30cm Height: 14cm Weight: 3.2kg

HENSOLDT SENSORS

LTR 400

The LTR 400 is claimed to be the smallest and lightest Mode S/IFF transponder available worldwide. It is used for civilian ATC and military applications in order to recognise friendly units. The LTR 400 equipment set includes the transponder, the remote control and display unit. The set provides the capability of Mode S enhanced surveillance and extended squitter as defined in ED-73C, DO-260B and Mode S level 2 as defined in STANAG 4193. Length: 22.1cm Width: 13cm Height: 2.4cm Weight: 2.8kg

HONEYWELL AEROSPACE

Skyforce Sentinel

The Honeywell Skyforce Sentinel is a multi-function display system designed for emergency medical, executive and utility operations. The Sentinel uses a simple menu structure and clear display. It delivers vectored mapping, traffic and weather information, raster charts and flight plan overlays. In addition to basic functionality, the Sentinel can also deliver AIS data for those who operate in littoral environments. If required, EO/IR camera tracking for special role applications and display PAL/NTSC images, is also available.

IAI ISRAEL AEROSPACE INDUSTRIES

Combat Helicopter Upgrades

IAI Lahav led the development of the upgrade package for the Mi-8 and Mi-17 helicopters along with other IAI divisions. The package utilises subsystems which were designed for the Russian Mi-35 and Ka-52 attack helicopters. IAI Ramta is responsible for the installation design of the cockpit panels and various avionics systems, as well as adapting the cockpit to be NVG-compatible.

RAFAEL ADVANCED DEFENSE SYSTEMS

RAVNET-300

The RAVNET-300 is an integrated VHF/UHF voice and data network, supporting airborne combat operations. It is a multi-band, jam-resistant and multi-function communication system that is designed to provide instantaneous voice and high-capacity data communication between aircraft (air-to-air) and ground terminals (air-to-ground). Length: 29cm Width: 12.5cm Height: 17cm Weight: 7.5kg

RAYTHEON

AN/ARC-164

Raytheon's AN/ARC-164 UHF communications systems provide the US Department of Defense and NATO standard anti-jam UHF voice communications, in support of modern military operations. Raytheon has delivered more than 60,000 AN/ARC-164's over two decades. Width: 16.5cm Weight: 4.2kg

AN/ARC-231 Skyfire

The AN/ARC-231 Skyfire is an airborne VHF/UHF/LOS and DAMA SATCOM system. This system supports US DoD requirements for airborne, multi-band, multi-mission, secure anti-jam voice, data and imagery transmission. Additionally, it provides network-capable communications. Length: 25.22cm Width: 13.67cm Height: 14.94cm Weight: 6.59kg

ROHDE & SCHWARZ

R&S SDAR

The R&S; SDAR is a software defined airborne radio that extends the Rohde & Schwarz R&S; M3AR airborne radio family. The R&S; SDAR offers secure broadband voice and data communications for network centric operations, allowing customers to remain as flexible as possible. Length: 32.05cm Width: 9.044cm Height: 19.4cm

The AN/VRC-99A is a programmable, wideband, secure, open-architecture tactical communications system providing virtual circuit and datagram service.



SAAB

ACMS

Airborne Communications Management System (ACMS) is a control and display system for the management of aircraft communications and radio navigation equipment. It integrates digital audio and equipment control facilities. ACMS is integrated, military-qualified and civil-certified as well as flexible and future-proof. According to the company, communications can be configured for all management requirements in any aircraft. It features audio, radio and radio-navigation equipment management, enabling the generation, integration and management of aircraft audio warning signals. Weight: 1.9kg

THALES

ARC-6999 MMAR

The Multichannel, Multiband Airborne Radio (MMAR) repackages two AN/PRC-148 JTRS enhanced multi-band inter/intra team radios into an airborne-qualified air transport rack-style enclosure. It is targeted at airborne VHF/UHF communications/relay payload applications, and supports dual-independent radios or retransmission with cross-banding configuration. With integrated co-site filtering, the MMAR is well suited to reduce interference from other emitters on the platform.

NextWave

The TRA 6030-N NextWave is a VHF/UHF EPM airborne SDR terminal designed to increase operational capability across new and existing platforms. Covering the 30-600MHz band, it offers full joint/combined interoperability and enables new services and an extended communications spectrum. It supports data transmission rates of up to 250kb/s to enable network-centric warfare services, such as intranet, imagery on-demand, image transmission, video and tactical data link (LX16).

VIASAT

ViaSat Mobile Transceivers

ViaSat Mobile Transceivers and network are designed to provide improvements in situation awareness compared to the US Army/USMC legacy BFT system, through faster position location information rates and C2 communications across the battlefield. Paired with a scalable, adaptable network and ground infrastructure, tactical users are able to increase their situation awareness, send tactical messages, report enemy positions and prevent blue-on-blue fratricide.



EQUIPMENT

SENSORS

A selection of major electro-optical and infrared sensors, radars and sonar systems now in service on military helicopters or under development for rotary-wing applications.

Systems are listed in alphabetical order by manufacturer.

