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ASIA PACIFIC'S LARGEST CIRCULATED DEFENCE MAGAZINE

SINGAPORE'S ARMED FORCES
ASIA-PACIFIC MAIN BATTLE TANKS
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CORVETTES AND OPVS
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Luke AFB, USAF

A pair of Royal Singapore Air Force AH-64 Apache helicopters launch from Gila Bend Air Force Auxiliary Field to conduct a Forging Sabre 2013 live-fire mission at the Barry M. Goldwater Range.

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Editorial

SEE THE TREES, NOT THE WOOD

Congratulations are in order to Bell Helicopter for the first flight of its tiltrotor V-280 Valor, which took to the air around 2pm on Monday 18 December, 2017 at the Bell plant where it has been under construction in Amarillo, Texas.

This is an important moment for the next generation of smaller military rotorcraft. Although its rival in the U.S. Army's Joint Multi-Role Technology Demonstrator (JMR TD) initiative, the joint Sikorsky/Lockheed Martin/Boeing SB.1 Defiant, has been delayed and is now predicted to take its first flight during the first half of 2018, both are vital to the continuing development of rotorcraft technology.

Both programmes are ensuring that the aviation industry, and its tier supply chain, are engaged in a long term programme that is keeping their own rotorcraft related specialties current so that those development skills are not lost. Bell Helicopter's Team Valor reads like a who's who of aviation engineering and systems designers: Lockheed Martin (with a foot in both camps), GE, Moog, IAI, TRU Simulation & Training, Astronics, Eaton, GKN Aerospace, Lord, Meggitt and Spirit AeroSystems.



Yes, Bell Helicopter first flew the XV-15 small tiltrotor back in 1977.

No, a pusher prop at the rear is not new either - witness the Lockheed AH-56 Cheyenne which first flew in 1967. But having long reported on these JMR TD developments since the conception of the Future Vertical Lift (FVL) programme in 2004, and whatever is said about the ideas behind the designs not being new, this is most certainly new technology with all the advances in materials, avionics, digitisation and fly-by-wire that have burst through since those early days.

While the JMR TD is not a programme of record, the point to be made is that the development is breaking new ground as the designs mature. Whether or not these actual models will go into production and on what scale does not do justice to the 'intent' to keep breaking new ground and keeping rotorcraft development pushing forward.

As an endnote, I would like to introduce Veerle Nouwens who will be writing an Analyst Column for *AMR* from this issue onward. She is a research analyst, Asia Studies at the International Security Studies Department of the Royal United Services Institute, Whitehall, London. Her first comments concern the return of the Quadrilateral Security Dialogue (the Quad).

Andrew Drwiega, Editor



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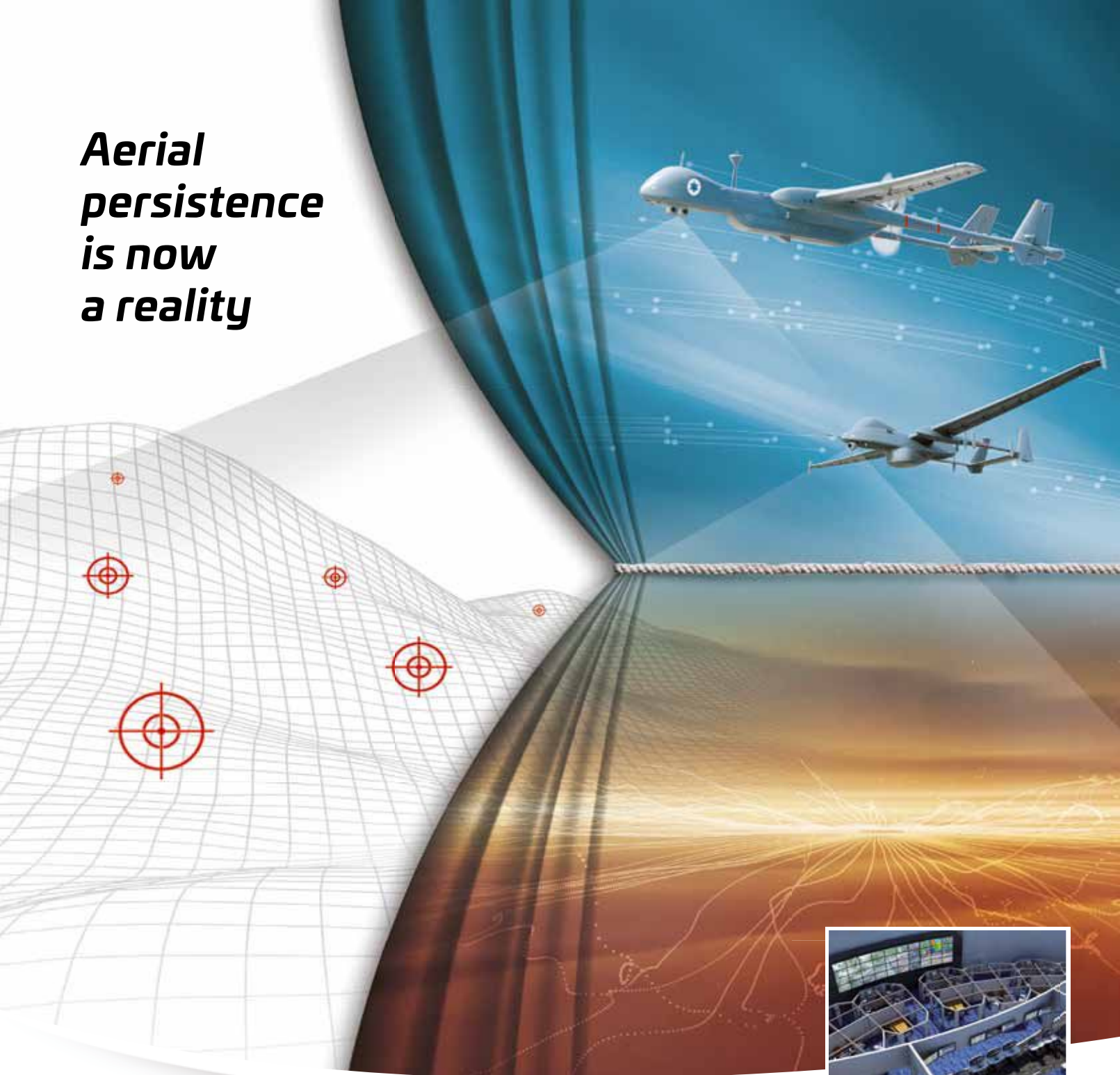
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A USAF MQ-4B Global Hawk UAS deployed to Tokyo's Tokota Air Base between May and October 2017 while Misawa Air Base was undergoing repairs.

UNMANNED, UNBLINKING EYES OVER THE OCEAN

The ramp-up of capability in terms of MALE/HALE operations is happening, although fully operational systems in many cases are still some years away.

by **David Oliver**

At the dawn of the New Year, tensions in the Asia-Pacific region remain at a high level. With North Korea's leader announcing the continued development of its nuclear and ballistic missile programmes and concerns about the situation in the East and South China Seas remaining, an increasing number of countries are enhancing their intelligence, surveillance, target acquisition, and reconnaissance (ISTAR) capabilities with medium-altitude long-endurance (MALE) unmanned aerial vehicles (UAV).

Singapore was one of the first countries in the region to acquire state-of-the-art MALE UAV when it took delivery of Elbit Systems Hermes 450s in May 2007. However, it was not until March 2015 that the H-450s operated by the Republic of Singapore Air Force's (RSAF) 116 Squadron at Murai Camp, achieved Full Operational Capability (FOC) status. The UAV pilots, air force engineers and maintenance crew had

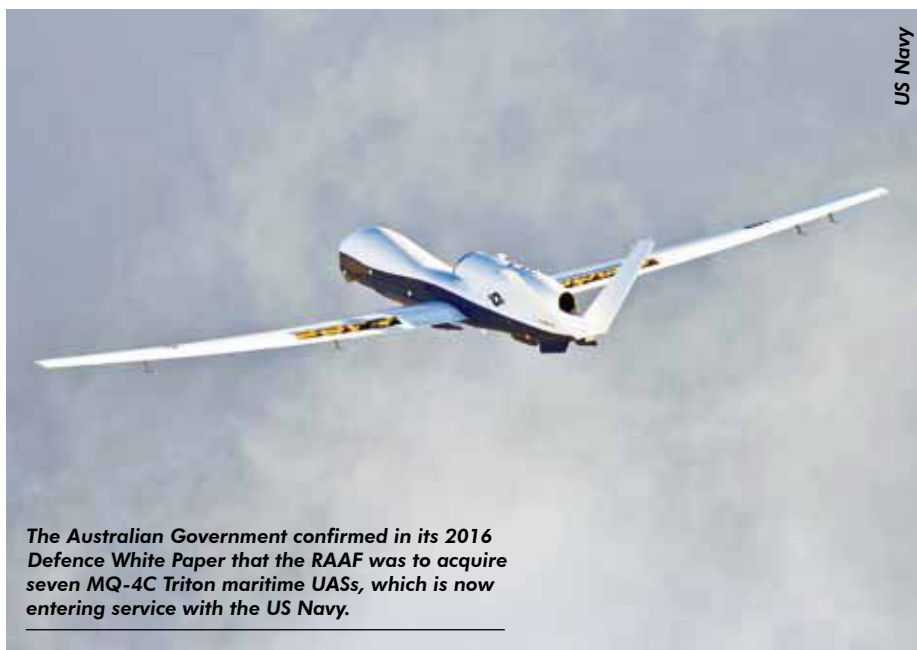
undergone intensive training to operate and maintain the aircraft, as well as integrating the capability to support the RSAF's operations.

The RSAF also took delivery of Israeli Aerospace Industries (IAI) Heron 1 MALE UAVs in 2012 which achieved FOC status with the RSAF's 119 and 128 Squadrons in March 2017. The Heron 1s are capable of being deployed alongside RSAF fighter aircraft and attack helicopters.

The Heron 1 MALE has a wingspan of around 16m (54ft) and can carry a 250kg (550lb) payload to an operating altitude of 9,145m (30,000ft) for up to 52 hours. It can be equipped with an Elta EL/M-2055 SAR/GMTI or EL/M-2022U maritime surveillance radar in a large ventral radome, which allows multi-target track-while-scan of up to 32 targets. Other payloads can include communications intelligence (COMINT), electronic support measures/electronic intelligence (ESM/ELINT) Ku-band SATCOM or other customer-furnished sensors.

In December 2014, the Republic of Korea Army (ROKA) selected the Heron 1 and after tests over South Korea's West Sea islands, a small number were issued to an army aviation unit in August 2016. The Heron 1s are being deployed on the Northern Limit Line (NLL), the de facto maritime border between the two Koreas in the Yellow Sea, and there are plans to eventually form a UAV squadron. The NLL has been frequently breached by North Korea which does not recognise it as a legitimate border.

The Indian Navy (IN) also acquired the Heron 1 UAV and in 2016 the Indian defense ministry approved the purchase of 10 Heron TP all-weather MALE multi-mission systems with the Israeli manufacturer. However, the imposition of technology transfer restrictions by the Israeli defense ministry put a halt to any firm contract and in June 2017 the United States approved a \$3 billion Foreign Military Sale (FMS) of 22 non-weaponised General Atomics Aeronautical Systems



The Australian Government confirmed in its 2016 Defence White Paper that the RAAF was to acquire seven MQ-4C Triton maritime UASs, which is now entering service with the US Navy.

(GA-ASI) Sea Guardian maritime UAVs for the Indian Navy. The FMS would also include training for Indian Navy personnel in the United States. The Sea Guardian, a variant of the Predator B, is fitted with the Raytheon SeaVue multi-mode maritime radar and can be used for wide-area, long-endurance maritime ISR missions, with an endurance of up to 27 hours at maximum altitude of 15,250m (50,000ft).

In December 2017 the Indian Ministry of Defence was awaiting a response from the US Office of Defense Cooperation to its 14 November request for information (RFI) for the UAVs. The acquisition was being progressed under the 'Buy (Global)' category of the MoD's Defence Procurement Procedure-2016, and that no transfer of technology was envisaged in the purchase.

In the meantime India's Defence, Research and Development Organisation (DRDO) has been developing an indigenous replacement for the Heron 1s. The prototype TAPAS 201, Rustom II, made its first flight from the Aeronautical Test Range (ATR) near Challakere in November 2016 after a three-year delay. DRDO plans to develop 10 TAPAS 201 prototypes in different variants for all branches of Indian armed forces. The TAPAS 201 has a 21m (68ft) wingspan, a capacity payload of 350kg (858lb), an endurance of over 24 hours, and an operational ceiling of 10,607m (34,776ft). It can carry medium- and long-range optic sensors, synthetic aperture radar (SAR), ELINT, COMINT and situational awareness payloads for round-the-clock operations.

In December 2017 Bangladesh's procurement agency, the Directorate General Defence Purchase (DGDP), issued a Request for Proposal (RFP) to procure a MALE UAV for the Bangladesh Air Force (BAF). In its notice, the DGDP said the procured UAV will be used for intelligence, surveillance, armed reconnaissance and targeting operations and will fulfil requirements highlighted by the Bangladesh military's Forces Goal 2030 modernisation plan.

The procurement will consist of a UAV system that has a maximum speed of 108kts (200km/h) or higher, a minimum loiter speed of 75kts (140 km/h) or lower, a maximum range of 1,000km (620 miles), and a maximum ceiling of 6,000m (20,000ft).

Bangladesh's close relationship with China could mean that bidders include China Aerospace Science and Technology Corporation (CASC) with its CH-4 or Aviation Industry Corporation of China's (AVIC) Wing Loong II.

MALE market

At the top end of the MALE technological spectrum is the Northrop Grumman RQ-4 Global Hawk High-Altitude, Long Endurance (HALE) Unmanned Aerial System (UAS) and its maritime variant, the MQ-4C Triton.

In December 2014 Northrop Grumman was awarded a \$657.4 million hybrid contract for four RQ-4B Block 30 Global Hawk aircraft, two spare engines and ground control equipment for the Republic of Korea Air Force (ROKAF). Each aircraft

will contain an Enhanced Integrated Sensor Suite (EISS). The first Global Hawk is scheduled to be delivered in 2018.

An memoranda of understanding (MoU) was signed between Northrop Grumman and Korean companies Firstec and Korean Jig and Fixture (KJF) in 2013 to support the Global Hawk with the manufacture of components for the ROK Global Hawk programme, the first of which were delivered in 2016.

In November 2015 the US State Department made a determination approving a possible FMS to the Government of Japan for three RQ-4B Block 30 (I) Global Hawk remotely piloted aircraft with EISS, eight Kearsarge Inertial Navigation System/Global Positioning System (INS/GPS) units, eight LN-251 INS/GPS units and logistical support for an estimated cost of \$1.2 billion.

The proposed sale of the RQ-4 will significantly enhance Japan's ISR capabilities and help ensure that Japan is able to continue to monitor regional threats. The Japanese Air Self-Defense Force (JASDF) plans to introduce the three drones beginning in 2020. The Japanese Global Hawk system is tentatively planned to be deployed at Misawa Air Base, where United States Air Force (USAF) Global Hawks have been deployed since May 2014.

A USAF RQ-4B Global Hawk was deployed Yokota Air Base in May 2017, starting a five-month operational tour in Tokyo, to survey ballistic missiles and nuclear facilities in North Korea. The aircraft is part of the 69th Reconnaissance Group Detachment 1 and provides near real-time aerial imagery reconnaissance support to United States and partner nations. Four more USAF Global Hawks were deployed to the base along with a total of 110 personnel including mechanics while maintenance and repair facilities were carried out at Misawa Air Base. The USAF RQ-4Bs were controlled from Yokota during takeoff and landing, and then from the US mainland once they reach a sufficient altitude.

In 2001, the Australian Defence Science and Technology Organisation (DSTO) collaborated with the USAF and Northrop Grumman in developing and testing a maritime surveillance mode for the Global Hawk's synthetic aperture radar (SAR) in order to evaluate the UAS's suitability to meet the Royal Australian Air Force (RAAF) Project Air 7000 multi-mission maritime HALE UAV requirement.

The DSTO awarded Northrop



South Korea and Japan are acquiring Northrop Grumman MQ-4B Block 30 high-altitude, long endurance (HALE) unmanned aerial systems (UAS) by US Foreign Military Sale (FMS) contracts.

Grumman an \$3.5 million (AUD\$4.7m) contract for a virtual trial in October 2006 at Northrop Grumman's Cyber Warfare Integration Network in San Diego, California, to examine how the UAS would perform in the Australian environment. Subject to US export approval, the RAAF planned to seek funding for at least six Global Hawks by 2012 but due to cuts in the defence budget, the plan was abandoned.

However, the Australian Government confirmed in its 2016 Defence White Paper that the RAAF was to acquire seven MQ-4C Triton aircraft as part of Plan *Jericho*, the Chief of Air Force's plan to transform the RAAF into a fighting force that capitalises on the high technology systems that are being introduced in the next few years. Under Plan *Jericho*, the RAAF will develop and evolve new operating concepts, support arrangements and sustainment processes to best exploit the P-8As capabilities when operated with the MQ-4C Triton UAS as part of an integrated maritime ISR family of systems.

The MQ-4C Triton is a maritime variant of the Global Hawk that the US Navy selected to meet its requirement for Broad Area Maritime Surveillance

(BAMS) project. First flown on 22 May, 2013, the MQ-4C Triton is equipped with a AN/ZPY-3 Multi-Function Active Sensor (MFAS) X-band AESA radar that provides a 360-degree view of its surroundings, for over 2,000 nautical miles, and incorporates a reinforced airframe for increased payload, and wing along with de-icing and lightning protection systems. These features allow the UAS to ascend and descend rapidly in harsh maritime weather environments. The 40m (131ft) wingspan Triton can fly for up to 30 hours at over 16,750m (55,000ft) with an operational range of 8,200 nautical miles. The first of a US Navy requirement for 68 operational Tritons was delivered to the US Navy facility at Point Mugu, California in 10 November, 2017.

Triton would be part of the Australian Defence Forces Project Air 7000 two-phase AP-3C Orion replacement programme. Phase 1B entails procuring the Triton UAS, and Phase 2B was the acquisition of 12-15 manned P-8A Poseidon maritime patrol aircraft (MPA) between 2016-2020. RAAF Tritons and Poseidons would be used in a similar complementary fashion to the proposed US Navy operation, where the MQ-4C performs high-

altitude broad area surveillance missions, allowing the P-8A to be more dedicated to anti-submarine and anti-surface warfare, search and rescue response, and electronic intelligence missions.

The Triton would be home based at RAAF Edinburgh, although many missions will be launched and recovered from RAAF Tindal. The Triton will be capable of supporting missions of over 24 hours while covering an area of over one million square nautical miles - an area larger than Western Australia. Initial Operating Capability (IOC) for the RAAF MQ-4C Triton is expected in 2023-24.

Like other RAAF aircraft, the Triton will be flown by a qualified RAAF pilots, experienced in complex airspace. The Triton will be flown from a ground station with a pilot supported by a co-pilot while the information gathered will be analysed and disseminated by operational staff that may include aircrew, intelligence, operations and administration officers, engineers and logisticians, depending on the training or mission requirements.

