



Boeing and RAAF's unveiled an experimental unmanned fighter, the Air Power Teaming System (or the less clunky 'Loyal Wingman'), at the Avalon airshow in Australia this year. The concept has been derived through Minor Program 6014 Phase 1. It could accompany the RAAF's F-35s or F-18s and have kinetic as well as ISR potential.

ASIA-PACIFIC UNMANNED AERIAL VEHICLE DIRECTORY 2019

The development and acquisition of unmanned aerial vehicles (UAVs) is picking up the pace in the Asia Pacific, with demand driven by ongoing modernisation efforts across the region.

by **JR Ng**

The past year has been another dynamic year of expansion for regional UAV developments, particularly in terms of fielded technologies and their use in an operational environment. China has unsurprisingly taken the lead in terms of indigenous production and innovation, demonstrating its intent to dominate the region at the Airshow China 2018 exhibition in Zhuhai with hundreds of homegrown state-owned and private companies showcasing an enormous range of UAV platforms, payloads, and associated technologies in a dedicated exhibition hall.

A particular theme that stood out among the spectacle was the large representation of stealthy, long-range platforms that are aimed at penetrating deep into contested or heavily defended

environments - a development which highlights indigenous mastery of the advanced technologies necessary to produce and operate such platforms.

Not to be outdone, at the Avalon 2019 exhibition in March 2019 Australia unveiled a next-generation combat UAV that could eventually serve as robotic 'wingmen' for the Royal Australian Air Force's (RAAF's) combat aircraft, a joint effort between Boeing and the Australian Department of Defence (DoD) and the first known development of its kind in the region.

Elsewhere, the proliferation of UAVs is indicative of the increasing maturity of such platforms and their associated technologies, as well as the growing confidence and desire of regional countries to incorporate these into their military forces.

AUSTRALIA

The Australian Defence Force (ADF) has emerged as a leading regional UAV user in recent years, with its three services simultaneously pursuing a broad range of development and acquisition programmes that are noteworthy for being diverse, from pocket-sized 'nanocopters' to high-end medium-altitude long endurance (MALE) and high-altitude long endurance (HALE) systems.

The Australian Army has been experimenting with UAVs as early as the 1990s before introducing some of these capabilities during overseas deployments - including Afghanistan, East Timor, and Iraq - from 2005. The service is looking into expanding its use of such systems following more than a decade of successful UAV operations, with new

capabilities expected to be introduced by the mid-2020s.

The Royal Australian Navy (RAN) has stood up a dedicated UAV unit known as 822X Squadron, which is also the fourth operational squadron in the RAN's Fleet Air Arm. The unit oversees the service's fleet of Boeing ScanEagle and Schiebel S-100 Camcopter VTOL UAVs.

The Royal Australian Air Force (RAAF) formerly operated four Israel Aerospace Industries (IAI) Heron 1 MALE UAVs leased from Canadian company MDA, while an Memorandum of Understanding (MOU) for logistics and training support was concluded with Canadian forces deployed in Afghanistan.

Following the ADF's withdrawal from Afghanistan, two Heron 1 UAVs were retained at the Woomera test range in south Australia to ensure that RAAF personnel continued to hone their operational skills prior to the introduction of future MALE and HALE platforms. These were subsequently retired in July 2017, having trained over 200 pilots and accumulated more than 30,000

flight hours. At present, a dedicated RAAF UAV capability is absent until a new armed MALE platform is selected through Project Air 7003. Defence Minister Christopher Pyne announced in November 2018 that General Atomics had been selected as the preferred bidder for Air 7003, with candidate platforms either be the MQ-9 Reaper Block 5 variant or the MQ-9B Sky Guardian under development for the UK armed forces. A procurement decision is expected by mid-2019, with initial delivery expected between 2020-2021 and fully operation by 2023.

In February 2019, Boeing and the DoD announced a partnership to develop a large UAV concept demonstrator that will be capable of smart teaming with existing military aircraft, using Artificial Intelligence (AI) enabled technologies to fly independently or in support while maintaining safe separation between other aircraft.

Fielded Capabilities

Boeing-Insitu ScanEagle: Initial flight trials to assess the operability of the long-

endurance ScanEagle UAV system aboard the RAN's three Adelaide class FFG-7 frigates were completed aboard HMAS Newcastle in June 2016. The system is now in operational use aboard the Adelaide-class frigates and was deployed in June 2017 along with HMAS Newcastle as part of Operation Manitou in the Middle East, where its visual and ranging system (ViDAR) helped gather surveillance data. While on its deployment, the ScanEagle UAV was also involved in the RAN's first operational manned/unmanned teaming (MUM-T) with the frigate's Sikorsky MH-60R helicopter in September 2017. The Australian Army also leased army leased ScanEagles and completed 45,000 flying hours while deploying the system in Afghanistan before acquiring the Shadow 200 system.

Schiebel Camcopter S-100: The RAN selected the S-100 Camcopter under the Navy Minor Project 1942 tender request. Although the number of S-100 systems was not disclosed, the rotary UAV was to be used for operational training and

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Royal Australian Navy sailors launch HMAS Newcastle's embarked Scan Eagle Unmanned Aerial System from the ship's flight deck during Exercise Kakadu 2018.

Royal Australian Navy



development ahead of a future phase of Joint Project 129 that aims to select one to two vertical take-off and landing (VTOL) UAV platforms to conduct operations from the RAN's Future Frigates and offshore patrol vessels (OPVs). Delivery of the first S-100 systems powered by 55hp (41kW) Diamond gasoline piston engines occurred in mid-2017, with additional systems equipped with modified Rotron 600 HFE propulsion systems delivered in December 2017. Schiebel will update two of these vehicles with the internally developed S-2 HFE system, which is expected to be delivered to the RAN in the third quarter of 2019 for acceptance testing. The Australian Army is also operating the type under lease, and in December 2018 tested Elta Systems' ELK-7065 high frequency (HF) communications intelligence (COMINT) and direction-finding system and Overwatch Imaging's TK-5 Firewatch smart tactical mapping payload aboard one of its leased platforms.

AAI Unmanned Aircraft Systems/ Textron Systems RQ-7B Shadow: The acquisition of two complete RQ-7B Shadow 200 tactical UAV systems at a cost of \$133 million (AUD\$175m) for the Australian Army was announced in August 2010 under Joint Project 129 Phase 2. The package comprised 18 air vehicles, four ground control systems, support

systems, and initial training. It also included funding to deliver the UAVs to Australian troops in Afghanistan. The two systems were delivered by April 2012 and were operated by 20 Surveillance and Target Acquisition (STA) Regiment. By September 2013, the type had completed 10,000 flying hours in support of International Security Assistance Force (ISAF) troops before returning to Australia the following month. The army is presently seeking its replacement under the Land 129 Phase 3 programme with the aim of acquiring a new capability by around 2022.

AeroVironment RQ-12 Wasp AE: In June 2017 the Australian government announced a contract worth up to \$36.5 million for the delivery of hand-launched AeroVironment Wasp AE UAVs to fulfil the army's small unmanned aerial system (UAS) requirement under Project Land 129 Phase 4. The Army plans for every combat team to be equipped with the 1.2kg Wasp AE mini-UAV, which can operate for up to 50 minutes out to a range of 5km. The UAV is equipped with a pan-tilt-zoom Mantis i22 AE gimballed payload that delivers live, streaming colour and infrared (IR) video.

Boeing Airpower Teaming System (BATS): The 11.7m long BATS features a design range of around 3,700km and is expected to make its first flight in 2020,

following its unveiling in mock-up form at the Australian International Airshow in March 2019. The DoD is investing \$28 million in the development programme. Boeing also stated that it will build three prototypes in Australia.