Equipment is split into three sections:

- EO and IR systems
- Radars
- Sonars

If you think your product should be listed, please contact the team at reference@shephardmedia.com to ensure it appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: An MH-60S Seahawk with Helicopter Sea Combat Squadron 21 prepares to land during routine training as part of the Boxer Amphibious Ready Group in the eastern Pacific Ocean. (Photo: USMC)

Star SAFIRE 275-HD

The Star SAFIRE 275HD is a lightweight and compact gimbal with all European content, single LRU for ease of installation and integration, digital HD output for all video channels and IMU for precise geolocation. The system, which can operate in all-weather conditions, can be delivered with EASA Form 1 certification. Height: 37.85cm Weight: 15kg

Star SAFIRE 380-HD

The Star SAFIRE 380-HD is a digital HD, gyro-stabilised single-LRU imaging system featuring six-axis stabilisation with high-magnification optics. Sensor and geospatial data are embedded within the digital video stream, eliminating the need for separate dedicated ports. The system has HD-SDI video channels with symbology overlay, an optional SWIR payload for expanded multi-spectral imaging and multiple laser payloads. The image processor core provides AGC, auto-focus, filtering, edge enhancement and optional real-time image blending. Width: 38cm Height: 47.5cm Weight: 45kg

Star SAFIRE 380-HDc

The Star SAFIRE 380-HDc is a stabilised HD imaging system, designed to maximise ground clearance on rotary aircraft. The image processor core provides image quality with AGC, auto-focus, filtering, edge enhancement and optional real-time image blending. Spotter optics extend DRI range and the SWIR sensor expands imaging capability in degraded visual conditions, penetrating through smoke, haze and pollutants. Width: 38cm Height: 35.3cm

Star SAFIRE 380-HLD

The Star SAFIRE 380-HLD is an all-digital HD system, which provides image stabilisation, long-range imaging, metadata embedded in digital video and laser target designation. Designed for military fixed-wing and helicopter operations, it is military-qualified and features six-axis stabilisation with high-magnification optics. The image processor core provides AGC, auto-focus, filtering, edge enhancement and optional real-time image blending. The system also features a single-LRU configuration, high bandwidth HD-SDI video channels with symbology overlay and multiple laser payloads.

Star SAFIRE HD

The Star SAFIRE HD is an all-digital, HD, gyro-stabilised imaging system. It is military-qualified and has six-axis stabilisation. The system includes megapixel thermal, daylight and low-light cameras with high-magnification optics, laser payloads and an integrated IMU for target location. The Star SAFIRE HD has high-bandwidth HD-SDI video channels with symbology overlays and multiple laser payloads. The image processor core provides AGC, auto-focus, filtering, edge enhancement and optional real-time image blending.

Star SAFIRE III

The Star SAFIRE III is a military-qualified COTS multi-purpose and gyro-stabilised airborne platform carrying seven payloads.

Talon

The Talon is a gyro-stabilised 9in turret that can be housed in a range of mounting positions. Designed to



The ARGOS-II HD airborne multi-sensor observation system features a continuous zoom HD multi-spectral camera and an HD Gen III TI. (Photo: Hensoldt Optronics)

meet mid-range RSTA mission requirements, it contains up to six payloads simultaneously including IR, colour CCD, EMCCD, laser pointer or illuminator, LRF and embedded IMU/GPS. The Talon is available in a multi or single LRU configuration, with workload reduction features such as scan mode, video auto tracking and auto gain/level. Weight: 14.5kg

Ultra 8500

The Ultra 8500 is a military-qualified, stabilised turret with triple payload capability. It is optimised for light to medium fixed- and rotary-wing aircraft. The system provides real-time automatic image optimisation, an embedded multimode autotracker and icon-based colour graphical overlay. Width: 22.9cm Height: 34.2cm Weight: 13kg

GENERAL DYNAMICS MISSION SYSTEMS**V-14HD**

With a five-axis gyro-stabilised gimbal assembly, the V-14HD is designed to provide 1080p HD imagery with high stability. The system's capture device, the Sony HDC-1500, provides high-colour clarity and resolution for improved target identification at long range. It includes five-axis stabilisation, HD imagery, interchangeable lens options and is easily integrated into existing systems.

V-14-HS

The V-Series offers gyro-stabilised EO/IR and HD gimbal systems, providing real-time, day and night situational awareness and long-range threat detection. With searchlight controls, laser illuminating and geo-pointing functions, the V-Series camera systems can help detect and identify entities, as well as determine if a threat is hostile. The V14-HS camera system includes a high-sensitivity 3CMOS sensor for high-contrast colour imagery in dark, misty and foggy conditions. The gimbal incorporates noise reduction, de-haze and IR-pass functions. Length: 50.8cm Width: 33cm Height: 12.7cm

V-14-LRx

The V-Series offers gyro-stabilised EO/IR and HD gimbal systems while providing real-time, day and night situational awareness and long-range threat detection. With searchlight controls, laser illuminating and geo-

Gyrocacm 15DS

The 15in Gyrocacm 15DS (Dual Sensor) integrates an MW cooled TI with high-resolution and three-chip colour CCD camera into a gyro-stabilised system. Along with day/night mission capability, the dual sensor offers 360°, 20:1 continuous zoom functionality and four-axis gyro-stabilisation for image clarity. A stable platform for aerial surveillance missions is also offered. The Gyrocacm 15DS interfaces with other sensor systems, including remote weapons, moving maps and DVR.

Gyrocacm 15HDIR

The 38cm (15in) Gyrocacm 15HDIR (High Definition IR) sensor is designed as a multi-mission surveillance system that allows law enforcement and military personnel to perform long-distance aerial surveillance. It integrates a high-resolution, HD, three-chip colour CCD camera and continuous zoom, midwave cooled TI capabilities. This four-axis, gyro-stabilised hybrid system produces a straight HD signal and an NTSC system signal.