Australia is interested in the multi-intelligence (Multi-INT), also known as Integration Functional Capability 4 (IFC-4) configuration that will have significant enhancements over the baseline aircraft now entering service with the US Navy, including signals intelligence (SIGINT).

The Australian Department of Defence is negotiating an MoU with the US Navy to establish a co-operative programme which would include the development, production, and sustainment of the Triton capability. The Defence Department expects to enter into this formal agreement pending government approval in early 2018.

If approved the Triton will be acquired through a United States Navy contract to Northrop Grumman Corporation Opportunities for Australian Industry participation exist on a competitive contracting basis throughout the lifecycle of MQ-4C Triton, including facilities construction, deep maintenance, training system operation and support, mission planning system support, logistics support and component repair. An Australian-developed ground control station for the RAAF would also be created.

While there is no doubt that the deployment of increasing numbers of highly capable MALE UAVs to monitor disputed islands in the South and East China Seas and activities by North Korea, it will be several years before the Australian, Japanese and South Korean HALE UASs will be operational. **AMR**

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MINDEF



SINGAPORE FORGES NEXT GEN CAPABILITIES IN ARIZONA

During its biennial overseas exercise, *Forging Sabre*, the Singaporean Armed Forces used enhanced C2 to further integrate fast jets, attack helicopters and UAVs into the precision, and simultaneous delivery of kinetic munitions

by **JR Ng**

The Singapore Armed Forces (SAF) recently concluded its latest air-land strike integration and live-fire exercise which was carried out from 28 November to 13 December 2017 in the dry and dusty expanse of the Barry M Goldwater Range (BMGR) in Arizona, in the United States.

This biennial overseas exercise, code-named *Forging Sabre*, was the sixth and largest iteration to date since the exercise series began in 2005. It brought together 800 personnel from the Republic of Singapore Air Force (RSAF) and the Singapore Army to fine-tune operational planning and execution processes, as well as conducting joint live-fire training.

"This exercise provides an excellent opportunity for the SAF to validate its integrated strike capabilities through the conduct of dynamic strike missions," said Brigadier General Tommy Tan, commander of the RSAF's Air Combat Command and director of *Forging Sabre* 2017.

"These missions involve identifying 'pop-up' targets that may be moving, tracking them continuously and making

dynamic adjustments to ongoing strike plans to destroy them," General Tan added. "The exercise scenarios also include destroying multiple targets in various locations simultaneously...these missions are carried out in a realistic and challenging environment which strengthens our operational capabilities."

He also revealed that the latest exercise made use of a significantly larger area of the BMGR facility with a total area of approximately 780km² in size, in addition to the usual 300km² live range employed in previous visits, injecting an increased level of complexity for participating troops.

According to the Singapore Ministry of Defence (MINDEF), the RSAF deployed six Boeing AH-64D Apache attack helicopters from the Peace Vanguard detachment at Silverbell Army Heliport in Marana, Arizona; 10 Boeing F-15SG multirole combat aircraft from Peace Carvin V at Mountain Home Air Base in Idaho, and 10 Lockheed Martin F-16C/D multirole combat aircraft from the Peace Carvin II detachment at Luke Air Force Base.

Support elements comprised three

Boeing CH-47D heavy-lift helicopters from the Peace Prairie detachment at Grand Prairie Army Aviation Support Facility in Texas, which were deployed for combat search and rescue (CSAR) and commando insertion missions, as well as three Israel Aerospace Industries (IAI) Heron 1 medium-altitude long-endurance unmanned aerial vehicles (MALE UAVs) providing reconnaissance and targeting support to the air and ground strike assets.

The Heron 1 UAVs were declared fully operational in March 2017 and are operated by the RSAF's 119 and 128 squadrons. The first was introduced by the service in May 2012 as a replacement for the ageing fleet of IAI Searcher tactical UAVs that entered service in the mid-1990s. Measuring an overall length of 8.8m with a wingspan of 16.6m, the air vehicle has a maximum take-off weight (MTOW) of 1,100kg and a payload capacity of 250kg. According to MINDEF, typical mission systems include an electro-optical infrared ball turret and a laser designator.

"The Heron 1 can be deployed with fighters and attack helicopters, amplifying the SAF's precision strike capabilities," said defence minister Ng Eng Hen. "Apart from these conventional operations, it can also be deployed against terrorist threats, because its persistence enables it to cover a wide area of surveillance," he added, referring to its ability to stay aloft for as long as 24 hours in a single mission.

MINDEF also revealed that as many as 150 precision munitions were expended in day and night training missions during the two-week exercise. These included the Lockheed Martin AGM-114L Longbow Hellfire radar guided air-to-ground missiles, GBU-10 and GBU-12 Paveway II laser-guided bombs (LGBs), GBU-31 and GBU-38 Joint Direct Attack Munitions (JDAMs), and GBU-54 Laser JDAMs (LJDAMs).

In particular, the use of the 2,000 lb-class GBU-31 JDAM at *Forging Sabre* 2017 marks the first time the precision bomb has been employed in an SAF live-fire exercise. The weapon was recently introduced into RSAF service with first launch occurring during the USAF's Combat Hammer air-to-ground weapons evaluation exercise at the Utah Test and Training Range maintained by Hill Air Force Base (AFB) in May 2017. Singapore acquired 913 KMU-556B/B JDAM kits for Mk-84 2000 lb bombs, 100 FMU-152A/B fuzes, and 300 DSU-40 Precision Laser Guidance Sets via the US Foreign Military

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The air force's latest weapon is the 2000-lb GBU-31 Joint Direct Attack Munition, which complements the in-service GBU-10 Paveway II Laser Guided Bomb for attacks on heavily fortified or large targets.

Sales 9FMS) programme along with associated parts, logistical support, as well as training under a \$63 million deal approved by the US government in 2014.

As one of the largest air-launched precision guided munitions in the RSAF's arsenal, the GBU-31 enhances the ability of the service's Boeing F-15SG and Lockheed Martin F-16C/D combat aircraft to destroy large or heavily fortified structures. Other known precision munitions employed by Singapore include the GBU-10 Paveway II Laser Guided Bomb (LGB), GBU-12 Paveway II LGB units, and GBU-38 JDAM.

New C2 system

The SAF also took the opportunity at *Forging Sabre 2017* to test out new enhancements to the networked command and control (C2) system that had been developed specifically to support the exercise series. The bespoke C2 system is a joint effort between the armed forces and the country's Defence Science and Technology Agency (DSTA), and is also used as a platform to trial new technologies that could eventually be applied to its operational systems. Development of the system was initiated in 2009 and it has continuously improved inputs from operators and technological advancements in software and military hardware.

Acting as the central command node for the exercise, the C2 system supplies an integrated battlefield picture to commanders. By fusing information from

disparate sources – such as special forces troops, army reconnaissance teams known as the STRIKE ObserveRs Mission (STORM), as well as aerial assets such as the Heron 1 UAVs – the C2 system is designed to reduce the overall sensor-to-shooter loop for SAF units on the field.

For example, the system provides real-time updates of the ground situation picture by overlaying high-definition live video feeds from the Heron 1 UAVs onto an augmented reality display. Using advanced graphics rendering techniques, geographical data such as landmarks, roads, buildings, and vegetation are superimposed on the feed, which is then exploited using video analytics technology to automatically derive target locations onto the display. This reduces the cognitive load of operators, enabling them to quickly orientate to the latest ground situation picture for timely decision making, as well as improving their ability to monitor multiple targets.

DSTA also highlighted that the set-up time for the C2 system was also cut down from weeks to just days by incorporating new server virtualisation technology. This enabled its engineers to replace bulky physical servers with virtual systems, which reduced the overall server footprint bringing savings in power, cooling and space requirements. With its modular architecture, the C2 system can also be expanded with other training systems such as the Army Warfare Simulation System, which allows exercise planners

MINDEF

to incorporate ground-based scenarios and assets into training scenarios without requiring actual troops or vehicles.

Singapore Army update

The Singapore Army's STORM teams, which comprise of specially trained reconnaissance troops who direct the action of SAF air or artillery assets from forward positions, have benefited from a new ground designator that replaces the venerable Laser Target Marker (LTM-91).

Supplied by local electro-optics firm STELOP and introduced in late 2016, the new Target Acquisition Designation System (TADS) integrates the high-definition Day Night Ranging System (DNRS) with Elbit Systems' PLDR III long-range portable lightweight designator/rangefinder.

The DNRS features a Class 1 laser rangefinder as well as a high-definition thermal imager, which is affixed on the PLDR-III and enables STORM troopers to acquire target ranging information at distances of up to 5 km at night, while the latter is equipped with a Class 4 laser target designator/rangefinder that has an effective range of 10 km, double the range of the LTM-91. TADS weighs around 10 kg as a complete system – which is about 40 percent lighter than the LTM-91 – and also offers a 20 percent increase in runtime.

The army's artillery formation also unveiled the new Battery Command Post, which has been specifically developed to improve the effectiveness of its Lockheed Martin-built M142 227 mm High Mobility Artillery Rocket System (HI-MARS) platforms on the field. The new command post is based on a 4x4 MAN truck chassis and is operated by a crew of eight personnel. It is equipped with an on-board power supply that supports a suite of software-defined radios as well as an optional satellite communication (SATCOM) capability, which when combined with its automated antenna masts, enables its crew to perform on-the-move command and control.

According to media reports, the battery command post is networked to platoon-level command posts and their respective launcher units via the Army Battlefield Internet (ABI). The ABI is a system connecting all computers used by ground forces and forms the backbone of the army's battlefield communications network. It was also reported that the indigenously developed Battlefield Management System (BMS) – which enables blue-force and red-force tracking as well as receive real-time situational

awareness and targeting updates from reconnaissance assets - is also expected to be integrated in the near future.

The command post is outfitted with two integral power generators, which can provide continuous power for up to 48 hours, and four deployable antennas that are electronically raised or lowered from within the command cabin. Set up and tear-down is fully automated and does not require the vehicle to come to a halt. Previously, personnel had to dismount to unload and set up a portable power generator which would have taken as long as seven minutes to complete. In contrast, the new command post can be fully deployed within four minutes, increasing the crew's survivability.

"The new battery command post enables us to process information and shoot faster," said Colonel Michael Ma, the army's chief artillery officer and the land director for the exercise.

"One of the advantages that it brings is that it enables us to command on the move...this means that I don't need to

stop; I can fight as I move and ensure that my range is continuously maximised and that we keep up with forces that need our support," he added.

The Singapore Army also field tested upgraded HIMARS launcher units which have been enhanced with Lockheed Martin's Universal Fire Control System (UFCS). First delivered to the service in 2010 and operationalized in September 2011, the service's HIMARS is operated by the 23rd Battalion Singapore Artillery

Each launcher - which is operated by a three-man crew comprising a detachment commander, a gunner and a driver - is armed with the M31 GMLRS pod, which carries high explosive unitary rockets that have a maximum range of 70 km, and feature GPS-aided inertial guidance that enables the rockets to achieve a hit probability of around 15 m circular error probable (CEP) from their aimpoints.

Singapore's HIMARS launchers are also equipped with BMS and is fully connected to the platoon and battery level

command posts as well as STORM teams that have been deployed.

Lieutenant Colonel Jackson Tong, commanding officer of 23rd Battalion, told reporters that HIMARS operators were previously required to recalculate firing orders and lay on the target separately for each of the launcher's complement of six rockets.

However, with the installation of UFCS, the operators can now input specific aimpoints for each rocket, which effectively enables each launcher to engage six targets simultaneously. According to Lockheed Martin, the UFCS is an evolutionary block upgrade that enhances the existing MLRS Fire Control System and enables the use of Guided Multiple Launch Rocket System (GMLRS) munitions that incorporate anti-jamming technology.

In a first for the *Forging Sabre* series, the army's HIMARS operated in the same battlespace with the RSAF's Heron 1 UAVs, exploiting the latter's persistent surveillance as well as laser targeting capabilities for greater effects. **AMR**



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CHINESE THREAT TEMPORARILY OVERSHADOWED BY NORTH KOREA CONUNDRUM

China's role as main protagonist involved in raising tension in the Asia-Pacific region has been overshadowed by North Korean leader Kim Jong-Un's deadly game of (verbal, for now) brinkmanship with American President Donald Trump. Yet China continues to expand its military reach, largely unchecked.

by Alan Warnes

While China's shadow continues to loom large over most of the 25 states in Asia, many of the region's military have pinned their colours to the USA mast. Leading air forces in Australia, Japan, Singapore, South Korea, Republic of Korea (Taiwan) and increasingly, India continue to build their capabilities, allied with the United States. Their inventories are dominated by US built aircraft, allowing interoperability between the nations. Working with the Washington government allows these countries a lot of military support, particularly use-ful during tense times. China's expansion is enduring, but North Korea emerged during 2017 as the biggest threat to peace in the region, if not globally through its threat of intercontinen-tal nuclear armed missiles.

Firing 15 ballistic missiles, has meant that the North Korea's Dictator, Kim Jongun has hardly been out of the news. His actions have sparked an outrage throughout the world, with Japan, South Korea and the USA being among the most vocal. Japan is alarmed at seeing these missiles fly through their air space,

while South Korea is extremely concerned at a pre-emptive strike. The fact that several were inter-continental ballistic missiles (ICBMs) is particularly worrying to the US Government, because as the latest launch (at time of press) on November 28, of a Hwasong-15 missile showed, it has an extremely long range. Jong-Un even boasted during his New Year speech that North Korea could now hit the mainland USA, and that he always had the nuclear-button on his desk. Experts believe that Hwasong-15 has a range of more than 8,000 miles (13,000kms) placing the continental USA within striking reach. While Japan and South Korea have been cautious with their rhetoric, to ensure the tension with the North Korean dictator does not spiral out of control, the same cannot be said of the USA. President Donald Trump has been outspoken in terms of rhetoric (and tweets) in his criticism of the Pyongyang Government and has deployed Rockwell B-1, Boeing B-52 bombers and assorted fighters and aircraft carriers to the region as a show of strength. Russia and China are also being dragged into the war of words over North Korea, as both sides

continue, allegedly, to break sanctions.

North Korea and China are now posing a real conundrum to the likes of Japan. In a press briefing on December 28, Japan's Defence Minister Itsunori Onodera summed up the current situation facing his country, as well as others in the region: "Looking back at the past year, I have the sense that the current security environment is severer than when I became defense minister the first time three years ago. Since last year, North Korea has conducted three nuclear tests, including an explosion with the largest-ever maximum force that is estimated to be 10 times as powerful as the force of a Hiroshima-type bomb, and launched as many as 40 ballistic missiles, including ones which flew over Japan or which had an ICBM-class long range. North Korea's nuclear and missile development is posing a more serious and imminent threat than ever, a new level of threat to Japan's security.

"Meanwhile, China is bolstering its non-transparent military build-up, and it is also continuing attempts to unilaterally change the status quo in the maritime areas and airspace over the East and South China Seas by force, based on its own arguments that are in conflict with the existing international order.

"Furthermore, global security challenges are becoming more and more wide-ranging and diverse, as indicated by the proliferation of weapons of mass destruction, the deepening problem of international terrorism, and the emergence of challenges in new fields such as cyber-space and outer space. It is not too much to say that the current security environment surrounding Japan, as I understand it, is the severest in the post-war period. The MOD will continue to deal with this harsh reality head on and fulfill the most important responsibility of the government, which is to protect the Japanese people's lives and peaceful living, by developing full preparedness to appropriately respond to changes in the security environment."

According to some reports, the Japanese MOD has been studying the possibility of deploying Lockheed Martin F-35s to its two Izumo flat-top helicopter destroyers. The vessel can carry up to 14 helicopters, but they do not have a catapult or a ski-jump, so a lot of modification work would be required.

However, the Japanese Defence Minister has stated that under the country's strictly defence-oriented policy, Japan cannot possess 'attack aircraft carriers,' saying that they are among what can be deemed as offensive weapons exceeding the minimum necessary capacity for self-defence.

Japan plans to purchase 42 conventional take-off and landing F-35As for the Japanese Air Self-Defense Force (JASDF), but the Defense Ministry has considered acquiring short-take-off and landing (STOVL) F-35Bs as part of any purchase, or buying some F-35Bs in addition to 42 F-35As.

Deploying fighters to the two flat-tops could trigger a backlash from China and other neighbouring countries, because they could perceive it as contradicting Japan's so-called "exclusively defense-oriented policy" under the country's pacifist constitution. Chinese bombers are also regularly intercepted by Japanese air defence fighters, with the most recent stand-off coming on November 20 when four Xian H-6 bombers flew through international air space in the East China Sea. At the time, the US and Japan were involved in a joint exercise, which isn't uncommon, as are US and South Korea manoeuvres. All three allies regularly test their military's state of readiness. One of the most obvious moves by South Korea to resist any attack from North Korea has been the deployment of US Army Terminal High-Altitude Area Defence (THAAD) which is designed to shoot down missiles in the terminal phase of their approach to a target. In early September, the latest system was deployed to Seongju, 200 miles (300kms) south of the capital Seoul.

Tensions over North Korea has meant that China's assertiveness in the South China Sea has slipped from the headlines. During 2017, the Beijing Government has continued to build up its presence having dredged up 2,000 acres of new land in the Spratley Islands, creating seven new islands with three new airfields. The most advanced facility, on Fiery Cross Reef which has an airstrip which can handle military aircraft, has seen 27 acres of new construction. According to the US Government's latest National Security Strategy released just before Christmas, the new construction includes underground bunkers, hangars and shelters for missile emplacements. The document also signals that the US considers the Indo-Pacific region as the most strategically important geographical area, ahead of the Middle East which has dominated previous US administrations strategic thinking.

AFGHANISTAN

■ AFGHAN AIR FORCE

19+6 on order

EMB-314 (A-29) Super Tucano ground attack aircraft. One aircraft lost during training on March 6, 2017 while operating from Moody AFB, Georgia. Six more aircraft were ordered on October 25, 2017. Cessna 208B Caravan, transport. One aircraft lost

25



on October 12, 2015 and another damaged on October 3, 2017.

4	Lockheed Martin C-130H Hercules
9	Mil Mi-17-V5 medium-lift utility helicopter
16	Mi-8MTV-1
11	Mil Mi-24/25 attack helicopter
3	SA-315B Cheetal light attack helicopter
27	MD Helicopters MD-530F reconnaissance helicopter. Two aircraft destroyed.
3	Boeing 727, being acquired from Ariana Afghan Airlines

AFGHAN SPECIAL MISSION WING

18	Pilatus PC-12NG turboprop transport (operated by MAG)
52	Mil Mi-17 medium-lift utility helicopter (operated by MAG)
53 on order	Sikorsky UH-60 Black Hawks medium lift utility helicopters were ordered in 2016 to replace the above Mi-17s, to allow standardisation on US origin equipment. A first batch delivered in September 2017.

