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Welcome

Fighter jets embarked on the HMS *Queen Elizabeth* have completed strike training missions that move the UK a step closer to the carrier's operational deployment due next year.

The Royal Navy's newest flagship recently returned to Portsmouth after a successful two-week cruise with the largest group of fifth generation F-35B Lightning fighters ever put to sea, courtesy of the US Marine Corp's VMFA-211 and the UK's 617 Squadron 'The Dambusters'.

What a difference a decade makes.

Turn back the clock to December 3, 2010 and the HMS *Ark Royal* was sailing into Portsmouth for the final time. That year's Strategic Defence and Security Review had wielded an axe across the bow of the UK's only aircraft carrier, forcing its retirement as defence budgets were slashed. This period marked one of the lowest points in the Royal Navy's recent history, leaving the nation with no capability to launch fixed-wing aircraft at sea as the Harrier was culled. In one governmental blow relations were soured between the air force and navy.

Ironically, today the RAF's most famous squadron, 'The Dambusters', is headed by a Royal Navy pilot, Commander Mark Sparrow, giving an insight into how those differences have been resolved through the UK's Joint Lightning Force. Alan Warnes provides a fascinating view of the country's strike group and multinational partners on **pages 52 to 57**.

HMS *Queen Elizabeth*'s majestic return is reason to celebrate a milestone in military operations during a year that's been short of such occasions in the commercial aviation sector. Some insiders are cautiously optimistic we have reached the nadir of the

COVID-19 crisis and early analysis of the efficacy of the Pfizer and BioNTech vaccine candidate provides hope for an industry still in the eye of the pandemic storm. Shares in Rolls-Royce and British Airways owner IAG soared on the strength of the news.

But talk of a sustained recovery is a little premature. Eye-watering global economic losses, job cuts and belt-tightening measures persist. To expedite recovery, intergovernmental agreements are vital, securing common procedures, testing and screening standards. Transport Secretary Grant Shapps has committed to virus tests being in place by December but with a comprehensive vaccine roll-out still months away it cannot come soon enough for the sector.

While airports and airlines have worked hard to extol the relative safety of commercial air travel, many consumers are spooked at the prospect of taking to the skies as the virus looms large and wide-reaching restrictions on leisure travel continue.

So, as 2021 approaches, a more co-ordinated approach involving all stakeholders is essential to supercharge the recovery and minimise the long-term damage to the industry we know and love.

In the spirit of that sentiment, the entire *AIR International* team wishes you all a happy, healthy and prosperous New Year.

Carol Randall

Associate Editor, Commercial Aviation

ABOVE: Embraer has joined the urban air mobility segment with its new Eve unit, just one of many tech triumphs in commercial aviation during 2020. See pages 42-45 for our spotlight on more industry developments Embraer

COVER IMAGE: F-35B fighters arrive on HMS 'Queen Elizabeth' to take part in a joint exercise in the North Sea in September 2020 Royal Navy





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Airbus unveils its popular A220-100 commercial jet as a business/VIP variant; US-based Gulfstream bolsters

its G700 test airframe fleet with the introduction of two more examples, and the sector's aircraft deliveries remain stagnant amid the continuing COVID-19 pandemic.

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In October 2020, the Royal Navy's new carrier strike group assembled for the first time to mark the beginning of a new era of naval operations centred around the HMS *Queen Elizabeth* aircraft carrier with 14 F-35Bs aboard – the largest group of fifth-generation fighters at sea ever seen.

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In the midst of surging internal turmoil in Israel, caused by the effects of COVID 19, the 117 'First Jet Squadron' based in Ramat David Airbase has shut down. Yissachar Ruas reports on the unit that operated continuously for 67 years.

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In late summer 2020, Exercise Northern Lightning took place at Wisconsin's Volk Field. We caught up with the action, which once again saw some of America's most lethal fighters soaring across the usually placid Midwest skies.

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Two rival companies are in an ambitious race to take commercial passengers into sub-orbital space. Nick Spall investigates the craft and characters behind an incredible vision.

82 UNLEASH THE LYNX

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90 INDIAN AVIATORS HEAT UP HEATHROW

As both Vistara and SpiceJet launch scheduled non-stop services between India and London, Tom Batchelor analyses the technology and equipment each carrier plans to use for their new flagship routes.

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27 for details



Another A380 axed

Hi Fly will withdraw its sole A380-800, 9H-MIP (c/n 006), by the end of this year Airbus

PORTUGUESE WET-LEASE specialist Hi Fly is set to phase out its one and only Airbus A380-800. The carrier has been using the super jumbo, 9H-MIP (c/n 006), since 2018, but only two-and-a-half years later has decided to remove the type from its fleet at the end of its lease term. The jet is due to leave the airline's service by the end of this year.

Configured with 471 seats, it was built in 2008 and was originally used by Singapore Airlines (SIA) bearing the registration 9V-SKC. When SIA began to phase out its older A380s in 2018, Hi Fly opted to take on the aircraft to offer a high-capacity option for the wet-lease market. Subsequently

re-registered with Hi Fly's Maltese division, the jet was repainted in a distinctive 'Never Too Late For Coral Reefs' colour scheme.

A Hi Fly statement said the decision not to extend 9H-MIP's lease followed "drastically reduced" demand for large passenger aircraft due to COVID-19's impact on air travel. The airframe's cabin was temporarily converted to transport freight and medical supplies earlier this year.

Hi Fly continued: "The A380 will be replaced by additional Airbus A330s, a smaller and more adequate aircraft for current market conditions." The firm already operates eight A330s (two -200s, four -300s and a pair of -900s).

Last year, Airbus announced A380 production would end, having received 251 orders for the type since its launch two decades ago. The company's latest orders and deliveries data up to the end of September showed 242 deliveries had been completed. Most of the remaining handovers will be to Emirates, although All Nippon Airways (ANA) will receive its third example.

Fifteen airlines have used A380s. Hi Fly was the sole secondhand operator, with 9H-MIP leased from Doric Aviation. Air France withdrew the A380s from its fleet in July and several other operators, including Lufthansa, Qatar Airways and Qantas, have grounded their examples.

Delta cuts 'sign of the times'



The Boeing 777 has been a casualty of cost-cutting at the Atlanta-based Airline Delta Air Lines

DELTA AIR Lines phased out its last Boeing 777 on October 31, ending the Triple Seven's two decades of service with the carrier. The final commercial flight – flown by 777-200LR, N701DN (c/n 29740) – routed from New York/JFK to Los Angeles, after which the aircraft flew to Victorville, California for storage.

Two different 777 variants have served Delta: the -200ER (ten examples) and the -200LR (eight), delivered to the carrier between 1998 and 2010. The -200LR's range enabled Delta to operate the 7,333nm Atlanta-Johannesburg service, one of the world's longest non-stop air routes.

Delta's Triple Seven move is yet another sign of the widespread cost-cutting across the industry as carriers battle the effects of the COVID-19 pandemic.

The International Air Transport Association (IATA) recently delivered a bleak outlook for the industry, warning that airlines "cannot slash costs sufficiently to neutralise severe cash burn to avoid bankruptcies and preserve jobs in 2021." Total industry revenues next year are expected to be down 46% from the 2019

figure of US\$838bn, IATA predicts, worse than an earlier analysis for 2021 that predicted revenues would fall by about 29%.

The association said: "Recovery has been delayed owing to new COVID-19 outbreaks and government-mandated travel restrictions including border closings and quarantine measures. IATA expects full year 2020 traffic to be down 66% compared to 2019, with December [2020] demand down 68%."

It expects the first half of 2021 to be little better as lockdowns continue (or are reimposed) and travel restrictions and quarantines reaffirmed. IATA stated: "To achieve a break-even operating result and neutralise cash burn, unit costs will need to fall by 30% compared to average cost per available seat kilometre for 2020. Such a decline is without precedent."

BOEING 747-436, G-CIVB (c/n 25811), one of the last two British Airways jumbos to leave Heathrow, is now at Cotswold Airport (Kemble) in Gloucestershire. The Negus-liveried jet, one of three 747-400s painted in a retro livery in 2019, is to become a conference venue, cinema and school visit venue from next spring.

SWISS AEROSPACE group RUAG intends to sell its Dornier 228NG turboprop programme to General Atomics Europe. Final regulatory approval is required, but General Atomics Europe MD Harald Robl said the acquisition will enable the Dresden-based company to expand its portfolio. The purchase would also cover RUAG's business aviation and helicopter MRO operations.

Performance boost for A330neo

AIRBUS CAN now offer increased payload and range on its A330neo after receiving European Union Aviation Safety Agency (EASA) certification for its latest performance improvement for the type.

Customers can currently opt for a 251,000kg maximum take-off weight (MTOW) option on the A330-900, which provides a 650nm range increase to 7,200nm. French leisure operator Corsair will be the first airline to receive the 251-tonne weight variant.

To achieve the higher performance, the company undertook "weight-neutral structural reinforcements" and modified the nose and main landing gears to extend undercarriage time-before-overhaul to 12 years.

An Airbus statement said the new offering means that operators "will have the necessary

range and capacity to capitalise on longer routes," claiming it is "the perfect fit for longer trans-Pacific or Asia-Europe routes." It adds to the various certified MTOW options available on the jet, from the standard 242,000kg version down to 238,000kg.

The -900 is the longer-fuselage A330neo version, seating 260-300 passengers in

a typical three-class cabin configuration. Certification of the 251-tonne weight option for the shorter-fuselage, longer-range A330-800 (which carries 220-260 passengers in three-classes and has an 8,150nm range), is due next year "to enable airlines to open up even longer-range trans-Pacific routes," Airbus stated.

Airlines can now choose a higher-weight option on the A330-900 Airbus



BER opens at last



THE LONG-DELAYED Berlin Brandenburg Airport Willy Brandt (BER) finally opened on October 31 with the arrival of easyJet and Lufthansa Airbus A320neos.

Even at the very end, nature added complications to nine years of changed plans, when a parallel inaugural landing was scuppered by bad weather on Halloween afternoon. As a result, special flight EJU 3110 landed first, on time at 2pm. The initial departure, by the same jet, flew to London/Gatwick the next morning.

Authorities will hope the opening will bring to a close years of negative headlines regarding the German capital's new hub. State-owned broadcaster Deutsche Welle (German Wave) reported last November

that BER's development had become regarded as "something between a running joke and a national embarrassment."

Airport operator Flughafen Berlin Brandenburg's CEO, Engelbert Lütke Daldrup, remarked: "The people here in the German capital region had to wait a long time for this day."

Dr Dietmar Woidke, Minister-President of the State of Brandenburg, where the airport is located, said: "With the opening of the airport, the time has come to regain lost confidence. Now it is time to look ahead."

Construction work began in 2006, with October 2011 the original opening date. Numerous issues ranging from incorrectly fitted fire safety systems to the wrong

light bulbs repeatedly delayed completion. Martin Delius, who chaired a Bundestag (German Parliament) investigation into BER's development, told the BBC in 2019 that there were more than half-a-million problems with the project.

Covering a total area of 1,470 hectares, equivalent to around 2,000 football pitches, BER concentrates all Berlin air traffic in one place, with capacity for more than 40 million passengers per year. BER's Terminals 1 and 2 are located between two parallel runways, while the former Schönefeld Airport has been repurposed as Terminal 5. Both runways can be operated independently. BER's opening meant Tegel closed on November 8.

Lufthansa and easyJet A320neos, D-AINZ (c/n 9442) and G-UZHF (c/n 8193), inaugurated the new hub Flughafen Berlin Brandenburg

RYANAIR ANTICIPATES Boeing 737 MAX recertification either side of Christmas with US Federal Aviation Administration and the European Union Aviation Safety Agency approval to follow for the MAX 200 variant it has on order. The Irish budget airline is hoping for its first delivery in the first quarter of next year.

LOW-COST carrier Wizz Air's UK footprint is expanding. It has based an Airbus A320 at Doncaster Sheffield Airport, with a second due this December. Routes include Alicante, Lisbon and Malaga. Wizz is also flying to Tenerife and Fuerteventura from London Gatwick. The carrier now operates 132 routes to 73 destinations from 11 UK airports.



Rolls-Royce motors are set to power Tecnam's all-electric P-Volt

ITALIAN AIRFRAMER Tecnam has officially begun developing what it calls the P-Volt, a new all-electric short-to-medium-range passenger aircraft.

The P-Volt, a collaboration with UK-based Rolls-Royce which is due to supply the all-electric engines, is another example of an aircraft manufacturer exploring alternative technologies to minimise the environmental impact of aviation.

Based on Tecnam's 11-seat P2012 Traveller airframe, the P-Volt will be a commuter aircraft seating up to nine passengers. It

will also have cargo, medical evacuation and special mission configurations. Tecnam said the P-Volt will be "specifically targeted at commercial operations" while being "designed for maximum versatility and safety, powered by renewable energy."

Tecnam and Rolls-Royce are already partners on the H3PS project to produce a hybrid-electric version of Tecnam's P2010 four-seater, pairing a Rolls-Royce electric motor with a conventional Rotax engine.

No details were provided about the P-Volt's physical characteristics and performance

Partners plug into P-Volt

specifications, but Tecnam said: "Dedicated battery technology will ensure full power availability for quick turnaround times between landing and take-off. The benefits of the propulsion system also extend to reducing the aircraft's operating costs and noise emissions for a more accessible and comfortable transportation system." Rob Watson, director of Rolls-Royce Electrical, added: "We are delighted to work with all the partners on a programme that has the potential to develop the technology to make a significant leap in the commuter market."

From Shetland to space



Lockheed Martin will be using the Shetland base in Scotland for its commercial space launches

Lockheed Martin

THE UK Space Agency (UKSA) is supporting a Lockheed Martin proposal to shift its planned UK satellite launch missions from Space Hub Sutherland in northern Scotland to the Shetland Space Centre on the island of Unst.