Gyrocacm 15TS

The 38cm (15in) Gyrocacm 15TS (Triple Sensor) integrates four-axis gyro-stabilisation, advanced mid-wave cooled thermal imaging, a three-chip colour CCD camera and next-generation NV capabilities into one system. This configuration incorporates an auto-gated night vision camera, Gen IV intensifier (2000ma/lumen sensitivity). Options include remote viewing capabilities, geolocation, auto-tracking and scene lock.

Gyrocacm 9 Series

The Gyrocacm 9 Series provides all the functionality of a larger unit in half the weight and one third the volume. It is available in mid-wave cooled (9M) or long-wave uncooled (9L) thermal imaging configurations. Optional capabilities include HD colour, laser pointing, geolocation and an eye-safe laser rangefinder capable of ranging up to 20km from the observer.

INFIRNO

INFIRNO is a targeting and ISR sensor system. It introduces a modular two-level maintenance, designed with nine light replaceable units. Customers are able to swap, and reconfigure sensor payloads to meet specific mission requirements without moving the turret from the host platform. INFIRNO is applicable across ground, airborne and maritime platforms. It includes high-definition sensors, advanced image processing and multi-target track capabilities proven in Lockheed Martin's Sniper ATP and Apache M-TADS/PNVs.

M-DSA

M-DSA is the next step in the sensor modernisation of the M-TADS/PNVs system. Upgraded capabilities support more rapid target identification and coordination, as well as improve mission success and system reliability for Apache aircrews. M-DSA incorporates a laser rangefinder designator, inertial measuring unit (IMU) and extended range algorithms to increase M-TADS/PNVs designation and ranging possibilities. The upgraded sensor enables Apache pilots to see high-resolution, high-definition, near infrared and colour imagery on cockpit displays.



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SPECIFICATIONS

WEAPONS

This section features a selection of major weapon systems designed or adapted for use on helicopters. Although many of these systems can be mounted on air, ground or naval platforms, only helicopter applications are included in these listings. As most light, medium and heavy machine guns can be fired from a helicopter, only the weapons most widely deployed on pintle, fixed and pod mounts are described here.

The weapon systems specifications include:

- Air-to-air missiles (AAMs)
- Air-to-ground missiles (AGMs)
- Anti-ship missiles (ASMs)
- Guns, pods and turrets
- Rockets (guided and unguided)
- Torpedoes

Information has been supplied by the manufacturers.

If you think your product should be listed, please contact the team at reference@shephardmedia.com to ensure it appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: The AH-64E Apache helicopter ground crew members assigned to Task Force Tigershark, 16th Combat Aviation Brigade, load an AGM-114 Hellfire missile for a mission at Jalalabad Airfield, Afghanistan. (Photo: US Army)

Thales Air Defence Ltd (TADL) ▶ Starstreak AAM

The Starstreak AAM is a variant of the Thales hypervelocity SAM. The helicopter-fired ATASK (Air-To-Air Starstreak) was developed in combination with McDonnell-Douglas and Lockheed Martin between 1995 and 1998 specifically for use with the AH-64 Apache. **Length:** 1.4m **Diameter:** 130mm **Missile weight at launch:** 16kg **Range:** 6km



V.A. Degtyarev Plant ▶ 9M39 Igla-V

The 9M39 Igla-V ('needle') is a Russian infrared homing SAM adapted for helicopter use. It is an air-launched version of the Igla MANPADS whose US Department of Defense designation is the SA-18 and NATO reporting name is Grouse. **Length:** 1.69m **Diameter:** 72mm **Missile weight at launch:** 11kg **Range:** 8km



Air-to-ground missiles ▶ Denel Dynamics ▶ Ingwe

The Ingwe (leopard) is a multipurpose guided missile developed from the ZT3 family primarily for antitank purposes. Passive target acquisition, high countermeasure resistance and ease of use are claimed. The Ingwe was intended to supplement the older MILAN in service at the time. It was developed in the 1980s as a long-range antitank guided missile for South Africa's mechanised infantry vehicles, such as the Ratel IFV. **Length:** 1.75m **Diameter:** 127mm **Missile weight at launch:** 28.5kg **Range:** 5km



Denel Dynamics ▶ Mokopa

The Mokopa (Black Mamba) is a long-range precision-guided missile similar in concept to the Hellfire. Produced in South Africa and designed as an antitank weapon, the Mokopa is currently integrated onto the South African Air Force Rooivalk attack helicopters. **Length:** 1.995m **Diameter:** 178mm **Missile weight at launch:** 49.8kg **Range:** 10km



KBM ▶ 9M120 Ataka-V

An improved version of the 9M114, the 9M120 Ataka-V is a long-range antitank guided missile that is equipped with a tandem HEAT warhead. The 9M120 (NATO reporting name AT-9 'Spiral-2') uses laser-beam riding guidance, and is optimised for target engagements in visual conditions. Tracking is provided by the GOES-451M optronic payload. **Length:** 1.63m **Diameter:** 130mm **Missile weight at launch:** 35kg **Range:** 5km

**KBM ▶ 9M123 Khrizantema**

The 9M123 Khrizantema (NATO reporting name AT-15 'Springer') is an antitank missile, designed to engage slow and low flying aerial targets. The missile can be employed without the need for visual contact. Its targeting is provided via a millimetre-wavelength radar suspended on one of the underwing pylons of the helicopter. **Length:** 2.06m **Diameter:** 150mm **Missile weight at launch:** 46kg **Range:** 6km