AUSTRALIA

■ ROYAL AUSTRALIAN AIR FORCE

55	McDonnell Douglas/Boeing F/A-18A Hornet, multi-role combat aircraft.
16	McDonnell Douglas/Boeing F/A-18B multi-role combat aircraft. Both types will start being replaced by the Lockheed Martin F-35A Lightning-II multi-role combat aircraft from late-2018 but will continue until 2023.
24	Boeing F/A-18F Super Hornet multi-role combat aircraft Achieved Final Operational Capability (FOC) in December 2012.
12	Boeing EA-18G Growler electronic warfare aircraft. First batch due to arrive in Australia in 2017 and deliveries completed by end of year.
4 + 8 on order	Boeing P-8A Poseidon maritime patrol aircraft. First one delivered in November 2016 and the rest are following at a rate of one every four months. An order for four more aircraft was announced in April 2017.
16	Lockheed Martin AP-3C Orion maritime patrol aircraft. To be replaced by the P-8A Poseidon, with retirement due in 2019.
8	Boeing C-17 Globemaster III strategic turboprop freighter
12	Lockheed Martin C-130J Hercules turboprop freighter. To undergo capability upgrades
6+1 on order	Airbus KC-30A multi-role tanker transport. Two A330-200s were ordered in mid-2015, to be upgraded to MRTT at Air-bus' Getafe facility. One was delivered in August 2017 and second will be delivered in early-2018. The latter will be fitted with a partial VIP interior. The Australian

2 accepted 72 planned government predicts a need for two more KC-30s in the second half of next decade.

16 Lockheed Martin F-35A Lightning-II multi-role combat aircraft. Australia has committed to acquire 72 F-35A conventional take-off and landing aircraft at a cost of more than \$12bn to replace RAAF's aging F/A-18A/B Hornet fleet (see above). The Australian Government approved a \$2.5 billion procurement of 14 F-35A Lightning IIs on 25 November, 2009. The first two aircraft are now at Luke AFB, Arizona where they are being used for aircrew training. 100 F-35As were originally planned. First deliveries to Australia expected in December 2018.

61 Hawker Beechcraft King Air 300/350 turboprop transport. Five Beech 300s have been obtained via a lease contract. for training and support.

8 + 2 under conversion Pilatus PC-9A, turboprop training aircraft. Four converted for FAC training platforms.

33 Alenia Aermacchi C-27J Spartan turboprop freighter. The Australian Defence Minister announced the purchase of ten C-27J Spartans in May 2012. All ten have now been delivered to L3 at Waco, Texas where they are fitted with the RAAF's preferred self protection system.

6 BAE Systems Hawk 127 lead in jet trainer. Capability up-grade underway.

2 Boeing E-7A Wedgetail (737-700) AEW&C (Airborne Early Warning and Control)

3 Boeing 737 BBJ turboprop transport leased from industry

2 of 49 delivered Bombardier Challenger 604

Up to 5 PC-21 turboprop trainer. Will replace PC-9/A for fixed wing training run by industry

Up to 7 Gulfstream G550 ISR&EW. During June 2017 it was announced that the RAAF was to acquire five highly modified Gulfstream G550 under a \$US1.3bn deal that will see them delivered in the early 2020s. Waco-based L3 will modernise the green airframes. They are being acquired under Project AIR 555 and will be assigned to the RAAF Surveillance and Response Group based at RAAF Edinburgh.

MQ-4C Triton Unmanned Aerial Vehicle (UAV). If purchase sanctioned deliveries will start in early 2020s.

ROYAL AUSTRALIAN ARMY AVIATION CORPS

10 Bell Helicopter 206B-1 Kiowa multipurpose utility helicopter. Used mainly for helicopter flying training. Will be increasingly withdrawn from use now EC135T2s delivered.

6+10 Boeing CH-47D/F heavy-lift helicopter. Seven CH-47F were delivered in 2015 and a further three in a separate Dec 2015 contract in 2016. With no dedicated CSAR capability, the Australian Defence Force will upgrade the Chinooks to improve their ability to conduct medevac. In the longer-term, options will be investigated to enable CSAR tasks to be carried out much faster and at long range.

22 Airbus Helicopters Tiger EC-665 ARH. The Feb 2016 White Paper, revealed that from the mid-2020s, the Tigers will be replaced with a new armed reconnaissance capability. This could involve either manned or unmanned systems, or a combination of both.

35 Sikorsky SA-70A Black Hawks/UH-60L medium-lift utility helicopter. Were originally going to be retired during 2011-13, however with delays to the NH90s and the CSAR configuration not yet finalised, this has now been extended to 2021. Eighteen equip the 6th Aviation Regiment at Holsworthy on the western outskirts of Sydney and two others at the Oakey Army Aviation Centre.

41 NH Industries NH90 medium-lift utility

16

15 helicopter. Total of 45 MRH-90s on order, including four for the Royal Australian Navy, to replace the retired AgustaWestland Sea King Mk-50.

18 Airbus EC135T2 training helicopter. Shared with Navy under the Australian Defence Force (ADF) Helicopter Aircrew Training System (HATS). Last six were handed over on 22 November, 2016.

RQ-7B Shadow 200. Four systems comprising 18 aircraft

ROYAL AUSTRALIAN NAVY

1 Dash 8-Q202 is a uniquely configured aircraft operated under contract of the RAN's Laser Airborne Depth Sounder Flight for coastal survey duties.

23 Sikorsky MH-60R Seahawk maritime support helicopter. Selected in June 2011 and all delivered between 2014-16. One of the aircraft suffered significant damage during bad weather while deployed aboard HMS Warramunga on 20 October, 2017 and maybe beyond repair.

7 Airbus Helicopters AS-350BA Squirrel light utility helicopter

3 Bell Helicopter 429 Global Ranger multipurpose utility helicopter. Were on a three-year lease 2012-2015.

4 NH Industries MRH-90 maritime support helicopter. Rotated with Army aircraft.



BANGLADESH

■ BANGLADESH AIR FORCE

6/2 MiG-29SE/UB MRCA. The Russian Aircraft Corporation announced the beginning of negotiations with the Bangla-desh government for the upgrade of the current MiG-29 fleet to MiG-29SMT status in April 2013.

48 Chengdu F-7 MRCA. 13 F-7BG and four FT-/BG received in 2006. 12 F-7BGI along with four FT-7BGI were received in 2013 as replacement of the Nanchang A-5C ground-attack aircraft fleet which were retired in November 2014. Approximately eight F-7MBs and seven FT-7MBs survive.

7 Aero L-39ZA Albatros lead-in jet trainer. Total of eight delivered, one aircraft crashed in 2012.

3 Antonov AN-32 turboprop freighter. The aircraft are being upgraded with the first one returning in late-2017.

4+4 planned Lockheed Martin C-130B/E Hercules turboprop freighter. Bangladesh Air Force was negotiating the acquisition of four C-130Es but its unclear what happened to deal. Its increasingly likely that two ex-RAF C-130Js will be sold to the BAF.



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13	Xian Y-7 light transport aircraft
10	Harbin Y-12 light transport aircraft
170	Hongdu JL-8 jet trainer/light attack aircraft
10	Mil Mi17/171 medium-lift utility helicopter
34	Changhe Z-8K/KA/KH search and rescue helicopter
10?	Changhe Z-10K
42	Harbin Z-9 medium-lift utility helicopter
35	Chengdu JJ-7 air superiority fighter
4	Xian Y-20 transport aircraft. Requirement for up to 1000.

PEOPLE'S LIBERATION ARMY GROUND FORCE

7	Xian Y-7 turboprop freighter
3	Shaanxi Y-8 turboprop freighter
220+20 ordered	Mil Mi-8/17/171 medium-lift utility helicopter
52	Mil Mi-17E medium lift helicopter. Last four delivered Ju-ly 2014.
20	Sikorsky S-70 medium-lift utility helicopter
53	Changhe Z-8 heavy-lift helicopter
70	Harbin Z-9 medium-lift utility helicopter
121	Changhe Z-10 attack helicopter
120	Harbin Z-19 attack helicopter
46	Changhe Z-11 light utility helicopter
1	Airbus Helicopters AS-350 light utility helicopter
150	Airbus Helicopters EC-120 light utility helicopter

PEOPLE'S LIBERATION ARMY NAVAL (PLAN) AIR FORCE

14	Xian H-6 strategic bomber
30	Xian Y-7 turboprop freighter
16	Shaanxi Y-8/KJ-200 airborne early warning and control
3	Shaanxi Y-8 maritime patrol aircraft
14	Shaanxi Y-8 reconnaissance aircraft
18	Chengdu J-7 air superiority fighter
47	Shenyang J-8 air superiority fighter
6	Chengdu J-10 MRCA
34	Xian JH-7 MRCA
30	Nanchang Q-5 ground attack aircraft
27+50 planned	Sukhoi Su-30/33 MRCA
3	Harbin SH-5 search and rescue turboprop
17	Kamov Ka-28 maritime support helicopter
9	Kamov Ka-31 maritime support helicopter
27	Changhe Z-8 search and rescue helicopter
28	Harbin Z-9 medium-lift utility helicopter
5	Changhe Z-18 medium-lift utility helicopter
14	Shenyang JJ-6 lead-in jet trainer
11	Hongdu JL-8 (K-8) lead-in jet trainer/light attack aircraft
8	Mil Mi-8 medium-lift utility helicopter
6	Airbus Helicopter AS-365 medium-lift utility helicopter
1	Kamov Ka-27 maritime support helicopter
5	Xian Y-7 turboprop freighter

■ **NOTES:** The Shenyang J-31 Gyrfalcon is one of China's two prototype fifth-generation MRCAs, along with the Chengdu J-20, and is currently under development by Shenyang Air-craft Corporation. The second J-31 prototype flew in late December 2016. CATIC believe it has a strong change of domestic sales to the PLaAF and PLANAf. The J-31 has the potential to become a future carrier-based MRCA for China's air force and navy. While the export market is also a distinct possibility with Pakistan, the Democratic People's Republic of Korea and Iran being potential customers. Another possibility is the development of two different versions of the aircraft: China may, in fact, sell a variant abroad under its 'F-60' designation, while maintaining a fleet of domestic J-31s for the People's Liberation Army Air Force.

INDIA

■ INDIAN AIR FORCE

36 on order	Dassault Rafale MMRCA. A firm contract for the purchase of 36 Dassault Rafales was signed on 23 September, 2016. The order will comprise 28 single-seat and eight twin-seat aircraft. The first aircraft is scheduled for delivery within 36 months of contract signature, with the
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remainder to follow within 60 months. The estimated total cost of the deal is around \$9.3 billion, including weapons and equipment. Part of the acquisition also includes five years of performance based logistics (PBL). The aircraft are expected to be based at Ambala and Hasimara air bases. Indian defence officials said the terms of the contract include a requirement that France must ensure that 75 percent of the fleet (27 aircraft) are operational at any one time. There is also a penalty clause for late deliveries. Although details of the weapons being ordered have not been announced, they are expected to include the MBDA Meteor BVRAAM, Mica short and medium range air to air missile and Scalp stand-off cruise missile.

240+72 outstanding

Sukhoi Su-30/MKI MRCA. The IAF has ordered 312 Su-30MKIs, the first 50 were delivered by Russia, while 262 have been either built or are being built at HAL Nasik. Seven have been lost. They are based at Bareilly (8 Sqn and 24 Sqn), Bhatinda (17 Sqn), Chabua (102 Sqn), Halwara (220 and 221 Sqn), Jodhpur (31 Sqn), Pune-Lohegaon (20 Sqn and 30 Sqn), Bhuj (15 Sqn), Tezpur (2 Sqn), Gwalior (TACDE), Sirsa (21 Sqn). Meanwhile, Irkutsk which is the Su-30 OEM has proposed major upgrades to the Su-30MKIs, with reports that the IAF is looking at an initial batch of 80 Super Sukhois, in a contract worth up to \$8 billion.

66

MiG-29B/UPG MRCA. Fifteen aircraft lost to crashes be-tween 1994 and 2013. To be upgraded to MiG-29UPG status.

51

Dassault Mirage 2000H/TH MRCA. Of the aircraft ac-quired, ten have been lost to crashes. The current fleet of 51 aircraft is currently being upgraded to Mirage 2000-5 Mk.II standard known locally as the Mirage 2000I Vajra. The process is to be completed within a ten-year time frame by HAL Bangalore. The first upgraded Mirage 2000H/TH un-derwent its maiden flight in October 2013. The first two aircraft, Mirage 2000I KF107 and 2000TI KT201, were de-livered to Jamnagar Air Force Station on 22 April, 2015, after a ferry flight from Istres, France. They were delivered to the TACDE (Tactical Development and Evaluation) at Gwalior two days later.

80

MiG-21Bis/Bisons/M/MF MRCA. To be phased-out by 2019. Fifteen aircraft were involved in crashes in the past three years. 110 upgraded MiG-21 Bisons are likely to fly until 2025.

35

MiG-27ML MRCA

144 planned

Sukhoi T-50 PAK-FA MRCA. Joint development of this fifth generation aircraft involves India and

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5 plus another 35 on order	Russia. Delays mean requirement reduction from 220 to 130-145 aircraft. Dropped requirement for 45-50 twin-seat FGFAs.	100	HAL Tejas Light Combat Aircraft (LCA). The supersonic aircraft received the Initial Operational Clearance in December 2013. To date Hindustan Aeronautics Ltd (HAL) at Bangalore has built 16 Tejas light combat aircraft comprising: two technology demonstrators (TD-1/2), three single-seat prototype vehicles (PV-1/2/3), a dual seat prototype vehicle (PV-5), seven Limited Series Production (LSP-1/2/3/4/5/7/8), dual seat Naval Prototype (NP-1) and single seat NP-2. The Indian Air Force has 40 Tejas Mark 1s on order, in two batches of 20 with deliveries of the first batch of 20 delivered 'before 2019'. A further 83 Mk1As are being built for the IAF, which will feature enhanced indigenous self projection electronic warfare system and AESA radar. The first two examples SP-01 and SP-02 were handed over to 45 Sqn on 1 July, 2016. They will operate from Bangalore for nearly two years before moving to their permanent base at Sulur, near Coimbatore in Tamil Nadu. It is planned to have a total complement of six Tejas squadrons by 2022. However, with HAL currently only having the capability to produce eight Tejas per year, it must double production to meet this requirement.
100	The naval version of Tejas, has an arrestor hook installed for aircraft carrier deck operations. A modification to the control surface in the wing apex, will allow the pilot to reduce the approach speed for carrier landings, when deflect-ed up. The first navy prototype NP-1 made its maiden flight on 27 April, 2012 followed by NP-2 on 7 February, 2015. However the project was cancelled in December 2016 because it was too heavy for carrier ops.	59	2 being converted
3	SEPECAT Jaguar IM/S MRCA	5	2
2	Gulfstream Aerospace G-IV SRA-4 turboprop transport	3	3
17	IAI 1125SPX Astra	2	2
3+2 planned	Ilyushin Il-76MD strategic turboprop freighter	6 planned	2 planned
7	Beriev A-50EhI airborne early warning and control	2	2
10	Ilyushin Il-78 tanker	3	3
10+1 replacement	Boeing C-17A Globemaster-III strategic airlifter	49	2
	Lockheed Martin C-130J Hercules turboprop freighter. Lost a C-130J on 28 March, 2014 and approval was given in August 2016 to replace it. The IAF signed a Letter of Offer and Acceptance on 27 December, 2013, for the purchase of six special mission C-130Js. Lockheed Martin was awarded a production contract for these aircraft on 18 July, 2014, and deliveries to Arjan Singh (formerly Panagarh) AFS in west Bengal took place during August/September 2017. No 84 Squadron will be raised during the winter of 2017/18. A second aircraft was lost on 13 December, 2017 when it hit obstructions at Thoise airfield.	30	103 plus 20 outstanding
56 planned	Airbus C295W turboprop airlifter. At a meeting of India's Defence Acquisitions Council (DAC) on 13 May, 2015, approval was granted for the proposal to purchase 56 C295W aircraft, to replace the IAF's Avro HS748 fleet. If the contract which was still being negotiated in mid-2017 is successfully concluded, the C295Ws will be produced jointly by Airbus Defence & Space (ADS) in conjunction with local partner, Tata Advanced Systems Ltd (TASL), which will establish an indigenous assembly line. The first 14 aircraft will then be manufactured by ADS at its premises in Seville, Spain, after which the remaining 42 will be produced locally in India by		
	TASL. The Border Security Force (BSF) is also expected to order four which will push the contract up to 60 aircraft.		
	Antonov An-32 turboprop freighter. Upgrade of the aircraft under a contract signed on 15 June, 2009 is continuing. An initial 40 were worked on in Ukraine, while a further 64 An-32s are undergoing similar upgrade work in-country at the IAF's No 1 Base Repair Depot at Kanpur-Chakeri Air Force Station. Completion will see all 104 surviving IAF An-32s modified to An-32REs. BAE Systems/Hawker-Siddeley HS 748-100 turboprop transport. To be replaced by C295W - see above.		
	Boeing 707 reconnaissance aircraft		
	Boeing 777 VVIP transports. The 777-300ERs will be used for long-range international flights. These dedicated aircraft will replace the current system, which involves requisitioning Air India Boeing 747s as required for such VVIP flights.		
	Embraer EMB-145 airborne early warning and control		
	Gulfstream G100 reconnaissance aircraft		
	Airbus A330-MRTT multi-role tanker transport. On January 7, 2013 Airbus Military announced that the IAF had selected the A330MRTT as its preferred option to meet the IAF's requirement for six new tanker aircraft. However the tender was then withdrawn in August 2016.		
	Airbus A330 AWACS. India's Defence Acquisition Council (DAC) gave approval on March 28, 2015 for development of a next generation airborne warning and control system (AWACS) aircraft that will be based on the Airbus A330 airframe. It calls for the production of an initial two aircraft, fitted with an indigenously-designed active electronically scanned array (AESA) radar that will give 360° coverage. The development programme, led by India's Defence Research and Development Organisation (DRDO), has been allocated \$817.85 million and is eventually planned to produce four more of these aircraft for the Indian Air Force. It is expected to be between five and seven years before the first two are ready for delivery with the remaining four ordered about half-way through the project, according to India media reports. However, its likely that deal has been put on hold after Airbus withdrew its A330MRTT tender in August 2016.		
	Dornier Do 228-201/202 turboprop transport		
	Bombardier Global 5000 special mission aircraft. Took delivery of the second of its two Global 5000 in February 2015. They are operated by the Aviation Research Centre (ARC), which is part of India's external intelligence agency, the Research and Analysis Wing, under the control of the Cabinet Secretariat.		
	SEPECAT Jaguar T lead-in jet trainer		
	BAE Systems Hawk 132 lead-in jet trainer. The IAF Hawk Mk 132s are being produced under licence in India by HAL, following manufacture of an initial batch of 24 in the UK, the first of the latter being delivered in November 2007. They were followed by a batch of 42 HAL-assembled Hawks, the first of which was handed over on August 14, 2008, with the last being delivered in 2012. There have been three losses to date - April 30, 2008, June 3, 2015 and August 4, 2016. A further contract was signed in July 2010 for an additional 40 Hawks for the IAF, of which HAL should deliver all 40 by 2017. A further 20 have been ordered to equip the 'Surya Kiran' aerobatic team. HAL signed a MoU with BAE Systems UK, announced on May 26, 2015 for upgrade of the Indian Air Force (IAF) Hawk Mk 132s, plus development of a combat Hawk for both the		

	IAF and export markets. In addition, the HAL announcement on May 26 stated that the MoU also covers maintenance solutions for supporting the Indian Hawk and Jaguar fleets.	5
22 on order	Boeing AH-64E attack helicopter. Contract signed on Sept 28, 2015 and deliveries will continue after 36 months, completed after 48.	25
15 on order	Boeing CH-47F heavy-lift helicopter. Contract signed on Sept 28, 2015 and deliveries will continue after 36 months, completed after 48.	15
80	Hindustan Aeronautics HJT-16 Kiran basic trainer	14
12 ordered but canx	Hindustan Aeronautics HJT-36 Sitara intermediate trainer. Project terminated in March 2017 after three limited series production (LSP) and two prototypes. One of the latter was destroyed and the other damaged.	
75	Pilatus PC-7 Mk II turboprop trainer. The last was handed over on November 10, 2015.	
74	Hindustan Aeronautics Dhruv ALH light utility helicopter	
65 ordered	Hindustan Aeronautics LCH attack helicopter. To date four technology demonstrators have flown.	
2 prototypes	Hindustan Aeronautics Light Utility Helicopter. Two proto-types being tested	30
1	Mil Mi-26 heavy-lift helicopter	27
222+34 ordered	Mil Mi-8/Mi-17 medium-lift utility helicopter. One Mi-17V5 crashed June 2013.	8
20+	Mil Mi-35P Hind-E attack helicopter	8+16 on order
14+1	Airbus Helicopters SA-315 light utility helicopter	
74	Airbus Helicopters SA-316/319 light utility helicopter	8
194	Pipistrel Virus SW80 advanced microlight aircraft. The manufacturer announced on 12 October, 2015 that it would supply the carbon fibre two seat aircraft to the Indian Air Force (IAF), Indian Navy (IN) and National Cadet Corps (NCC). The contract specifies that all 194 aircraft must be delivered within a period of 30 months after the first aircraft arrived. As it will be used for training of Flight Safety and Air Wing Cadets, for additional safety Pipistrel has equipped it with a special Ballistic Parachute Rescue System which saves the entire aircraft and both pilots in the case of accident. The aircraft also have several other safety-enhancing features, such as energy attenuation seats and a Kevlar-reinforced cockpit cell.	16

INDIAN ARMY AVIATION

73+22 ordered	Hindustan Aeronautics Dhruv ALH light utility helicopter. Five have been lost, while a contract for an additional 22 was place in September 2017.
20	HAL Cheetal. A contract for 20 was signed on 22 February, 2013.
100+	Airbus Helicopters SA-315 Cheetah light utility helicopter
32+18 on order	HAL Rudra (armed Dhruv). An additional 18 were ordered in September 2017.
200	Kamov Ka-226T Sergei light utility helicopter. India and Russia finalised a joint venture agreement on 15 October, 2016 for the manufacture of 200 Kamov Ka-226T helicopters for the Indian Army and Indian Air Force. The first 40 helicopters will be procured 'off-the-shelf' from Russian Helicopters' Kumertau Aviation Production Enterprise. The remaining 160 will be produced locally by HAL over a period of eight-to-ten years under the 'Make in India' initiative.