A UKSA statement in October said the move to the Shetland Islands would "help establish a sustainable, commercial launch market" as part of the UK's spaceflight programme,

LaunchUK. The space agency had announced in July 2018 that Lockheed Martin and Orbex, a small launch vehicle start-up, would be the first customers of the Sutherland spaceport, but the October announcement didn't detail why the corporation was moving sites.

Lockheed Martin's activities are part of continued evolution in the commercial space market. The UKSA feels the UK's "favourable

geographical position" can meet demand both for putting small satellites into orbit and other space services including telemetry, tracking and navigation, space situational awareness and data download and storage.

Shetland Space Centre anticipates that, by 2024, the spaceport could support 605 jobs in Scotland, including 140 locally and 210 across the other Shetland Islands.

BOEING IS optimistic about future air travel growth in its latest Commercial Market Outlook. The company acknowledged a slow return to long-term growth trends, but despite what it called "unparalleled near-term decline", it predicts a 3.2% growth in commercial aircraft fleet numbers and 43,110 deliveries over the next 20 years.

AIRBUS DELIVERED the initial US-built A220 from its Mobile, Alabama final assembly line to Delta Air Lines as N302DU (c/n 55070). All A220s delivered previously were produced at the Mirabel, Canada, plant. The first Mobile-built jet entered production at the factory in August last year, with its initial test flight taking place last June. Delta has ordered 97 A220s.



Fire service's Avanti

ITALY'S MINISTRY of the Interior has purchased a Piaggio Aerospace P180 Avanti EVO, which is set to be delivered by next summer to serve with the Italian National Fire Brigade.

Replacing an older P180, the Avanti will be "customised to the needs of the brigade", Piaggio Aerospace said.

Paolo Maurizi, head of the Aerial Service and Airport Rescue Coordination Office,

Emergency Central Directorate, National Fire Brigade, said: "One of the two aircraft in our fleet needed significant configuration updates. Replacement seemed to us to be the optimal solution."

The fire brigade's Avanti EVO will be able to carry up to eight passengers for personnel transport. It will also be used to support search and rescue missions using SAR mode in the aircraft's

flight management system. A larger-than-standard passenger door will permit stretcher loading/unloading, enabling the aircraft to be used for medical evacuation.

Piaggio Aerospace will be contracted to perform scheduled and non-scheduled maintenance on the new Avanti, as well as a second National Fire Brigade aircraft, for two years following the 2021 delivery.

The new P180 Avanti will support SAR missions for Italy's National Fire Brigade Piaggio Aerospace

Dash for Dutch coastguard

TWO DE Havilland Canada Dash 8-100s are to be converted into maritime surveillance aircraft for the Kustwacht Nederland (Netherlands Coastguard).

Canadian aerospace and defence company PAL Aerospace and Amsterdam Schiphol-based JetSupport, have been contracted to provide a pair of "fully missionised" Dash 8s for air reconnaissance in the North Sea. The contract also covers crew training on all systems and support for the operation of the aircraft for an initial ten-year period, with two additional one-year contract extensions included.

A statement issued by PAL explained that the Dash 8s will be equipped



to perform surveillance activities, search and rescue support, and law enforcement missions, as well as

additional deployments in support of FRONTEX, the European Union's border control and coastguard agency.

The Dash 8s will serve the Dutch Coastguard in a variety of capacities PAL Aerospace

TWO SIGNIFICANT delivery milestones were recently reached by Airbus. Firstly, it delivered an A321neo, T7-ME3, bearing the construction number 10,000 to Middle East Airlines (MEA), although due to Airbus' order process, it was actually the 9,543rd A320 Family jet to be built. Meanwhile, Atlanta-based Delta Air Lines received the 1,500th A330.

THE AIRBUS and ST Engineering joint venture, Elbe Flugzeugwerke (EFW), has delivered the first A321P2F (passenger-to-freighter) conversion to Vallair. The jet, VH-ULD (c/n 835), is operated by Qantas for Australia Post (see page 43). With capacity for 14 main and ten lower-deck containers, the A321P2F is designed for express work.



Third and Fourth RAF Poseidons arrive in UK

The third RAF Poseidon MRA1 to arrive in the UK, ZP803, kicks up spray from the wet runway as it lands at RAF Lossiemouth, Moray, to complete its delivery flight from the USA on the evening of October 14 UK MOD Crown Copyright/RAF Lossiemouth

TWO MORE Royal Air Force Poseidon MRA1s have been delivered to the UK. The third to arrive, ZP803 (c/n 65752/8065, ex N481DS) 'Terence Bulloch DSO DFC,' was delivered to RAF Lossiemouth, Moray, to join CXX Squadron on October 14, landing at 1738hrs local time. The aircraft had left Boeing Field, Seattle, Washington, the previous day using callsign 'Poseidon 1' and flew initially to Naval Air Station Patuxent River, Maryland. After a night stop there, it continued to its new Scottish home the next day.

It was followed by the fourth aircraft, ZP804 (c/n 65753/8103, ex N482DS) 'Spirit of Reykjavik', which followed the same routing, making a night stop at Patuxent River before arriving at Lossiemouth on

November 3. The aircraft's name honours CXX Squadron's association with the Icelandic city during World War Two.

Of note is that ZP803 was the first to be delivered direct to Lossiemouth, the previous two having been flown initially to nearby Kinloss Barracks while runway work was completed at Lossiemouth. This work had only just been finished when ZP803 arrived. It had been preceded by the first two, the first of which, ZP802, made the short hop from Kinloss to Lossiemouth on the previous day, October 13. Following it on October 14 was ZP801, which came in earlier in the day, prior to ZP803's evening delivery to the base.

A further Poseidon for the RAF has been

flown by Boeing and is being outfitted prior to delivery. The aircraft, ZP805 'Fulmar', made its maiden flight on September 19.

The name 'Fulmar' was chosen as RAF Lossiemouth was previously known as HMS Fulmar when it was a Fleet Air Arm base.

Re-opening of the runway has also allowed the dispersed RAF Typhoons to return home. The first to arrive back was ZK362, in 2 Squadron markings, flown by Lossiemouth Station Commander Group Captain Chris Layden. For routine training during the runway work, most of the Typhoons had been operating from Kinloss Barracks, although others were deployed to Leuchars Station, Fife, to provide a quick reaction alert (QRA) detachment.

Tutor paint trials continue



RAF Tutor T1 G-BYXH, painted in the first of three new trial colour schemes for the type, at RAF Wittering on October 26 MOD Crown Copyright/RAF Wittering

FOLLOWING REPAINTING earlier this year of an RAF Grob Tutor T1 in a new trial colour scheme, a further two aircraft are to be tested in alternative colours.

The first Tutor involved in the trial is registration number G-BYXH – see 'New colour scheme tested on RAF Tutor', August issue, page 8. Following an A/I request, RAF Wittering press officer Ed Palmer confirmed on October 26 that this aircraft had returned to Wittering in September as a full-time addition to the local fleet.

Wg Cdr Gordon Pell, the station's senior pilot, said: "An RAF Wittering Grob Tutor T1

is one of three aeroplanes taking part in a new trial assessing methods of improving the conspicuity of the training aircraft. The first aircraft has been painted yellow and black; a combination of colours believed to be particularly conspicuous to the human eye. A second Tutor T1 will receive an all-over blue 'wrap' and the final aircraft will receive a blue topside and a black underside.

"For safety reasons, the RAF's training aircraft have, in recent years, been painted all over black to make them more visible. The aircraft schemes will be assessed by MOD Boscombe Down and I am looking forward to seeing the results."

SIKORSKY AIRCRAFT was awarded a \$13.74m Foreign Military Sales (FMS) contract on October 21 by US Army Contracting Command for a single UH-60M Black Hawk. The helicopter has been ordered for Jordan using Fiscal Year 2010 FMS funding. Estimated completion date for the contract was November 30, 2020.

A **SUNDOWN** ceremony was held at Marine Corps Air Station (MCAS) Yuma, Arizona, on October 15 to mark the end of Marine Attack Squadron 311 (VMA-311) AV-8B Harrier operations. In spring 2022, VMA-311 will be reactivating as Marine Fighter Attack Squadron 311 (VMFA-311) with the F-35C Lightning II at MCAS Miramar, California.



First mile for F-35

The first F-35A Lightning II for the Royal Danish Air Force (RDAF), L-001 (c/n AP-01), is pictured above being lifted out of the Electronic Mate and Alignment Station (EMAS) on Lockheed Martin's one mile-long production line at Fort Worth, Texas, on September 15. The Danish MoD released the image on October 19, by which time the aircraft was stood on its undercarriage, with its twin tail fins, radar, engine and other systems all installed. The first of the 27 RDAF aircraft on order will be delivered in early 2021 but will initially remain in the USA for training – it will not be until 2023 that the first Danish F-35 aircraft will land at Skrydstrup Air Base Forsvaret



Japanese Sea Dragons enter retirement in Arizona

A PAIR of ex-Japan Maritime Self-Defense Force (JMSDF) MH-53E Sea Dragons have arrived for storage with the 309th Aerospace Maintenance and Regeneration Group (AMARG) at Davis-Monthan Air Force Base, Arizona. Both had been acquired by the US Navy for spares use following retirement of the type by the JMSDF.

The first, JMSDF serial 8630, arrived on September 17 and, despite there being no plans to fly the aircraft, it is now allocated US Navy serial BuNo 169604. A second example, previously JMSDF 8629, but now allocated BuNo 169603, arrived on September 30.

At least six former JMSDF MH-53Es were shipped to the US during 2017-2018

for spares use by the US Navy. Three had appeared at Marine Corps Air Station Cherry Point, North Carolina, by May 2018 to be stripped of useful parts. The two that have appeared at AMARG came from Erickson's facility in Portland, Oregon, where the company had stripped them for spares on behalf of the US Navy.

ABOVE LEFT: JMSDF MH-53E Sea Dragon 8630 in storage with the 309th Aerospace Maintenance and Regeneration Group (AMARG) at Davis-Monthan Air Force Base, Arizona, on October 2. The helicopter had arrived on September 17 USAF

COLONEL DAVID Shevchik Jr, commander of the 158th Fighter Wing of the Vermont Air National Guard (ANG), delivered the wing's 20th and final F-35A Lightning II, 18-5361 'VT,' to the 134th Fighter Squadron 'Green Mountain Boys' at South Burlington ANG Base in Vermont on October 14, 2020. The unit took delivery of its first two F-35As in 2019.

FRANCE'S PROCUREMENT agency, the DGA, announced on October 9 that it had signed a contract with NHIndustries and equipment suppliers Safran and Thales to convert ten NH90s into NH90FS variants for French Special Forces. Under the 2019-2025 Military Programming Law, five of these helicopters will be delivered in 2025 and the remaining five in 2026.

RIGHT: US Marine Corps AH-1W Super Cobra 165051 'MM-20' operated by Marine Light Attack Helicopter Squadron 773 (HMLA-773) Detachment A 'Nomads' makes its final flight over 'Big Easy' – New Orleans, Louisiana – on October 14 during the Whiskey Sundown Ceremony at Naval Air Station Joint Reserve Base New Orleans. After 933,614 flight hours over a 34-year career, this marked the retirement of the AH-1W from USMC service. The type has been replaced by the AH-1Z Viper USMC/Lance
Cpl Christopher England

Cobra bids farewell to 'Big Easy'



Philippines to buy South Korean helicopters

THE PHILIPPINES' Department of National Defense (DND) announced on October 2 that it intends to acquire surplus Bell UH-1H Iroquois and MD Helicopters (MDHI) MD500s from South Korea.

The nation's Secretary of National Defense, Delfin N Lorenzana, confirmed the proposal in a congratulatory letter to the newly appointed South Korean Defence Minister, Suh Wook.

Lorenzana stated that the DND plans to conduct a joint

visual inspection (JVI) of the aircraft in the fourth quarter of 2020. The JVI will be conducted by a team comprising representatives from the DND and the Armed Forces of the Philippines.

The acquisition project is still in the exploratory stage, with the details yet to be finalised, including the timeline and quantity of the assets to be acquired.

South Korea operated more than 200 UH-1Hs over a 53-year career with the Republic of Korea Army (ROKA)

but retired the type in July 2020. The ROKA is currently employing two variants of the MD500 – the MD500E and MD500MD Scout.

Both variants are slated to be retired in the next few years and replaced by the AH-64E Apache.

The Philippine Air Force (PAF) has both the UH-1H and MDHI's MD-520G Defender in its inventory. The PAF also operates four UH-1H-II Huey IIs, upgraded from existing UH-1H airframes.

RIGHT: Newly outfitted VVIP Boeing 777-337ER VT-ALV (c/n 36320) arriving on delivery at Delhi-Indira Gandhi Airport on October 1. The aircraft is allocated military serial K7066 and is the first of two that will be operated by the Indian Air Force on behalf of the government. This former Air India aircraft had been in the US at Fort Worth Alliance Airport, Texas, since June 1, 2018, for installation of its VVIP interior. The second aircraft, VT-ALW (c/n 36321), was delivered from Fort Worth to Delhi on October 24 and will become K7067 v1images.com/Sandeep Suresh

India's 'Air Force One' lands



Colombian Air Force chooses T-6 Texan as new pilot training aircraft

BEECHCRAFT'S T-6C Texan II has been selected by the Colombian Air Force (FAC) as its new basic and advanced training aircraft. The FAC announced the decision on October 19.

The new aircraft will enter service with the 'Marco Fidel Suárez' Military Aviation School (EMAVI) at Cali. They will progressively

replace the current Cessna T-37B Tweets used by EMAVI for the last 51 years, following acquisition in 1969.

The new T-6s are expected to begin operations with EMAVI in March 2021 as part of the training process to qualify new military pilots. The FAC gave no indication of how many T-6s are being acquired to fulfil the role.

Earlier, as another element of its plans to upgrade its pilot training system, the FAC had announced on August 29 that it was ordering the Cessna 172S Skyhawk SP to replace its ageing Cessna T-41D Mescalero fleet – see Military News, October, page 11. Similarly, the number involved has not yet been announced.