**KBP Instrument Design Bureau ▶ Hermes**

Hermes is a two-stage supersonic missile designed for helicopters as well as fixed-wing strike aircraft. It is from a family of modularly-designed guided missiles capable of being fired from land, air or sea. A typical system includes missiles packaged in transport/launch tubes, control equipment, two launchers and maintenance equipment. **Length:** 3.5m **Diameter:** 210mm **Missile weight at launch:** 110kg **Range:** 20km

**KBP Instrument Design Bureau ▶ Vikhr**

The 9A4172K Vikhr-1 (AT-16) long-range ATGM is a large dual-purpose antitank/AAM. It is a Russian laser guided ant-tank missile launched from air, land or sea. The missile is designed to engage armoured ground targets that are equipped with explosive reactive armour, at a range of 8km when fired from a helicopter and 10km when fired from a fixed-wing aircraft. The 9 4172 Vikhr-1 missile was commissioned by Russian military service in 1995. **Length:** 1.5m **Diameter:** 130mm **Missile weight at launch:** 45kg **Range:** 10km





EQUIPMENT

PROTECTION SYSTEMS

The following helicopter-mounted protection systems are featured in this section:

- Armour
- Chaff, flare and decoy systems
- Integrated self-protection systems
- IR jammers
- Laser warning receivers
- Missile launch detectors and approach warners
- RF jammers
- Radar warning receivers

The systems are listed alphabetically by manufacturer. The data in these entries has been supplied by the manufacturers. Further information can be obtained by contacting companies directly.

If you think your product should be listed, please contact the team at reference@shephardmedia.com to ensure it appears in the Shephard Plus online database (shephardplus.com) and is included in the next print edition.

ABOVE: An Australian Army Tiger ARH performs a demonstration of its countermeasure-dispensing system at the Port Wakefield proving ground, South Australia. (Photo: Australian DoD)

area. ISBI has armoured over 20 helicopters for both civil and military customers in France, Russia and the US.

NORINCO

Aircraft Armor

Norinco Shanghai has developed bulletproof and anti-explosive technologies to armour aircraft by using a variety of armoured panels, lightweight composite materials and bulletproof structures. Norinco is able to upgrade various helicopters, transport aircraft and fighter jets.

PERMALI GLOUCESTER

Lightweight Armour Systems

Permalis uses advanced composite and ceramic materials to provide lightweight ballistic protection for helicopters. The materials used by Permalis include UHMWPE, aramids and ceramics. They provide protection levels against small arms to heavy machine gun fire. Armour panel constructions meet the requirements of FAR/CS25 and FAR/CS29. The company has developed an armour upgrade for the CH-47 Chinook helicopter that provides protection to both the cockpit and cabin areas. It is a modular system allowing for installations according to mission requirements. This equipment is in active service with the UK RAF and the Royal Netherlands Air Force.

PLASAN SASA

Lightweight Armor Airborne Solutions

Plasan's integrated solutions include modular, portable or fixed add-on armour kits. The company's installation kits can be used on multiple models of the same aircraft and offer shipping to remote locations, as well as rapid, on-site, mid-mission installation and on-the-fly repair.

PROTECH ARMOR SYSTEMS

Protech Helicopter Armour

Protech aircraft armour kits are designed and manufactured by Protech for a range of applications. Add-on armour kits can be customised to meet mission, weight and performance objectives for all types of light and AP threats. According to Protech, the lightweight composite design reduces the weight of the armour system while offering multi-hit ballistic performance. Protech's aircraft armour reaches the FAA requirements for fortified cockpit doors. Ballistic panels can be installed, and in most cases removed, by front-line personnel with no special tooling. Armour systems can also be transferred from one aircraft to another. Replacement panels are available, which eliminates the need to replace the full kit. Features of the aircraft armour kit include non-reflective polyurethane protective coatings, which provide slip-resistance; vertical burn resistance, which is FAA certified; and resistance to, and protection from, a variety of environmental and chemical situations and environments.

TENCATE ADVANCED ARMOR

Aircraft Armour

TenCate Advanced Armour designs 'built-to-print' and 'built-to-spec' ballistic protection panels, which can be

quickly installed or de-installed. Ballistic protection is achieved through the use of lightweight materials such as TenCate Liba CX or TenCate Ceratogo CX. TenCate Liba is a material made with pellets of silicone carbide or boron carbide. TenCate also provides whole-life support for ballistic protection products. Transparent armour is produced to protect the cockpit crew providing both protection and continued visibility. Pilot seat protection solutions can be integrated into various aircraft designs without impairing the operability of the equipment while protecting the crew against penetrating projectiles and against trauma sustained from turbulence and other environmental threats. TenCate's modular floors are installed with the use of QR-skewers and can be designed in collaboration with the platform OEM or be integrated into existing designs as a retro-fit application. Side doors and ramps can be integrated into the overall design of the flooring system to provide additional protection. Exterior aircraft protection solutions can be designed with radar-transparent armour which are created with system performance and centre of gravity in mind. 3D composite armour solutions can also be provided for the protection of engines and exhaust systems. These solutions are designed for extreme temperature performance. Ballistic protection is designed and produced in a dedicated aerospace EN91000-certified and NATO security cleared production site. TenCate has supplied kits for the AW101 from its facility in Vissenbjerg, Denmark.