FLIR Systems PD-100 Black Hornet II: The Australian Army outlined plans in 2017 for each combat platoon to be equipped with FLIR PD-100 Black Hornet II 'nano-UAVs'. Weighing approximately 18g, the hand-launched UAV features a tadpole-shaped fuselage design that is propelled by an electric motor driving a 120mm two-bladed main rotor and tail rotor. It can stay airborne for up to 25 minutes on a full charge, and can operate to a maximum range of 2km from the base station. Around 160 Black Hornet systems will be deployed across every combat platoon as a reconnaissance asset with deliveries commencing in early 2018 and expected to be completed by 2019.

Under Development/Consideration/Trials

Northrop Grumman MQ-4C Triton: A HALE UAV capability for persistent long-range maritime patrol and other surveillance missions is being sought under Project AIR 7000 Phase 1B, with the latest Defence White Paper in 2016 stating that up to seven of these UAVs are expected to be acquired from the early 2020s. The Australian Department of Defence (DoD) ultimately committed to six Tritons, with the first being contracted in June 2018 and the second in March 2019. The first air vehicle is also expected to enter service in mid-2023 and be fully operational by 2025. All six platforms are planned to be delivered by late 2025 and based at RAAF Base Edinburgh in South Australia. When in service, the Triton UAVs are expected to complement the RAAF's Boeing P-8A Poseidon maritime patrol aircraft, paving the way for the retirement of the service's ageing Lockheed Martin AP-3C Orions. The total value of the programme is expected to be worth approximately \$5 billion.

BANGLADESH

Although Bangladesh does not presently operate any military UAVs, the country's procurement agency – the Directorate General Defence Purchase (DGDP) – issued a tender notice in December 2017 to procure a MALE-class UAV for the Bangladesh Air Force (BAF). The DGDP said the UAV will be used for intelligence,

surveillance, reconnaissance (ISR) and targeting operations under the military's Forces Goal 2030 modernisation plan.

The UAV is expected to have a maximum speed of 108 knots (200km/h) and maximum range of 1,000km, as well as a maximum ceiling of 6,000m or higher. Also desired is a ground control station, avionics systems, sensors, datalinks, electro-optical and IR payloads, and the provision to carry weapons.

Unconfirmed reports have suggested that the Bangladeshi Air Force (BAF) has selected China's Wing Loong II strike-capable reconnaissance UAV, with an initial contract covering four air vehicles, a ground control station (GCS), and associated training and logistical support. Delivery is expected to be made in mid-to late-2019.

DEMOCRATIC PEOPLE'S REPUBLIC OF KOREA (DPRK)

The DPRK's interest in UAVs can be traced back to the 1970s, although it was not until the late 1980s when a number of ASN-104/D-4 UAVs were acquired from China. During the 1990s a small number of Russian-made DR-3 Reys were received from Syria and Pchela-1T UAVs from Russia.

By the early 2000s North Korea possessed not only a growing inventory of UAVs but had begun to manufacture a UAV based on the ASN 104, known locally as the Panghyon I. The improved Panghyon II based on the ASN-105 followed several years later.

Reports also indicate that the DPRK is developing a long-endurance UAV, with Republic of Korea (RoK) officials revealing that "numerous test flights" by such prototypes have been detected since early 2016. In June 2017, a crashed 1.8m-long and 2.4m-wide UAV was discovered in the South Korean county of Inje, Gangwon province. South Korean officials subsequently revealed that the UAV had taken photographs of the deployment site of the US Army's Terminal High Altitude Area Defense (THAAD) system in Seongju prior to the crash, suggesting that the communist state has significantly improved the range of its UAVs.

Fielded Capabilities

Xi'an ASN Technical Group ASN-104/D-4: Development of the D-4 began in March 1980 and was originally intended to be a low-altitude, low-speed UAV for civilian applications such as aerial survey

and mapping. This was subsequently acquired by the People's Liberation Army (PLA) for tactical missions such as front-line reconnaissance and electronic jamming.

Panghyon I and II: Domestically manufactured versions of the Xi'an ASN-104 (described above) and ASN-105 UAVs. The Panghyon II is essentially the same airframe but incorporates an extended range control system.

Yakovlev OKB Pchela-1T: Developed in the early 1990s to meet a tactical surveillance and electronic countermeasures requirement, the Pchela-1T adopts a pusher-propeller propulsion arrangement and carries a TV camera with zoom lens. It is believed that the DPRK acquired up to 10 of these UAVs.

Taiyuan Navigation Technologies Sky-09P: The Sky-09P is powered by a two-blade propeller driven by a tractor engine mounted in the nose. It is now likely that the DPRK is locally manufacturing the type, following the acquisition of several of these UAVs in the 1990s.

MALAYSIA

The Malaysian Armed Forces (MAF) presently operates leased UAVs - the Boeing-Insitu ScanEagle and the indigenously developed Alliance Unmanned Developmental Research Aircraft (ALUDRA) Mk1 tactical UAV. The country is looking to expand its use of UAVs - particularly by the Royal Malaysian Air Force (RMAF) and Royal Malaysian Navy (RMN) as it seeks cost-effective measures to monitor developments in the South China Sea, Straits of Malacca, and the Sulu Sea near Sabah.

Korean Air Aerospace Division (KAL-ASD) agreed in April 2018 to transfer technologies and expertise to the Malaysian company DRB-HICOM Defence Technologies (Deftech). This would allow it to support local co-production of the Korean Unmanned System (KUS)-FS MALE UAV, the KUS-FT tactical UAV, the KUS-VH vertical helicopter, the KUS-VT tiltrotor, and the KUS-HD hybrid multi-rotor UAV.

Deftech is also partnering with Turkish Aerospace Industries (TAI) to meet an anticipated RMAF requirement for wide area surveillance with its Anka MALE UAV, also with potential technology transfers in advanced aero

composites and control technology.

In August 2018, the RMAF released its Capability 55 (CAP55) roadmap that outlines its modernisation plans up to 2055, which also highlighted the need for a MALE-class reconnaissance UAV. A request for information was issued in late December and called for responses by February 2019, indicating that the service has yet to firm up its requirements.

Fielded Capabilities

Boeing-Insitu ScanEagle: Malaysian company Unmanned Systems Technology (UST), a subsidiary of Composites Technology Research Malaysia (CTRM), is contracted to provide UAV surveillance covering sections of land and sea in and around Sabah. ScanEagle UAVs have been leased by the MAF Joint Force Headquarters to operate from its Kudat base.

Unmanned Systems Technology (UST)

ALUDRA Mk1: Development of the ALUDRA Mk1 can be traced back to a number of earlier efforts by CTRM and SCS (SR-1 and SR-2; Nyamok) that commenced from 2003. At least 15 systems are believed to be operated under lease since 2006, with UST as main contractor.

Thales España Fulmar: The Malaysian Maritime Enforcement Agency (MMEA) acquired six Fulmar UAVs for its latest New Generation Patrol Craft (NGPC) in 2016. The Fulmar UAV is designed to support ISR roles and can carry an 8kg payload. The MMEA-specific model will carry one high-resolution video camera with automatic target tracking capabilities. The MMEA's Fulmar UAV is launched via a catapult launcher, situated just behind the ships' SMASH 30mm naval gun system. The UAV is recovered using an impact-absorbing net deployed on the deck space immediately behind the bridge.

Under Development/Consideration/Trials

Unmanned Systems Technology (UST) ALUDRA Mk2: The ALUDRA Mk2 is intended to be acquired by the MAF, although this requirement appears to have lapsed with the armed forces still operating the Mk1.

Deftech ALUDRA Camar: Deftech and Universiti Teknologi Malaysia (UTM) are jointly developing a 40kg-class surveillance UAV which is expected

to be completed by 2019. The Camar is constructed from reinforced composites is 2.5m long with a 4m span. Deftech states that the Camar will be capable of flying for up to six hours with a control radius of approximately 80km

MYANMAR

The Myanmar Air Force (Tatmadaw Lay) is believed to be operating a squadron of Chinese-manufactured UAVs based at Meiktila Air Base in north-central Myanmar. Reports of UAVs being tested by the Tatmadaw in Rakhine State near the Bangladesh-Myanmar border surfaced in early 2015 before the outbreak of the Kokang conflict. It is also pursuing indigenously developed systems, with one example armed with small unguided bombs showcased at its 71st anniversary parade in December 2018.