THE DUTCH Ministry of Defence announced on October 13 that it will be replacing the Royal Netherlands Air Force's four current C-130H Hercules ahead of schedule. State secretary Barbara Visser had informed the government the previous day. The project will now be implemented between 2021 and 2028, with the first replacement aircraft due to start arriving from 2026.

FRANCE'S Air and Space Force began the first international deployment of its new A330 Phénix on October 5 as part of Operation Chammal. Although the type had previously flown missions in support of Operations Barkhane and Chammal, they had been operating only from and to France. The new deployment sees the aircraft based at Al Udeid Air Base, Qatar, for several weeks as part of France's support for Operation Inherent Resolve.

Slow route to Cameroon



LEFT: New production Leonardo AW109E Power CSX81393 (c/n 11840) test flying at Venegono, Italy, on October 13. The helicopter is the first of four destined for the Cameroon Air Force. The other three are CSX81934 (c/n 11841), CSX81935 (c/n 11842) and CSX81936 (c/n 11843). All four have been test flying in Italy for around two years, but none have yet been delivered, for reasons unknown.

Oscar Bernardi

First SAR NH90 arrives in Spain

AIRBUS HELICOPTERS announced on October 14 that the first of 12 NHIndustries NH90 Tactical Transport Helicopters (TTHs) ordered by the Spanish Air Force has been delivered. Spain ordered the type to boost the air force's search and rescue (SAR) and combat search and rescue (CSAR) capabilities and replace its ageing fleet of Aérospatiale AS332 Super Pumas. In Spanish service, the 12 SAR-configured NH90 TTHs will be operated

by Ala 48/803 Escuadrón, based at Cuatro Vientos Air Base, near Madrid.

Spain's General of the Air Force, Javier Salto, said: "The NH90 provides an essential asset capable of performing a wide range of missions. The platform's core role will be to support SAR operations in hostile environments, which is one of the most demanding and complex missions for helicopter units."

In total, Spain has ordered 45 NH90s for use across all three of its military air arms. The Spanish Air Force will receive 12 and the Spanish Army Airmobile Force (FAMET) has ordered 26 NH90 TTHs, 13 of which have already been delivered. The Spanish Naval Air Arm has seven examples of the NH90 NATO Frigate Helicopter (NFH) variant on order, but is yet to accept its first aircraft.

New imports for Bangladesh



LEFT: Seven new production Bangladesh Air Force (BAF) K-8W Karakorums on the ramp at BAF Base Zahurul Haque, Chittagong, on completion of their delivery flight from China on October 15. They are part of a contract for an undisclosed number (possibly 23) signed with CATIC – China's aviation technology import/export body – on June 20, 2018. Previously, the BAF has taken delivery of nine K-8Ws which are operated by 15 Squadron at BAF Base Birsresthore, Matlur Rahman, Jessore, although two have been lost in accidents Bangladesh Air Force

Falcon project: Eurofighter submits offer to replace Spanish Hornets

EUROFIGHTER HAS submitted a proposal to the Spanish government for the supply of 20 new-production EF-2000s for the Spanish Air Force. The offer, announced by the European consortium on October 19, is in response to a requirement to replace the fleet of 20 Spanish Air Force F/A-18A Hornets, which are all operated by 462 Escuadrón and based

at Gando in the Canary Islands. As part of the proposed deal, the new-build Tranche 3+4 aircraft would feature the E-Scan active electronically scanned array (AESA) radar.

The move is part of the nation's Project Halcon (Falcon) to modernise the Spanish Air Force. Eurofighter stated that it expects a contract for the aircraft to be signed in 2021

and will secure Eurofighter manufacturing and final assembly work at the Airbus facility in Getafe until at least 2030.

The new EF-2000s would be delivered between 2025 and 2030, enabling Spain to begin phasing out and replacing its ageing F/A-18A Hornet fleet. The final Spanish Eurofighter from the original order was delivered earlier this year.

THE US Defense Security Cooperation Agency (DSCA) made an official announcement on October 9 that it had approved the possible sale of 64 F-35A Lightning IIs to Finland. On the same day, the DSCA also passed an approval for Finland to purchase 50 F/A-18E and eight F/A-18F Super Hornets, along with 18 EA-18G Growlers. All three types are options for Finland's future fighter purchase.

THE PHILIPPINE Navy revealed on October 16 that it may acquire at least eight Beechcraft TC-12B Hurons through the US Excess Defense Articles (EDA) programme to boost its naval air wing. They could be used for intelligence, surveillance and reconnaissance, search and rescue, and limited cargo transport for humanitarian assistance during disaster relief missions. The US has offered the Philippines up to 13 TC-12Bs.



After the Reaper?

An MQ-9 at Creech AFB.
The US Air Force wants to start replacing this type from 2030 US Air Force/Airman 1st Class William Rio Rosado

THE MAJOR unmanned systems manufacturers have recently revealed their responses to MQ Next, the US Air Force's plan to find a successor to the General Atomics-Aeronautical Systems, Inc (GA-ASI) MQ-9 Reaper.

Northrop Grumman, GA-ASI and Lockheed Martin unveiled flying wing concepts at the Air Force Association's Air, Space and Cyber conference in September. Boeing and Kratos have also reportedly submitted concept designs.

A USAF request for information (RFI) to manufacturers issued earlier this year called for potential solutions for a next-generation unmanned platform that was capable of strike and intelligence, surveillance and reconnaissance (ISR) missions, to replace the MQ-9.

The RFI noted: "The Air Force is also interested in researching alternative ways to support future lower-end, lower-cost ISR missions which may include initiatives to modernise, augment and/or replace existing systems. This RFI enquires about unique and innovative practices that can deliver relevant capability efficiently, timely and at a reduced life-cycle cost."

Autonomy, artificial intelligence, machine learning, digital engineering, open mission systems and attributable technology are key aspects sought in the MQ Next responses. The RFI stated: "Interested parties are encouraged to consider/assume the Air Force Research Laboratory Skyborg programme as the primary unmanned air systems autonomous baseline solution"

for their response. The document added: "Solutions from the commercial marketplace that are scalable to a military platform are highly encouraged."

Respondents' proposals must encompass the air vehicle and supporting equipment and infrastructure such as the data link, ground control station, ground data/satcom terminals, and communications and data networks, the RFI said.

Unit and per-hour operating costs must also be provided, and the document added that interested parties are encouraged to "propose solutions of reduced lifecycle cost" due to fiscal constraints.

Initial deliveries of the chosen MQ Next platform are targeted for the fourth quarter of 2030, with initial operational capability following in the third quarter of 2031.

BELOW: UMS Skeldar's V-150 platform
UMS Skeldar



V-150 goes global by remote control

AUTOMATIC FLIGHTS have been undertaken on UMS Skeldar's V-150 platform in its Switzerland home, controlled from locations on different continents.

A company statement said: "Remote product demonstrations to prospective customers across the globe give attendees the opportunity to fully test the system without leaving their base. In the current climate of continued travel restrictions, this is of maximum value."

UMS Skeldar VP Business Development and Strategy, David Willems, commented: "Unlike other demonstration capabilities, we

are not just presenting the customer with the chance to take off and go in circles. Instead, the V-150 will perform a simulated mission with various events taking place. We are advancing traditional flight demonstrations and incorporating many new elements that will maximise the customer experience, even from thousands of kilometres away."

The scenarios simulated by the remote demonstrations include operations for intelligence, surveillance and reconnaissance, search and rescue, border patrol and infrastructure monitoring.

FRONTEX, THE European border and coast guard agency, has awarded Airbus and Israel Aerospace Industries a contract to operate a Heron UAV for maritime aerial surveillance. No service entry date was provided and there were no specifics about which base will be used, although the service will be delivered from either Greece, Italy or Malta.

NORTHROP GRUMMAN has started production work on the first MQ-4C Triton, a co-operative development programme between the Royal Australian Air Force (RAAF) and the US Navy. Australia will receive six Tritons, with the first due for delivery in 2023. They will provide a round-the-clock maritime wide-area intelligence, surveillance and reconnaissance capability.

Drones for medical runs

SEVERAL PROJECTS are under way to discover how unmanned systems could benefit the UK's National Health Service.

An initiative called Dreadnought, led by a start-up company, Apian, which was founded by clinical entrepreneurs and doctors Hammad Jeilani and Christopher Law, aims to establish a network of secure air corridors for drones to enable them to transport COVID-19 samples, test kits and personal protective equipment.

Based at Broomfield Hospital in Chelmsford, Essex, this project's partners include York-based UAV training company Flyby Technology; SYNLAB; Pathology First; Skylift UAV; and Electric Aviation.

Separately, Cranfield University in Bedford is participating in two new UK Research and Innovation-backed projects that intend to facilitate the movement of medical items by

unmanned systems to speed up deliveries, help alleviate road congestion and reduce emissions.

One of these projects, led by freight and cargo company Skyfarer, will look to create a flight testing corridor in Warwickshire. If approved by the Civil Aviation Authority (CAA), this would become the UK's first drone service to undertake medical deliveries in a populated suburban environment within unsegregated airspace.

The initiative will focus on validating the reliability and redundancy of unmanned technology and creating a concept of operations. The aim is to work towards an application to the CAA for the creation of a drone flight corridor.

A further scheme involving Cranfield and Skyfarer will create the first UK set of standard operational procedures for routine drone delivery operations to hospitals.



Skyfarer founder and CEO Elliot Parnham said the work will provide "a sustainable blueprint for gaining CAA approval and [will pave] the way for commercial deliveries by drones to begin in the UK".

Efforts are under way to introduce UAVs for medical deliveries in the UK
Annalisa Russell-Smith

Wildcat teaming

ARMY AIR Corps AW159 Wildcat AH1 ZZ395 (c/n 493) and a semi-autonomous UAV recently conducted the UK's first manned-unmanned teaming (MUMT) technology demonstration involving a military aircraft.

The trial took place during the British Army's latest Army Warfighting Experiment on Salisbury Plain, Wiltshire. Led by the UK government's Defence Science and Technology Laboratory (Dstl), it involved the Wildcat's manufacturer Leonardo and Callen-Lenz Associates, who are based in Salisbury and who supplied a UAV and a 'Gateway Processor' to interface between the drone and the Wildcat.

Manned-unmanned teaming involves a helicopter's crew controlling a UAV as if it were a sensor aboard the aircraft. Leonardo's solution enabled the Wildcat's crew to control the UAV's flight path and payload in a capability known as Level of Interoperability 4.

Bryan Finlay, the Dstl's Technical Partner, commented: "The clever design



of the human-machine interface means cockpit workload is well managed and the demonstration has successfully de-risked that technology." He added: "This is a key step towards realising an effective operational MUMT capability."

Major Benjamin Thomas, Military

Adviser Platform Systems Division at Dstl, highlighted its possibilities: "MUMT has undoubtedly the potential to be a game-changing capability for aviation operating in the land environment, increasing both situational awareness and survivability."

Wildcat AH1 ZZ395 with the Callen-Lenz Associates UAV Leonardo

THE ARMY Warfighting Experiment on Salisbury Plain involved the Tekever AR4 using an Enhanced Mission Autonomy Pack to demonstrate automated mission and sensor planning, and target identification. The demo "showed how increased automation reduces the operational burden of using UAVs, particularly when monitoring large open areas for targets," said Tekever.

BAE SYSTEMS' PHASA-35 high-altitude long-endurance system spent 72 hours in a simulated environment modelling the harsh stratospheric conditions in which it is designed to operate as a communications platform. The 'soak' test at a facility near Farnborough was operated by Prismatic, its original developer, preceding further flight trials.



ABOVE: Multicopters could be a speedy method of flying doctors to medical emergencies Volocopter

MULTICOPTERS COULD offer a swifter emergency medical services (EMS) response, according to a feasibility study by the German air rescue organisation, ADAC Luftrettung. Until now, these new vertical take-off and landing (VTOL) aircraft with electrically powered rotors have been conceived for air taxi and cargo

Rotary route to emergencies?

transport applications, but the ADAC report says they "make sense" for EMS missions.

According to the organisation, multicopters would transport doctors to an emergency faster than ground cars. In a statement it said: "Emergency physicians could often be at the scene of an emergency twice as fast in rural areas compared to a conventional emergency medical service vehicle and reach around two to three times as many patients in a larger health service area."

Multicopters could improve the efficiency of EMS services by releasing regular rescue helicopters for transporting patients to specialised hospitals and clinics, although ADAC stressed: "The multicopter is not intended to replace the rescue helicopter, but to complement the rapid assistance from

the air. Patient transport is not planned for initial implementation."

Using the Volocopter VoloCity, currently in development, as the basis for studies, researchers from the Institute for Emergency Medicine and Medical Management at the Ludwig-Maximilian University of Munich simulated more than 26,000 emergency responses with multicopters covering different ranges and speeds.

Building on the results, ADAC is now planning operational piloted multicopter trials for EMS work in 2023 in Bavaria and Rhineland-Palatinate. Before then, Volocopter will test the VoloCity's suitability for air rescue services in special conditions, such as taking off and landing on slopes, in poor visibility, at night and in winter.

King Stallion stable grows

BELOW: Initial CH-53K delivery is due in nine months Lockheed Martin

SIKORSKY WILL supply six additional production-standard CH-53K King Stallion helicopters for the US Marine Corps to

support expeditionary heavy-lift assault transport. Part of a 200 aircraft Program of Record for the marines, six examples

are due for delivery from January 2024.

Twenty-four CH-53K production aircraft are now under the Low Rate Initial Production (LRIP) Lot 4 contract, the first of which is scheduled for delivery from Sikorsky's Stratford, Connecticut factory next September.

Five CH-53Ks were on the line in this factory at various stages of production in October. A Sikorsky statement said the company and its suppliers, "have made significant investments in facilities, machinery, tooling, and workforce training to ramp up production required for the CH-53K".

The CH-53K is nearing the end of developmental flight testing ahead of its initial operational test and evaluation programme, with test pilots having flown more than 2,000 flight hours validating the type's performance.