CHAFF, FLARE AND DECOY SYSTEMS

ALLOY SURFACES

IRCM Flares

Alloy Surfaces' family of visually covert Special Material Decoy IRCM are designed to protect rotary-wing aircraft, fighters and transports from MANPADS and IR-guided AAMs in both reactive and pre-emptive dispensing scenarios. The M211 was developed under the US Army Advanced IRCM Munitions programme for helicopter protection and use in ALE-40/-45/-47, M130 and any CMDS capable of employment of countermeasures.

ARNOLD DEFENSE

SUU-25 F/A Flare Dispenser

The SUU-25 F/A flare dispenser is for use aboard high-performance aircraft to deploy LUU-1 or LUU-2 illumination rounds. The dispenser can carry eight rounds in four tubes, and uses two five-pin firing connectors through a stepping switch. A small explosive charge is used to eject the parachuted illumination round aft, behind the aircraft.

ASELSAN

CMDS

The Helicopter Countermeasures Dispensing System (CMDS) is designed to dispense chaff/flare decoys to protect helicopters against RF/IR-guided missiles. It comprises five LRUs: system control unit, dispense control unit, dispenser base, magazine and safety switch. The

CMDS dispenses 1x1 in IR or RF decoys. The system is also able to dispense each half of RR-180-type dual-chaff decoys independently, increasing the total number of RF decoys by a factor of two.

SPREAD

Self Protection Expendables Airborne Dispenser (SPREAD) is a countermeasures dispensing system that is designed to increase the survivability and mission effectiveness of airborne platforms against RF and IR threats. SPREAD is capable of operating with any RWR/LWR via MIL-STD-1553B data bus and discrete interfaces. It also has glass cockpit and NVG-compatible versions and is capable of dispensing 1x1 in chaff, 1x1 in dual chaff, 1x1 in flare, Multi-Blu-3 and other chaff/flare cartridges with similar dispensing characteristics.

BAE SYSTEMS

Chaff and Flare Cartridges

The BAE Systems family of chaff and IR expendables includes M206 207x25x25mm (0.04kg) IR decoy flare; MJU-x 264x74mm (0.4kg) IR decoy flare; RR-129/AL 147x36mm (0.23kg) chaff cartridge; RR-136/AL 196x40mm (0.09kg) chaff cartridge; RR-170/AL 207x25x25mm (0.03kg) chaff cartridge; RR-171/AL 31 m long (19kg) chaff roll; and RR-179/AL 19kg chaff roving bundle matching any frequency in A-L bands.

M130 General-Purpose Dispenser

The M130 General-Purpose Dispenser system provides survival countermeasures against radar-guided weapon systems and IR-seeking missile threats. Able to dispense 30 decoy flares or chaff cartridges manually or automatically, cued by the AN/ALQ-156(V) missile detector, the M-130 is electrically powered and constructed of modules to facilitate quick replacement. The M-130 dispenser consists of a dispenser assembly, payload module assembly, electronics module and dispenser control panel.

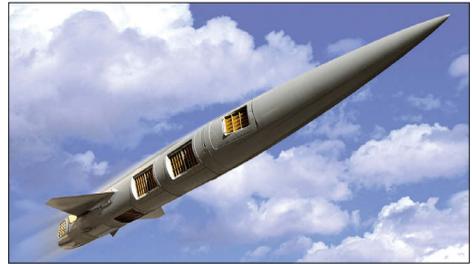
BAE SYSTEMS ROKAR

ACDS

The Advanced Countermeasures Dispensing System (ACDS) is a combat-proven computer-controlled airborne system that has capabilities for chaff, flare and decoy dispensing. Functioning as a standalone unit or integrated with an EW suite, ACDS includes a range of smart dispensers. The NVG-compatible mini-control and display unit provides display of the threat direction detected by EW sensors and generates an audio warning. The system interfaces with EW warning systems, aircraft avionics and smart dispensers of any type.

ADDS

The Advanced Digital Dispensing System (ADDS) is a computer-controlled, threat-adaptive CMDS for use on fast jets, helicopters, transport and maritime patrol aircraft. Via its cockpit control and display unit, ADDS can dispense chaff, flare, RF and future types of expendable payloads. ADDS operates in automatic, semi-automatic, or manual modes. It can fire dual-chaff cartridges that double the number of onboard stores per mission. In addition, ADDS can dispense multiple



The Advanced Countermeasures Dispensing System is a combat-proven computer-controlled airborne system that has capabilities for chaff, flare and decoy dispensing. (Photo: BAE Systems)

payloads simultaneously to provide a multispectral response or a stronger decoy signal when needed.

BHARAT DYNAMICS

CMDS

The Bharat Dynamics Counter Measures Dispensing System (CMDS) is an airborne defensive system providing self-protection to aircraft by passive ECM against radar-guided and IR-seeking AAMs and SAMs. Protection for the aircraft is achieved by misguiding the missiles by dispensing chaff and/or flare payloads.

CEIEC - CHINA NATIONAL ELECTRONICS

IMPORT & EXPORT

GT-1

The GT-1 is a countermeasures dispensing system that is capable of ejecting chaff (up to 68 cartridges) that covers 2-18GHz and flares (up to 32 cartridges) covering the 1.5-5µ IR waveband.

CHEMRING COUNTERMEASURES

Alloy Surfaces and Kilgore IRCM flares

Chemring Countermeasures develops and manufactures the Alloy Surfaces and Kilgore range of airborne IR flares that are compatible with most available dispensers on a variety of platforms. They form a family of visually covert, special material decoy IRCM designed to protect fighter, transport and helicopter aircraft from MANPADS and air-to-air IR-guided missiles in both reactive and pre-emptive dispensing scenarios.