Fielded Capabilities

China Aerospace Science and Technology Corporation (CASC) Cai Hong/Rainbow (CH)-3: CASC's CH-3 UAV, developed by its China Academy of Aerospace Aerodynamics (CAAA) subsidiary, features a cranked wing design a span of 8m as well as forward canards. The UAV has a maximum take-off weight of around 650kg. It is powered by a rear-mounted piston engine driving a three-bladed pusher propeller and can carry a payload of up to 180kg. The company has stated that it can fly for up to 12 hours with a control radius of 200km via line-of-sight (LOS) datalinks. Between 10-12 CH-3 UAVs are believed to have been acquired by Myanmar.

NEW ZEALAND

The New Zealand Defence Force (NZDF) has expressed its desire for aerial ISR UAVs in its Future Land Operating Concept 2035 paper, which outlines potential challenges for its armed forces in the next decade and beyond.

A similar desire had also been highlighted by the NZDF in its latest 2016 Defence White Paper, which has proposed \$14 billion (NZ\$20 billion) out to around 2030 to enhance the capabilities of its various services, although both documents do not offer any specific timelines or preferred systems.

The Royal New Zealand Navy (RNZN) has also indicated an interest to field a maritime UAV aboard its Otago-class OPVs, which would greatly benefit from an organic high-speed surveillance

capability for their extended maritime and economic exclusive zone (EEZ) patrols. However, no formal requirement has been raised to date.

In November 2018, NZDF chief Air Marshal Kevin Short noted in a televised interview that the service is seeking a new UAV capability by the mid-2020s.

Fielded Capabilities

Skycam UAV Kahu: The Kahu has been designed as a high performance, aerodynamically efficient mini-UAV that is equipped with an autopilot system designed by the New Zealand Defence Technology Agency. It is presently operated by the New Zealand Army and can carry a range of high performance still, motion video and forward-looking infrared (FLIR) sensors, with a flight endurance of two hours and a range of 25km.

INDIA

India has been involved in UAV development for over two decades, with research and development (R&D) organisations such as the Aeronautical Development Establishment (ADE), Bharat Electronics Limited (BEL), Defence Research and Development Organisation (DRDO), Hindustan Aeronautics Limited (HAL), National Aerospace Laboratories (NAL), developing UAVs with ISR, targeting, and weapon guidance capabilities for a number of years.

The country has a growing UAV requirement for its military, paramilitary, border security forces, and commercial organisations across the platform size spectrum. Indigenous efforts have thus far resulted in a number of deployable mini- to tactical-class UAVs, although local industry has been struggling to develop larger platforms in the MALE and HALE class.

However, collaboration with foreign developers such as Israel's IAI as well as technology research institutes - which are also involved in R&D or part-manufacture of more advanced platforms - could finally provide the necessary breakthroughs in the development of larger multi-role UAVs. In March 2019, US DoD acquisition head Ellen Lord revealed that the US Air Force Research Laboratory is aiming to partner with DRDO to develop a small, air-launched UAV system that would likely be deployed via air mobility transports

such as the Boeing C-17 and Lockheed Martin C-130J, which both countries operate.

Fielded Capabilities

IAI Heron 1/2: The Indian Air Force (IAF) is known to operate at least 20 Heron MALE UAVs for long endurance ISR mission, with the first examples delivered in 2001. Meanwhile, the Indian Army signed a \$218 million contract in February 2013 for additional Heron UAVs that were delivered from early 2014 to equip its artillery regiments situated along the disputed Sino-Indian border. The army earlier acquired 16 Heron UAVs in 2009. The Indian Navy (IN) is believed to operate at least 12 Heron UAVs, with a number of these located at its Porbandar facility on the west coast to monitor the waters off Karachi. However, a Heron UAV crashed soon after take-off in March 2018. Taken together, the total number of these air vehicles in Indian military service likely exceeds 50 units.

IAI Searcher Mk II: All three services of the Indian armed forces have also been operators of the tactical-class Searcher II UAV since 2001. The MkII variant features extended-span wings and an AR 682 rotary engine that provide improved flight endurance over the earlier model. It is also configurable for tactical surveillance and communications relay and can carry multiple payloads simultaneously.

IAI Harop/Harpy: Although not specifically a UAV, the IAF has procured at least 10 units of the Harop loitering munition under a \$100 million deal in 2009, which were operational by 2013 to provide an all-in-one search, observe, track, and attack capability against fleeting targets of opportunity. The IAF also operates a number of the Harpy anti-radar attack munitions.

Under Development/Consideration/Trials

IAI Heron TP/TP-XP: In September 2015 India's Minister of Defence approved a US\$400 million purchase of 10 Heron Turboprop (TP) MALE UAVs, with deliveries within 12-18 months of contract signing. However, these air vehicles have yet to materialise - likely due to India's entry into the Missile Technology Control Regime (MTCR). In February 2017, IAI announced a new export-version of the Heron TP called the Heron TP-XP. This



IAI's Heron TP is under consideration by several Asian countries, with a delivery to India apparently imminent.

export variant has a reduced payload of 450kg compared to the 1,000kg capacity of the original model to enable members of the MTCR to acquire it without violating the regime's obligations.

DRDO Rustom I/II: The DRDO's Rustom programme aims to produce an indigenously developed multirole MALE UAV to equip all three Indian military services. The platform is expected to undertake long-endurance missions, including communications relay, ISR, maritime patrol, as well as artillery fire direction and battle damage assessment (BDA). In 2012, the agency suggested that a strike capability involving the integration of the Helina missile - an air-launched variant of the Nag anti-tank guided missile currently under development - could be pursued at some stage. Following its maiden flight in November 2016, Rustom II has been renamed the Tactical Air-Borne Platform for Surveillance-Beyond Horizon 201 (TAPAS BH 201) and is expected to be employed primarily as an ISR platform.

DRDO Nishant: Work on the catapult-launched Nishant multirole tactical UAV began in the mid-1990s with its maiden flight in 2008. Four of these systems were acquired by the Indian Army in 2011, although a series of crashes between 2013 and 2015 prompted the service to cease acquisition of the system. A conventional take-off and landing variant with a wheeled undercarriage, designated

Panchi, was under development but this effort also appears to have ceased following the cancellation of the army's order.

General Atomics Aeronautical Systems Inc (GA-ASI) Predator B Guardian: Up to 22 units of the Guardian, an unarmed maritime variant of the MQ-9 Reaper MALE UAV system, worth \$3 billion could be acquired for the Indian Navy under the US Foreign Military Sales (FMS) programme. Capable of operating at a maximum altitude of over 15,000m, the turboprop powered Guardian is fitted with a Raytheon SeaVue multimode maritime radar under its belly that provides wide-area maritime ISR coverage for 27 hours. In July 2018, the US government reportedly approved the sale of these air vehicles to India, with local media sources suggesting that the Modi administration is planning to conclude a deal within 2019, should he be re-elected.

HAL Unmanned Wingman: The Unmanned Wingman programme adopts a similar configuration with the US XQ-58A Valkyrie and is currently envisaged as a low-observable, multirole unmanned combat air vehicle with a flight endurance of up to 80 minutes and powered by the indigenously developed HAL PTAE 7 turbojet engine with a cruise speed of 466 knots (Mach 0.7), and a combat radius of up to 400km. The air vehicle can be directed by a combat aircraft at distances of up to 200km, with a possible candidate

being the IAF's updated Jaguar MAX (Mothership for Augmented Xploitation). The company has said it aims to complete a prototype by 2022 and have a production-ready model ready by 2029.

INDONESIA

Indonesia has maintained a stated need for UAVs for several years in a bid to shore up defences across its huge territorial waters, which include around 17,000 islands. Attempts to procure and indigenously develop UAV platforms for the Indonesian armed forces (Tentara Nasional Indonesia, TNI) have been hindered by a lack of industrial and technical capabilities as well as financial constraints.