This year, the helicopter has completed air-to-air refuelling with a 27,000lb external load, undertook initial sea and sling load trials, and completed hot and dusty conditions testing at the US Army Yuma Proving Ground in Arizona.

Other recent testing achievements are reaching 150kts in forward flight, attaining 18,500ft altitude, conducting 60° angle of bank turns and 12° slope landings/take-offs, and external load auto-jettison and gunfire testing.



BELL HELICOPTER recently delivered three 407GX variants to the Polish National Police. It marks the fifth Bell sent to Poland this year and the first parapublic 407GX to be received by the country. The helicopters feature a Trakka Systems searchlight, downlink, camera and operator console. There have been 97 407s delivered across Europe and Russia.

RUSSIAN HELICOPTERS is assessing its Mi-8/-171 family in Indonesia. Two examples of the Mi-8AMT variant, launched earlier this year, are involved in forest firefighting operations on Kalimantan, the Indonesian part of the island of Borneo. They are being operated by Russian Helicopters' crews and support staff, who are working with Indonesian company National Utility Helicopters in the trial.

Upgraded NH90 TTH for special ops



FRENCH SPECIAL forces are due to receive an upgraded version of the NHIndustries (NHI) NH90 Tactical Troop Helicopter (TTH) by 2025. The final batch of ten NH90s already ordered by the French Ministry of Armed Forces will be delivered in a new configuration known as TFRA Standard 2.

NHI said the latest iteration will substantially increase the NH90's mission capability in the tactical troop transport role, "particularly in challenging conditions such as sand, snow or fog."

The TFRA Standard 2 configuration will incorporate a new-generation

Safran EuroFLIR electro-optical system, with displays and controls for pilots, commandos, gunners and loadmasters. The sensors will provide outputs so personnel can conduct updated mission planning on connected screens or tablets.

Removable leaf doors, a fast-roping beam from the side doors, a fast-roping system from the rear ramp, a digital 3D map, folding boarding steps and additional ceiling-mounted rope anchor points are other differences in the special forces standard.

A distributed aperture system, comprising fixed infrared cameras displaying 3D vision

in a new-generation helmet-mounted sight will also be incorporated into the flight deck, which the manufacturer said would give crews "an unprecedented level of pilot support in low visibility".

Separately, NHI recently delivered the first of 12 Ejército del Aire (Spanish Air Force) NH90s that will replace AS332 Super Pumas in the search and rescue (SAR) and combat SAR roles. These are part of the Spanish defence ministry's order for 45 NH90s for the country's three armed forces, 13 of which have already been delivered to the army.

ABOVE: A rendering of the NH90 TTH TFRA Standard 2 NHIndustries

BELOW: HeliOperations is training Royal Norwegian Air Force pilots HeliOperations

HeliOperations trains Norwegians

PERSONNEL FROM the Luftforsvaret (Royal Norwegian Air Force) are receiving anti-submarine warfare (ASW) training from British helicopter services specialist, HeliOperations.

The company provides aircrew, equipment and training to military, civilian and coastguard operators globally, including search and rescue pilot training for the Federal German Navy using two ex-Royal Navy Sea King HU5s operating from Portland, Dorset.

Norway awarded HeliOperations a contract in September to provide ASW training for a mix of aviation and mission support professionals.

The bespoke course aims to support the Luftforsvaret as it modernises ASW capability by replacing Westland Lynx with NHIndustries

NH90s and Lockheed P-3 Orions with Boeing P-8A Poseidons.

Business development director of HeliOperations, Dan Howard, said: "Through our extensive network of subject matter experts, we have assembled a team of highly experienced former Royal Navy ASW instructors to deliver this course."

The six-week course is designed to deliver the fundamentals of ASW missions and includes theoretical and practical instruction and assessment.

Operating from the HeliOperations' training facility at Cudrose, Cornwall, home to the UK's ASW helicopter squadrons, the first Norwegian students were due to graduate in November.



THE Fuerza Aérea Ecuatoriana (Ecuadorian Air Force) recently received a pair of Airbus Helicopters H145Ms, becoming the first operator of the military version of the H145 in South America. Four more are set to follow next year. Called the 'Cobra' in Ecuadorian service, the H145Ms are assigned to Ala de Combate 22 (22nd Combat Wing) in Guayaquil. The deal includes in-country training for 12 pilots and 15 technicians.

BRISTOW GROUP'S contract providing the UK's search and rescue helicopters for the Maritime and Coastguard Agency has been extended by two years until December 31, 2026. The procurement process for the second-generation service, known as UKSAR2G, will now begin in 2022. The MCA is also evaluating fixed-wing and remotely piloted aircraft use.

RIGHT:
The fourth test
Gulfstream G700 (T4,
N705GD) completing its
first flight on October 2

BELOW: The fifth
Gulfstream G700 during
its maiden flight on
October 23 Gulfstream



TWO NEW G700s have joined Gulfstream's G700 evaluation programme. The fourth test G700 (T4; N705GD c/n 87005) completed its first flight on October 2 at Hilton Head International Airport in Savannah, Georgia. It flew for 1hr 56mins, reaching 41,000ft and Mach 0.89. On October 23, (T5; N703GD c/n 87007) flew up to 48,000ft and at more than Mach

G700 test fleet grows

0.925 during its 3hrs 8min test flight. A sixth G700 is due to join the fleet and will serve as the production test aircraft for the certification programme.

T5's test criteria included gathering data to develop the level-D full-flight training simulator, while both it and T4 will test the G700's avionics, including the Gulfstream Symmetry flight deck. T4 will also evaluate the environmental control, mechanical, electrical power and hydraulic systems. T1 was assigned flight envelope expansion, flutter, stall, flying qualities and control, as well as ice shape trials; T2 cabin development and static tests; and T3 carried out

loads/parameter identification data, engine/thrust reverser operation, and field and climb performance testing. Since T1 first flew on February 14, the test fleet has accumulated more than 600 hours. It was joined by T2 in March and T3 in May.

The G700 is a stretched version of the G650ER, with a five-area cabin and 20 windows. It has a design range of 7,500nm and Mach 0.92 cruise speed at up to 51,000ft. The test fleet has already demonstrated a maximum speed of Mach 0.99 and flown at 54,000ft, well over the desired certification performance. The long-range business jet is planned to enter service in 2022.

Last chance for Eclipse?

AML GLOBAL Eclipse, a subsidiary of the international fuel provider AML Global, announced in October that it has reached agreement with ONE Aviation Corporation, the Albuquerque, New Mexico based aircraft manufacturer in Chapter 11 bankruptcy protection, to purchase the assets of Eclipse Aerospace and the Eclipse Aircraft project for US\$5.25m. Its plans for the light jet are unclear and it is not known if it is interested in ONE Aviation's other programme, the Kestrel K-350 turboprop.

The proposal has been put before the US Bankruptcy Court for the District of Delaware, which has overseen the ONE Aviation case since late 2018. A sale will prevent the

outright liquidation of Eclipse, which would have implications for owners and operators of the Eclipse 500/550.

On November 6, the court was due to hear objections to the sale from Citiking International US of Wilmington, Delaware. Citiking previously failed to fund ONE Aviation's emergence from Chapter 11 bankruptcy protection and was excluded from participating in the sale process by the court in late August. At the same time, SE Falcon (SEF OA LLC) made a US\$13m bid for Eclipse, but did not move forward with the purchase. If the latest sale does not take place the court has indicated it is willing to move towards liquidating the assets of ONE Aviation.

Year-to-date deliveries down

THREE MAJOR business jet manufacturers reported delivery figures for the third quarter of 2020 in October, with all three recording a decrease in the number of aircraft handed over so far this year.

Embraer delivered 21 business aircraft in the third quarter, comprising three Phenom 100s, 16 Phenom 300s and two Praetor 500s, raising its total for the year to date to 43. While this is four more for the quarter than the same period last year, the company had handed over 63 aircraft in the nine months to the end of September 2019.

Textron Aviation dispatched 25 Cessna Citations to customers in the third quarter,

20 fewer than the same period last year. For the second quarter in a row, the company posted a financial loss.

Gulfstream delivered 32 aircraft in the third quarter of this year, comprising seven midsize G280s and 25 large-cabin aircraft, down by two and four respectively over the same months in 2019. The company had delivered 87 (including 16 G280s) by the end of September 2020, compared with 103 (24 G280s) in the same period last year. A total of 130 Gulfstreams are expected to be handed over in 2020, according to Phebe Novakovic, chief executive officer of parent company General Dynamics.



Latest Learjet enters service

BRIDGEPORT, NEW York-based Heavy equipment and machinery auctioning company Alex Lyon & Son has become the first customer to put a Learjet 75 Liberty into service.

Bombardier announced the handover of the first Liberty variant of the business jet on October 6. Alex Lyon & Son has operated

Learjets for more than two decades to support its operations across the United States, Canada, Mexico and South America.

The Liberty was launched in July of last year to re-energise sales of the Learjet 75. Its sales were suffering as a result of competition from the Cessna CitationJet and

Embraer Phenom 300 light jets, which were available at lower list prices. The new variant features a revised cabin configuration with seating for six, two fewer than the baseline Learjet 75, giving passengers more space. The most significant change was a reduction in the list price from US\$13.8m to US\$9.9m.

The Learjet 75 Liberty has a revised cabin configuration and a significantly lower sticker price Bombardier

Airbus launches ACJ TwoTwenty

AIRBUS CORPORATE JETS has formally launched a large business/VIP variant of the A220-100 single-aisle regional airliner, known as the ACJ TwoTwenty.

The manufacturer described the aircraft as an 'extra large bizjet', an alternative to the purpose-designed large-cabin business jets on the market, and builds upon the company's strategy of offering corporate versions of its airliners.

Five additional fuel tanks, raising capacity by more than 25% over the standard airliner, will give the ACJ TwoTwenty a range of up to 5,650nm. The variant will also incorporate the increase in maximum take-off weight (to 63,000kg) due to be introduced to the A220-100 in the second half of 2021.

The TwoTwenty will be certified for 180-minute extended twin-engined operations. Airbus Corporate Jets partnered with Comlux Aviation on the project. In an exclusive deal with the manufacturer, Comlux will outfit the cabins of the first 15 aircraft. Work is to be performed at its completion centre in Indianapolis, Indiana.

Up to 18 passengers will be accommodated within a six-zone cabin, which will have a total floor space of 73m². It will feature



electronically dimmable windows, LED lighting and modern in-flight entertainment, Wi-Fi and environmental systems, controlled via personal electronic devices.

Comlux is also the launch customer for the ACJ TwoTwenty, with two on order. The first is due to be delivered for outfitting in December 2022 and will enter service the following year. According to Airbus, undisclosed customers have placed commitments for four further aircraft.

Given that Airbus offers VIP variants of its other commercial products, a corporate version of the A220 has been anticipated by the completion industry since the manufacturer acquired the then C Series programme from Bombardier in 2018. In May 2019, Lufthansa Technik announced its SkyRetreat cabin concept for the A220-100, while Camber Aviation Management and Kestrel Aviation Management have also proposed configurations for the larger A220-300.

An artist's impression of the ACJ TwoTwenty, the recently launched VIP version of the A220-100 Airbus Corporate Jets

Successful flight for hybrid-electric aircraft



The Cessna 337-based Cassio 1 testbed during its maiden flight on October 11 after installation of the new hybrid-electric powertrain designed for the ten-seat Cassio 600 VoltAero

FRENCH COMPANY VoltAero gave the first public presentation of its hybrid-electric Cassio 1 testbed aircraft during an event on October 21 at the firm's Aérodrôme de Royan-Médus headquarters in southwest France. The Cassio 1, test registration F-WOLT, is a modified Cessna 337 Super Skymaster that has been fitted with the most powerful hybrid-electric powertrain for VoltAero's family of Cassio production aircraft. It made its first flight in this configuration on October 11 from the airfield. Two further flight evaluations were completed over the following two days.



An impression of the production configuration for VoltAero's Cassio family aircraft, which was unveiled on May 6 this year
VoltAero

Installed in an aft-fuselage 'pusher' position with a five-blade propeller, this proprietary power module combines three 60kW high-performance electric motors with a 370hp internal combustion engine.

In addition to the pusher propeller, the Cassio 1 testbed also retains two wing-mounted ENGINEUS 45 electric motors from Safran Electrical & Power, with three-blade propellers, installed earlier in the forward-facing 'puller' position, in line with the twin booms. The original nose-mounted engine and propeller were also removed previously and the nose faired over.

The aircraft is testing the propulsion system to be used on VoltAero's largest production Cassio aircraft, the ten-seat Cassio 600 version, which is to deliver a total hybrid-electric power of 600 kW (800hp). The ongoing testing of these 'smart' electric motors, as well as the hybrid-electric power module, is providing unmatched in-flight experience for VoltAero with cutting-edge electrical propulsion.

In regular operation, the power module's electric motors will be used for low-noise take-offs and landings, with the internal combustion engine serving as a range extender and for recharging the Cassio's batteries while aloft. The power module can operate in modes from full electric to full hybrid, depending on the customer mission profile and range requirement.

The company hopes to have initial Cassio production aircraft entering service during late 2022 or early 2023. In addition to the ten-seat Cassio 600, the aircraft family will include the four-seat Cassio 330 and six-seat Cassio 480. Each version will share a high degree of modularity and commonality. The Cassio 330 will be the first production version.

RAAF KC-30A fleet gets systems upgrade

AIRBUS HAS been selected to develop a communications and mission system upgrade for the Royal Australian Air Force's (RAAF) KC-30A (A330) Multi-Role Tanker Transport (MRTT) fleet.

The upgrade incorporates a retrofit package, comprising new and additional communications capabilities and enhanced mission systems for the aircraft. The work intends to fulfil interoperability needs under the RAAF's new requirements and bring its

KC-30A fleet up to the same standard as the latest A330 MRTTs.

Additionally, Airbus will provide related data packs and support to ensure that the upgrade is integrated into the RAAF's existing A330 MRTT simulators and training systems.