Chaff and Flare Expendables

Chaff and Flare Expendables are standard and customer-specific IR and RF countermeasures, including aerodynamic, thrust and spectral flares in a variety of formats to counter missile threats. The solutions are compatible with most dispenser formats. Proprietary Modular Expendable Block is based on the need to increase the number of chaff salvos. The expendables can be used with a range of digital dispensers.

RR170 Chaff Cartridge

The RR170 Chaff Cartridge forms part of a defensive aids system to protect the host aircraft from passive



PRODUCTS

GUIDE TO SUPPLIERS

This section lists key companies supplying goods, services and equipment to the military helicopter 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 p127 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 please contact the team at reference@shephardmedia.com.

ABOVE: US Army paratroopers assigned to the 4th Infantry Brigade Combat Team (Airborne), 25th Infantry Division, jump from a CH-47 Chinook helicopter during airborne training at Joint Base Elmendorf-Richardson, Alaska, in November 2018. (Photo: USAF)

PRODUCTS

Accessories

3M Aerospace (USA)
 Aage Christensen (DENMARK)
 ACES Systems (USA)
 ADS (USA)
 Aero Telemetry (USA)
 Air Asia Company (TAIWAN)
 Air Covers (UK)
 Air Methods (USA)
 Airborne Industries (USA)
 Airbus Helicopters (FRANCE)
 All-System Aerospace International (USA)
 AmSafe Logistics & Support (UK)
 Armour of America (USA)
 ASE (ITALY)
 ASU Baltija (LITHUANIA)
 Aviall Australia (AUSTRALIA)
 Barum & Dewar (UK)
 Breeze-Eastern (USA)
 Bruggemann (GERMANY)
 Capewell Aerial Systems (USA)
 CFD International (USA)
 Concorde Battery (USA)
 Controp Precision Technologies (ISRAEL)
 Dakota Air Parts International (USA)
 DART Aerospace (CANADA)
 David Clark Company (USA)
 Dillon Aero (USA)
 DMS Technologies (UK)
 Downing Heliport Systems (USA)
 Drallim Industries (UK)
 EDMO Distributors (USA)
 Electronic Concepts & Engineering (USA)
 Emergency Beacon (USA)
 Emteq (USA)
 Euravia (UK)
 Executive Instruments (USA)
 Flight Helmet (USA)
 Flight Helmets Australia (AUSTRALIA)
 GSI International (USA)
 HAL - Hindustan Aeronautics (INDIA)
 Hawker Pacific (AUSTRALIA)
 Hawker Pacific Aerospace (USA)
 Hawker Pacific Middle East (UAE)
 Heli-Mart (USA)
 Helicopter Support (USA)
 Helylux Industries (FRANCE)
 Honeywell Aerospace (USA)
 HR Smith Group of Companies (UK)
 L3 Aviation Products (Grand Rapids) (USA)
 L3 Wescam (CANADA)

Linstol (USA)
 LKD Aerospace (USA)
 Luma Technologies (USA)
 MAC Aerospace (USA)
 Masley Enterprises (USA)
 Measurement Systems International (USA)
 Meeker Aviation (USA)
 Meggitt Sensing Systems (SWITZERLAND)
 Merit Apparel (USA)
 Motorflug Baden-Baden (GERMANY)
 MSA France (FRANCE)
 Nordam Transparency Division (USA)
 Onboard Systems International (USA)
 Ordtech Military Industries (SWITZERLAND)
 Oregon Aero (USA)
 Paravion Technology (USA)
 Parker Aerospace - Aircraft Wheel & Brake (USA)
 Parker-Hannifin Control Systems (USA)
 PM Research (USA)
 Polyformes (UK)
 Powervamp (UK)
 Pratt & Whitney Canada (CANADA)
 RBI Hawker (UAE)
 REB Technologies (USA)
 RF System Lab (USA)
 Rolin Industries (USA)
 Rotorcraft Services Group (USA)
 RTC Aerospace (USA)
 RUAG Aviation (SWITZERLAND)
 Saffran Helicopter Engines (FRANCE)
 Sandia Aerospace (USA)
 Sayre Enterprises (USA)
 ST Engineering Aerospace (SINGAPORE)
 StandardAero (CANADA)
 StandardAero- UK (UK)
 Switlik Parachute Company (USA)
 Thomas Jacks (UK)
 Triumph Integrated Systems - Geared Solutions (USA)
 United Design (ITALY)
 US Night Vision (USA)

Air Conditioning/ Temperature Control

Adams Aviation (UK)
 Advanced Cooling Technologies (USA)
 Air Comm Corporation (USA)
 Air Methods (USA)
 Ametek Aerospace & Defense (USA)
 DIMO (USA)
 Hawker Pacific (AUSTRALIA)
 Hawker Pacific Aerospace (USA)

Hawker Pacific Middle East (UAE)
 Honeywell Aerospace (USA)
 IAI North America (USA)
 Limco Airrepair (USA)
 Pacific Oil Cooler Service (USA)
 Pall Aeropower (USA)
 Paravion Technology (USA)
 Port-A-Cool (USA)
 Powervamp (UK)
 Ross Aviation (UK)
 ST Engineering Aerospace (SINGAPORE)
 United Rotorcraft (USA)