The country's top defence officials have reiterated a requirement for armed MALE-class UAVs. PT Dirgantara Indonesia (PTDI) and Turkish Aerospace indicated an interest in joint development - based on the Anka UAV - for the Indonesian Air Force (TNI-Angkatan Udara, TNI-AU) In January 2018 and again in August 2018. Officials have also outlined an interest to acquire armed UAVs from China, with an eye on technology transfer that could eventually enable PTDI to develop advanced UAV platforms and systems.

Fielded Capabilities

Aeronautics Defense Systems Aerostar: The TNI-AU operates an Israeli-made tactical UAV that features a stabilised, gimbal-mounted day/night electro-optic sensor, and a CommTact datalink. It is powered by a 38hp Zanzottera piston engine with a two-blade pusher propeller, enabling it to reach a service ceiling of 5,500m and an operational radius of 200km with an endurance of 14 hours. This type is being operated by the service's Aviation Squadron 51 based near the city of Pontianak in West Kalimantan.

PT Dirgantara Indonesia (PTDI)/Agency for the Assessment and Application of Technology (BPPT) Wulung: The Wulung UAV programme, which began in 2004, originally sought to produce an indigenously developed UAV to perform a variety of civilian missions across the country's extensive archipelagic territory, from illegal fishing and logging surveillance to cloud-seeding missions and supporting firefighting activities. The TNI subsequently requested an improved variant with increased endurance and range for potential intelligence,

surveillance, and reconnaissance (ISR) missions. PTDI is understood to have delivered up to 11 Wulung UAVs to the TNI-AU by end of 2015.

UMS Skeldar V-200: Indonesia became the first customer of UMS Skeldar to receive a heavy fuel variant of the Skeldar V-200 VTOL UAV, with the Ministry of Defence (MoD) deploying the air vehicle for performance and acceptance tests in late 2016 ahead of potential acquisition and pilot training. The number of Skeldar V-200s delivered to Indonesia remains undisclosed.

Under Development/Consideration/Trials

UMS Skeldar Rajawali-330/F-330: The Indonesian Army (TNI-Angkatan Darat, TNI-AD) acquired three fixed-wing Rajawali-330 surveillance and reconnaissance UAVs and associated equipment under a 2015 contract. The air vehicle – which is equipped with an EO/IR camera, a hyper-spectral camera, and a mapping camera with light detection and ranging (LIDAR) capabilities – is a derivative of the F-330 and is being co-developed under licence by Indonesian defence manufacturer PT Bhinneka Dwi Persada (BDP). Training was conducted from April 2016, with all three air vehicles believed to be delivered by mid-2016.

PT Indo Pacific Communication & Defence (IPCD) Tactical UAV: The hand-launched Tactical UAV was first unveiled by IPCD at the 2014 Indo Defence exhibition in Jakarta. The air vehicle, which typically carries a high-definition camera, is backpack transportable and is operated by a two-person team. It is believed that several of these examples were trialled by the Komando Pasukan Khusus (KOPASSUS/Special Forces Command) in mid-2014.

JAPAN

Although the Japan Self-Defense Force (JSDF) is widely seen as one of the most technologically advanced defence forces in the Asia Pacific, it is interesting to note that its present UAV capabilities have been for many years comparatively modest compared to regional peers such as China and South Korea.

However, since 2014 the country has outlined a series of initiatives to grow its indigenous UAV development capabilities, with the aim of introducing new and more capable air vehicles that

can perform persistent ISR and early warning missions across its vast maritime domain and airspace.

Fielded Capabilities

Boeing-Insitu ScanEagle: The March 2011 earthquake and ensuing tsunami and nuclear crisis prompted the Japan Ground Self-Defense Force (JGSDF) to improve its humanitarian assistance and disaster relief (HADR) and ISR capabilities, awarding a contract with then Insitu Pacific to deliver a ScanEagle UAV via Mitsubishi Heavy Industries (MHI) for operational testing. The system was developed and tested by Insitu Pacific in collaboration with MHI to meet Japanese spectrum requirements and was delivered by May 2013.

Subaru FFOS: Development of a rotary UAV for the JGSDF for target acquisition, artillery fire-control, and BDA commenced in 1991. Known as the Forward-Flying Observation System (FFOS), a prototype performed its maiden flight in December 1993 and trialled for the Technical Research and Development Institute (TRDI) until 1997. The FFOS carries a daylight TV or FLIR sensor mounted under the fuselage and can also be equipped with a laser rangefinder.

Yamaha R-MAX Mk IIG: A rotary UAV first developed as the R-50 from 1983 for commercial agriculture and entered service in 1991. The more advanced R-MAX featuring an improved engine, flight stability, and safety functions was introduced in late 1997. An evolved version, G-1, was introduced in October 2005 and certified in January 2008. This was followed by a military variant, the MkIIG, which entered service with the JGSDF and deployed for peacekeeping missions in Iraq in 2005.

Under Development/Consideration/Trials

Northrop Grumman RQ-4 Global Hawk: In December 2013, the Japanese MoD confirmed plans to purchase three RQ-4 Global Hawk HALE UAVs, and announced its firm decision in January 2015. This was followed by a US Defense Security Cooperation Agency (DSCA) announcement in November detailing the request and potential sale of three RQ-4 Block 30i (international) air vehicles to Japan at an estimated cost of \$1.2 billion. In October 2017, Northrop Grumman signed a \$130 million contract

to acquire long-lead materials for three Global Hawk Block 30s, two ground control elements, as well as spares and site survey. Japan firmed up its order in November 2018, awarding a \$489.9 million contract to the company for the three air vehicles. These will be equipped with the Raytheon Enhanced Integrated Sensor Suite (EISS) – which comprises EO/IR, synthetic aperture radar, and ground moving target indicator systems – and to be delivered by 1 September 2022. The Japanese government is also selecting a base for the UAVs, which is anticipated to be Misawa Air Base in northern Japan.

Subaru IR-OPV: Subaru is developing three optionally piloted vehicles. Based on the Japan Maritime Self-Defense Force's (JMSDF's) Fuji T-5 (KM-2Kai) turboprop-driven primary trainer, the IR-OPV is an all-metal low-wing cantilever monoplane powered by an Allison 250-B17D turboprop with a three-bladed constant speed propeller. Under a March 2016 government contract, Subaru integrated an EO/IR sensor and an "advanced" flight control system aboard one of the prototypes, with first flight achieved in October 2018 before delivery to the Acquisition, Technology & Logistics Agency (ATLA). Future testing will be performed by the agency.

PAKISTAN

Pakistan has attempted to acquire Western made UAVs since the early 2000s, but it was not until 2006 before it acquired the German-made Luna and Italian Falco UAVs. Concerted efforts to develop its indigenous UAV production capabilities have also borne fruit, with a number of domestically produced systems already in service with the Pakistan armed forces.

Fielded Capabilities

Advanced Computer Engineering Services (ACES) Uqab II: The Uqab II is a tactical short-range UAV system developed from the Eagle Eye and has an operational range of 150km and a ceiling of 10,000ft. It is fitted with a pan-tilt-zoom camera and can downlink digital video in real time. The Uqab UAVs have GPS-based navigation and tracking systems that can be pre-programmed and altered during flight. They can also operate under manual control and use conventional take-off and landing.

Boeing-Insitu ScanEagle: Pakistan has acquired an unspecified number of



China's AVIC Wing Loong/Gongju-2.

ScanEagle UAVs under a \$15 million FMS contract awarded in September 2015. The contract, which emerged after nearly seven years since the country expressed its interest in the air vehicle, was handled via the US Naval Air Systems Command and is believed to cover up to 30 systems if all options were fully exercised. Deliveries of the ScanEagles commenced from the third quarter of 2016 to the Pakistan Navy.

CASC CH-3: At least 20 CH-3 UAV systems are believed to have been delivered to Pakistan in 2011. See earlier entry for air vehicle details.