INDIAN NAVAL AIR ARM

45	MiG-29K/KUB MRCA	
17	BAE Systems Hawk 132 lead-in jet trainer. A contract was signed in July 2010 for 17 Hawks for the Indian Navy, with all expected to be delivered in 2017.	16+8 planned
8+ 4 ordered	Boeing P-8I maritime patrol aircraft. Eight	9

delivered and four more ordered on 1 July, 2016. Ilyushin Il-38SD maritime patrol aircraft
 Dornier Do-228 maritime patrol aircraft
 Kamov Ka-28 maritime support helicopter India signed a contract with Russian arms export agency Rosoboronexport on 29 July, 2016 for the mid-life upgrade (MLU) of all ten of the Indian Navy's surviving Kamov Ka-28 Helix-A anti-submarine warfare helicopters. The MLU is scheduled for completion within 42 months. Kamov Ka-31 maritime support helicopter. The first two Kamov Ka-31 Helix-B radar picket AEW helicopters were delivered back to the Indian Navy on 6 May, 2015 after re-pairs which were undertaken by Kumertau Aviation Production Enterprise. Kumertau had supplied nine Ka-31s to India in 2004, but prior to their first scheduled overhaul, six of them were in need of extensive repairs. Those helicopters were returned to Kumertau for the work to be undertaken. The remaining four were scheduled for redelivery later in 2015/16. Airbus Helicopters SA-316B light utility helicopter
 AgustaWestland Sea King 42 maritime support helicopter
 Britten-Norman BN-2 maritime patrol aircraft
 Hindustan Aeronautics Dhruv ALH light utility helicopter. 16 ordered in September 2016.
 Sikorsky S-61/H/UH-3H maritime support helicopter
 In December 2014 the Navy selected 16 S-70B Seahawks with 8 options to replace the Sea Kings but no contract has been signed.



INDONESIA ■ INDONESIAN AIR FORCE

16	Embraer A-29 Super Tucano trainer/light attack turboprop. Embraer made an official announcement on 10 November, 2010 that the TNI-AU had selected the Super Tucano as a replacement for their OV-10 Bronco COIN aircraft and would acquire an initial batch of eight which saw deliveries completed in September 2014. A second order for eight A-29s was placed in July 2012 with all eight now delivered. One aircraft was lost on 10 February, 2016 killing both crew members.
	Sukhoi Su-27/30MK/MK2/Su-35 MRCA. The final two of six Su-30MK2s ordered in 2011 were delivered in September 2013. The TNI-AU plans to acquire eight Su-35s to replace its F-5s.
	General Dynamics/Lockheed Martin F-16A/B

23	MRCA combat aircraft. Indonesia formally requested to buy 19 second hand F-16C and five F-16D Block-25 MRCA from the United States in 2011. The last six were delivered by the end of 2017. One of the F-16Cs had an accident in April 2016 and is believed to be a write-off.	6	Airbus Helicopters AS550C3 Fennec light utility helicopter
23	BAE Systems Hawk 209 lead-in jet trainer. At least eight lost.	2	Airbus EC 120 Colibri training helicopter
3	Boeing 737 Surveiller maritime patrol aircraft.	6	PTDI NC-212 turboprop freighter
4	Obsolete and desperate need of replacement.	40	Bell Helicopter 412 medium-lift utility helicopter.
24	Boeing 737 VIP aircraft		Ten Bell Helicopter 412 enhanced performance rotorcraft ordered under a \$65 million purchase contract in March 2012 and received in March 2013.
24	Lockheed Martin C-130B/H, and L-100 turboprop freight-ers. A separate transfer contract for an additional five C-130Hs was signed with Australia on 26 July 2013.	12	Bell Helicopter 205 medium-lift utility helicopter
2	Airbus CN-235 maritime patrol aircraft	15	Airbus Helicopters BO-105 light utility helicopter
9+7 ordered	Airbus/PTDI C-295	17	Mil Mi-8/17 medium-lift utility helicopter. One lost to crash in November 2013.
5	Airbus/PTDI CN-235 turboprop freighter	5	Mi-35P attack helicopter
5+27 planned	Airbus/PTDI C-212 turboprop freighter. Airbus and PT Dirgantara Indonesia have signed an agreement (part of the contract signed in October 2011) to jointly manufacture and launch an upgraded variant of the C-212-400. The aircraft will be equipped with new digital avionics and autopilot systems and will feature 28 seats.	5	Schweizer 369/TH-300C light utility helicopter
1	Lockheed Martin KC-130B tanker	INDONESIAN NAVY	
12	Airbus Helicopters EC-120 light utility helicopter	4+7 on order	Airbus AS565MB Panther maritime support helicopter. 11 ordered on 23 November, 2016. First two were delivered to PTDI in March 2017, for fitting with ASW and sonar system. They were due to be delivered in mid-2017.
6	Airbus H225M CSAR. The helicopters handed over in November 2016 are in combat search and rescue configuration. They are the first of six of the type ordered for the TNI-AU under a contract signed in 2013. They are armed with FN Herstal Minimi 7.62 Mk 3 7.62 x 51mm calibre machine guns, pintle-mounted in the cabin doorways. The cockpit is armour-plated for crew protection, while the helicopters al-so have weather radar and a forward-looking infrared (FLIR) turret under the nose. Emergency flotation gear is also fitted.	10	Airbus/PTDI C-212 turboprop freighter
7	Airbus Helicopters BO-105 light utility helicopter. SAR - Basernas.	6	Airbus/PTDI C-212 maritime patrol aircraft
14	KAI KT-1B trainer/light attack aircraft. Three have been lost.	3	CN235MPA maritime patrol aircraft
15	Korea Aerospace Industries T-50 lead-in jet trainer. \$400 million contract signed in May 2011. This aircraft replaced the BAE Systems Hawk Mk 53s. One has been lost.	10	Bell Helicopter 412EP/SP maritime support helicopter
7	BAE Systems Hawk 109 lead-in jet trainer	8	Airbus Helicopters BO-105 maritime support helicopter
26	Grob G120TP trainer aircraft. Order placed in September 2011. Aircraft replaced the Hawker Beechcraft T-34C Mentor trainer aircraft and FFA/SIAI-Marchetti AS/SA 202-18A3 Bravo light transport aircraft. A second batch for eight was ordered in 2013.	3	Airbus Helicopters EC-120 maritime support helicopter
16	Airbus/PTDI Helicopters NAS-332 medium-lift utility helicopter. 14 search-and-rescue/transport, two for VIP use.	8	Beech Bonanza G36 turboprop training aircraft. Delivered in two batches of four.
6	Airbus EC 725. First was handed over in mid-2014	2	Beech G58 Baron. In service from December 2015
3	Airbus NAS332 VIP built in France	4	Socata TB-10 Tobago GT training aircraft. Replaced by G-36?
2	Airbus Helicopters SA-330J light utility helicopter	3	Socata TB-9 Tampico training aircraft. Replaced by G-36?
6	Soloy Bell 47G light training helicopter. Five are also stored.	<p>■ NOTES: The Indonesian Air Force plans to focus on the introduction of new MRCA and the implementation of new training programmes for its pilots. After the delivery of the final two Russian-made Sukhoi Su-30Mk. II, part of an order for six aircraft, in September 2013, Indo-nesia intends to create eight new fast jet squadrons by 2024, each consisting of 16 aircraft.</p>	
5	Cessna 172/182	JAPAN	
6	DG Flugzeugbau 1001 motorised glider	<p>■ JAPAN AIR SELF DEFENCE FORCE</p>	
INDONESIAN ARMY		64/21	Mitsubishi F-2A/B MRCA
8 ordered	Boeing AH-64E Apache attack helicopter. On 26th January 2015 the US DoD announced the award of an FMS contract to Boeing, for the manufacture of 8 AH-64E Apache Guardian attack helicopters for Indonesia. The \$295 million deal has an estimated completion date of 28 February 2018. First examples undergoing flight testing in the US during May 2017.	74	McDonnell Douglas/Boeing F/EF/RF-4EJ multi-role com-bat aircraft. Being phased out to be replaced by existing Boeing F-15DJ/Js and new Lockheed Martin F-35As Light-ning-II (see below) MRCA.
6	Airbus Helicopters AS555 Fennec 2	4+38 ordered	Lockheed Martin F-35A Lightning-II MRCA. The Japan MOD announced on June 29, 2012 that it had signed an initial LOA (Letter of Offer & Acceptance), for four aircraft, with the Japanese Ministry of Defence stating that the cost of each F-35A amounts to approximately \$128 million. The total requirement for the type currently is for 42 aircraft. The initial \$40.2 million advance-acquisition contract for the first four JASDF aircraft was awarded to Lockheed Martin Corp. (via the US Naval Air Systems Command) on 25 March, 2013, which accounts for the long lead-time parts, materials and components required to commence construction. Following assembly of the first four (AX-1 to AX-4) in the US, the remaining 38 will be as-ssembled at Nagoya in Japan by Mitsubishi Heavy Industries. Mating of the major components of the first of the latter, AX-5, began at Nagoya on 15 December, 2015. The first US-built aircraft, AX-1 was completed and rolled out of the paint shop at Fort Worth on 15 August, 2016. It was flown to Luke AFB, Arizona on 29 November, 2016 and is being

used along with another three (AX-2 to AX-4) that have subsequently been delivered.

156/45 McDonnell Douglas/Boeing F-15J/DJ MRCA. 12 have been lost.

4 Boeing E-767 airborne early warning and control

2 on order Boeing 777-300ER VIP aircraft

26 Hawker-Siddeley/BAE Systems 125 search and rescue aircraft

3 Hawker-Siddeley/BAE Systems 125 ILS calibration

13 Northrop Grumman E-2C airborne early warning and control

4 (1 ordered, 3 planned) Northrop Grumman E-2D airborne early warning and control. On June 1, 2015 the DSCA notified US Congress of the possible sale to Japan of four E-2D Advanced Hawkeye AEW&C aircraft, plus associated equipment, spares & logistical support. The overall sale will be a reported \$1.7 billion. On 12 November, 2015, Northrop Grumman was awarded an \$151.3 million contract for the first JASDF E-2D, with contract completion due in March 2018. The first aircraft flew on 13 November, 2017.

14 Lockheed Martin C-130H turboprop freighter

2 Lockheed Martin KC-130H air to air refueller

25 Kawasaki C-1A tactical transport aircraft

1 Kawasaki EC-1 reconnaissance aircraft

5+6 on order Kawasaki C-2 turboprop freighter

5 Gulfstream IV U-4 transport aircraft

10 Nihon Aircraft YS-11/YS-11 reconnaissance aircraft

? Cessna 680 Citation Sovereign. 'Some' ordered to take over from YS-11 for flight checking.

1 Lockheed Martin KC-130H tanker

4 Boeing KC-767 tanker

1 on order Boeing KC-46A Pegasus. US State Department approved sale of four aircraft on 21 September, 2016. One contracted so far, on 22 December, 2017.

13 Hawker Beechcraft T-400 turboprop transport

14 Mitsubishi F-2B MRCA

45 Boeing F-15DJ MRCA

49 Fuji T-7 primary trainer

199 Kawasaki T-4 intermediate trainer

16 Boeing CH-47JA heavy-lift helicopter

33+40 ordered Sikorsky S-70/UH-60J medium-lift utility helicopter. On December 8, 2010 Sikorsky announced that Mitsubishi Heavy Industries' proposal to build an additional 40 'new generation' UH-60J helicopters had been accepted, with deliveries taking place over the next 20 years. Deliveries are underway.

3 RQ-4B Global Hawk. Deliveries are expected to be completed by 27 July, 2018.

JAPAN GROUND SELF DEFENCE FORCE

130 Bell Helicopter UH-1H/J medium-lift utility helicopter

31/34 Boeing CH-47J/JA heavy-lift helicopter

105 MD Helicopters MD500 reconnaissance helicopter

69 Bell Helicopter AH-1S attack helicopter

13 Boeing AH-64DJP attack helicopter

80? Kawasaki OH-1 reconnaissance aircraft.

112 on order Kawasaki OH-6D scout helicopter.

7 Hawker Beechcraft King Air 350 turboprop transport

4 Mitsubishi MU-2 turboprop transport

40 Sikorsky UH-60JA medium-lift utility helicopter

30 Enstrom TH-480 light utility helicopter

3 Airbus EC225LP Super Puma Mk II VIP.

5+4 (all on order) MV-22B Osprey tilt-rotor transport helicopter. An FMS contract, for an initial buy of 5 MV-22 Ospreys, valued at \$332 million, was lodged with the Bell-Boeing Joint Project Office, on 14 July, 2015. The contract constitutes the first FMS sale of the Osprey and is for the Block C version known in the US as the MV-22. It was followed up on

19 July, 2016 by a further contract valued at \$545 million for an additional four aircraft. It comes after the US Congress agreed a sale for 17 MV-22Bs in April 2015.

JAPAN MARITIME SELF DEFENCE FORCE

83 Lockheed Martin P-3C/OP-3C/UP-3C/UP-3D Orion maritime patrol aircraft

2 Kawasaki XP-1 maritime patrol aircraft. The first prototype was handed-over to the Japanese Ministry of Defence on 29th August 2008 to continue its programme of test flights. The second prototype performed its maiden flight on 19th June 2008. The aircraft will both be reconfigured, one to become a standard, operational P-1 & the other to utility-specification UP-1.

11 (+ 60 planned) Kawasaki P-1 maritime patrol aircraft. An order for four production aircraft was announced on 31st August 2007, with a further announcement in November 2010 that ten would be procured over the next five years. The aircraft is the long-term replacement for the JMSDF's P-3C Orions, with an in-service date originally scheduled for 2011. The total requirement could be as high as 80. Included in the number in the 13 operational aircraft is a UP-1 converted from a prototype.

2 ShinMaywa US-1A search and rescue aircraft

4 ShinMaywa US-2 maritime patrol aircraft. Replacing the older US-1 (*see above*).

1 NAMC YS-11 turboprop transport

4 Learjet 36 reconnaissance aircraft

5 Lockheed EP-3E Aries SIGINT aircraft

18 Hawker Beechcraft King Air 90 turboprop transport

136 AgustaWestland/ CH-101/MCH-101 maritime support helicopter

15 Sikorsky SH/UH-60J/K maritime support helicopter

8 Airbus Helicopters EC-135/TH-135 maritime support heli-copter. Last one delivered in December 2015.

8 Sikorsky MH-53E maritime support helicopter

8 MD Helicopters MD-500 reconnaissance helicopter

20/1 Hawker Beechcraft King Air 90 (TC-90/UC-90) turboprop transport. On 30 October, 2016 Japan and Philippines finalised an agreement under which five TC-90s will be transferred to the Philippines Navy in the maritime patrol.

32 Fuji T-5 primary trainer

6 Lockheed C-130R Hercules transport aircraft. Ex US Navy LC-130Rs converted at Hill AFB, Utah. They were delivered between November 2015 - 9 July, 2016.

4 MDHI OH-6DA scout helicopter

■ **NOTES:** Despite its record as one of Asia's most technologically advanced air forces, the Japan Air Self Defence Force (JASDF) is now facing the technological improvement of China's People's Liberation Army Air Force (PLAAF). The advanced MRCA that China is developing represent a significant challenge to Japan. Japan's answer to the Chengdu J-20 MRCA came in December 2011, when it selected the Lockheed F-35A Lightning-II over the Boeing F/A-18E/F and Eurofighter Typhoon MRCA's.