At the time of the October 12 announcement, Airbus also said that the upgrade work will be split across two contracts. Phase One will see Airbus carry out the design and systems development and integration ahead of the

critical design review maturity gate. Phase Two will see Airbus install and deliver a prototype upgraded KC-30 for use in the certification and qualification process, ahead of finalising and supplying the modification kits for the entire fleet. Subsequent retrofit to the remainder of the fleet will be under customer responsibility.

The RAAF's KC-30A fleet comprises seven aircraft, all operated by 33 Squadron and based at RAAF Base Amberley, Queensland.

Glide bomb cleared for Strike Eagle

RAYTHEON MISSILES and Defense and the US Air Force (USAF) announced on October 13 that the company's GBU-53/B StormBreaker precision-guided glide bomb has been cleared for use on the USAF's F-15E Strike Eagle fleet. The weapon, formerly known as the Small Diameter Bomb II (SDB II), gained approval for operational use on the F-15E from Air Combat Command on September 23.

The milestone followed conclusion of a series of test and integration activities with StormBreaker on the Strike Eagle. A combination of 138 developmental

and operational test flights were flown from Eglin Air Force Base, Florida, to gain approval. The 96th Test Wing's 40th Flight Test Squadron and the 780th Test Squadron performed the developmental tests. The Air Force Operational Test and Evaluation Center, Det 2 and the 53rd Wing's 422nd Test and Evaluation Squadron completed the operational tests.

StormBreaker was designed to be small to allow fighter aircraft to carry more of them. For example, a single F-15E can be equipped with up to 28 individual munitions in seven groups of four weapons. The munition employs a unique

tri-mode seeker system, which uses imaging infrared or millimetre wave radar to detect and track targets, as well as a semi-active laser to hit designated targets.

The F-15E will become the first aircraft to operationally employ the munition, which is capable of striking stationary and moving targets from more than 40 miles away, day or night, and in adverse weather conditions. By the end of 2020, it is expected that the US Navy will approve use of StormBreaker on its F/A-18E/F Super Hornet fleet. StormBreaker will also be integrated onto all three variants of the F-35 Lightning II.

Boeing wins US Navy's SPEAR contract

BOEING AND the US Navy are to demonstrate advanced missile technologies that will make carrier air wing strike fighters more lethal against threats, into the next decade. The US manufacturer announced on October 20 that it has been awarded a \$30m contract from the navy to co-develop the Supersonic Propulsion Enabled Advanced Ramjet (SPEAR) flight demonstrator in association with the US Navy's

Air Warfare Center Weapons Division.

The contract followed a US Department of Defense request for information from the defence industry to help the navy determine technical requirements of future carrier-based land and sea strike weapons systems.

Steve Mercer, Boeing's SPEAR programme manager, said: "The SPEAR flight demonstrator will provide the F/A-18 Super

Hornet and carrier strike group with significant improvements in range and survivability against advanced threat defensive systems.

We have a talented team of engineers to meet the challenging technical demands and schedule timeline that the SPEAR programme requires." Boeing and the Navy Air Warfare Center Weapons Division plan to fly the SPEAR demonstrator in late 2022.



2Excel evaluates spray nozzles

LEFT: 2Excel Aviation/Oil Spill Response Boeing 727-2S2F(ER) G-OSRA makes a pass down the runway at RAF Valley, Anglesey, on October 11 spraying fresh water over data collection points on the ground as part of a trial. The aircraft made a series of 12 passes, carrying out spray runs at heights down to about 150ft to measure and optimise the performance of the recently installed TERSUS spray boom nozzles. MOD Crown Copyright/RAF Valley/Cpl Simon Armstrong

BOEING AUSTRALIA announced on October 22 that the Boeing Loyal Wingman aircraft being developed jointly with the Royal Australian Air Force (RAAF) had recently moved under its own power for the first time, a key milestone for the combat drone that is due to make its first flight this year.

Air Vice-Marshal Cath Roberts, RAAF Head of Air Force Capability, commented: "Boeing's Loyal Wingman project is a perfect example of what this collaborative approach can achieve."

"Seeing the prototype take to the runway for this low-speed taxi test is an exciting moment – another significant development

milestone ahead of its first flight."

Reaching a maximum speed of 14 knots (approximately 16mph or 26km/h on the ground) the aircraft demonstrated several activities while manoeuvring and stopping on command. Paul Ryder, Boeing Australia Flight Test manager, said: "The low-speed taxi enabled us to verify the function and integration of the aircraft systems, including steering, braking and engine controls, with the aircraft in motion."

Three Loyal Wingman prototypes will be the foundation for the Airpower Teaming System that Boeing will offer customers worldwide. The aircraft will fly alongside

other platforms, using artificial intelligence for such teaming missions. It has advanced design and flight characteristics, including a modular nose section that is customisable for specific needs and a conventional take-off and landing approach suitable for many missions and runway types. The prototype had been unveiled on May 5 and carried out its first engine run on September 3 – see 'Boeing fires up engine on Loyal Wingman', November issue, page 21. Testing is being carried out at an unspecified Australian airfield and production of the aircraft will be undertaken in Queensland.

The first prototype Loyal Wingman taxiing under its own power on October 18 during testing prior to its maiden flight Boeing Australia



Loyal Wingman makes milestone move

Paving way for deliveries



The 360 and 360ER variants are the latest addition to the Super King Air family Textron Aviation

TEXTRON AVIATION'S latest Beechcraft King Air variant – the 360/360ER – has been awarded type certification by the US Federal Aviation Administration (FAA), paving the way for customer deliveries to commence.

Announced in August, the Beechcraft King Air 360 provides an autothrottle, upgraded avionics and digital pressurisation.

The autothrottle supports pilots in their critical mission of delivering people or cargo safely by automatically managing engine power from the take-off roll through the climb, cruise, descent, and go-around phases of flight. Textron said this capability will reduce pilot workload and support them in their continuous vigilance to help prevent over-speed or under-speed, over-temp and over-torque conditions.

Another important update in the cockpit is the new digital pressurisation controller, which automatically schedules cabin pressurisation during both climb and descent, reducing pilot workload and increasing overall passenger comfort. The cabin altitude has also been

lowered by approximately 10% compared with the King Air 350i to 5,960ft at a typical cruising altitude of 27,000ft, providing greater comfort for passengers.

Chris Hearne, senior vice president, engineering and programmes at Textron Aviation, commented: "The new era of the industry-leading Beechcraft King Air begins today. The King Air 360 is a perfect combination of customer input, innovative technology and next-generation capabilities. By incorporating superior features and engineering advancements into an aircraft that is renowned for its versatility and reliability, we have elevated the King Air to the next level. With certification now in hand, we are thrilled to soon get these aircraft into the hands of our eager customers."

Almost 7,600 Beechcraft King Air turboprops have been delivered to customers globally since 1964, making it the best-selling business turboprop family in the world. See 'Long live the King', in November's *AIR International*, for more on the King Air 360.

Sub-600kg Tecnam P92 certificated

The Tecnam P92 Echo MkII's certification to LTF-UL2019 standards doubles the number of sub-600kg aircraft approved by the German Ultralight Flying Association Tecnam

Small Fly!

The US Federal Aviation Administration (FAA) has issued an airworthiness directive (AD) affecting more than 14,000 Cessna single-engine aircraft. The AD – number FAA-2018-0049 – relates to the lower area of the forward cabin door post bulkhead where cracking has been found on several aircraft.

The directive came into effect on November 14 and impacts most of the American manufacturer's product line with a wing strut including the Cessna 172, 182, 206, 207 and 210. It also affects several Reims Aviation-built aircraft including the Reims Rocket, F177 and F182.



THE GERMAN Ultralight Flying Association (Deutscher Ultraleichtflugverband) has certificated the Tecnam P92 Echo Mk II as an ultralight aircraft. It is only the second type to be approved under the new LTF-UL 2019 regulations.

Among improvements made to the Echo Mk II – which marries the P92's short field performance with a streamlined composite fuselage – are an increased cabin volume and wider seats with extra fore and aft adjustment.

Enhanced safety features, which include a ballistic parachute, has been made standard in the EU 600kg variant, and advanced Garmin G3X touchscreen avionics, equipped with synthetic view and ground proximity warning functions.

Germany was the first country to opt out of the European Union Aviation Safety Agency's (EASA) regulation of light aircraft with a maximum take-off mass (MTOM) of 450-600kg. It was also the first nation to develop and publish

the necessary technical requirements, doing so on January 15, 2019. The Czech Republic, and France were also quick to opt out and the UK's Civil Aviation Authority confirmed it would do the same in June of this year.

The Italian designed and built two-seater follows the Pipistrel Virus SW 600D, which was certificated on April 10, 2019. More than 1,000 examples of the P92 Echo have been delivered since the type's first flight in March 1993.

Bye Aerospace has secured more than 700 orders for its eFlyer 2 and 4 models
Bye Aerospace



South Korean bulk Bye

DENVER, COLORADO-BASED electric aircraft manufacturer, Bye Aerospace, has received purchase deposit agreements for 300 aircraft from Aerospace9. The South Korean company also agreed to invest in the US airframer.

Aerospace9's commitment includes 150 two-seat eFlyer 2s and 148 four-seat eFlyer 4s. Additionally, the firm has become the launch customer for soon-to-be-announced nine-seat, twin-motor Envoy, ordering two examples. It also holds options to acquire an extra 100 aircraft.

George E Bye, CEO of Bye Aerospace, said: "We are extremely honoured to share

with Aerospace9 in this extraordinary announcement. Bye Aerospace is on a rigorous path to achieve FAA certification on our eFlyer 2 airplane, and once that approval is obtained, to begin production on our expanding backlog of orders."

Seunghyuk Cha, Aerospace9 chairman, added: "This investment is not just a purchase contract, it is a very meaningful contract that creates an amazing opportunity for Asia.

"Our company has a very important responsibility in the aviation industry as a new strategic partner of Bye Aerospace."

Bye Aerospace is in the process of

attaining FAA certification for the eFlyer 2 for flight training missions and the eFlyer 4 for air-taxi and advanced training roles. The manufacturer claims that its aircraft offer "five-fold lower operating costs, no CO₂ emissions, and decreased noise" while the eFlyer family will "eliminate the release of millions of metric tons of CO₂ each year for flight training alone".

The deal takes Bye Aerospace's order book to 711 aircraft. The overwhelming majority of commitments are for the eFlyer 2 and 4. It is not presently known if the Aerospace9 investment in Bye Aerospace requires US government approval.

Border Force agreement needed for European flying

THE UK government has advised operators of small airfields that they require a certificate of agreement (CoA) from Border Force to permit flights to and from Europe after the UK's transition period with the European Union ends on December 31.

The CoA is an agreement between non-Customs and Excise designated aerodromes and the UK's customs authorities and will allow an airfield to handle a specific range of flights from overseas, including EU countries, from January 1, 2021. It is to be issued by Border Force's National Frontier Approvals Unit.

A letter sent to airfield operators stated: "From January 1, 2021 until June 30, 2022 your aerodrome will be covered by a 'blanket' interim CoA which will allow you to continue operating permitted flights to and from EU countries until you obtain an individual CoA.

"You do not need to take any action to receive this interim CoA as it will be done automatically."



Piper PA-30 Twin Comanche Martin Needham

HMRC legislation states an aircraft can only land at approved aerodromes and restrictions have been placed on non-Customs and Excise designated airfields. These include no

merchandise in baggage, no freight and limits on passenger numbers.

Responsibility is to be placed on airfield operators rather than pilots.

Small Fly!

Rolls-Royce has completed ground testing of the YASA-developed electric motor that will power its single-seater ACCEL aircraft – hopefully to more than 260kts, making it the fastest of its type in the world. The 500hp electric powertrain and battery, containing more than 6,000 cells, have been tested on a full-scale replica of the forward fuselage. Ground trials included running the propeller up to full speed, understood to be around 2,400rpm. The airframe – a highly modified Sharp Nemesis NXT with previous record-breaking form as Big Frog, the first diesel engine-powered aircraft to win a race at the National Championship Air Races in Reno, Nevada – is due to make its first flight in the near future.

The UK's Department for Transport (DfT) has made funding available to encourage the adoption of electronic conspicuity (EC) devices within the country's general aviation and unmanned aircraft systems communities. The Civil Aviation Authority (CAA) is running a rebate scheme to distribute the allocated funds. The project – which opened for applications on October 5 – will run until March 31, 2021. Those meeting the requirements can claim back 50% of the purchase cost of an EC device up to a maximum of £250. The CAA expects 10,000 rebates to be available.



Russian aviation expert
Piotr Butowski reports on
the latest aerospace and
technology news from
the Russian Federation

Il-112V '01' at the Voronezh
VASO plant's airfield on October
5, 2020, getting ready for its
second flight UAC



Lighter Il-112V ready

On October 5, Russia's minister of industry and trade, Denis Manturov, visited the Voronezh Aircraft Production Association (VASO) plant in Voronezh where he was updated about the Ilyushin Il-112V lightweight military transport aircraft.

The first Il-112V carried out its maiden flight on March 30, 2019. Further flights were suspended – officially due to the renovation of the runway in Voronezh and the need to lighten the weight of the aircraft. The second flight was then promised for autumn 2019, then for spring 2020.

However, it was not until September 2020 that the aircraft was painted in the colours of the Russian Aerospace Forces (VKS), with tactical number '01' and registration RF-41400, appearing to show the conversion phase had been completed. The aircraft was towed out of the production hall to the airfield, where final preparations are under way. As of late October, the Il-112V '01' had not yet flown.

According to an earlier statement from the United Aircraft Corporation (UAC), "the weight of the first aircraft will be reduced by up to one tonne" before it begins further trials. Manturov said the modifications have led to a reduction of "almost 800kg".

The weight of the next series aircraft, including 01-03 and 01-04, will be decreased by a further 2 tonnes (previously, UAC gave 2.5 tonnes), which is significant for an aircraft with a 21-tonne maximum take-off weight. According to UAC, lighter materials will be used in its construction and lighter equipment installed. However, it is

difficult to understand how some aluminium hatch covers and other secondary elements can be replaced by composites, or how replacing the wiring would achieve a significant weight reduction.