EMT Luna: The fixed-wing Luna is a short-range battlefield reconnaissance, surveillance, and target acquisition UAV with a flight endurance of approximately six hours and an operational radius of 100km. Potential payloads include a daylight CCD camera with zoom, a thermal imager, or a miniature single aperture radar. At least three systems have been acquired for the Pakistan Army.

Leonardo Falco: Originally developed by Selex ES/Finmeccanica, the long range Falco UAV comprises a fuselage module that supports a fixed tricycle undercarriage, shoulder-mounted gull wings and a rear-mounted pusher engine. The company states that the air vehicle has an operational radius of 200km and

a 14 hour endurance, although this can be further extended via command handover between ground control stations (GCS). Deliveries of the Falco to the Pakistan Air Force is believed to have been completed in 2008 with service entry in 2009.

Global Industry and Defence Solutions (GIDS) Burraq: Claimed to be a fully indigenous development by the state-owned National Engineering and Scientific Commission (NESCOM), the Burraq appears to be heavily inspired by the Chinese-made CH-3 tactical UAV with its canard and swept-wing configuration and pusher-propeller propulsion arrangement. The Burraq entered service with the Pakistan Air Force in November 2013 and is equipped with two underwing hard points, which can be used to launch a variety of munitions including Barq laser-guided missiles.

Global Industry and Defence Solutions (GIDS) Shahpar: Adopting a similar airframe configuration with the Burraq, the Shahpar is optimised for ISR missions and does not feature an offensive capability. It is presently equipped with a four-stroke Rotax 912 ULS engine that provides up to seven hours with an operating radius of 250km while carrying a 50kg payload, although the company is planning to upgrade the air vehicle with a new and more powerful engine.

Under Development/Consideration/Trials

Pakistan Aeronautical Complex (PAC) ZF-1 Viper: Promotional material of the ZF-1 Viper stealthy unmanned combat air vehicle (UCAV) concept emerged in May 2019, depicting a blended wing design with a 18m wingspan and a 16,000kg MTOW, which is expected to achieve a maximum speed of 533kts (988km/h) and a service ceiling in excess of 30,000ft, while carrying a 300 kg payload up to a range of 500km. The concept is aimed at performing deep penetration and suppression of enemy air defences, as well as reconnaissance and electronic warfare. The effort is part of Pakistan's 'Project Azm' which seeks to develop next-generation military aviation capabilities.

PEOPLE'S REPUBLIC OF CHINA

Chinese industry has introduced scores of unmanned systems over the past decade, mainly produced by state-owned defence primes such as the Aviation Industry Corporation of China (AVIC) and CASC, although the number of private firms involved in military and dual-use UAV development has also increased significantly. Indeed, the US Department of Defense (DoD) believes that the country could manufacture as many as 41,800 UAVs worth over \$10 billion by 2023, with the majority of these acquired by the military.

The DoD also believes that the development and acquisition of longer-range UAVs will increase the People's Liberation Army's (PLA's) ability to conduct long-range reconnaissance and strike operations, with notable developments such as the Wing Loong (Pterodactyl) and Xianglong (Soaring Dragon). Although information about the capabilities of in-service systems remains shrouded in secrecy, these programmes represent major advances in Chinese technology.

It is evident that Chinese developers are rapidly moving up the value chain, showcasing ambitious and sophisticated flying wing UAV designs that incorporate low-observable, large payload, and long range capabilities at the most recent Airshow China exhibition in November 2018.

Fielded Capabilities

CASC CH-1: The short-range general-purpose CH-1 entered production for the PLA's artillery forces from around 2003. The tactical UAV carries a 20kg payload

comprising a range of electro-optical sensors appropriate for its intended missions, which include artillery fire direction, battlefield damage assessment, as well as reconnaissance and surveillance within a radius of 100km.

CASC CH-2: The CH-2 medium-range general UAV is essentially a larger and night operations-capable air vehicle based on the CH-1 design and was produced from 2005. The newer platform improves on almost every aspect of its predecessor, including an increased operating radius of 200km and an endurance of eight hours. An increased payload capacity of 30kg enables the air vehicle to take on a greater variety of roles, such as data communications relay.

AVIC Wing Loong-I/Gongji-1: Developed by AVIC's Chengdu Aircraft Design and Research Institute (CADI) subsidiary, the Wing Loong-1 is a MALE-class UAV that has a wingspan of 14m and shares a close physical semblance to the US-made RQ-1 Predator. The air vehicle - which is identified as the Gongji-1 (GJ-1) in People's Liberation Army Air Force (PLAAF) service - has a payload capacity of 200kg and can carry munitions, such as the indigenous HJ-10 anti-armour missile, CS/BBE2 50kg high-explosive bomb, and LS-6-50 small-diameter bomb. The Wing Loong I is also being actively marketed for export, and has been acquired by several countries including Egypt and Kazakhstan.

AVIC Wing Loong II/Gongji-2: Unveiled in its production-ready form at the 2016 Airshow China Exhibition, the Wing Loong II has an overall length of 11m and wingspan of 20.5m. The air vehicle has a stated internal payload capacity of 200kg, with provision for up to 480kg of external stores, and can operate for up to 20 hours. It reportedly made its maiden flight on 27 February 2017, with AVIC announcing that it had secured an unidentified international customer on the same day. The type was revealed in November 2018 to be in PLAAF service with the in-service designation of Gongji-2 and is differentiated from the export variant by the absence of winglets on the main wings. It has also found export success, with international customers including Saudi Arabia and the UAE.

Beijing University of Aeronautics and Astronautics (BUAA)/ Harbin Aircraft

Industry Group (HAIG) BZK-005: The existence of the multirole BZK-005 MALE UAV was first made known in 2006 in a promotional video. Equipped with a satellite communications (SATCOM) datalink and carrying up to 150kg of stores and equipment, the air vehicle can stay airborne for up to 40 hours and is specifically designed for long-range reconnaissance missions. The type was confirmed in November 2018 to be operational across the PLA's air, land, and sea services for long-range COMINT, ISR, and electronic intelligence (ELINT) missions. An armed variant, designated BZK-005C, was revealed to be under trials at the same time.

Guizhou Aviation Industry Group Xianglong (Soaring Dragon): The Xianglong is believed to be the primary HALE UAV operated by the PLAAF for high-end ISR missions. Often compared to the RQ-4 Global Hawk. The UAV debuted as a concept at Airshow China 2006, with prototype reportedly performing its maiden flight in 2009. Commercial satellite imagery captured in February 2018 showed at least two Xianglong UAVs deployed to the Lingshui naval airbase on Hainan Island: a strategic location for military operations in the South China Sea. It is the third known operational location for the Xianglong, which have been seen operating from Shigatse airbase, which is in the Tibet Autonomous Region of China near the disputed Doklam tri-junction, since August 2017, as well as Yishuntun airbase in northeastern China in February 2018.

Xi'an ASN Technical Group ASN-206: Development of the short-range tactical ASN-206, which reportedly incorporated technical assistance from Israeli firm Tadiran Spectralink, began in December 1994 with serial production believed to have occurred from 1996. The ASN-206 has a payload capacity of 50kg and has an operational radius of 150km and flight endurance of up to eight hours.

Xi'an ASN Technical Group ASN-207: The ASN-207 was revealed in 2002 and is essentially a larger and more capable version of the ASN-206, featuring a 100kg stores carrying ability, a 600km operational radius, and a 16 hour endurance.

Xi'an ASN Technical Group ASN-209: The ASN-209 multirole tactical UAV,

which appears to be derived from the earlier ASN-206/207 design, is believed to have been acquired by the PLA Navy (PLAN), with several examples reportedly sighted during a major naval exercise between Hainan and the Spratly Islands during July 2011 as a shore-based surveillance platform and communications relay.

Export-oriented systems

Beihang Unmanned Aircraft System Technology TYW-1: The export-oriented TYW-1 is a strike-capable MALE UAV derived from the in-service BZK-005 design. It reportedly features a 370kg payload capacity and is equipped with four underwing hard points, with a flight endurance of up to 40 hours.