LAOS

■ **LAO PEOPLE'S LIBERATION ARMY AIR FORCE**

4 Xian MA60 turboprop transport

2 Airbus EC155B

1 Kamov Ka-32T Helix-C

12 Mi-17-V1/5 Hip medium lift utility helicopter

3 Shijazhuang Aircraft Le 500 Eaglet

6 Harbin Y-12 turboprop transport/transport aircraft

3 Sukhoi S100 Superjet passenger aircraft

MALAYSIA

■ **ROYAL MALAYSIAN AIR FORCE**

18 Sukhoi Su-30MKM MRCA



12 retired	MiG-29N MRCA. RMAF continues to look at Eurofighter Typhoon, Dassault Rafale-B/C/M, Boeing F/A-18E/F Super Hornet, Saab JAS-39C/D/E Gripen and Sukhoi Su-35 MRCA to fulfil this requirement but unlikely to be a contract award for several years.
8	Boeing F/A-18D MRCA
12	BAE Systems Hawk 208 lead-in jet trainer
1/1	Northrop Grumman F-5E/F MRCA
1	Northrop Grumman RF-5E reconnaissance aircraft
4	Airbus A400M strategic turboprop transport aircraft.
5	Lockheed Martin KC-130H tanker
4	Hawker Beechcraft King Air 200 maritime patrol aircraft
9	Lockheed Martin C-130H turboprop transport
6/1	Airbus CN-235 turboprop freighter/VIP aircraft
6/8	Alenia Aermacchi MB-339AM/CM trainer/light attack air-craft
6	BAE Systems Hawk 108 lead-in jet trainer
33	Pilatus PC-7 turboprop trainer. In service from January 1983, gradually being phased out and now in store.
21	Pilatus PC-7/PC-7 Mk II turboprop trainer
12	Airbus Helicopters EC-725 medium-lift utility helicopter. Contract signed in 2010.
10	Sikorsky S-61 Nuri medium-lift utility helicopter
4	Sikorsky S-70 medium lift ex Royal Brunei Air Force
2	AS61N Sea King medium lift VIP helicopter
10	MD3-160 AeroTiga training aircraft
8	Airbus Helicopters SA-316 light utility helicopter
1	Bombardier Global Express VIP aircraft
1	Falcon 900 VIP aircraft
9	Cessna 402 utility/training aircraft

■ **NOTES:** The search for an maritime patrol aircraft continues, and despite the lessons learnt from the loss of MH370 in March 2014, the Malaysian Government doesn't seem to be in any rush to make a decision. Both the Royal Australian Air Force and Japanese Maritime Self De-fence Force has offered surplus P-3C Orions.

ROYAL MALAYSIAN ARMY

2 of 12 S-61A Nuri medium lift helicopter. A batch of 12 Nuris are being transferred from the Royal Malaysian Air Force, with the first two examples officially accepted into service on 20 March, 2015. All 12 will be subjected to an upgrade before delivery, to resolve obsolescence issues, including replacement of old analogue instruments with a new glass cockpit. Although they had been in TUDM service since 1967, these

elderly helicopters have only accumulated an average of 14,000 flight hours each and the Army says that they will be good for another 15 years of service. The Nuris are also being fitted with door-mounted 12.7mm guns to provide support for ground troops.
AgustaWestland AW-109 light utility helicopter

ROYAL MALAYSIAN NAVY

6 AgustaWestland Super Lynx 300 maritime support helicopter
6 Airbus Helicopters AS555SN Fennec maritime support helicopter

NEW ZEALAND

■ ROYAL NEW ZEALAND AIR FORCE

6 Lockheed Martin P-3K2 maritime patrol aircraft. The RNZAF is now looking at replacements now, with the US State Department Boeing P-8 Poseidon approving a possible sale of four valued at \$ 1.46bn. Japan has also offered the Kawasaki P-1.
2 Boeing 757-200 turbofan transport
6 AgustaWestland AW-109 light utility helicopter.
4 Hawker Beechcraft King Air 200 turboprop transport
3 Lockheed Martin C-130H turboprop freighter
9 NH Industries NH-90 medium-lift utility helicopter
8 Bell Helicopter UH-1H medium-lift utility helicopter
11 Hawker Beechcraft T-6C Texan II training aircraft

ROYAL NEW ZEALAND NAVY

10 Kaman SH-2G maritime support helicopter. The decision to buy ten ex-Australian SH-2G Super Seasprites was announced on 19 April 2013. Eight of the new aircraft will replace the five existing SH-2G.

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA

■ KOREAN PEOPLE'S ARMY AIR FORCE

20+ MiG-29 MRCA
56 MiG-23 MRCA
50? MiG-21 MRCA
106 Shenyang F-5 MRCA
97 Shenyang F-6 MRCA
120 Chengdu F-7 interceptor aircraft
80 Harbin H-5 medium bomber
36/4 Sukhoi Su-25K/UB MRCA
1 Antonov An-24 turboprop freighter
20 Mil Mi-24 attack helicopter
4 Mil Mi-26 heavy-lift helicopter
8 Mil Mi-14 maritime support helicopter
84 MD Helicopters MD500 light utility helicopter
46 Mil Mi-2 light utility helicopter
40 Mil Mi-8 light utility helicopter
100? Shenyang FT-5 trainer aircraft
30? Nanchang CJ-6 training aircraft
2 Tu-134B airliner
3 Tu-54B airliner
2 Tu-204 airliner

PAKISTAN

■ PAKISTAN AIR FORCE

100 of 112 on contract Chengdu JF-17 Thunder MRCA. All current aircraft are Block-1. The next 50 JF-17 will be Block-II and the third 50, Block III. A total of 150 aircraft are planned to be re-quired. All will eventually be upgraded to Block 3. The Block 1s are being upgraded to Block 2s. An additional 12 Block 2s were ordered in early 2017.
76 General Dynamics/Lockheed Martin F-16A/B MRCA, comprising 58 Block-A/B and 18 Block-C/D.
50 Dassault Mirage-III/EP/OF/RP MRCA. Expected

50 to remain in service until 2017.
 Dassault Mirage-5EF/F/PA MRCA. The fleet will be replaced with the Chengdu JF-17 by 2017 (see above).

12 Dassault Mirage-III BE/D/DP MRCA

2 Dassault Mirage-5DPA MRCA

8 Chengdu FT-7 combat/trainer aircraft

36 Chengdu F-7P.

35 Chengdu F-7PG MRCA.

39 Hongdu K-8 Karakorum light attack/ lead-in jet trainer

2 Dassault Falcon 20/200 reconnaissance aircraft

3/1 Saab 2000 AEW&C aircraft, plus a utility aircraft.

4 Shaanxi Y-8/ZDK-03 transport/airborne early warning and control

4 Ilyushin Il-78 tanker

3/1 Airbus CN-235 turboprop freighter/VIP

16 Lockheed Martin C-130B/E and L-100 turboprop freighter

6 Mil Mi-8/171 medium-lift utility helicopter

10 Airbus Helicopters SA-316 light utility helicopter

8 Leonardo AW139. Deliveries commenced in mid-2017

10 Aérospatiale SE-3160 light utility helicopter

40 Cessna T-37B/C trainer aircraft. Recently acquired a batch from Turkish Air Force

40 MFI-17 Super Mushshak primary trainer/comms aircraft. Four have been upgraded with glass cockpit, unsure how many on contract.

PAKISTAN ARMY

48 Bell Helicopter AH-1F attack helicopter

12 Bell AH-1Z. An initial three were delivered in 2017 and an other nine will follow in 2018.

19 Bell Helicopter 206 medium-lift utility helicopter

45 Bell Helicopter 412 medium-lift utility helicopter.

45 Mil Mi-8 and Mil-171 medium-lift utility helicopter

8 Bell Helicopter UH-1H medium-lift utility helicopter

14 Airbus Helicopters SA-315 light utility helicopter

10 Airbus Helicopters SA-316 light utility helicopter

31 Airbus Helicopters SA-330 medium-lift utility helicopter

22 Airbus Helicopters AS-550 U2 medium-lift utility helicopter

30 Schweizer 260/TH-300 training helicopter

1 Citation Bravo turbofan transport

4 Hawker Beechcraft King Air 350 turboprop transport

4 Harbin Y-12 turboprop transport

100 MFI-17 Mushshak training aircraft

PAKISTAN NAVY

6 Lockheed Martin P-3C maritime patrol aircraft. Two new aircraft delivered in February 2012 following the attack by armed militants on the Mehran Naval Airbase, southern Pakistan in May 2011. Two upgraded P-3C were destroyed on that occasion and two additional aircraft were delivered in February 2012.

7 Airbus Helicopters SA-316 maritime support helicopter

6 AgustaWestland Sea King 45 maritime support helicopter. All upgraded with Selex Seapray 7300 radar

6 Harbin Z-9EC medium-lift utility helicopter

2 ATR 42 utility aircraft

PHILIPPINES

PHILIPPINE AIR FORCE

12 Korean Aerospace Industries (KAI) FA-50PH lead in fighter trainer/light attack. Of the 12 ordered, two were delivered by end of 2015, two on December 1, 2016 and the remaining eight in 2017.

6 on order A-29 Super Tucano. An order was announced on



30 November, 2017 for six aircraft that will be used in the air support, light attack, surveillance, air to air interception and counter-insurgency. They will be delivered from 2019 and operated by the 15th Strike Wing.

8 North American Aviation OV-10 light attack turboprop

2 Lockheed Martin C-130H/B turboprop transport

2 Lockheed Martin C-130T turboprop transport. Ex USMC first delivered April 5, 2016 and second, 9 October, 2016

3 Airbus C295M turboprop transport. Delivered between March-December 2015

1 Fokker F-27 turboprop transport

1 Fokker F-28 Fellowship VIP transport

1 GAF Nomad 22 turboprop transport

2 PTDI NC212i transport aircraft. Ordered in 2014 and delivered in 2017.

2 Cessna 208 Grand Caravan EX light transport aircraft converted into ISR aircraft. In service from July 2017.

5 Cessna R172 utility aircraft operated by weather unit

19 Cessna T41 training aircraft. 15 ex ROKAF aircraft were delivered in 2008/09

5 SIAI-Marchetti S.211 trainer aircraft

8 AgustaWestland AW-109AH Power light utility helicopter. Contract signed in November 2013 and first two officially inducted into service on 17 August, 2015. They are being used to support of homeland security, in armed reconnaissance & close support tasks, for which they are fitted with a pair of 0.50in calibre machine guns and rocket launchers. The value of the acquisition package, which also includes initial training for aircrew & technicians, was declared at \$56.4 million.

4 ordered Airbus Helicopters AS550 medium-lift utility helicopter

6 PLZ W-3 Sol light utility helicopter. Two lost.

10 MD Helicopters MD-520MG light utility helicopter. Lost 11 and around seven are stored.

5 Sikorsky S-76A/AUH-76A medium-lift utility helicopter. 5 lost

38 Bell Helicopter UH-1H medium-lift utility helicopter. 33 are beyond economical repair, 25 recoverable but need a budget for repair, 21 are operational. Bidding for 21 refurbished ex German Air Force/ Army UH-1H helicopters failed for the third time in September 2013 as it fell short of requirements. Nine were eventually delivered before the contract was terminated. One was lost on 4 June, 2017. Four have been converted to Huey II standard.

4	UH-1H-II Huey II
3	Bell Helicopter 205 medium-lift utility helicopter
11	Bell 412EP medium-lift utility helicopter. The eight Bell 412EPs were ordered through a 4.8 billion pesos (\$106 million) contract with Canadian Commercial Corporation on March 28, 2014. The first two arrived in the Philippines in June 2015. Three of the B412EPs, which are in a VIP con-figuration and colour scheme, are being assigned to the 250th Presidential Airlift Wing for VIP transport. The other five, in standard overall dark green camouflage, will supplement the Huey helicopters of the 205th Tactical Helicopter Wing, undertaking medium-lift missions, plus humanitarian and disaster relief operations.
2	Bell 412HP
1	Sikorsky S-70A-5 Black Hawk. 1 lost
17	Alenia aermacchi SF260FH trainer aircraft. 1 lost
6	Alenia Aermacchi SF-260 light attack/trainer aircraft. Seven lost, around six in store.

PHILIPPINE NAVY AVIATION

5	Britten Norman BN-2 maritime patrol aircraft. Will be replaced by King Airs.
2+3 on order	Beech TC-90 King Air. In service from March 2017, final three are due for delivery in March 2018
4	Cessna 172F/N/177B/A152
1	Airbus Helicopters BO-105 light utility helicopter
5	AgustaWestland AW-109E Power maritime support helicopter.
2 on order	AW159 Wildcat. After the Philippine Navy selected the AW159 Lynx Wildcat as its preferred option for two new anti-submarine warfare (ASW) helicopters, on March 17, 2014 the Department of National Defence (DND) confirmed that \$120.479 million had been approved for the acquisition. A formal contract was finally signed on 29 March, 2016, with deliveries scheduled to take place in 2018.

PHILIPPINE ARMY AVIATION

4/2	Cessna 172/206
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SINGAPORE

■ REPUBLIC OF SINGAPORE AIR FORCE

40	Boeing F-15SG MRCA. Declared combat-ready by Singapore Defence Minister in September 2013.
60	Lockheed Martin F-16C/D MRCA. Aircraft due for upgrade. Lockheed Martin was awarded a \$914 million Foreign Military Sales contract by the US Air Force on 1 December, 2015 to upgrade RSAF F-16s. The work will be carried out at the company's plant in Fort Worth, Texas, where it is expected to be completed by 30 June, 2023. Plans for modernising the RSAF's 60 F-16C/D Block 52s had first been revealed publicly by Defence Minister Ng Eng Hen in response to a question in parliament in September 2013. A subsequent announcement by the Singapore Ministry of Defence on 30 June, 2015 said a \$27 million deal exercising four options on a previous contract to upgrade Republic of Singapore Air Force aircraft. No details of the work were revealed, but it is expected to be complete by 30 June, 2023. The work will include a new AN/APG-83 active electronically scanned array radar, together with more capable precision weapons, including the Laser Joint Direct Attack Munition (Laser JDAM) and new advanced air-to-air weapons. A datalink capability and advanced helmet-mounted display will also be included. It was also stated that the modernisation will commence in 2016 and be carried out in phases. On 23 November, another announcement saw Lockheed Martin awarded an



6/10	additional contract worth \$27 million after the RSAF exercised four options of which no details were given.
?	Boeing CH-47D/SD heavy-lift helicopter
18	Boeing CH-47F Chinook heavy-lift helicopter. Order announced on 7 November, 2016 but no numbers disclosed they will replace CH-47SD
14	Airbus Helicopters AS332M1 Super Puma medium lift/SAR
?	Airbus AS532UL medium-lift utility helicopter
19	Airbus H225M Caracal medium-lift utility helicopter. Order announced on 7 November, 2016 but no numbers disclosed they will replace AS332/ AS532
5	Boeing AH-64D attack helicopter
6+2 on order	Airbus Helicopters H120 Colibri light utility helicopter. All are owned by ST Aero, but are used for training by RSAF under a performance based logistics support programme.
5/4	Sikorsky S-70B maritime support helicopter. Operated from Singapore Navy frigates. The two on order will be delivered in early 2018.
4	Fokker F-50 MPA maritime patrol aircraft and UTA utility transport (4)
4	Gulfstream G550 CAEW airborne early warning and control
6	Lockheed Martin C-130H turboprop transport
4	Lockheed Martin KC-130B/H tanker
12	Boeing KC-135R tanker
19	Alenia Aermacchi M346 lead-in jet trainer. Deliveries completed in September 2014 and 150 Squadron activated, based at Cazaux Air Base near Bordeaux
6 on order	Pilatus PC-21 turboprop transport
	Airbus A330MRTT multi role tanker transport aircraft. On 6 March, 2014 MinDef announced that the A330 MRTT had been selected over the Boeing KC-46 Pegasus, although gave no details of the quantity involved, nor a timescale for conclusion of the contract details, or deliveries. On 7 March, 2014 it was officially confirmed by Airbus Military that the RSAF has ordered six aircraft, to replace the four existing KC-135R Stratotankers in the aerial refuelling role. The first aircraft, Airbus A330-243 emerged from the conversion line at Getafe, near Madrid, Spain, after completion and was noted performing its first test flight on 30 September, 2016. This aircraft is the first to incorporate a number of enhancements introduced on the basic A330 as well as upgraded military systems as part of Airbus Defence and Space's continuous product improvement programme. The new

standard A330 MRTT features structural modifications, aerodynamic improvements giving a fuel-burn reduction of up to 1 percent, upgraded avionics computers and enhanced military systems. The first aircraft is due for delivery in the summer of 2018.

12 Elbit Systems Hermes 450. In service from 2007.

8+ MALAT Heron I. Inducted into service in May 2012 and declared fully operational in March 2017.

REPUBLIC OF KOREA

REPUBLIC OF KOREA AIR FORCE

60 Boeing F-15K Slam Eagle MRCA. The first lot of Taurus KEPD 350K stand-off missiles was handed over to the ROKAF on 14 October, 2016. MBDA says that the Taurus KEPD 350K programme is progressing according to plan and its integration onto the ROKAF F-15K Slam Eagle is in the final stages. The Taurus weapon system will provide the RoKAF with what MBDA claims is the most advanced stand-off and deep strike capability currently available on the world market. The US would not export cruise missiles when the contract was awarded and hence a European weapon on a F-15K. One lost.

57 Korea Aerospace Industries FA-50 MRCA. The new FA-50s will replace the Northrop Grumman F-5E/F MRCA fleet which will be retired by 2019.

10 on order Lockheed Martin F-35A Lightning-II MRCA. Deliveries for 10 aircraft will begin in 2018. There is a requirement for 60 F-35As.

30+ McDonnell Douglas/Boeing F-4E MRCA

72+ Northrop Grumman K/F-5E MRCA

44 Northrop Grumman K/F-5F MRCA

90/42 Lockheed Martin K/F-16C/D MRCA. Lockheed Martin was awarded a \$1.2 billion fixed-price-incentive-fee Foreign Military Sales contract on 18 November, by the US Air Force Life Cycle Management Center to upgrade the Republic of Korea Air Force (ROKAF) KF-16 fleet. Work will be undertaken in Fort Worth, Texas, with contract completion expected by 15 November, 2025. The brief announcement by the US Department of Defense gave no further details. However, the Defense Security Cooperation Agency revealed more on the upgrade when it notified Congress of the planned deal on 14 July, 2015. It will involve all 134 ROKAF KF-16C/D Block 52 aircraft and is valued in total at an estimated \$2.5 billion including weapons, associated equipment and

27/8 logistical support. It will include the Northrop Grumman AN/APG-83 scalable agile beam radar (SABR).

22 Lockheed Martin F-16C/D. Deliveries commenced in 1986 prior to the KF-16 kits supplied to Samsung (now KAI).

4 Korea Aerospace Industries FTA-50 lead-in jet trainer

4 on order Boeing 737 airborne early warning and control Airbus A330MRTT multi role tanker transport aircraft. South Korea's Defense Acquisition Program Administration (DAPA) announced on 30 June, 2015, that the A330 MRTT had been selected to meet the country's KC-X requirement for four air refuelling tanker aircraft. The first aircraft which flew from Toulouse to Getafe for MRTT conversion in May 2017 is expected to be delivered in 2018 and the last before the end of 2019. On 16 November, 2016 the US State Department granted a possible Foreign Military Sale to the Republic of Korea, for AN/AAQ-24(V) Large Air-craft Infrared Countermeasures (LAIRCM) systems, equipment, training and support, at an estimated cost of \$141 million. Which will be integrated into the A330MRTTs.

2 Dassault Falcon 2000SIGINT reconnaissance aircraft

4 on order Northrop Grumman RQ-4B Global Hawk. On 4 November, 2013 the Republic of Korea's Defence Acquisition Programme Administration (DAPA) confirmed that plans 'to adopt Global Hawks in 2017' had been formalised, with the signing of a contract for 4 air vehicles, plus associated equipment & logistical support, anticipated to take place during early 2014. This was duly completed when an order was placed with Northrop Grumman on 16 December, 2014, for manufacture of the four air vehicles.