Aircraft Covers

Air Covers (UK)
 Cambrai Aircraft Covers (UK)
 Cocoon (USA)
 Dynatech International (USA)
 Lite Flite (DENMARK)
 Shield Technologies (USA)

Airframes

Airbus Helicopters (FRANCE)
 Airbus Helicopters Inc (USA)
 Aurora Flight Sciences (USA)
 AVIC - Aviation Industry Corporation of China (CHINA)
 Avicopter (CHINA)
 AVX Aircraft (USA)
 Babcock Mission Critical Services Australasia (AUSTRALIA)
 Bell Helicopter Textron (USA)
 Boeing Defense, Space & Security (USA)
 Changhe Aircraft Industries Corporation (CAIC) (CHINA)
 Denel Aviation (SOUTH AFRICA)
 Enstrom Helicopter (USA)
 HAL - Hindustan Aeronautics (INDIA)
 Harbin Aircraft Industry Group (CHINA)
 IAI North America (USA)
 Indonesian Aerospace (INDONESIA)
 KAI - Korea Aerospace Industries (SOUTH KOREA)
 Kaman Aerospace (USA)
 Kawasaki Heavy Industries - Aerospace (JAPAN)
 Leonardo DRS (USA)
 Leonardo Helicopters (ITALY)
 Leonardo UK (UK)
 MD Helicopters (USA)
 NHIndustries (FRANCE)
 Piasecki Aircraft (USA)
 PZL-Świdnik (POLAND)
 RUAG Aviation (SWITZERLAND)

Russian Helicopters (RUSSIA)
 Sikorsky, a Lockheed Martin Company (USA)
 ST Engineering Aerospace (SINGAPORE)
 Times Aerospace Korea (SOUTH KOREA)
 Turkish Aerospace (TURKEY)

Ambulance/Medevac Equipment

Aage Christensen (DENMARK)
 Adams Aviation (UK)
 ADS (USA)
 AEM (UK)
 Aerolite (SWITZERLAND)
 Airbus Helicopters (FRANCE)
 Astronics DME (USA)
 Bell Helicopter Textron (USA)
 Brief Relief (USA)
 Cantel (UK) (UK)
 Combat Medical (USA)
 Doctor Down (USA)
 Downing Heliport Systems (USA)
 Enviro Systems (USA)
 Essex Industries (USA)
 Life Support International (USA)
 LifePort (USA)
 Lifesaving Systems (UK)
 Lite Flite (DENMARK)
 Masimo (USA)
 MJ Cases (UK)
 REB Technologies (USA)
 S.O.S. Group (UK)
 Saffran Aerosystems (USA)
 Skedco (USA)
 Sloane Helicopters (UK)
 Spectrum Aeromed (USA)
 Switlik Parachute Company (USA)
 ZOLL Medical (USA)

Armour

3M Advanced Materials (USA)
 3M Technical Ceramics (GERMANY)
 Armor Australia (AUSTRALIA)
 ArmorWorks (USA)
 Armour of America (USA)
 ASU Baltija (LITHUANIA)
 BCA Ballistic Protection (BRAZIL)
 Bullet Proofing Technology (SOUTH AFRICA)
 CoorsTek (USA)
 IAI Golan Industries (ISRAEL)
 ISBI Armoring (COLOMBIA)
 Morgan Advanced Materials Composites and Defence Systems (UK)
 MTL Advanced (UK)

Norinco (CHINA)
 Permali Gloucester (UK)
 Plasan Sasa (ISRAEL)
 PPG Aerospace (USA)
 Protech Armor Systems (USA)
 Protective Group (USA)
 Rheinmetall Ballistic Protection (GERMANY)
 TenCate Advanced Armor (USA)

Associations

ADS Group (UK)
 AFCEA International (USA)
 AHS International (USA)
 American Helicopter Services and Aerial Firefighting Association (USA)
 Army Aviation Association of America (USA)
 Association of the United States Army (USA)
 Canadian Association of Defence & Security Industries (CANADA)
 Helicopter Association International (USA)
 ISBI Armoring (COLOMBIA)
 Military Officers Association of America (USA)
 National Defense Industrial Association (USA)

Cables and Connectors

Adams Aviation (UK)
 Aircraft & Commercial Enterprises (USA)
 Amphenol (UK)
 Avionics Technologies (USA)
 Click Bond (USA)
 Crestwood Technology Group (USA)
 FilConn (USA)
 HarcoSemco (USA)
 Isodyne (USA)
 ITT Enidine (USA)
 Kuerzi Avionics (SWITZERLAND)
 Lancer Systems (USA)
 Micro-Coax (USA)
 Mil-Base Industries (USA)
 QRP (USA)
 Senior Aerospace Metal Bellows (USA)
 Spectrum Technologies (UK)
 Staco Systems (USA)
 W.L. Gore & Associates (USA)
 W.L. Gore & Associates Cables (UK)
 Yulista Aviation (USA)

Communication Systems

Active Headsets (USA)
 Adams Aviation (UK)
 Advanced Helicopter Services (USA)
 Aerlyper (SPAIN)