CASC CH-3: The CH-3 has found regional success with Myanmar and Pakistan acquiring a number of these systems for armed reconnaissance missions. The company has also developed civilian variants for applications such as geological survey and low-level aerial mapping. Advanced flight control technologies resulting from these efforts have also benefited its military systems.

CASC CH-4: Inspired by the US-made RQ-1 Predator, development of the MALE-class CH-4 UAV commenced in 2009, with the first production-ready example rolled out in 2014. Glass fibre-based composite materials are used extensively to reduce the overall weight of the air vehicle as well as its radar cross-section (RCS). Two variants are currently offered: the CH-4A, which is configured principally for reconnaissance missions with a flight endurance of 30 hours; and the strike-oriented CH-4B, which can carry a 345kg weapons payload but has a shorter flight endurance of 14 hours. At least 30 CH-4s - valued at \$700 million - have been exported worldwide since 2014.

CASC CH-5: Also unveiled in its production-ready form at Airshow China 2016, the CH-5 features a lightweight all-composite airframe that measures 11.3m long with a wingspan of 21m and bears a striking resemblance to the US MQ-9 Reaper UAV. The company claims it can carry a maximum payload of 1,200kg. The air vehicle has a stated flight endurance of over 40 hours, although a heavy fuel variant with an extended endurance of 60 hours is under development. The company has specified an operating



China's CASC CH-7.

radius of 250km via line-of-sight control, although this can be extended to 2,000km when a SATCOM datalink is fitted.

China Aerospace Science and Industry Corporation (CASIC) WJ-600: The WJ-600 is a high-speed, armed reconnaissance UAV that adopts a form factor that is comparable to that of a cruise missile and is available with a turbojet (WJ-600) or turbofan (WJ-600A) engine. It is believed to have been acquired by the PLAAF, although it has yet to be seen in operation despite multiple public appearances at defence exhibitions around the world. However, the existence of operational WJ-600s was proven when at least two examples were displayed during Turkmenistan's Independence Day parade in October 2016.

Under Development/Consideration/Trials

AVIC Wing Loong I-D: State media reported in January 2018 that AVIC is developing the Wing Loong I-D, an improved version of its Wing Loong I UAV. It will feature a wider wingspan of 17.6 m and be able to carry up to 400kg of external stores. The type completed its maiden flight in December 2018, signalling the end of its development and marking it ready for production.

AVIC AV500W: Under development by

AVIC's China Helicopter Research and Development Institute (CHRDI), the AV500W is a modified version of the civilian model AV500 VTOL UAV with a more robust structure and improved performance. The AV500W is stated to have a payload capacity of 160kg. This typically comprises a chin-mounted, stabilised electro-optical infrared sensor turret as well as internally carried payloads such as a synthetic aperture radar (SAR) or communications relay systems. Weapons can also be carried on its stub wings.

CASC CH-4C: CASC is developing an improved variant of its widely exported CH-4 MALE UAV with an updated electronic architecture that will enable it to carry more powerful mission payloads. Designated the CH-4C, it has been seen carrying what appears to be an electronic warfare (EW) or signals intelligence (SIGINT) pod during flight trials in early 2018.

CASC CH-7: The CH-7 is a turbofan-powered high-altitude UCAV with a MTOW of 13,000kg, which will be capable of carrying a range of payloads including active and passive sensors and electronic warfare systems, as well as precision air-to-ground/surface missiles and guided bombs. The air vehicle can achieve a high subsonic speed of 500kts (926km/h) and

will have a service ceiling of over 40,000ft. It will also be equipped with a secure satellite communications datalink for long-range operation.

Tengden Technology TB001 'Twin Tailed Scorpion': A new starter in China's UAV industry, Tengden took the opportunity at the 14th China-Association of Southeast Asian Nations Exposition in Nanning in September 2017 to unveil its twin-engine, twin-boom TB001 armed reconnaissance UAV. The TB001 has a stated maximum range of 6,000km and an endurance of 35 hours, and is equipped with two hard points under each wing. State media reported that the prototype air vehicle performed its maiden flight just days after its public unveiling in Nanning.

Zhong Tian Guide Control Technology Company (ZT Guide) Feilong-1 (FL-1): The FL-1 adopts a similar configuration to that of the CH-5, with a MTOW of 3,200kg with a payload capacity of 1,400kg inclusive of fuel. Two hard points can be mounted under each wing, with each carrying up to 250kg of stores. The type performed its maiden flight in January 2019 following 18 months of R&D work by ZT Guide's Zhong Tian Fei Long subsidiary.

PHILIPPINES

Despite engaged in decades of counterinsurgency (COIN) operations, the modernisation of the Armed Forces of the Philippines (AFP) has been hampered by a lack of funding and ineffective policy. The Department of National Defense (DND) has in recent years made significant efforts to boost AFP capability and transform it from a COIN-oriented force into one that can undertake the full spectrum of military operations, which has seen its services benefit from a number of new acquisitions. The AFP initially adapted hobby drones for tactical ISR support, but has recently taken delivery of US-made military systems.

Fielded Capabilities

AeroVironment RQ-11B Raven: The Philippine Army has taken delivery of the RQ-11B Raven system comprising three UAVs as part of a United States-supported counterterrorism support programme. According to a US embassy announcement in February 2017, the army will also receive operations and maintenance training.

Boeing-Insitu ScanEagle: The Philippines was revealed to have acquired the ScanEagle UAV in a US Navy Naval Air Systems Command (NAVAIR) solicitation published in June 2017. In September 2017, the US Department of State announced that the Philippines is to receive a ScanEagle system comprising six UAVs by 2019. This was handed over to the Philippine Air Force during a ceremony held at Villamor Air Base in Pasay City in March 2018. The system is operated by 300 Air Intelligence and Security Wing (AISW) out of Antonio Bautista Air Base in Palawan.

Philippine Army Research and Development Center (PARDC) Raptor: Publicly unveiled at an AFP open house event in Camp Aguinaldo in December 2013, the Raptor is a fixed wing drone based on the airframe of a commercially available remote-controlled aircraft. It has an endurance of around three hours and carries a video camera that provides real-time imagery and video out to an operating radius of 3km. The Raptor was first deployed during the Zamboanga City crisis in September 2013.

Philippine Army Research and Development Center (PARDC) Knight Falcon: Similar to the Raptor, the Knight Falcon is a fixed wing UAV that was adapted from a commercial airframe, although it is larger and features a longer range of around 7 km.

REPUBLIC OF KOREA

The Republic of Korea (RoK) is one of a handful of Asia Pacific countries that possess advanced aerospace industries and are pursuing wide ranging unmanned aircraft system development programmes. At present, the RoK's military forces rely on a mix of indigenously developed systems – with the majority of these operating at the tactical level and below – from established international manufacturers at the MALE-class and above, such as IAI's Heron I and Northrop Grumman RQ-4 Block 30 Global Hawk.

Present domestic development efforts largely centre on MALE-class platforms for the Republic of Korea Air Force (RoKAF) and Republic of Korea Army (RoKA), the introduction of an unmanned combat air vehicle (UCAV) capability, as well as vertical take-off and landing (VTOL), and tiltrotor platforms.

UAVs are also expected to be an

important element of the so-called 'Kill Chain' integrated surveillance and strike system for detecting and neutralising hostile missile launches from the DPRK.

Beyond serving the needs of its armed forces, the country aspires to be one of the leading manufacturers and exporters of world-class UAV systems, with key government agencies and industry primes such as the Agency for Defense Development (ADD), Korea Aerospace Research Institute (KARI), Korea Aerospace Industries (KAI), and Korean Air Aerospace Division (KAL-ASD) spearheading efforts to advance its UAV technology base.