4/4 Hawker-Siddeley/BAE Systems 125-800RA/-800SIG reconnaissance aircraft

12 The four -800SIGs are configured for ISR and SIGINT tasks, under Lockheed Martin 'Peace Krypton' programme.

4 Lockheed Martin C-130H turboprop transport aircraft

4 Lockheed Martin C-130J turboprop transport aircraft

12 Airbus/PTDI CN-235 turboprop transport aircraft including four Coast Guard

22 KAI KC-100 T-103 piston-engine basic trainer

2 Airbus Helicopters AS332 medium-lift utility helicopter. Two lost

3 Bell Helicopter 412 medium-lift utility helicopter

7 Boeing HH-47D heavy-lift helicopter. Five operated by Army

7 Kamov Ka-32 maritime support helicopter

25 MD Helicopters MD500 light utility helicopter

29 Sikorsky S-70/HH/UH-60P medium-lift utility helicopter

3 Sikorsky VH-60P VIP medium lift helicopter

3 Sikorsky VCH-92. Used for Presidential and VIP transport

84 Korea Aerospace Industries KT-1 basic trainer aircraft

20 Korea Aerospace Industries KA-1 light attack aircraft

? Korea Aerospace Industries KT-100. Development is underway for the training aircraft which will replace the Ilyushin T-103s. First aircraft flew on 5 October, 2015.

22 Ilyushin T-103 training aircraft. 1 lost

59 Korea Aerospace Industries T-50/B/TA-50 lead-in jet trainer

10 Antonov An-2. Used for special operations. Two lost.



REPUBLIC OF KOREA ARMY

60+	Bell Helicopter AH-1F/S attack helicopter
36	Boeing AH-64E attack helicopter. On 17 April, 2013 it was officially announced, by Korea's Defense Acquisition Program Administration (DAPA), that the AH-64E Guardian had been selected to meet the requirement for new attack helicopters, beating off competition from Bell's AH-1Z Viper & TAI's T-129 ATAK. Although no details were disclosed regarding the number of Guardians being acquired, the \$1.790 billion deal is confirmed to account for 36 examples. On 23 August, 2013, Boeing was awarded a production contract for these helicopters. After being shipped by sea, the first four were unloaded at the port of Busan on 25 May, 2016. All are now believed to have been delivered.
12	Airbus Helicopters/KAI BO-105 light utility helicopter
35?	Boeing CH-47D/SD heavy-lift helicopter
180	MD Helicopters MD500 light utility helicopter
60	Bell Helicopter UH-1H medium-lift utility helicopter
130+	Sikorsky S-70/UH-60L/P medium-lift utility helicopter
70+	Korea Aerospace Industries Surion KUH/1 medium-lift utility helicopter. Requirement for 245.
214 on order	Airbus Helicopters H155. Airbus Helicopters signed a contract on March 16, 2015 in Seoul with Korea Aerospace Industries (KAI) for the development and production of 214 military Light Armed Helicopters (LAH) and around 100 Light Civil Helicopters (LCH). Both designs will be based on the Airbus Helicopters H155, the new designation for the EC155B1 Dauphin. Initial helicopters will be produced at the manufacturer's production site in Marignane, France, before final assembly shifts to KAI's factory in Sacheon. A joint venture will also be created to tap the export market for both types, for which Airbus Helicopters estimates potential sales of up to 600.

REPUBLIC OF KOREA NAVY

16	Lockheed Martin P-3C/CK maritime patrol aircraft
5	Reims F406 Caravan II turboprop utility transport
23	AgustaWestland Lynx 99/99A maritime support helicopter. Two lost
8	Sikorsky UH-60P maritime support helicopter. One lost.
4	Bell Helicopter UH-1H maritime support helicopter.
8	AgustaWestland AW159 maritime support helicopter. Purchased in a \$560 million deal that saw the four AW-159s inducted on 29 July, 2016. Final four were delivered in November 2016 and commissioned on 5 July, 2017.

REPUBLIC OF KOREA MARINE CORPS

30 ordered	Korea Aerospace Industries Surion KUH/1. The Marines contracted KAI/Airbus for supply of 30 KUH-1Ms in December 2016.
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■ **NOTES:** The RoK hopes to leap into the rank of major arms exporters as a result of its ongoing Korea Fighter Experimental (KFX) programme. The programme, which is to be led by the RoK's largest aircraft manufacturer Korea Aerospace Industries (KAI), focuses on the development of an advanced fifth-generation multi-role combat aircraft for the Republic of Korea Air Force (RoAF) and the Indonesian Air Force (TNI-AU). Facing the threat from the Democratic People's Republic of Korea and the strategic situation involving China and Japan, the RoK has developed its own initiatives to respond to the urgent need to replace obsolete platforms in its fleet of MRCA. The country has also announced its intentions to purchase 60 Lockheed Martin F-35A Lightning-II MRCA fifth-generation fighters under the FX-III programme,



with a contract for ten already signed. First deliveries should occur in 2018.

SRI LANKA

■ SRI LANKAN AIR FORCE

6	Israel Aerospace Industries Kfir C2/7/(T)C2 MRCA. Only one airworthy in mid-2016.
8	Chengdu F-7BS/GS/FT-7 MRCA. None airworthy in mid-2016.
2	Shenyang FT-5 jet trainer. Both aircraft are now stored.
6	MiG-27M MRCA None airworthy in mid-2016.
1	MiG-23UB MRCA not airworthy in mid-2016.
2	Hawker Beechcraft King Air 200 maritime patrol aircraft
2	Lockheed Martin C-130K turboprop freighter
4	Antonov An-32 turboprop freighter. Six lost.
7/2	Harbin Y-12-II/IV turboprop transport
2	Xian MA60 turboprop transport. Operated by Helitours, the commercial arm of the SLAF.
4	Bell Helicopter 206 medium-lift utility helicopter
13	Bell Helicopter 212/412 medium-lift utility helicopter
4	Mil Mi-17 medium-lift utility helicopter. Seven
lost.	Mil Mi-171 medium lift helicopter. Includes four civilian operated by Helitours
18	Mil Mi-24/35 attack helicopter. Most believed to be grounded mid-2016
9	Hongdu K-8 lead-in jet trainer/light attack aircraft
7	Cessna 150 utility aircraft. Used for primary training.
4	Cessna 421C Golden Eagle. Used for survey work.
1	Nanchang PT-6 training aircraft
8	

TAIWAN

■ REPUBLIC OF CHINA AIR FORCE

115/27	Lockheed Martin F-16A/B MRCA Taiwan is the launch customer for the new F-16V variant from Lockheed Martin. The company has won a contract worth \$1.85 billion to upgrade its fleet of 144 Block 20 F-16A/Bs to the F-16V status. This will include Northrop Grumman's Scalable Agile Beam Radar (SABR) as well as enhancements to mission computers, vehicle systems, aircraft structure, cockpit and electronic warfare systems. On 22 November, 2016 Lockheed Martin was awarded a \$12.3 billion contract for developmental support equipment for the ROCAF F-16s. The contractor will provide equipment required for reliability, performance, and sustainability for 144 Taiwan F-16s. The company also will provide
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1	With Selex Seapray 7000 radar Canadair/Bombardier CL-215 fire-fighting amphibious aircraft	10
6/3	Bell Helicopter 212/214 maritime support helicopter	30/7
5	Sikorsky S-76B search and rescue	3
6/2	Sikorsky S-70B/MH-60S maritime support helicopter	4
2	AgustaWestland Super Lynx 110 maritime support helicopter	5
5	Eurocopter EC-635 T2 utility helicopter. Deliveries accepted into service in 2016.	15+

VIETNAM

■ **VIETNAMESE AIR FORCE**

40	MiG-21bis MRCA
6/5	Sukhoi Su-27SK/UBK MRCA
35	Sukhoi 30MK2V MRCA. Contract announced in August 2013. Aircraft delivered in 2014-2015 timeframe. The first loss of the type occurred on June 14, 2016, when the aircraft crashed into the sea. Both pilots ejected and one was rescued the next day but the other was never found.
25	Sukhoi Su-22 MRCA
3	Airbus C295M transport aircraft. The first example was handed-over to the VPAF on 17 October, 2014, but retained at the Airbus DS facility in Seville, for crew training, with delivery to Vietnam taking place in early December 2014. The second C295M departed Seville on 5 March, 2015, to undertake its delivery flight to Vietnam, whilst it is also thought that the third aircraft has been delivered.

1	Antonov An-26 turboprop transport
1	PZL M28MPW Skytruck maritime patrol aircraft. One lost.
30/7	Mil Mi-8/17 medium-lift utility helicopter
3	Mil Mi-172 VIP/transport medium lift utility helicopter
4	Mil Mi-171 SAR-equipped
5	Bell Helicopter UH-1H medium-lift utility helicopter
15+	Aero L-39 lead-in jet trainer
10	Aerostar Iak-52. Ten delivered during 2009-10.
6	An-2TD Colt supplied by PZL Mielec in 2002

VIETNAMESE NAVY

3/3	Viking Air DHC-6-400/Guardian 400 Twin otter turboprop transport. Agreement for six aircraft signed in May 2010. First DHC-6 arrived in Vietnam in October 2013. The three Guardian 400s are being utilised for transport, resupply, maritime surveillance & SAR operations throughout Vietnam's coastal regions.
2	Airbus Helicopters EC-225 medium-lift utility helicopter
3/1	Kamov Ka-28/32 maritime support helicopter

VIETNAMESE COAST GUARD

3	CASA 212-400 Aviocar. Two ex-Swedish Coast Guard aircraft, and a third brand new NC 212 built by PTDI in Bandung, Indonesia. All fitted with the Swedish Space corporation (SSC) MSS6000 maritime surveillance system. AMR
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“TANK!!” THE PSYCHOLOGICAL IMPACT OF ARMOUR



The Japanese Ground Self Defence Force Manoeuvre Combat Vehicle offers a highly mobile, easily deployable and lethal 105mm cannon capability to support rapid reaction operations against intrusions. Its lighter weight allows easy air and sea transport while its wheeled design permits long distance travel on roads.

Mobility, firepower and protection. Three qualities of the main battle tank that ensure that they are retained, modernised or replaced.

by Stephen W. Miller

The tank is a uniquely valued battlefield asset due to its unique combination of mobility, firepower, and protection. It is equally capable of executing offensive and defensive operations with the ability to shift from one to the other literally in minutes. The tank can also demoralize an opponent sowing confusion and fear thereby breaking down the cohesion of their combat and support forces. It possesses arguably the greatest capacity to physically destroy an enemy and his assets of any other single ground combat system. Yet it is its ability to apply precise fires while moving at speed and to reposition to attack or defend from unexpected quarters at will that are its most significant attribute. In many ways the physiological impact is the tanks greatest contribution.

It is the combination of mobility, firepower, and protection that defines the tank. The impact of these attributes is not necessarily dependant on a perfect mix of these characteristics. In fact, history has repeatedly shown that small numbers of tanks even with lesser capabilities have dominated battlefields. The success of Japan's lightly armoured and armed tanks in overcoming the British Commonwealth defence of the Malaya peninsula in 1942 is a case in point. The fact is that the tanks attributes are multiplied when it is employed and properly supported in terrain and conditions where or when it is not anticipated. It is a tactical lesson armies operating in the Asian-Pacific appear to have taken to heart as they acquire not only modern main battle tanks but develop and field other highly manoeuvrable and deployable

direct fire gun systems.

Manoeuvre Tanks

The current generation of main battle tank (MBT) has become to some military the ideal combination of mobility, firepower, and protection that cannot be compromised. The difficulty is that this MBT has become increasingly difficult to move easily in response to operational demands. This is particularly true on rural roads and over bridges but also travelling long distances on paved roadways. In addition, their transport by air and sea to conduct expeditionary operations is limited. Modern MBT's like the Rheinmetall Leopard 2A6 have a combat weight of over 62 tonnes. Even the Japanese Ground Self Defence Forces (JGSDF) Type 10 MBT, designed specifically to be lighter, comes in at 48 tonnes. A principle driver for weight is the protection level requested since technologies have been introduced that allow for even 120mm cannon to be mounted in lighter vehicles. A number of armies in the Asian-Pacific have chosen increased manoeuvrability and expeditionary capability accepting reduced passive protection.

Type 16 Manoeuvre Combat Vehicle – Japan

The JGSDF recognizing a capability gap in its forward defence strategy developed a highly mobile direct fire support combat vehicle. The Manoeuvre Combat Vehicle (MCV) or Type 16 debuted in 2013. Produced by Mitsubishi Heavy Industries the 26 tonne eight wheeled drive vehicle mounts a 105mm rifled cannon.

The turret has fire controls equivalent to the latest MBT including the commander's independent panoramic hunter-killer sight that allows target detection on the move and hand off engagement by the gunner. Its wheeled running gear permits autonomous long distance road movements at speeds up to 100 km/h. In addition, MCV can be transported in the Kawasaki C-2 tactical cargo aircraft allowing deployment to even remote islands. Despite its moderate weight its modular armour resists penetration of 35mm and 40mm projectiles in the frontal area and 14.5mm projectiles all around. The first MCV's were fielded in 2016 with plans for around 300 and the possibility of replacing some older MBTs.

CM-32 – Taiwan

The Republic of China's (Taiwan) Clouded Leopard family of indigenously developed 8 X 8 armoured fighting vehicles includes a mobile gun variant with a 105mm rifles cannon. This version has been displayed at several defence shows. It has been considered as an appropriate replacement for the Army's M41 Walker Bull Dog light tank fleet. Although locally upgraded in the M41D with thermal sights, new fire controls, and a Detroit 8V-71T diesel engine, the M41's are considered marginally capable at best. Reportedly 400 are still in operational use. Production of the CM-32 infantry version was to begin in 2010 but local news has reported delays which would certainly impact on any further commitment to the 'gun variant'.

Light Tanks

Light tanks have the attributes of MBTs but compromise armour protection levels for lower combat weight. This lower weight is more suited for the lower capacity of rural bridges, thus, light tanks found service with many Asian-Pacific armies. Introduced in the 1960s and 70s, armies including the Philippines, Thailand, Taiwan, and Indonesia retain light tanks, albeit upgraded with improved fire controls and, in some cases, larger main armament. The GIAT (now Nexter) AMX-13, for example, remains in use in Indonesia with a new fire control, and additional armour fitted locally by PT PINDAD.

ZTQ - PLA

As early as 2011 reports of a new People's Liberation Army (PLA) of China tank surfaced. This new tank appeared destined for use in the western mountainous regions and was later identified as the ZTQ, a 105mm gun equipped tank with an automatic loader with a 33 tonne weight. Its public display by NORINCO, the developer, at the Beijing Exhibition Centre in 2016 confirmed some of its details as well as the offering of an export version, the VT-5. It reportedly uses composite armour and can fit explosive reactive armour. The PLA is reported to be fielding 300 units.

Modern Medium Weight Tank (MMWT) – Indonesia

This weight class appears to be a compromise made by other armies as well. Since 2015, Indonesia's PT PINDAD has been pursuing a joint development of its new Modern Medium Weight Tank (MMWT) with Turkey's FNSS.



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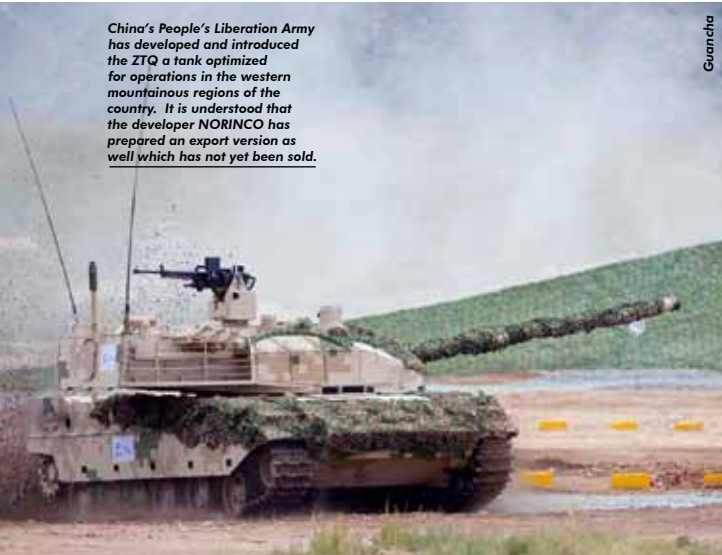
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China's People's Liberation Army has developed and introduced the ZTQ a tank optimized for operations in the western mountainous regions of the country. It is understood that the developer NORINCO has prepared an export version as well which has not yet been sold.

Guancha



Called the Kaplan MT (Turkey) or Harimau Hitam/Black Tiger (Indonesia) it was first displayed in November 2016 at the Indo Defence expo. The 35 tonne vehicle was shown with a CMI Cockerill 3105 turret with 105mm low recoil cannon equipped with an automatic loader. FNSS sources indicate that the MMWT uses modular armour that can provide protection to STANAG 4569 Level 4 (14.5mm armoured piercing and 155mm shrapnel). It also has stabilisation, thermal sights and a commander panoramic hunter-killer sight. Two prototypes currently exist while Indonesian officials have suggested future plans for up to 200 which will be likely replace the AMX-13s.

Mobile Protected Firepower (MPF) -US

In the United States it is the Mobile Protected Firepower (MPF) programme that has top attention. MPF was earlier defined by Col William Nuckols, director, Mounted Requirements Division to AMR "as a tracked protected direct firepower vehicle that will provide support for the Infantry Brigade Combat Teams (IBCT) in forcible or early-entry operations." It is to be able to be readily deployed particularly by transport aircraft. The programme has seen effort by the Army to more closely involve industry earlier in the programme development which it hopes will encourage innovation, reduce risk and allow an accelerated schedule. David Dopp, the project lead for MPF stated. "We've had constant, positive industry engagement including one-on-one sessions with Industry and top Army leadership." As a result engaged industry has invested their own Independent Research and Development (IRAD) funds to enhance their potential designs to a level of readiness consistent with the anticipated schedule.

A Request for Proposals (RfP) was released by the Army Contracting Command on 27 November 2017. Two Engineering Manufacturing Development (EMD) contracts will be awarded in late 2018 (1st Quarter Fiscal Year 2019). There are three contenders currently anticipated as General Dynamics Land Systems, BAE Systems, and SAIC. BAE is expected to draw on its M8 Armoured Gun

System (AGS) design which Mr. Deepak Bazar BAE Programme Director Combat Vehicles suggested "had been originally developed to meet the Army's air-drop and LAPES (Low Altitude Parachute Extraction System) requirements. Although an MPF objective requirement we view it as highly desirable and achievable." General Dynamics has shown a concept using a lightweight 120mm tank gun on the Ajax scout vehicle chassis. SAIC is leading a team that will integrate Singapore's ST-Kinetics Next Generation Armoured Fighting Vehicle chassis and CMI Cockerill's 3105 gun/turret system.

Main Battle Tanks Leopard 2 – Indonesia and Singapore

There have been a number of initiatives by Asian-Pacific armies to introduce the most advanced MBTs in the last few years. This is partly the result of state-of-the-art MBTs becoming available at attractive prices from surplus created by several NATO Army reorganisations. Rheinmetall Defense has successfully offered upgrades and customized improvements for the Leopard2 MBT to both the Indonesian Army (Tentara Nasional Indonesia Angkatan Darat, TNI-AD) and Singapore Armed Forces (SAF). Oliver Hoffman, a Rheinmetall spokesperson verified to AMR that "the modernization program includes both Leopard 2A4+ and either a Leopard 2 RI (in the case of Republic of Indonesia) or Leopard 2SG (for Singapore). Improvements cover climate control system, improved ballistic protection, conversion from a hydraulic to an electric turret drive, an auxiliary power unit, and installation of rear cameras. In addition, Rheinmetall is enhancing the 120mm smoothbore gun in the RI with a programming kit that will enable it to fire Rheinmetall's new programmable DM11 multipurpose round."