The Il-112V, '01', is the 01-01 aircraft, the first of the production series; immediately after it, the VASO plant produced the 01-02 airframe for ground strength and fatigue tests. On August 25, 2020, during the Army 2020 forum in Kubinka, the Russian defence ministry ordered two more aircraft, 01-03 and 01-04, for state qualification tests.

Manturov announced on October 5 that they would be completed by the end of 2021, with trials starting in 2022. From 2023, aircraft deliveries to the air force should start. "We saw today, the plant's ability to do the job – producing ten to 15 aircraft per year," said Manturov.

Su-35's longer reach revealed

The Russian MoD's 929th Flight Test Centre (929 GLITs) in Akhtubinsk conducts qualification tests of military aircraft and weapons. At the end of September 2020, the centre celebrated its 100th anniversary and for the occasion, published a video presenting some of the experiments conducted there.

A highlight is footage of a heavy air-to-air missile 'izdelye 620' launched by an Su-35S (NATO: Flanker-M) fighter. The history of this missile, created by the Toropov Vypel design bureau in Moscow, is very long. Trials of the original K-37 ('izdelye 610'; NATO: AA-X-13) version began in 1989. On August 18, 1993, a MiG-31M interceptor shot down an air target with a K-37 missile at a distance of 228km. However, the development of both K-37 and



This shot from the video shows the Su-57 '058' in a test flight with the cockpit's canopy removed Russian MoD



The Su-57's cockpit features two large MFI-50 displays, small MFPI-50 display and control panel, and a ShkAI-50 head-up display Russian MoD

MiG-31M was stopped shortly afterwards, due to lack of funding.

It restarted in the 2000s in an improved version K-37M ('izdeliye 610M'), especially for the modernised MiG-31BM interceptor. The new missile was fired for the first time from a MiG-31BM in 2011 and completed state trials in 2014. Since 2016, it has been mass produced as the R-37M (NATO: AA-13 Axehead) by the Tactical Missiles Corporation's plant in Korolev. Russian air-to-air missiles are marked with the letter K at test stage and the letter R when they enter service.

So far, the R-37M missile has only been used by the MiG-31BM heavy interceptors. The version intended for other carriers, 'izdeliye 620' (its K or R designation is yet unknown) is believed to have different seeker frequencies, software and interfaces from the '610M' of the MiG-31BM, but externally they are both the same.

Now the '620' missile has finished its tests, it will be integrated with the Su-30SM fighter, and there are plans to equip MiG-35 fighters too. At the Army 2020 exhibition in Kubinka in September, the '620' missile was displayed next to a MiG-35S.

The '620' missile is offered by Russia to foreign customers under

to fly again

the no-thrills name Air-to-Air Missile, Long Range (RVV-BD). China was the first country to receive these missiles, having previously acquired 24 Su-35 fighters in 2016-2018. The Chinese order has been indirectly confirmed by official Russian sources. Sukhoi is now executing another contract for 30 Su-35SE fighters to Egypt.

One more export contract is known for a similar number of Su-35 fighters, with delivery in 2022-2024. The customer remains unknown, but it is likely to be China again.

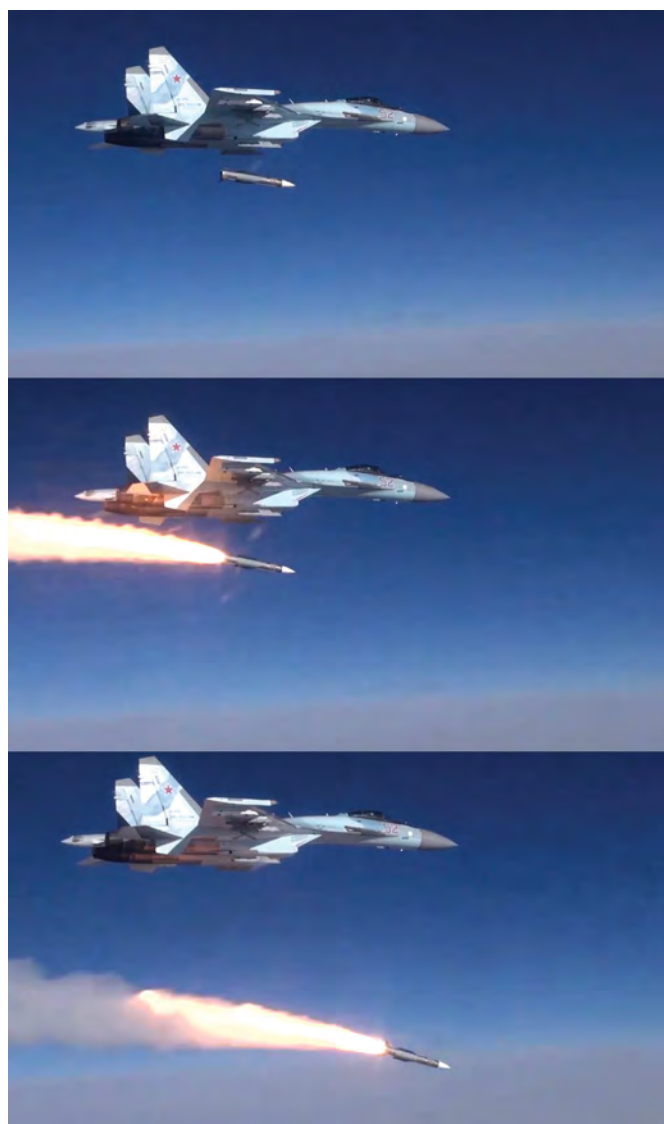
The characteristics of the export RVV-BD version are already known. A large missile, it weighs 510kg (including a 60kg warhead), is 4.06m long and has a body diameter of 380mm. The missile is initially jettisoned downwards by an AKU-620 catapult pylon, before the dual-mode, solid-propellant rocket motor ignites. It flies to the target at lofted trajectory profile.

The maximum launch range of the RVV-BD is up to 200km from the head-on position 'against some types of targets', as it was described in Vympel's release.

Rare glimpse of Su-57 cockpit

In the same video, we also saw a simulator for training pilots to fly the new-generation Su-57 fighter. We have never seen the actual Su-57 cockpit before; only images of a simulator located in the Sukhoi headquarters. However, while it was not certain the Sukhoi simulator corresponded to the real cockpit (it could have been one of several tested variants), the Akhtubinsk simulator is certainly real – otherwise it wouldn't make sense to see pilots training in it.

The Su-57's fully 'glass' cockpit has no analogue indicators.



A Su-35S fighter during trials carried out at the 929 GLITs in Akhtubinsk, fires a very-long range 'izdeliye 620' AAM Russian MoD

It has two large MFI-50 multifunction displays by RPKB of Ramenskoye, as well as a ShkAI-50 head-up display by Elektroavtomatika of St Petersburg. In the final version of the cockpit, two connected MFI-50 displays will be replaced by one widescreen display with folded sides. In the cockpit there is also a small multifunction MFPI-50 display and control panel made by RPKB.

In close-air combat, the target indication is provided using the NSTsl-50 helmet-mounted sight and display by Elektroavtomatika. There is also a voice warning system. **AI**



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Located in the southeast of Bangladesh, Cox's Bazar was until recently most famous for having the world's longest unbroken natural beach, which extends more than 155km from Sea Beach in the north to Kolatoli Beach in the south. Unfortunately, the area has become known for a less attractive record-breaking event in recent years.

Since 2017, hundreds of thousands of Rohingya refugees have settled here, making Kutupalong the world's largest refugee camp, spanning 13sq km and holding nearly 600,000 people (having decreased from 725,000 in 2018) who mostly fled persecution in Myanmar.

Refugees have played a big part in the town's history, as it was named after Captain Hiram Cox, who served with the British East India Company as a superintendent of Palongkee outpost. To commemorate his

role in refugee rehabilitation work, a market was established and named after him.

Today, Cox's is the hub of the fishing industry in Bangladesh and massive hauls are delivered around the country from its airport by five cargo airlines that have a diverse inventory, like the only Saab 340 and HS-748 in Bangladesh, as well as an Antonov An-26 and a couple of Fokker 50s.

Cox's airport has recently seen its runway extended to more than 10,000ft, as well as the addition of upgraded navigation aids and the building of a new passenger terminal in a bid to attract tourists to the beaches.

Cox's Bazar Airport also hosts the fifth Bangladesh Air Force (BAF) base, which has its own new ramp and facilities to house military aircraft, although it still has no permanent aircraft for regular deployments. The BAF regularly deploys fighters for up to two days to its southernmost base, instead of just making instrument practice flights.

Only a decade ago, Cox's Bazar was a small airport with a handful of movements a day and a minimal air force presence. Now the airport has been transformed into one of Bangladesh's major hubs, with airliners bringing in tourists, and freight aircraft ferrying out fish caught in huge numbers off the coast. And, of course, the BAF has a much larger presence here, now that the new ramp on the airport's base side has been completed.

Government officials and VIPs are regular visitors too, to observe the conditions within the refugee camp and to try to understand the plight of its Rohingya occupants.

Unfortunately, there is little they can offer other than symbolic gestures until Myanmar allows their return and assures their safety.

The following images provide a fascinating cross-section of the aircraft that have visited Cox's Bazar Airport. Some are regulars, like the airliners, while the military business jets are much rarer. ➔

On approach to Cox's Bazar Airport runway 17

All photos by the author

A decade ago, Cox's Bazar was a small airport with a handful of movements a day. Today, it has become one of Bangladesh's major hubs

Fishing, refugees, tourism and the military have all helped to increase activity at Cox's Bazar Airport on the southern tip of Bangladesh, as our Bangladeshi correspondent 'Hippo' discovers

Bazar

Flying into the



A relatively new Bangladesh Air Force Mi-171Sh operating with 31 Sqn touches down at Cox's Bazar Airport's air force facility. Note the external fuel tank attached to one of the helicopter's stores stations

Military sightings



A German Air Force Global 6000 14+05 visited during a hazy morning in February 2020, bringing diplomats from Germany and the EU to inspect the Rohingya refugee camp



A Bangladesh Air Force MiG-29 with its chute extended lands at Cox's Bazar Airport in June 2020, shortly after the new ramp was officially opened



A Turkish government Gulfstream G550 TC-CBK brought the first lady of Turkey, Emine Erdoğan, to visit the Rohingya refugee camp in February 2018



A United States Air Force SAF C-146A Wolfhound (Dornier 328), 16-3025, arrives in April 2018, carrying American diplomats to visit the refugee camps



A Bangladesh Air Force F-7BG of 5 Sqn 'Defenders' is among a number of military aircraft to recently visit Cox's Bazar, presumably to check out the new ramp

Civilian sightings



A US-Bangla Airlines Boeing 737-800, S2-AJC (c/n 30711), taxis to the terminal in February 2020. US-Bangla is the largest private airline in Bangladesh in terms of fleet size (and overall second-largest after the nation's flag carrier Biman Bangladesh Airlines). The firm began operations in July 2014 and currently has two 737-800s operational, with a further two parked up



This Easy Fly Saab 340, S2-AIF (c/n 089), is Bangladesh's only flying example. The aircraft is chained down for an incoming storm. Bangladesh has two cyclone seasons a year



When the COVID-19 pandemic hit Bangladesh, the local cargo handlers at Cox's Bazar Airport were issued with these protective blue suits



Bishmilla Airlines Hawker Siddley HS-748, S2-ADW (c/n 1766), seen here in June 2020, is based at Cox's. Construction work on the new ramp can be glimpsed in the background



True Aviation Antonov An-26, S2-AGA (c/n 47313505) (seen here at Jessore), is another Cox's resident. An An-26 crashed just after take-off from Cox's Bazar on March 9, 2016



Bangladesh's national carrier flies two 74-seater Dash-8s into Cox's, including this one, S2-AGR (c/n 4368). A third aircraft was written off in an accident at Yangon International Airport, Myanmar, in 2019. It will be replaced by one currently being tested in Canada **AI**

Dreamliner's big S

“Nobody, but nobody, should be surprised that Boeing is going to consolidate 787 production in Charleston”

Industry analyst Scott Hamilton

In a major move for the multinational corporation and a blow to Washington state's aerospace sector, Boeing will consolidate production of its 787 Dreamliner at its North Charleston plant in South Carolina from the middle of next year.

Boeing Commercial Airplanes president and CEO Stan Deal said in a statement the decision was made, “to ensure the long-term success of the 787 programme”.

Everett will be left with 747, 767 and 777/777X assembly work, although jumbo production is set to end in 2022. Boeing's

other factory in the Puget Sound area around Seattle, at Renton, will continue to produce the 737.

Predictions about consolidating Dreamliner output had been made since late July, when Boeing said it was studying the feasibility of producing 787s at a single location as part of a wider review of the company's organisational structure, supply chain and production system.

In October, Boeing stated: “This analysis confirmed the feasibility and efficiency gains created by consolidation.”



hft

Boeing is to centralise 787 Dreamliner production in South Carolina within months – a move with far-reaching consequences for people and production. **Mark Broadbent** reports on the reasons, reaction and future prospects

Mixed reactions

Around 900 jobs in the Puget Sound region are associated with the 787 at Everett, whether directly or in the wider supply chain, according to the *Seattle Post and Courier*.

Boeing said it would spend the next few months making decisions about staffing changes on the 787 programme “in conjunction with the overall transition plan” and “work to minimise the impacts” on employees affected by the change.

Deal credited Everett staff for helping to “give birth to an airplane that changed

how airlines and passengers want to fly”, but there was an angry response from politicians and union officials in the Puget Sound area. Washington state governor Jay Inslee stated on social media that it was “an insult to the hardworking aerospace employees who build 787s”.

Jon Holden, president of the International Association of Machinists (IAM) District 751 union, said: “Boeing leaders discount the efficiency, quality and productivity of our Puget Sound workforce.”