Fielded Capabilities

KAL-ASD Korean Unmanned System-FT (KUS-FT) /RQ-102: KAL-ASD, a unit of the South Korean national airline specialising in military systems, secured a contract from the Defense Acquisition Program Administration (DAPA) in 2016 to manufacture the KUS-FT tactical UAV system for the RoKA. The company will deliver 16 complete systems – each comprising four UAVs – by the end of 2020. The RQ-101 is designed for short take-off and landing operations, and can stay aloft for 24 hours. It is equipped with automatic target tracking capability with an effective range of up to 10 km.

Daewoo/KAI RQ-101 'Night Intruder 300': The RQ-101 is the RoKA's first tactical-class UAV platform, which adopts a fixed-wing configuration and offers a 120km operating radius with line-of-sight control or up to 360km with ground relay stations. It has a payload capacity of 45kg which is dedicated to high-definition day and infrared sensors as well as a SAR device. Deliveries are understood to have been completed by the end of 2004.

Elbit Systems Skylark II: Elbit's Skylark II is a larger and more capable version of the hand-launched Skylark I with an endurance of six hours and an operational radius of approximately 59 km. The system typically comprises up to two air vehicles, associated payloads, and a truck-mounted rail launcher and GCS.

Foosung Group/UCON Systems Remoeye: The RoKA signed a contract with Foosung Group for its RemoEye 002B mini-UAV in 2013, with deliveries of 120 systems – each comprising four air vehicles – commencing in the third quarter of 2015. The RemoEye 002B is

hand-launched and recovered with an air-bag cushion system. The electrically powered air vehicle has an range and endurance of 10km and 60 minutes, and is equipped with a nose-mounted, stabilised electro-optical infrared payload with pan and tilt scanning.

IAI Heron 1: IAI announced in December 2014 that the South Korean Defense Acquisition Program Administration (DAPA) selected its Heron 1 MALE UAV for the RoK armed forces' corps-level UAV requirement. An unspecified number of these air vehicles are understood to be operated by the RoKA. At least one of these air vehicles have been reported performing reconnaissance missions over the Demilitarised Zone (DMZ).

Under Development/Consideration/Trials

KAI Next Corps Reconnaissance UAV II, Tactical UAV, and unmanned combat air vehicle (UCAV): KAI is developing a range of next-generation UAV platforms positioned to meet the future requirements of the RoK armed forces. Detailed information on these developments have yet to be released.

KAI Night Intruder 600 VT: KAI has launched an internally funded programme to develop a VTOL UAV to meet a possible RoKA requirement, with flight trials expected to commence in 2019. The prototype air vehicle has an overall length of 9m with a planned MTOW of 600-750 kg. KAI has incorporated patented anti-spoofing GPS systems to improve its ability to operate in contested EM environments.

KAL-ASD KUS-FC: Very little is known about the stealth-optimised, turbojet-powered KUS-FC UCAV. The company has stated a wingspan of approximately 16 m and a flight endurance of 6 hours at the ADEX 2017 exhibition in Seoul, but has withheld further information.

KAL-ASD KUS-FS: Previously known as the Medium-Altitude UAV, the KUS-FS MALE UAV is being developed for the RoKAF and is in the same class as the US MQ-9 Reaper UAV. The multirole air vehicle is expected to perform missions such as communications relay, electronic warfare (EW), ISR, as well as signals intelligence (SIGINT). Images showing a prototype in flight reveal that it is also equipped with two hard points under



China's prototype NCSIST Teng Yun.

each wing, indicating a potential strike capability. Development of the air vehicle expected to be completed by end of 2018, which will then be transferred to the RoKAF for operational testing and evaluation.

KAL-ASD KUS-VH: KAL-ASD is developing a rotary-wing unmanned platform based on the MD-500 light attack helicopter. Flight endurance is extended to four hours with the installation of a large fuel tank in place of the rear passenger seats. If successfully developed, the KUS-VH could potentially support manned/unmanned-teaming operations with the RoKA's AH-64E Apache Guardians, which already feature the ability to command UAVs.

KAL-ASD KUS-VT: An unmanned tiltrotor aircraft developed jointly with the Korea Aerospace Research Institute (KARI) and based on the TR-60 system. The KUS-VT can carry a 30 kg payload and has an operational radius of 200 km with an endurance of 6 hours. It is expected to perform autonomous VTOL and shipboard operations.

Northrop Grumman RQ-4 Global Hawk: The RoK has acquired four RQ-4 Block 30i Global Hawks along with two GCS systems and two spare engines under a \$657 million FMS contract, which

will equip an RoKAF ISR unit. Delivery of the first two air vehicles was originally scheduled in late 2018, although this has since slipped to 2019 to improve its anti-hacking system and cyber security.

REPUBLIC OF CHINA (TAIWAN)

The Republic of China Air Force (RoCAF) has been reluctant to adopt unmanned technologies, with no UAVs known to be currently in service. The country's largest and most capable UAV, the tactical-class Chung Shyang II, is operated by the Republic of China Army (RoCA).

The country's UAV development efforts are being spearheaded by the National Chung-Shan Institute of Science and Technology (NCSIST).

Fielded Capabilities

NCSIST Cardinal II: The Cardinal II is a small hand-launched UAV that is understood to be in RoCA and Republic of China Navy (RoCN) service. The air vehicle is powered by an electric motor and can stay aloft for up to 60 minutes, and is recovered via parachute-assisted landing. An electro-optic camera enables it to capture ISR imagery.

NCSIST Chung Shyang II: Also known as the Albatross, the Chung Shyang II is a reconnaissance platform that is presently in RoCA service. Around 32 UAVs were acquired for the army under

a \$120 million contract inked in 2010. The package included eight complete control suites, each comprising a command post, GCS, launch and recovery system, remote video terminal, and other support equipment. Three of these air vehicles reportedly malfunctioned and were lost during routine operations and training in 2012, 2013, and 2016. Further work is underway to improve reliability and performance.

Under Development/Consideration/Trials

NCSIST Teng Yun: The prototype of a new MALE-class UAV was revealed at the 2015 Taipei Aerospace & Defense Technology Exhibition (TADTE), which appears to be modelled after the US RQ-1 Predator platform with proposed mission sets including communications relay, persistent ISR operations, as well as coastal patrol and civilian research missions. In December 2017, President Tsai Ing-Wen announced that the air vehicle, now designated Teng Yun (Cloud Rider), would enter production. However, the programme was subsequently delayed to 2020 to incorporate further updates on RoCAF's behest, including additional external stores carrying capacity.

SINGAPORE

Singapore has been described by some observers as an 'enthusiastic user' of



of one hour and operating radius of up to 8km. It is equipped with an automatic 'return-home' function and can be programmed to autonomously fly user-defined flight paths via waypoint-setting and also features three pre-determined loiter patterns.

Singapore Technologies Aerospace Skyblade III: At least six Singapore Army units have been equipped with the Skyblade III mini-UAV since 2010. The Skyblade III is a 5kg, man-portable UAV can be transported in two backpacks weighing 20kg each. It can be readied for flight within 20 minutes and launched by hand, flying for up to one hour out to a range of 8km.

Under Development/Consideration/Trials

DSO National Laboratories V15: The V15 is Singapore's first locally developed fixed-wing surveillance UAV with a VTOL capability. Unveiled in November 2017, the V15 is equipped with a day/night camera and is designed specifically for use in urban environments where conventional UAV take-off and recovery is a challenge. The V15 has a 3 hour endurance and has also demonstrated an ability to take-off and land on a moving unmanned ground vehicle.

Schiebel S-100 Camcopter: The RSN has reportedly conducted shipborne trials for the rotary-wing S-100 Camcopter aboard one of its latest Independence-class Littoral Mission Vessels. It is understood that the service is yet to commit to a buy, and is also exploring other similar UAVs before it selects the appropriate platform.

Singapore Technologies Kinetics Stinger: The Stinger Unmanned Aerial Multi-Rotor Gunship is envisioned to be a semi-autonomous, company-level reconnaissance and fire-support platform. Although still in early development, the company is aiming for an endurance of over 30 minutes when carrying high-definition daylight and thermal imaging cameras, a fire-control system (FCS), and a 5.56mm calibre Ultimax 100 Mk8 light machine gun.