The TNI-AD has ordered 103 of the Leopard 2 RI and taken delivery of more than half of these. Substantial work is being accomplished by Indonesia's state owned company PT PINDAD and the TNI-AD's Ordnance Depot. The Singapore MBT contract is being conducted with Singapore Technologies (ST) who's subsidiary STELOP is providing its Commander's Open Architecture Panoramic Sight (COAPS). COAPS appears to be being build under licence from Elbit Systems and was first seen on the Leopard SR in May at the Army Open House 2017. Singapore is receiving 66 Leopard SRs.

VT-4 Thailand

The Royal Thai Army's (RTA) quest for a new MBT has been taken several twists. Its original intent was to acquire 49 of the Oplot T-84T manufactured by Ukraine's Malyshev Factory. However, the 2011 contract worth \$241 million experienced repeated delays missing the 2014 delivery. This was a major concern as the RTA

had immediate need to begin replacing its 200 1957 vintage M41 light tanks. As of 2017 only 25 T-84s have been received. This prompted the RTA beginning in 2016 to look to other MBT options. With the United States arms embargo in place and China's government actively seeking improved ties with Thailand, it was not a surprise to see NORINCO step-up with its VT-4 MBT at an attractive price with an aggressive initial delivery schedule. Thai officials have stated the NORINCO price to be one third of Western offers.

The VT-4 was specifically developed by NORINCO for export and is considered a lesser step-sister to the PLA's Type 99A. It debuted in 2014 at NORINCO's Armour Day. The 52 tonne system mounts a 125mm smoothbore tank cannon capable of firing anti-armour, high explosive and cannon launched guided missiles. As typical of T-72 derived designs the VT-4 uses a carousel automatic loader allowing a crew size of only three. The \$150 million deal signed in April 2016 saw 28 VT-4s delivered by October 2017. In April 2017 the RTA ordered an additional 10 vehicles at \$58 million. This is the first fielding of the VT-4. Thai officials have suggested that discussions are underway for possible arms technology transfer from China and establishing production in Thailand, although areas of collaboration or details have not been provided.

T-90S Vietnam

Vietnam concerned about the age of its main battle tank fleet, in mid 2016 contracted with Russia's UralVagonZavod (UVZ) to provide 64 T-90S third-generation main battle tanks. The first delivery was reportedly shipped in November 2017. The army is understood to need around 200 MBTs. The T-90S has the 125mm smoothbore cannon and autoloader. It is similar in capabilities to the T-90s in service with Russia Army and has been widely exported.

K-2 Black Panther

In development since 1995, the Republic of Korea Army's K-2 Black Panther MBT began to be fielded in 2014. A fully local design it is considered one of the premier MBTs today. Its 120mm L/55 smoothbore gun developed by Hyundai Wia uses an autoloader capable of 10 rounds per minute. The fire control includes a panoramic sight, radar and capability to engage low altitude aircraft. It also fires the Korean Smart Top-Attack Munition (KSTAM) a fire-and-forget munitions with 8km range. The In-arm Suspension Unit (ISU) allows the tank to adjust its height and "kneel. Plans are to deploy 320 of the K-2s while a number of improvements are already being developed including Active Protection and reactive armour.

Future Needs

The level of activity in introducing modern tank capabilities into Asian-Pacific armies is unprecedented. The MBT programs will require several years to be completed and to field the numbers of vehicles required. At that point the 'manoeuvre' tank will have more clearly demonstrated its abilities. This could find it being considered as a solution for some of these armies to complement these MBTs. **AMR**



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The US Coast Guard Legend-class National Security Cutter USCGC Stratton, pictured in the Pacific Ocean during the 2016 'RIMPAC' exercise, with the US Navy Independence-class Littoral Combat Ship USS Coronado and the Royal Canadian Navy Halifax-class frigate HMCS Calgary following in formation. The Legend-class cutters displace 4,500 tonnes.

US Navy



CONSTABULARY MARITIME: OPVS AND CORVETTES ON PATROL

Not all naval ships have to be big to be useful. Home waters maritime security can be adequately prosecuted by smaller, yet increasingly more capable vessels.

by Dr Lee Willett

While Europe has woken up relatively recently to the resurgence of state-versus-state naval activity, the Asia-Pacific region has for some time been developing into a major maritime theatre. Analysts have often spoken of the 20th century being the era of the Atlantic Ocean and the 21st century being that of the Pacific. Certainly, since the turn of the century, maritime matters in the Asia-Pacific theatre – and their implications for regional and wider global security – have become a central element of the international strategic balance.

Depending on the geographic perspective taken, the Asia-Pacific region is dominated by the Pacific and Indian oceans, with areas of land (ranging from islands of all sizes to the littoral regions of major continents) fitted around the fringes. Within this maritime mass are key international access and choke points and sea lines of communication, sea spaces ranging from vast oceans to intricate littoral waters, critical natural resources, and economic and territorial assets that are subject to disputes between indigenous states.

Alongside the need to bolster national prestige and international standing, disputes over resources and territories have perhaps been the principal driver for a number of countries in the region to seek a substantial uplift in their naval capabilities.

At the high end of the operational scale, the region's major and medium navies – including Australia, China, India, Japan, and South Korea (the United States, as the major global naval power, is considered here as a global actor rather than a standalone regional one) – have all been developing complex naval capabilities for deterrent effect and to play a part in contributing to international stability at both regional and global levels. Indeed, some analysts have referred to the existence of a naval arms race in the Asia-Pacific region. However, in the light of the region's economic significance, at the lower end of the scale there is a requirement amongst these

and other navies to also develop constabulary maritime presence to (amongst other things) protect economic and territorial interests.

In this context, navies have been seeking to develop patrol capabilities which offer endurance, extended range, good seakeeping, reliable communications, and capable sensors, along with weapons system fits that are robust, low key, and interchangeable. While destroyers and frigates remain the preserve, in the region, of those navies seeking to operate at the higher end of the spectrum, for other navies seeking to boost constabulary presence corvettes and, especially, offshore patrol vessels (OPVs) are increasingly coming to be a platform of choice.

What's in a name?

Writing in his book *The Future of Sea Power* in 1990, as the strategic focus shifted from the European theatre to other parts of the world, Professor Eric Grove defined a corvette as a “small sea-going combatant of 500 to 1,750 tons of limited endurance and capability; best employed in coastal escort and patrol work and relatively low-level operations, although with some potential for higher endurance operations in the absence of more capable units; not usually air capable.”

It is widely recognised that different ship types, across many navies, have shown a trend generally for increasing in size as new classes are introduced. Moreover, writing in his 2004 book *Seapower: a Guide for the Twenty-First Century*, Professor Geoffrey Till noted that many navies, including those in the Asia-Pacific region, had seen step-ups in force structure composition as (for example) fast attack craft fleets were replaced with corvettes or frigates.

It is notable that OPVs per se were missing from such discussions. Indeed, OPVs seem to be a relatively new concept in terms of typology, capability, and operations. Grove's definition arguably covered in large part the role and capabilities of patrol vessels. However, today – as

high-end naval capabilities have become more expensive and have limited the number of such platforms as a result – a requirement has emerged to support constabulary tasks at distance with a lower-end platform. This has mandated a need for patrol vessel capabilities with offshore or even oceanic, rather than coastal, range and endurance.

Grove also argued that, for navies seeking constabulary capability, small but relatively high endurance vessels with very limited armament and probably some helicopter capability were the best solution. This hinted at the emergence of a requirement for offshore patrol capability. Today, such vessels require: greater endurance; organic aviation (currently a helicopter, but increasingly likely tomorrow an unmanned aerial vehicle?) to conduct maritime security operations. They can be supported by large, robust sea boats for at-sea interdiction; and perhaps slightly greater high-end sensors and weapons, as the platforms' extended reach and the blurring of lines within both tasks undertaken and risks faced at sea means that the possibility of confrontation is slightly higher. Grove added that such vessels required toughness, sea-keeping, and manoeuvring capability in particular to be able to deal with clashes over fisheries. This comment remains very relevant for naval – and coastguard – forces operating today in the Asia-Pacific region, given the persisting disputes over conflicting resource and territory claims.

Nick Childs, senior fellow for naval forces and maritime security at the International Institute for Strategic Studies (IISS), told *Asian Military Review* (AMR) that the increasingly complex maritime environment is seeing Asia-Pacific navies – like those in other regions – having to balance requirements and resources. “Larger navies with more blue-water ambitions are inevitably focusing on more capable platforms,” he said. “Some, like the South Korean navy, with both long-range ambitions and a very particular challenge closer to home, are trying to do both.”

“The smaller navies,” Childs continued, “with fewer resources, but still with significant bodies of water and dispersed territories to patrol, need affordable platforms in sufficient numbers.”

Increasing the capabilities of an OPV causes an interesting conundrum as, of course, a primary driver for many navies investing in OPVs has been affordability when compared to corvettes or frigates. Maritime surveillance and security tasks are core business for OPVs, but if regional capability build-ups encourage navies to consider larger gun or even compact anti-submarine warfare (ASW) capability fits for their OPVs, then this drives up cost as well as blurs lines between ship typology and task.

What's in a navy?

When talking about the low-end constabulary presence provided by OPVs in particular, it is notable that many of the higher-end Asia-Pacific navies do not possess OPVs. In terms of Japan, for example, the surface fleet of its navy – the Japan Maritime Self-Defence Force (JMSDF) – is dominated by destroyers. However, Japan's coastguard operates several different classes of large patrol vessel. One of the most recent to arrive is the Taketomi class: this programme has delivered 10 of these 1,700-tonne vessels to date, with more understood to be planned. According to the Asia Maritime Transparency Initiative, a number of the Taketomi ships are dedicated to patrolling waters around the disputed Senkaku/Diaoyu islands in the East China Sea.

China's People's Liberation Army Navy's (PLAN's) force structure similarly is full of surface escorts such as destroyers and frigates. However, it also operates the 1,500-tonne Type 056 Jiangdao-class corvette. With the first ship commissioned in

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Royal Australian Navy

The Royal New Zealand Navy's (RNZN's) lead OPV HMNZS Otago, pictured here departing Apia in Samoa. The RNZN is considering procurement of a third Otago-class OPV.

March 2013, reports in late 2017 suggest that more than 35 are now in service.

Patrol vessel classes are found within China's coastguard inventory. Of particular note here is the programme to deliver 10,000-tonne cutters. The first ship deployed on operations in 2015, and build on the second-in-class finished in early 2016. As has been noted in analytical commentary, these coastguard cutters are similar in size to the US Navy's CG 47 Ticonderoga-class guided-missile cruisers and DDG 51 Arleigh Burke-class guided-missile destroyers.

While the US Coast Guard (USCG) is one of the most widely deployed maritime forces in the world, its eight Legend-class National Security Cutters, which began entering service in 2008, displace at full load only 4,500 tonnes. Builder Huntington Ingalls Industries reported that the last-in-class Legend cutter, Midgett, was launched on 22 November 2017.

Western navies are increasingly having to blur the boundaries between ship types as reduced force numbers drive the development of more multipurpose vessels (which in turn drives up cost, drives down numbers, and places even-greater emphasis on multi-role requirements). Yet in the Asia-Pacific region, it seems that the overall build-up in naval and coastguard capabilities is enabling countries to draw clear differences between platforms acquired for higher-end operations and those procured to provide constabulary patrol capability. However, while deploying coastguard – rather than naval – platforms in waters where tensions exist over territorial rights could be seen as part of risk reduction strategies, it seems possible that some smaller regional coastguard – and naval – forces would be deterred by the presence of a 10,000-tonne coastguard platform.

Programme developments

In terms of both corvettes and OPVs, India is a prominent example of an Asia-Pacific country developing several new programmes. The Indian Navy operates five classes of corvette, the newest being the 3,500-tonne Kamorta class. Four have been built to date by Garden Reach Shipbuilders & Engineers (RSE), with third ship Kiltan commissioned in October 2017. Reports suggest the class is focused on ASW activity.

The Indian Coast Guard operates at least five different OPV classes. One of the most prominent developments here is the Sankalp-class programme. At least eight of these 2,350-tonne OPVs are to be delivered, with the most recent – ship seven, Shaurya – commissioned in August 2017. India's focus on developing constabulary platforms with a bit of punch was sharpened by the 2008 sea-based terror attack on Mumbai.

Singapore's latest corvettes – its planned class of eight Independence littoral mission vessels (LMVs) – will help meet what is a significant patrol task for the Republic of Singapore Navy (RSN). As well as Singapore sitting alongside the strategically critical international chokepoint of the Malacca Strait, the LMVs' patrol capacity will be required in the Singapore Strait, which remains a source of counter-piracy concern for regional security stakeholders. However, the fact that the LMVs will carry MBDA's VL MICA surface-to-air missile (SAM) system and a 76mm Leonardo/Oto Melara gun demonstrates

their ability to contribute to higher-end tasks, too. Defence minister Dr Ng Eng Hen has stated that the LMVs, built by Singapore Technologies Marine (ST Marine) provide "a quantum leap" in capability for the RSN. November 2017 saw ships two and three (RSS *Sovereignty* and RSS *Unity*) commissioned into service. According to Singapore's defence ministry, the other five ships are expected to be operational by 2020.

Indonesia sits in a strategically significant position in the southeast Asian region, and is seeking to strengthen its naval capability to increase its regional influence and global standing. Of note here are its Damen-designed four Sigma 9113 Diponegoro-class and four Sigma 10514 Perusak Kawai Rudal (PKR) corvettes. Fitted with several higher-end systems, such as the Thales Tacicos combat management system (CMS), the Thales Kingclip hull-mounted sonar, and (in the case of the PKR platforms) the Thales SMART-S Mk2 3-D air/surface search radar, these platforms seem focused towards frigate-type operations, including ASW. According to Damen, for the PKR frigates: "Their primary mission is anti-air, anti-surface and anti-submarine warfare. However, they are also equipped for maritime security, search and rescue, and humanitarian support tasks."

More is more?

In terms of Asia-Pacific platforms growing in size and numbers, two examples are notable. First, the Royal Australian Navy (RAN) is procuring 12 new 80m, 1,800-tonne, steel-hulled OPVs to replace its 13 in-service 57m, 300-tonne Armidale-class ships. Particularly to meet a requirement to manage maritime migration in traditionally heavy seas off northwest Australia, the Armidales have been worked very hard. The new platforms will bring more flexibility, improved sea-keeping, and scope for a greater range of capabilities, with such a step-up in capability enabled in large part by the larger size.

With the OPVs to be delivered under Project Sea 1180, the Australian government announced in November 2017 that German shipyard Lürssen would be the prime contractor.

The co-operative nature of maritime security operations is reflected in the OPVs' build programme. The programme will use Lürssen's OPV 80 design. The ships will be built at two sites in Australia: Adelaide, South Australia (by state-owned company ASC shipbuilding); and Henderson Maritime Precinct, Western Australia (prospectively using the facilities and capabilities of Austal and CIVMEC).

In announcing Lürssen's downselection, defence minister Marise Payne said the OPVs would provide a "significant capability leap

forward". The ships "will conduct enhanced patrol and intelligence and surveillance missions, search and rescue, humanitarian assistance and disaster relief, and border protection missions," the minister stated.

An Australian defence department spokesperson told AMR that the new OPVs will be "capable of extended operations". The ships also will boost Australia's capacity to conduct border security, maritime resource protection, and military patrol and response operations, the spokesperson continued. "Although primarily focused on border security missions, these larger vessels will have enhanced range and endurance for more extended operations across Australia's demanding maritime environment, incorporating the Australian Search and Rescue Region, Exclusive Economic Zone, and further abroad if required."

In terms of meeting maritime security requirements, the OPVs will carry a 40mm gun and three 8.4m sea boats, and will also embark a range of aerial, surface, and sub-surface unmanned systems. Many navies today are seeking to improve capability and reduce cost by increasing system commonality across their respective platforms. This trend is reflected here, with the RAN's new OPVs to receive the Saab 9LV CMS that is already fitted to other RAN platforms, such as its eight MEKO 200 Anzac frigates and two Canberra-class amphibious assault ships.

Lürssen's OPV 80 design has already been used for the Royal Brunei Navy's four Darussalam-class PV 80 OPVs. According to reports, the design will be adapted to meet Australian requirements. The nature of such adaptations, though, has yet to be revealed. The defence department spokesperson told AMR that "The details of the tendered OPV design are part of ongoing contract negotiations between the Commonwealth of Australia and Lürssen and as such, it would be inappropriate for Defence to disclose this information at this time."

Production work on the first OPV will commence in the fourth quarter of 2018, with the ship entering service in 2021. "Further schedule details are still under negotiation," the defence department spokesperson added.

Childs referred to the Sea 1180 Project as delivering "perhaps the most significant OPV programme" in the region. What he sees as "a step-change in sea-keeping and endurance" will provide "increased persistence, [and] greater ... physical presence and situational awareness".

Second, in terms of increasing platform numbers, the Royal New Zealand Navy (RNZN) is reflecting a trend growing steadily amongst other Western navies. Across the world, navies from countries such as Australia, Germany, Italy, the United Kingdom, and the United States are all looking to increase platform numbers for certain programmes, recognising that current force levels offer insufficient capacity to meet growing tasks. In Australia's case, this is in its future frigate programme, where its eight Anzac ships will be replaced by nine new platforms. For New Zealand, its navy is considering procurement of a third Otago-class OPV.

A New Zealand Defence Force spokesperson told AMR that "[the] possible project to acquire a third OPV is in the very early stages of capability definition. The government is yet to be presented with any options or proposed timeframes for delivery."

"However," the spokesperson continued, "the intent would be to increase New Zealand capability for maritime patrol tasks in the Southern Ocean." According to its 2016 defence white paper, New Zealand could ice-strengthen the third ship allowing it to patrol both the Southern Ocean and Antarctic waters. **AMR**

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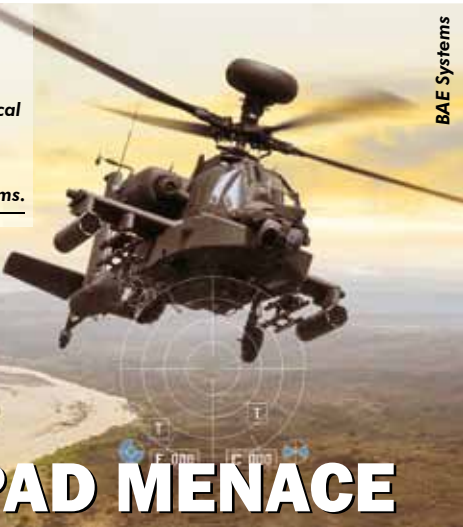
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"What you're seeing in the field of countermeasures is a constant cat and mouse game of cyclical capabilities" Tom Kirkpatrick, business development manager, BAE Systems.