Gary R Allen, general vice president of

IAM Western Territory, called the decision “short-sighted and vindictive”.

There was, of course, a totally different reaction in South Carolina where the state’s governor, Henry McMaster, hailed a “very welcome announcement” and highlighted the possibility of new jobs being created.

Boeing initially built 787-8/-9s solely at Everett. The second production line at North Charleston was announced in 2009, and the initial aircraft from there rolled out three years later. Subsequent production ramp-ups to respond to



Boeing 787 Dreamliners will be produced exclusively in North Charleston from mid-2021

Boeing/Alan Marts





CLOCKWISE FROM ABOVE:

The 787-10's longer fuselage means body sections cannot be airlifted to Everett
Boeing/Paul Weatherman

A United Airlines 787-9 in assembly at North Charleston Boeing/Alan Martsi

Boeing's decision to focus 787 production in South Carolina generated an angry response from officials in Washington State Boeing/Alan Martsi

Boeing rolls out its first 787 built in South Carolina during 2012. It was later delivered to Air India as VT-ANI (c/n 36277). Boeing/Alan Martsi

growing demand for the aircraft – monthly output rose to 14 jets in 2019 – meant the North Charleston facility turned out seven Dreamliners each month. The third and largest 787 variant, the -10, introduced in 2018, is produced solely at the facility.

Reduced air travel due to the effects of COVID-19 and the resulting lower demand for new aircraft means Boeing is cutting Dreamliner production to six 787s per month from next year.

Deal said moving all 787 work to South Carolina would make Boeing “more competitive and efficient” and better able to “weather these challenging times and win new business”.

However, Governor Inslee argued: “I

understand the serious market forces Boeing faces today. What I don't understand is why the company can't commit to restoring production here when the market for this plane improves.”

Decision reasons

Analysts would say that Boeing's decision should not have come as a shock. In commentary posted on the *Leeham News and Analysis* site in October 2020, the industry analyst Scott Hamilton reported: “Nobody, but nobody, should be surprised that Boeing is going to consolidate 787 production in Charleston. This die was cast [on] October 28, 2009, when Boeing announced that the second 787



final assembly line would be placed in Charleston instead of Everett."

Several factors explain Boeing's decision. With the Dreamliner production cut, *Leeham* maintained it "makes little sense" to split assembly across two sites.

Their analysis explained: "Charleston assembles only the 787. Everett assembles the 767-300ERF, KC-46A, 777 and, into 2022, the 747. Although rates are going down for the 777, these programmes give Boeing the ability to allocate the factory costs across three programmes (two after the 747 is terminated). The multi-billion-dollar investment in Charleston would have very little cost allocation if the 787 final assembly line there was closed."

Teal Group Vice-President Analysis, Richard Aboulafia told *AIR International*: "Boeing won't save much money by killing the Everett 787 line, since most of their costs are variable costs anyway, with around 75% going to suppliers. This appears to be a very short-term focused move."

However, South Carolina is a so-called 'right to work' state, where workers cannot be compelled to join a union. The *Leeham* analysis noted: "Labour costs are lower than Everett. State and local regulations are more relaxed. [The] cost of living and doing business is less."

Production simplified

All the 787's fuselage sub-assemblies from suppliers Fuji, Kawasaki and Mitsubishi in Nagoya, Japan and Leonardo in Italy are flown to North Charleston by Boeing's in-house fleet of four Boeing 747-400LCF Dreamlifters. There they are joined to other centre-rear and aft fuselage sub-assemblies produced in-situ by Boeing South Carolina.

For 787-8/-9s to undergo final assembly at Everett, the completed fuselage sections are then flown by Dreamlifter over to Washington. But the 787-10 is assembled exclusively in North Charleston because the variant's longer fuselage (68m compared with the -8's 57m and the -9's 62m) means its fuselage sections are simply too large for the Dreamlifters to fly to Everett.

Hamilton pointed out: "A method for transporting them to Everett would have to be developed, a needless expense."

In short, consolidating 787 production at North Charleston simplifies the Dreamliner build process. *Leeham* noted: "Moving these sections across the tarmac, so to speak, is a lot cheaper and logistically simpler than airlifting them to Everett."

Future options

Announcing the production changes Boeing stated it was undertaking a wider review "to reassess all aspects of Boeing's facility footprint, organisational structure, portfolio and investment mix, and supply chain health and stability."

However, Hamilton wrote in October: "Don't look for Everett to see 787



production ever again. Boeing will work to increase the throughput of the Charleston plant to accommodate more than its current maximum of seven/month should demand return after COVID is over."

Aboulafia feels moving the 787 out of Everett may lead to a wider shake-up of Boeing airliner production in Seattle.

He told *AIR International*: "Since Renton real estate is valuable, it's a reasonable assumption that they're looking at moving the 737 final assembly and wing work to Everett. They can't just sell parcels of Everett, and they can't close the whole thing, so consolidating all Puget Sound jetliner production might make sense."

Making space

Hamilton believes there might be a longer-term consequence of concentrating 787 work in North Charleston.

In a *Leeham* analysis, he noted empty production bays will appear in Everett after Dreamliner assembly moves and the 747 line stops in 2022. This will give, he reported, "the unique chance to design and install advanced production systems without retrofit challenges" for a future all-new airliner.

For much of the 2010s there was a 'will they/won't they?' debate in the industry about whether Boeing would launch a new mid-size product for the so-called 'middle of the market' segment for airliners sized between single-aisles and widebodies.

Eventually, the company shelved its New Mid-market Airplane concept for a fresh twin-aisle aircraft seating around 220 to 270 passengers. Airbus dominates the mid-market today with the A321XLR, now in development and due to fly in 2022, which has secured more than 450 orders.

But the aerospace sector is constantly moving; product strategy decisions are made years in advance of aircraft appearing. Hamilton believes Boeing will "need to begin making decisions in 2023-2024" about a new aircraft family, both to challenge Airbus' mid-market dominance with the A321XLR and find a successor to the 737.

Hamilton pointed out: "If Boeing launches a new airplane programme in 2024-2025, entry into service will be around 2030-2031. Airbus talks about an A320 family replacement about the same time. With two empty bays in Everett, Boeing can start from scratch... This is Boeing's big opportunity, [one] that won't come again for a long, long time." **AI**




The Dassault Falcon 10 Mer displays the elegance and classic lines that define a glorious era in France's military history – a time when new equipment was being procured regularly, when the navy commissioned two modern aircraft carriers (the *Foch* and the *Clemenceau*) in a single decade, as well as a new generation of helicopters, fighters, maritime patrol aircraft and the Falcon 10 Mer for the support mission. It's an era that we are never likely to see

again. On the ramp at Base Aéronavale (naval air station) Landivisiau, the Falcon 10 Mer aircraft in their elegant blue and white colour scheme stand out against the based grey Rafales. The Falcons with their smart white belly, fighter-like swept wings and a performance to match – Mach 0.87 at flight level 450, a speed that made the Falcon 10 one of the fastest ever business jets when it was certified in 1973. The aircraft was nicknamed 'Corporate Bullet' and today remains the zippiest of Falcons.

The veteran jets, flown by 57S (S

stands for *escadrille* – a small squadron or a flight) are, according to the unit's commander, Capitaine de Frégate François Daylaud, repainted every six years to prevent corrosion. "Number 101 has just been repainted and we also rinse them thoroughly after each flight over the sea," he said.

Flying for the carrier

The Falcon 10 Mer unit, 57S, flies six aircraft. Two are kept in long-term storage at Dinard-Pleurtuit-Saint-Malo Airport under the watch of Sabena Technics, 

Old dogs new tricks

With the Dassault Falcon 10 celebrating the 50th anniversary of its first flight on December 1, **Frédéric Lert** explains why the ageing jet is as valuable as ever

Formation flying behind an OV-10 Bronco camera ship, with the leading edge slats of the Falcon 10s extended to maintain a low speed

All images by Anthony Pecchi unless stated

First steps with the 57S

All navy Rafale pilots follow an initial carrier pilot training track in the United States, flying US Navy's T-45C Goshawks. On return to France, some pilots are then directed to the Rafale Transformation Squadron (ETR) based in Saint-Dizier. However, faced with the influx of foreign trainees, the ETR cannot meet all French needs. As a result, some of the marine pilots discover the Rafale directly in a flotilla, on a single-seater, and therefore without going through the two-seater box.

Another consequence after passing their initial IFR qualification is for them to learn the specifics of military air traffic on the 57S Falcons. Sub-lieutenant Quentin, a young Rafale pilot, explained the procedures: "The first six flights on a Falcon allow you to take control of the aircraft, to discover the local environment and to pass the IFR qualification while working on approaches. We then continue on navigation flights, going from high altitude to low altitude to familiarise ourselves with different flight profiles. Then comes the Rafale transformation, either at the ETR or directly in a flotilla with the fighter conversion section (STC)."

This is not the end of the work on the Falcon, though, because after being trained on the Rafale the young pilot will return to the 57S to learn the peculiarities of maritime flight over three missions. This covers anti-surface attack – management of trajectories, timing and communications – and discoveries of research patterns at sea. A young pilot clocks a total of 15 flights on the Falcon before joining a flotilla.

FROM TOP: The official 57S patch

Patch images Frédéric Lert

The patch commemorating 45 years of service within the Aéronavale

One of the numerous patches celebrating the versatility of the Falcon 10 Mer



the company contracted to maintain the other four Falcons flying from Landivisiau. The Sabena Technics contract calls for two of the aircraft to be available every day.

The escadrille is small in size, with only about 20 sailors in its ranks: eight flight engineers (MECBO, *mécanicien de bord*), several non-commissioned officers for administrative duties and eight pilots. Of the last of these, half are former fighter pilots

and the remaining four boast a maritime patrol background. Commander Daylaud explains the four fighter pilots provide the unit with some valuable experience in instrument flying and cockpit crew management.

Maintaining instrument flying expertise is the unit's primary mission, whether it is by training young fighter pilots or maintaining the qualification throughout their career. The 57S works, above all, for the benefit of carrier-based fighter units and their airmen.

Its presence in Landivisiau, alongside the 11F, 12F and 17F fighter flotillas of the Groupe Aérien Embarqué (GAé, equivalent to a Carrier Air Group) owes nothing to chance. The Falcons are also used to familiarise the young pilots returning from the United States (where they are trained in carrier operation with the US Navy's T-45s) with the peculiarities of military air traffic in France and maritime overflight.

Capitaine de Frégate Christophe Charpentier, who commands the GAé, said of 57S and its Falcons: "I also consider the unit, due to its proximity to the missions of the fighters, to be part of the Groupe Aérien Embarqué, even if it is not part of my orders."

Charpentier further explained: "As a pilot, my earliest memories with the GAé go back to 2002 and my first flights with



the 57S, when I was just a young pilot fresh out of Naval Air Station Meridian [in Mississippi, USA]. For most embarked pilots, the 57S is inseparable from their career. As commander of the GAé, I also recognise that the escadrille provides us with an important point of view on the young pilots returning to us from the United States. The opinions and forecasts that the 57S pilots give us are still relevant."

Greek tragedy

Charpentier's vision is confirmed by the OC of 57S, which does not select the pilots. "We just have to train them to the expected level," said Commander Daylaud. "However, if we feel that a pilot does not have the capacity to progress we can sound the alarm bells by pointing out weaknesses. We could even, if necessary, be required to participate in a pilot's 'instruction board', with the possible consequence of stopping his training on Rafale."

After an initial contact with the 57S to obtain their Instrument Flight Rating (IFR), the pilot will return to the unit throughout his or her career to extend the qualification. "The IFR culture is essential for naval fighter pilots because of the regular in-flight rerouting," explained Daylaud. "It is essential each pilot can fend for himself and know, in the event of a diversion, to integrate properly into civilian airspace with which he would be unfamiliar. The aircraft carrier is constantly moving, and the diversion airports therefore change every day, which adds to the complexity of the situations. We must not forget that a diversion ashore is, above all, the consequence of an abnormal and stressful situation resulting from a breakdown, difficult weather conditions or an aborted landing."

The so-called TourMed (Tour





Méditerranée) missions flown with the Falcons, allows them to visit the most difficult diversion airports to negotiate, whether it be the landing patterns or insufficient radio-electric aids. "Above all, it is a training oriented towards safety, which demystifies the terrain," said Commander Daylaud.

The procedure was born from a dramatic day at Kalamata in Greece on March 27, 1992. The *Foch* aircraft carrier catapulted a strike package of Crusaders and Super Etendards but, when the jets returned, the weather had deteriorated so badly that landings were excessively difficult. All the jets were subsequently sent ashore. Without Greek guidance, lacking a proper area map in the aircraft, and flying on fumes, disaster struck when Lieutenant Chapalain in his Crusader tried his luck flying visual in low altitude – and fatally flew straight into a mountain. ➔



CLOCKWISE FROM TOP RIGHT: Up to seven passengers (including three in the rearmost seating) can be accommodated in the Falcon

A very busy cockpit indeed, yet in excellent condition for a 45-year-old aircraft!

Rafales and Falcons share the same apron at Landivisiau naval air base, Brittany

Waiting to transport a VIP at Istres air force base, in Southern France Frédéric Lert

A very rare sight: six Falcon 10 Mer aircraft of 57S in formation flight Aymeric de Valence



Facing COVID-19

If the Mediterranean is the Falcon 10 Mer's favourite playground, the jet's four-hour range allows the unit to venture into northern Europe or even west Africa, covering an expanse from Greenland to Senegal. With its cabin sized to accommodate seven passengers, the aircraft is also suitable for many other missions.

These include flying VIPs – the 57S aircraft can be directly requested to transport the French Minister of the Armed Forces, the Chief of the Army Staff and the naval Chief of Staff – as well 'red air' missions to test a ship's anti-aircraft weapons. Most important, however, are the Falcon's missions to support the aircraft carrier.