SRI LANKA

Since the end of the Sri Lankan Civil War, the country's armed forces have been tasked with an increasing spectrum of missions, including air defence, strike, and cyber warfare, but is primarily geared

UAVs. The country first began unmanned aircraft operations with the army-operated Tadiran Mastiff tactical UAV in 1979, but has since acquired newer and more capable platforms that are now operated by the Republic of Singapore Air Force's UAV Command, which was inaugurated in 2007 and now oversees all major military UAV operation.

With a perennial shortfall in manpower, the Singapore Armed Forces (SAF) see technology as a critical force multiplier with the ongoing modernisation effort focusing deeply on the integration of command and control, ISR, and precision strike. In that regard, UAVs are seen as a key enabler for the SAF's transformational initiatives.

Fielded Capabilities

Boeing-Insitu ScanEagle: The Republic of Singapore Navy (RSN) operates the ScanEagle UAV as part of the upgrade and life extension of its six Victory-class missile corvettes, providing these vessels with an organic airborne ISR capability. The air vehicle is launched via a pneumatic launch catapult installed on the aft deck. A Skyhook recovery system is fitted just astern of the superstructure to snare the returning vehicle in mid-air.

Elbit Systems Hermes 450: The Republic of Singapore Air Force (RSAF) has operationalised a number of Hermes 450 tactical UAVs in March 2015, which

were first delivered in 2007. The RSAF's Hermes 450 UAVs are operated by 116 Squadron, which is based at the western Tengah Air Base. The air vehicle carries a 150kg payload, although the service opted for a belly-mounted turret with high-definition colour daylight TV and IR cameras, as well as a laser designator. Defence Minister Ng Eng Hen revealed that the type will be phased out "over the next few years" and replaced with a new platform.

IAI Heron 1: The RSAF's primary long-range UAV is the MALE-class Heron 1 UAV, which was introduced in May 2012 and replaces the ageing IAI Searcher tactical UAV. The service's Heron 1 UAVs were declared fully operational in March 2017, and are operated by the 119 and 138 Squadrons. It has opted for a MAN 4x4 truck-based mobile GCS configuration for general UAV and mission payload operation, with two modular workstations that handle critical mission planning, control, command, and processing functions. It was also revealed in March 2019 that the Heron 1 will be replaced by another system.

Singapore Technologies Aerospace Skyblade II: The Skyblade II is described as a short-range mini-UAV. The 5kg air vehicle is hand-launched and parachute-recovered and is powered by a hybrid propulsion system and has an endurance

towards providing tactical air support during COIN and naval interdiction operations. To this end, the Sri Lanka Air Force (SLAF) maintains a range of UAVs that have supported the ground forces for more than a decade.

Fielded Capabilities

IAI Searcher: Operated by SLAF's 111 UAV Squadron, the long-endurance Searcher UAV is believed to have conducted 265 sorties in support of ground troops during the civil war with the Liberation Tigers of Tamil Eelam from 1983 to 2009.

EMIT Aviation Consult Ltd Blue Horizon II: An unspecified number of the long-endurance Blue Horizon II tactical UAVs - which have a flight endurance of 24 hours and an operational radius of up to 150km via a datalink - have been acquired after a 2009 request from the Sri Lanka government. These are believed to be operated by the SLAF's 112 UAV Squadron.

THAILAND

Thailand's requirement for improved intelligence gathering has increased in recent years, with a concomitant growth in indigenous UAV research and development capability. Earlier efforts to manufacture locally made systems have largely revolved around highly affordable but technically rudimentary products from private- and military-owned firms with foreign assistance from countries such as Israel.

However, increasingly sophisticated and capable UAVs are beginning to emerge in recent years, following a Ministry of Defence initiative that was introduced in 2009 to reduce dependency on foreign UAV technologies and imports. Today, the ministry's Defence Technology Institute (DTI) is spearheading efforts to grow its indigenous UAV production capabilities and spur innovation within the local defence industry.

Fielded Capabilities

Aeronautics Defense Systems Aerostar: The Royal Thai Air Force (RTAF) fielded its first UAV, the tactical-class Aerostar as part of the military's wider effort to introduce surveillance and reconnaissance UAVs into service to support its fighting forces. Local media reported that a new unit, 404 Squadron, was created at Takhli to operate the

AeroVironment RQ-11 Raven: The Royal Thai Army is believed to have acquired around 12 of these hand-launched mini-UAVs in 2010 for tactical ISR missions.

Elbit Systems Hermes 450: The Royal Thai Army (RTA) revealed in June 2018 that it had taken delivery of four Hermes 450 UAVs, which are operated by the 21st Aviation Battalion at the Army Aviation Centre at Lopburi. These are being employed for missions including ISR, mapping, and target designation. It is understood that a deal worth around \$30 million was finalised in 2017, and included a GCS and remote video terminals.

IAI Searcher: The RTA's 21st Aviation Battalion also operates four Searcher Mk II UAVs that were acquired in the late 1990s for around \$12 million.

RTAF Research and Development Centre for Space and Aeronautical Science and Technology Tigershark II: Designed around 2015, the medium-range Tigershark II tactical UAV is stated to have an operating range of up to 150km while carrying a 30kg payload. Ministry of Defence reportedly awarded a US\$18 million contract in 2016 to procure parts for up to 17 Tigershark II UAVs. Local firm AVIA Satcom reportedly responsible for systems integration and testing, while G-Force Composites is constructing the airframe.

Under Development/Consideration/Trials

R V Connex Sky Scout: A smaller tactical UAV with a similar airframe configuration is also being developed by local firm R V Connex for DTI. The Sky Scout tactical UAV has a 10 m wingspan is capable of carrying a 10kg payload with a flight endurance of up to six hours. It is said to have accumulated over 200 hours in flight testing.

Royal Thai Navy (RTN) Naval Research and Development Office Tarem: Unveiled at the 2017 Thailand Defence & Security Exhibition in Bangkok, the multi-rotor Tarem tactical UAV is being developed by the Thai Naval Research and Development Office for communication and surveillance missions. It is also equipped with a stabilised mount that can accommodate a 9mm calibre automatic pistol.

Top Engineering Group Falcon V: The Falcon V is a fixed-wing surveillance UAV with a VTOL capability that is being developed under a DTI contract. It can carry a 5kg payload.

VIETNAM

There has been an observable emphasis on UAV development in line with a requirement to boost the ISR capabilities of the Vietnamese armed forces. The country is understood to have begun developing UAV technologies such as flight control and navigation systems, operating software and airframe design, since 2011. Moreover, programmes led by the state-owned Vietnam Aerospace Association (VASA) has ostensibly resulted in cooperation with Russia's Irkut and Sweden's Unmanned Systems Group (UMS) to develop and produce tactical UAVs based on the Irkut-200 and UMS Magic Eye 1 UAVs, although it appears that the momentum has since stalled with little known progress on development.

Fielded Capabilities

Viettel Group Patrol VT: The military-owned telecommunications firm Viettel Group publicly showcased its indigenous Patrol VT tactical UAV in 2014. The air vehicle, which is developed by the company's Flight Instrument Centre, is stated to be capable of operating out to 50km and carries an optical infrared camera that provides real-time transmission of high-definition imagery.

Under Development/Consideration/Trials

Academy of Science and Industry/Ministry of Public Security HS-6L: Vietnamese media have reported the existence of the HALE-class HS-6L, which has a twin-boom airframe and a wingspan of 22m. Stated performance include a range of up to 4,000km and a 35 hour flight endurance. The air vehicle is thought to be destined for military patrols over the South China Sea, where Vietnam maintains several claims. A prototype was reportedly completed by November 2015 with flight testing occurring during the second quarter of 2016.

Boeing-Insitu ScanEagle: It was revealed in March 2019 that Boeing is close to sealing a deal to sell the ScanEagle to the Vietnam Coast Guard (CSBV) under a government to government sale. [AMIR](#)