Aero Telemetry (USA)
 Aerodata (GERMANY)
 Aeronautics (ISRAEL)
 Air Methods (USA)
 Airbus Defence & Space (France) (FRANCE)
 Airbus Defence & Space (Germany) (GERMANY)
 Airbus Defense & Space, Inc (USA)
 Alion Science and Technology (USA)
 Aselsan (TURKEY)
 Astron Wireless Technologies (USA)
 ASU Baltija (LITHUANIA)
 Aviall Australia (AUSTRALIA)
 Aviatech (USA)
 Avibras Industria Aeroespacial (BRAZIL)
 Avionetics (SWEDEN)
 Avionics Technologies (USA)
 Axnes Aviation (NORWAY)
 BAE Systems (UK)
 BAE Systems Electronic Systems (USA)
 BAE Systems Inc (USA)
 Ball Aerospace (USA)
 Becker Avionics GmbH (GERMANY)
 BECKER AVIONICS, Inc. (USA)
 Bharat Electronics (INDIA)
 Blue Sky Network (USA)
 Boeing Defense, Space & Security (USA)
 Bose (USA)
 Broadcast Microwave Services (USA)
 Cobham Aerospace Communications (USA)
 Cobham Antenna Systems Microwave Antennas (UK)
 Collins Aerospace (USA)
 Collins Aerospace ARINCDirect (USA)
 Collins Aerospace France (FRANCE)
 Collins Aerospace UK (UK)
 Controp Precision Technologies (ISRAEL)
 Cooper Antennas (UK)
 Cubic Global Defense (USA)
 Curtiss-Wright Avionics & Electronics UK (UK)
 Curtiss-Wright Defense Solutions (USA)
 Dallas Avionics (USA)
 David Clark Company (USA)
 Dayton-Granger (USA)
 Diehl Aerosystems (GERMANY)
 Domo Tactical Communications (DTC) (USA)
 Dynetics (USA)
 EDMO Distributors (USA)
 Elbit Systems (ISRAEL)
 Elbit Systems EW & SIGINT - Elisra (ISRAEL)

Elta Systems (ISRAEL)
 Emteq (USA)
 ENSCO Avionics (USA)
 Enterprise Control Systems (UK)
 Esterline CMC Electronics (CANADA)
 Esterline Palomar Products (USA)
 Extant Aerospace (USA)
 Flightcell International (NEW ZEALAND)
 General Dynamics (USA)
 General Dynamics Mission Systems (USA)
 General Dynamics UK (UK)
 Guardian Mobility (CANADA)
 Harris (USA)
 Harris Communication Systems (USA)
 Hawker Pacific (AUSTRALIA)
 Hayward & Green Aviation (UK)
 Headset Services (UK)
 HeliMedia (UK)
 Hensoldt Sensors (GERMANY)
 HISS (CANADA)
 HR Smith Group of Companies (UK)
 Hyundai J. Comm (SOUTH KOREA)
 IAI MLM Division (ISRAEL)
 IAI North America (USA)
 IMT - Integrated Microwave Technologies (USA)
 Indra Sistemas (SPAIN)
 Inmarsat (UK)
 Inter-Coastal Electronics (USA)
 Iridium Communications (USA)
 Jabil (USA)
 Jagid Management (USA)
 Kongsberg Defence & Aerospace (NORWAY)
 KVH Industries (USA)
 L3 Aerospace Systems (Greenville) (USA)
 L3 Aviation Products (Sarasota) (USA)
 L3 Communication Systems-West (Salt Lake City) (USA)
 L3 Telemetry & RF Products (Bristol) (USA)
 L3 Wescam (CANADA)
 Latitude Technologies (CANADA)
 Leidos (USA)
 Leonardo Airborne & Space Systems (ITALY)
 Leonardo DRS (USA)
 Leonardo Helicopters (ITALY)
 Lockheed Martin Rotary and Mission Systems (USA)
 Lockheed Martin UK (UK)
 MASS (UK)

Mercury Defense Systems (USA)
 Mercury Systems (USA)
 Merit Apparel (USA)
 M3 Cases (UK)
 Motorflug Baden-Baden (GERMANY)
 MSA France (FRANCE)
 N Systems (USA)
 Navtech Systems (UK)
 Northrop Grumman (USA)
 Optical Air Data Systems (USA)
 Rafael Advanced Defense Systems (ISRAEL)
 Raytheon (USA)
 Robinson Aviation (USA)
 Rohde & Schwarz (GERMANY)
 Saab (SWEDEN)
 Sanmina-Technology (USA)
 Scandinavian Avionics (DENMARK)
 Scotty Group (AUSTRIA)
 Scotty Tele-Transport Corporation (USA)
 Secure Communications Systems (USA)
 Sennheiser Electronic (USA)
 Sensor Systems (USA)
 Sierra Nevada Corporation (USA)
 SkyNet Satellite Communications (AUSTRALIA)
 Sloane Helicopters (UK)
 Specmat Technologies (USA)
 ST Engineering Aerospace (SINGAPORE)
 StandardAero (CANADA)
 Sunhillo (USA)
 Technisonic Industries (CANADA)
 Tecom Industries (USA)
 Telegenix (USA)
 Telephonics (USA)
 Teletonics Technology (USA)
 Textron Systems (USA)
 Thales Defense & Security (USA)
 Thales UK (UK)
 Times Microwave Systems (USA)
 Times Microwave Systems International (UK)
 Ultra Electronics Communication & Integrated Systems (UK)
 Uniflight (USA)
 Universal Avionics Systems (USA)
 Vislink (US) (USA)
 VT Miltope (USA)

Completions, Modifications, Upgrades
 AAR Airlift Group (USA)
 Advanced Helicopter Services (USA)

SUPPLIERS

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Frank Kraft, Owner

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Michael Phillips, Pres

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David Brody, Chmn/CEO

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