BAE Systems



MANPAD MENACE

Countering the MANPAD threat consistently challenges industry's design and development teams

by Dr. Joetey Attariwala

One of the most unpredictable and terrifying asymmetric threats to military fixed-wing aircraft and rotorcraft revolves around Man-Portable Air Defence Systems, or MANPADS. These low-cost, light-weight, infrared surface-to-air missile systems are small in size, highly mobile, easy to employ, and exceptionally difficult to detect - all of which makes them incredibly lethal.

Numerous countries around the world manufacture MANPADS, and although these systems are tightly controlled, they are prevalent across the globe. Additionally, the features that make MANPADS suitable for soldiers also makes them attractive to those with nefarious intent. Collectively, these aspects make countering the MANPADS threat an incredibly important priority for militaries around the world.

The MANPADS threat

The first development of a rudimentary MANPADS dates back to the 1940s where unguided rockets were used. MANPADS became more refined and much more lethal in the 1960s when systems began to use heat-seeking infrared (IR) missiles which guide themselves by zeroing in on a target's infrared heat signature. Unlike radar guided missiles, infrared guided missiles are undetectable until launched.

Simply stated, a MANPADS consists of a launcher tube with a gripstock, a sight assembly, and a battery/coolant unit. Inside the launcher tube is a single infrared radiation homing (heat-seeking) guided missile that requires no control from the gunner after firing. The missile itself is comprised of three main sections: guidance, warhead, and propulsion.

The first MANPADS of significance in the United States was the General Dynamics FIM-43 Redeye; however the most well known system today is the Raytheon FIM-92 Stinger weapon system.

In Russia, the first generation MANPADS was

the KB Mashinostroyeniya (KBM) 9K32 Strela family (NATO code names: SA-7 Grail, SA-14 Gremlin). This system was superseded by the KBM 9K310 Igla family (NATO code names: SA-16 Gimlet, SA-18 Grouse, SA-24 Grinch); and since 2014 they have been superseded by the KBM 9K333 Verba (NATO code name: SA-25). The Verba's primary new feature is its missile's three channel multispectral optical seeker head which works on ultraviolet, near infrared, and mid-infrared wavelengths.

The United States and Russia are the primary countries that build or license these systems for manufacture, however other nations that have developed their own versions, whether they be copies or indigenous designs.

Depending on model and variant, MANPADS IR missiles have a range of 500 meters (546 yards) to 8km (5 miles), and can reach an altitude of 16,000 feet (4,876m). Many newer MANPADS now employ advanced microprocessors for improved tracking ability, and improved infrared counter countermeasures (IRCCM) capability. Threats are also evolving to incorporate imaging technology - visible energy - to 'look' for aircraft.

Designs to counter MANPADS

An important aspect to countering infrared threats, be it MANPADS or others, is to suppress or reduce an aircraft's infrared signature. This is particularly important in low flying military aircraft like helicopters. Aerospace engineers who design military aircraft are very cognisant of this, and go to great lengths to suppress an IR signature - this often entails masking an IR source, or dissipating IR energy.

Naturally, the greatest IR signature emanating from an aircraft is from its engines, which are difficult to mask without the expense of performance, considerations of maintainability, or a host of other factors. A prime example of an aircraft design which embodies engine masking is the Northrop Grumman B-2 Stealth Bomber.

Dissipating IR energy is usually done through the addition of IR suppressors, or by using heat exchangers. IR suppressors reduce exhaust temperatures by shielding a hot engine from view and mixing it with ambient air - as seen in the Boeing AH-64 Apache; and/or by 'bending' the exhaust with the aid of a cowl - as is seen in the Leonardo AW159 Wildcat.

Heat exchangers on the other hand, use fluid or materials to absorb and exchange heat. The Lockheed Martin F-35 Lightning II makes use of fuel to dissipate thermal loads generated by the aircraft's avionics suite and sub-systems.

Masking and dissipating techniques are helpful methods to reduce an aircraft's IR signature, however one can't cheat physics altogether as any aircraft moving through the air will emanate IR energy by way of friction, which newer guidance sections on IR missiles are adept at distinguishing.

Never enough knowledge

The old adage of 'knowledge is power' holds

very true when considering mission safety and success, therefore a key element to every sortie is a comprehensive pre-mission brief. This fact cannot be understated as unit/squadron intelligence officers are key in disseminating knowledge on threats in a given theater of operations.

If MANPADS threats are known to be present, the easiest way to counter them is to avoid the area entirely. If a mission necessitates entering a threat area, then the next best option is to fly above the MANPADS threat envelope, which safely means above 20,000ft (6,096m). This of course is a moot point when an aircraft needs to takeoff or land.

As noted previously, the problem with MANPADS are they are small, concealable, and very portable. These factors mean that a single person with a MANPADS can pop up and engage an aircraft virtually anywhere. If flying in an area where MANPADS are suspected, pilots can use the earth's topography to mask their aircraft. Nap-of-the-earth flying is a type of very low-altitude flight used by military aircraft to avoid enemy detection in a high-threat environment. During nap-of-the-earth flight, geographical features like valleys and folds in terrain are used as cover and concealment.

High-speed flight at low-altitude is another way to evade a MANPADS threat since a MANPADS operator needs to visually identify and track a target before engaging it. If an aircraft flies low and fast, the pilot effectively reduces the time in which a MANPADS operator can develop a tracking solution before the aircraft is out of view.

Interestingly, nap-of-the-earth flying has gone out of favor in recent years due to the proflience of small arms fire, as has been seen in Iraq and Afghanistan. Because of this, militaries around the world are flying their aircraft higher, and are therefore turning to technology to counter the growing MANPADS threat.

Blooming flares

The most common countermeasure against infrared missiles is flares. First-generation MANPADS missiles, often referenced to as 'tail-chase' missiles, were often defeated by the use of flares which burn hotter than an aircraft's engine/exhaust, thereby deceiving infrared heat-seeking missiles. Flares are still used to great effect today, however aircraft carry a finite number which is a critical limitation once stores are expended.

Later generation IR missiles employ enhanced guidance section cooling which increases their acuity for heat sources on aircraft. IR missile capability has been further enhanced by single or multiple detectors in the guidance section which have the ability to recognize and reject flares dispensed from aircraft. Newer infrared seekers also tend to have multi-spectral sensitivity tailored to more closely match the emissions of airplanes, and are also incorporating enhanced IRCCM.

"Because countermeasures have become so effective, threat manufacturers seek to add different ways to counter the countermeasures. What you're seeing in the field of countermeasures is a constant cat and mouse game of cyclical capabilities which constantly evolves, and is usually driven by the pace of geopolitical events," said Tom Kirkpatrick, a business development manager for BAE Systems Survivability, Targeting, and Sensing Solutions. "In today's world, they [MANPADS] are a very present threat so the technology has ramped up in the last few years as we see threats proliferate, and we see countermeasures advancing to counter those."

One of the most prolific infrared



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The Guardian system from Northrop Grumman provides 360° protection and includes a multiband laser pointer/tracker and an ultraviolet missile warning sensor.

countermeasures (IRCM) systems fitted to helicopters and small aircraft today is the “always-on” BAE Systems AN/ALQ-144 IR Countermeasures Set which provides protection against infrared missiles over a wide wavelength range. The system has an IR source which is surrounded by a large cylindrical mechanical shutter that modulates the infrared output, producing a pulsing pattern which serves to decoy IR missiles. The newest variant, the AN/ALQ-144C has an increased cooling and air filtering capability which provides greater mission versatility and readiness. There are multiple configurations available to complement small to medium signature aircraft. The system is fitted to one of the newest maritime patrol helicopters in the world, the Sikorsky CH-148 Cyclone.

The AN/ALQ-144 IR Countermeasures Set may operate independently, or improve survivability in combination with a missile warning system and flares. In the case of the Cyclone, the ALQ-144 works in conjunction with the AN/ALE-47 Countermeasures Dispensing System (CMDS).

To date, over 8,000 AN/ALQ-144 IR Countermeasures Sets have been delivered to the U.S. military and 23 other nations.

DIRCM technology

Modern MANPADS missiles can be launched from any aspect to a target, and can travel at speeds of 570 meters per second (Mach 1.7), so the ability for a pilot to detect a launch is extremely remote, and evading them is typically beyond human reaction time.

In order to address the time/speed/distance problem inherent in the MANPADS threat, companies have developed advanced infrared countermeasures systems which utilise electro-optical systems which automatically detect missile launches from the distinct thermal emission of a missile’s rocket motor, and then automatically deploy both thermal expendables (flares) and directable lasers to defeat - commonly known as Directional Infrared Countermeasures Systems (DIRCM).

BAE Systems is the current provider of a suite of systems for a U.S. Army program of record to protect its fleet of CH-47 Chinook helicopters. This suite of systems is comprised of the BAE Systems AN/AAR-57 Common Missile Warning System (CMWS) which provides advanced missile warning and hostile fire detection for rotary and fixed-wing aircraft. The system uses electro-optic missile sensors (EOMS) paired with an electronic control unit (ECU) to automatically detect a

wide range of missile and hostile fire threats. The system is linked to the AN/ALE-47 CMDS and the AN/ALQ-212 ATIRCM (Advanced Threat Infrared Countermeasure) directional infrared countermeasures system.

Once an IR missile launch is detected by the CMWS, the system automatically hands-off to the CMDS to dispense flares as needed, and it also provides a spatial cue to the ATIRCM system which acquires the missile and tracks the trajectory with a high-precision tracking sensor. The ATIRCM infrared jam head then fires a multi-band laser beam directly into the missile seeker, causing the missile to steer away from the aircraft.

“One of BAE Systems’ expertise lies in laser technology. The laser that we use in our ATIRCM system is called the multi-band laser. These bands are all columnated into one single beam, so it’s not just a single wavelength - we’re putting out multiple wavelengths in one beam that we’re directing towards the threat. That provides us with greater capacity to defeat infrared missiles,” said Kirkpatrick.

In 2015, the U.S. DoD approved ATIRCM for export. Now fielded in over 10 countries, BAE Systems has delivered and installed more than 2,000 CMWS units on over 30 different platforms with a recorded reliability four times the requirement. Since 2005, CMWS has logged more than 3 million combat theatre flight hours with the U.S. Army, saving dozens of aircraft and hundreds of lives. The most recently developed, third-generation CMWS technology integrates hostile fire indication with missile warning into one unit. This enables high performance in complex missile, small arms, and rocket propelled grenade scenarios.

CIRCM for US Army Aviation

DIRCM system technology is constantly evolving, and part of that effort is focused on reducing size and weight. The U.S. Army’s new programme of record for laser-based aircraft missile defence is the CIRCM (Common Infrared Countermeasures) programme, which is intended to develop a lightweight, low-cost and modular infrared protection system for U.S. helicopters and light fixed-wing aircraft.

Northrop Grumman was selected to deliver the CIRCM programme. CIRCM is part of a suite of infrared countermeasures that utilises the CMWS and an Improved Countermeasure Dispenser (ICMD) for flares and chaff. According to the company, their CIRCM solution uses a compact ECLIPSE pointer/tracker, a lightweight commercial-off-the-shelf processor, and advanced Quantum Cascade Laser (QCL) technology for greater reliability and scalability. Partnered with Northrop Grumman is Leonardo MW, Northrop Grumman’s IRCM partner for more than 15 years, and Daylight Solutions, an innovator in QCL-based laser technology.

“We have a very robust program and we are constantly looking at better techniques and tactics and hardware that allows us to stay ahead of the threat in terms of defeating it,” said Phil Loudon,

director, Business Development with Northrop Grumman’s Mission Systems. “We’re installed on 1,500 aircraft, our platforms are in combat every day, and we’ve had no missile hits and no loss of aircraft with our system. We get the benefit of all that performance and data feedback that allows us to continue to advance and develop techniques that are more effective against current threats and anticipated future threats.”

Implementing new technologies is never easy, and the CIRCM program is facing challenges. According to a 26 April 2017 U.S. Department of Defense Inspector General (DoD IG) report titled: “The Army Needs to More Effectively Prepare for Production of the Common Infrared Countermeasure System,” the report states that Army management did not adequately define firm system capability requirements (what the system must do to meet its mission). The Army also prepared requirements documents, which communicated system capabilities, and implemented a test plan that does not require CIRCM to demonstrate minimum required system reliability. The DoD IG report adds that CIRCM is demonstrating just 70 percent (150 hours) of the 214 hours mean time between operational mission failures needed to meet the minimum system reliability requirement.

Asian Military Review posed questions to Northrop Grumman about the status of the CIRCM program, and received the following reply via e-mail: “Northrop Grumman remains committed to delivering this critical technology to the Army. Contractor flight testing, live fire, guided weapons evaluation facility (GWEF), and recent reliability characterization have all shown very positive results. Our team is working closely with the Army to achieve programme milestones within Acquisition Program Baseline parameters and provide this important countermeasure protection to our warfighters.”

In other counter-IR efforts, Northrop Grumman has developed the Guardian system for use by larger legacy aircraft. The fully automatic system provides 360° protection against a wide range of missile threats. The system includes an ultraviolet missile warning sensor and a multiband laser pointer/tracker. The low-profile system is contained almost entirely in a single pod that mounts to the underside of the fuselage and protrudes just 18 inches into the air stream. Guardian is the role fit version of the Northrop Grumman AN/AAQ-24(V) LAIRCM (Large Aircraft Infrared Countermeasure) system which in use today with the U.S. Air Force, U.S. Navy and other military aircraft around the world.

There are many other DIRCMs on the market, as well as new systems which are being developed. In the United Kingdom, the Ministry of Defence (MoD) - Defence Science and Technology Laboratory (Dstl) has contracted Leonardo and Thales to demonstrate an infrared protection system. The companies are currently engaged in development activities to bring together two of their most advanced products: Thales’s ‘Eliv-IR’ Threat Warning System and Leonardo’s ‘Mysis’ DIRCM system. Under the contracts, funding from the UK MoD will support lab-based and field trials of the integrated system in early 2018 and help evaluate its use for current and future UK air platform protection.

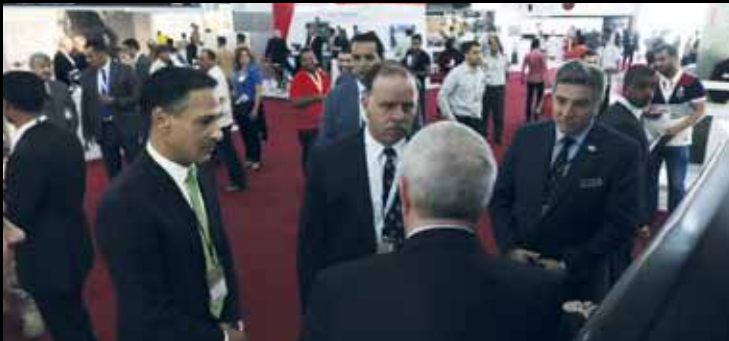
It is clear that DIRCM systems are the current gold standard in the cat and mouse battle to defeat MANPADS. DIRCM systems are undergoing a period of design and enhancement to stay ahead of this lethal and ever-evolving threat. **AMR**



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THE QUAD RETURNS - BUT WHAT'S CHANGED?

by Veerle Nouwens



The end of 2017 saw the reinvigoration of the 'Quad', an informal alliance between Australia, Japan, the United States and India that was first conceptualised by Japanese Prime Minister Shinzo Abe in 2006-2007. As maritime democracies, the four nations gathered under the title of the Quadrilateral Security Dialogue in an effort to continue to shape the regional order in the face of a rising China. The original Quad fell apart in 2008 with the election of Australian Prime Minister Kevin Rudd who decided that a formalised Quad too provocative at time when he had interest in a closer engagement with China. The question is now whether and what a new Quad will achieve in tangible terms this time around?

Its return marks a renewed concern over a rising and increasingly assertive China whose growing maritime power and increased assertiveness in the South and East China Seas – from island building to stand-offs over maritime territory – have led to speculation over whether it has a 'grand strategy' for regional dominance.

In 2009, the Obama Administration's 'pivot to Asia' policy, the roots of which can be seen in a classified Air-Sea Battle doctrine developed at the time, sought to counter-balance China's rise. This included a renewed focus of resources and policy to the region through strengthened bilateral and multilateral relations, and on a variety of norms pertaining to a liberal regional order like human rights, democracy, free trade and freedom of navigation. The Trans Pacific Partnership, an ambitious regional free trade agreement, and defence activities like freedom of navigation operations (FONOPS) sought to illustrate that the United States would continue its role as leading Pacific power.

Despite this, Beijing has successfully forged ahead with activities that have helped pave the way for Chinese predominance in its immediate neighbourhood. In addition to modernising its armed forces and placing an emphasis on becoming a major maritime power, Beijing has been able to continue its advances toward building anti-aerial access denial (A2AD) capabilities in the South China Sea. It has done so even in the face of the final ruling by the Permanent Court of Arbitration on 12 June 2016 that found no legal basis for China's maritime territorial claims of roughly 90 per cent of the South China Sea. The very public setback was followed by a strategic effort to step up regional engagement, for example through fast-tracking stalled negotiations between China and ASEAN on a Code for Conduct in the South China Sea, increasing Chinese overseas economic investment and public statements that island building had stopped.

However, over the past year, various observers have pointed toward the likelihood of a toothless and non-binding

Code of Conduct along the lines of its predecessor, the Declaration of Conduct, which will change very little in the South China Sea. Secondly, despite an increase in foreign investments, there is concern that they are made largely to increase political influence in Beijing's favour. Finally, recent reports show that China has continued to install defence infrastructure on the various islands in the Spratlys. Taken together, it seems that Beijing is poised to becoming a regional heavyweight, and one that is unlikely to be bound by the rules that the liberal order has largely upheld thus far, for example those enshrined in the United Nations Convention on the Law of the Sea (UNCLOS).

However, the strategic costs of China's rise seem to have grown for the countries of the Quad. For India, the stand-off at Doklam Plateau (*see AMR, Vol 25/Issue 7: Face Off, Step Back*) and reports of potential PLA-N bases in Pakistan and Sri Lanka are too close for comfort. Japan, too, has seen continued incursions into its airspace and maritime territory, while Australia has dealt with reports of Beijing's political influence campaigns. The United States, under the Trump Administration, has dealt a blow to wider multilateral efforts to counteract China's economic power by abandoning the Trans-Pacific Partnership (TPP). However, given the Trump Administration's insistence that maintaining regional security and stability is a burden that must be shared, the renewed Quad may be an ideal way to do so particularly, as Washington maintains, that China's militarisation of islands in the South China Sea is unacceptable and that FONOPS will continue.

Together, these countries have found value in returning to the Quad. The objective, as stated in their first senior-level working level meeting in Manila in November 2017, is to maintain a 'free and open Indo-Pacific'. Several themes were reported to have been addressed: the rules-based order in Asia, freedom of navigation and overflight in the maritime commons, respect for international law, enhancing connectivity, maritime security, North Korea and non-proliferation, and terrorism. However, the question is whether their doing so will have any impact. An analysis of the press releases of each of the four countries showed inconsistencies in how these topics were included or omitted. This may be a matter of reporting, rather than a different interpretation of policy. For the Quad to be successful this time around, and early identification and prioritisation of agreed and achievable goals is essential. However, if this initiative is to be taken seriously a concerted effort must be made sooner rather than later. There won't be much appetite for the Quad version 3.0.

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