These missions include a wide range of possible scenarios, with the transfer of personnel (and, in particular,

Landing Signals Officers, who are in great demand), or of confidential documentation and small spare parts and packages. The 57S has also devised a scenario where the aircraft could be used to transport COVID-19 patients, while adapting its operation to the requirements of the pandemic crisis

"During the period of confinement we continued to carry out our missions by working with two independent and isolated teams, to limit the risks of the virus spreading," said Commander Daylaud. "Cleaning the aircraft is systematic before and after the flights and the wearing of face masks is mandatory for the crew."

It should also be noted that, historically, the Falcon 10 Mer has operated with a crew of three: two pilots and a flight engineer. However, the revival of the maritime patrol community in France

(as a consequence of the Atlantique 2's upgrade) means there is a shortage of qualified flight engineers for the Falcon 10 Mer aircraft.

The aircraft are now flown regularly by a crew limited to two pilots, at least for aircraft that are on non-training missions. The story is different when a trainee takes the right seat because the flight manual requires the presence on board of a qualified pilot and another trained crew member. The presence of a flight engineer, who monitors the conduct of the flight and the work of the pilot in instruction, is therefore an essential requirement during these flights.

What's next?

With approximately 1,800 flight hours recorded each year, the 57S should surpass the symbolic 100,000-hour mark in just under three years. The escadrille



We continued to carry out our missions by working with two independent and isolated teams, to limit the risks of the coronavirus spreading

Capitaine de Frégate François Daylaud,
Commander of 57S



has now accumulated 95,000 flight hours in 45 years.

The Falcon is a reliable but ageing aircraft, with its maintenance costs increasing every year. At the same time, its avionics cannot keep up with European regulations. The aircraft is certainly very well equipped for everything related to conventional navigation procedures, incorporating an ILS (instrument landing system), VOR (VHF omnidirectional range), ADF (automatic direction finders), TCAS (traffic collision avoidance system) and mode S transponder.

However, they are not equipped with modern equipment such as automatic dependent surveillance broadcast (ADS-B) – surveillance equipment that automatically transmits the position of the aircraft to air traffic control. They also do not offer the ability to carry out GPS precision approaches, which could complicate their missions in European

airspace in the future. The need for a Falcon 10 Mer replacement has now surfaced, with the aircraft only having ten years of life remaining. Obviously switching to a new generation of aircraft will cost less in the long run than extending the Falcons indefinitely.

To meet the requirements of IFR training and to have the right speed range, a jet is required. Light transport missions also require a passenger cabin that is not too cramped. There is no shortage of business jets on the market that might be suitable for the French Navy.

It is clear the service should go for a new aircraft, with an operational life of several decades. The Honda Jet seems small for GAÉ's logistical support missions. Others, like Embraer's Phenom 300 or the Pilatus PC-24, are well placed in terms of performance. If Switzerland buys the Rafale to replace its Boeing F/A-18 Hornets – there would be room for a fine industrial offset. **AI**

CLOCKWISE FROM TOP LEFT:

The same Dassault design office produced both the Falcon and the Rafale

Light and fast (Mach 0.87), the Falcon 10 Mer was nicknamed the 'corporate bullet' when it entered service in the early 1970s

Commander François Daylaud (on the left), with a young Rafale pilot



Checking In

The Falcon 10 Mer aircraft train Rafale pilots on diversionary airfield approaches, but would a simulator be more cost-effective?

Share your views with us at
airinternational@keypublishing.com
under the subject heading *Checking In*.

From big



First, fastest and biggest are not the go-to superlatives immediately associated with the aviation industry this year. Yet beyond gloomy headlines there is much to celebrate in aerospace, as **Mark Broadbent** discovers

to

Dispiriting news dominated 2020, thanks to the COVID-19 pandemic's all-encompassing impact on lives and livelihoods. Airlines, manufacturers and the wider supply chain have been crippled, but the industry presses on with developments aplenty in commercial aircraft, helicopters, UAVs, business aviation and technology.

Boeing flew the 777X from Everett, Washington on January 25. At 69.8m long, it's the largest twin-jet airliner ever

developed, featuring folding wingtip sections to maintain the 777's established International Civil Aviation Organization (ICAO) Code E gate compatibility.

Due for delivery to initial operators Lufthansa and Emirates in 2022, N779XW (c/n 64240, test serial WH001) undertook the initial flight. Three more examples followed it into the flight test programme by September: N779XX (c/n 64241, WH002), N779XY (c/n 65799, WH003) and N779XZ (c/n 65800, WH004).

The 777-9's General Electric GE9X turbofan – which has the largest fan

diameter on any commercial jet engine ever developed, at just over three metres – received US Federal Aviation Administration (FAA) and European Union Aviation Safety Agency (EASA) certification in September.

More freighters

Repurposing aircraft became a recurring theme in 2020. Several manufacturers launched initiatives enabling operators to quickly re-role airliners and convert passenger cabins into temporary freighters.

Viking Aircraft now offers supplementary type certificates for the legacy de Havilland Aircraft Dash 8 -100/-200/-300 turboprops and the current-production -400 model that permit seats to be swapped for large cargo nets secured to cabin seat tracks.

Another regional aircraft supplier, Embraer, launched a quick-change conversion for its ERJ145 and E-jets, permitting small packages to be

New Cessna and ATR

Two other commercial types made their first flights this year: the Cessna SkyCourier from Wichita, Kansas on May 17, and the ATR 72-600F from Toulouse/Blagnac, France on September 16.

Powered by two 820kW Pratt & Whitney Canada PT6A-65SC turboprops, the SkyCourier utility aircraft will be available as either a 2,700kg payload-capable freighter, a 19-seat passenger airliner or a 'combi' passenger/freight type. Three SkyCouriers and two airframes used for static testing are now working to achieve type certification by next year.

Launch customer Federal Express (FedEx) has ordered 50 examples of the ATR 72-600F. FedEx will also be the initial operator of the type, the Franco-Italian company's first purpose-built freighter. With an 8,900kg maximum structural payload, the -600F variant of the highly popular '600 Series' passenger turboprop, will carry seven standard-sized pallets and containers or bulk cargo, offering increased cargo capacity for smaller regional markets.

twins



flying taxis

carried in overhead bins and stowage compartments and on passenger seats.

In the freighter conversions market, Miami, Florida-based Aeronautical Engineers, secured 737-300/-400/-800 conversions from customers including Air Caraïbe, Airwork, Allied Air Cargo, Aviation Holdings III Investments, CargoAir, GA Telesis, KF Aerospace and Nauru Airlines. In October, Precision

Conversions flew the maiden Airbus A321PCF (Precision Converted Freighter), N322WS (c/n 891). Another A321 passenger-to-freighter conversion, from the EFW/ST Engineering joint venture, had received regulatory approval in January.

The initial EFW/ST-converted A321P2F was subsequently delivered to launch customer Vallair, and in October, the company announced a letter of intent

(LOI) with GlobalX, a new operator serving the US, Caribbean and Latin American markets, which will lease ten A321P2Fs from Q3 of next year.

Gulfstream Aerospace has been testing the 6,400nm-range G700, its largest-ever business jet. Four prototypes, the first of which flew on February 14, have amassed more than 600 flying hours. The G700's 5,000nm-range stablemate, the G600, ➔



CLOCKWISE FROM TOP LEFT:

Four Boeing 777-9X test airframes have flown during this year. Here the prototype, N779XW (c/n 64240), becomes airborne Boeing

Embraer joined the urban air mobility segment with its new Eve unit Embraer

The initial EFW/ST-converted A321P2F, VH-ULD (c/n 835), operated by Qantas for Australia Post Vallair



CLOCKWISE FROM LEFT:

Pilatus is due to deliver six PC-24s to the Swedish Air Ambulance

Pilatus Aircraft

Airbus Helicopters' newly certified five-blade H145

Airbus Helicopters

UMS Skeldar launched the V-150

UMS Skeldar

received FAA certification in May.

Dassault Aviation started ground testing its latest Falcon jet, the 6X, that was due for rollout at the company's facility in Bordeaux-Mérignac, France by the end of this year. The second and third examples were nearing final assembly in October.

Pilatus continued to deliver more customer examples of the PC-24, its initial jet aircraft. It also flew the first of six PC-24s it is due to deliver to the Kommunalförbundet Svenskt Ambulansflyg (Swedish Air Ambulance) next year after outfitting with a medevac interior by Aerolite AG.

There were developments on several light jet programmes. Embraer introduced the upgraded Phenom 300E with more powerful Pratt & Whitney PW535E1 engines and speed and range increases. Bombardier delivered the first customer Global 5500 in June and Learjet 75 Liberty in October. Start-up developer Stratos flew the 716X six-seat light jet in July. Textron subsidiary Beechcraft received FAA airworthiness certification for its latest King Air 360/360ER models, which have

a new auto throttle, digital pressurisation controller and an upgraded cabin.

Among RQ-4 Global Hawk variants, NATO started training flights with the Northrop Grumman RQ-4D Phoenix from Sigonella Air Base, on the Italian island of Sicily and the US Navy MQ-4C Triton went to Andersen Air Force Base in Guam on its initial Pacific theatre deployment.

A multi-spectral camera and an upgraded AN/ASQ-230 sensor to provide additional high-resolution imaging capabilities for the RQ-4 were also announced by the manufacturer. Similarly, General Atomics Aeronautical Systems, Inc (GA-ASI) unveiled upgrades for its MQ-9 Reaper series. It also flew the Royal Air Force's initial Protector RG Mk1 and



Coastal patrollers and HAPS

Two examples of an earlier King Air version, the B200, were introduced in the UK by 2Excel Aviation under a new five-year Maritime and Coastguard Agency (MCA) contract providing maritime reconnaissance and coastal search and rescue support services.

The MCA also explored how unmanned air vehicles (UAVs) might support its operations in separate trials off the Welsh coast involving the Schiebel Camcopter S-100 and Elbit Systems Hermes 900.

Another civil turboprop, the Dash 8, was picked for coastal patrol work by the Netherlands Coastguard, which has awarded PAL Aerospace and JetSupport a ten-year contract to operate a pair for maritime surveillance. There were further developments in the new class of skeletal-looking

unmanned high-altitude pseudo satellite (HAPS) systems designed to fly in the stratosphere for long periods for survey

and communications purposes. Most notably, the newly renamed SunGlider (formerly the HAWK30) was flown to 62,500ft in September on its fifth flight from Spaceport America, New Mexico by its developer HAPSMobile, a joint venture between Japanese telecommunications company SoftBank and AeroVironment, Inc.

During its high-altitude sortie, an internet connectivity test using a communications payload jointly developed by HAPSMobile and Google subsidiary Loon was conducted using the solar-powered aircraft.

A HAPSMobile statement said: "Using smartphones connected to the internet through the payload in the stratosphere, members from Loon and AeroVironment successfully made a video call to HAPSMobile members based in Japan."

In the UK, although the Ordnance Survey HAPS project launched in 2019 called Astigan was quietly dropped, BAE Systems completed ground endurance testing of a sensor payload on its 35m-wingspan PHASA-35 in conjunction with Prismatic (the aircraft's original developer) and the UK Defence Science and Technology Laboratory.



The Beechcraft King Air B200 was introduced for coastal patrol work in the UK
Maritime and Coastguard Agency





the MQ-9B SeaGuardian. The US Air Force awarded Boeing, GA-ASI, Kratos Defense and Northrop Grumman contracts in its Skyborg programme to develop an artificial intelligence-enabled 'Loyal Wingman' drone.

Elsewhere, Boeing Australia completed the first such system for the Royal Australian Air Force; the aircraft conducting its initial taxi in October.

Switzerland-headquartered developer UMS Skeldar launched a new vertical take-off and landing system, the V-150, designed "to support tactical operations including defence forces, surveillance, blue light forces and homeland security", the company reported. Leonardo flew the new Xplorer version of its Falco UAV.

Developments in commercial UAVs continue, with many start-up companies launching products of varying sizes, from small hexacopter and octocopter systems (six and eight engines, respectively) to larger rotary and fixed-wing systems.

UK start-up Hill Helicopters launched its six-seat 500shp HX50 that it plans to fly in 2022. Airbus Helicopters' new H160 medium utility helicopter was certified by US and European regulators and the company launched a five-bladed H145 variant. Russian Helicopters began certification testing on the Kamov Ka-62, a civil version of the Ka-60, and started series production of the Mi-8AMT, a new variant of the Mi-8, for Arctic conditions.

In the USA, work continued towards the expected 2022 launch of the US Army Future Long Range Assault Aircraft (FLRAA) project to field a UH-60 Black Hawk replacement. One of two FLRAA proposals, the Sikorsky-Boeing SB-1 Defiant compound helicopter, attained ever-higher speeds, reaching 210kts in straight and level flight and 232kts in a descent in October. The rival Bell V-280 Valor attained 300kts last year.

Sunglider during its September flight to 62,500ft HAPSMobile



A SpaceX Falcon 9 rocket carrying the Crew Dragon spacecraft launches from NASA's Kennedy Space Center on May 30 NASA/Bill Ingalls

Rockets, flying wings and supersonics

The commercial space industry continues to evolve, with the May 30 launch of SpaceX's Crew Dragon mission arguably the standout aerospace event of the year. This was the first time a commercially produced and operated crew transportation system flew astronauts to the International Space Station.

Virgin Orbit's Boeing 747-400 carrier aircraft undertook the initial demonstration release of the company's LauncherOne rocket. It failed to reach orbit, but a second launch carrying a NASA payload is mooted soon, see 'Race to the edge of space', pages 76-81.

A significant regulatory development for commercial space came in October when the FAA's Office of Commercial Space Transportation authorised the Streamlined Launch and Re-entry Licensing Regulation-2, which aims to increase space access for companies while maintaining safety. Under the new rule, a commercial space operator requires just a single licence for all types of launch and re-entry operations, as opposed to one for each separate activity.

Other striking developments were the first flights of MagniX's all-electric Cessna 208B Grand Caravan from Moses Lake, Washington and ZeroAvia's hydrogen-powered Piper M250 from Cranfield Airport, Bedfordshire.

TU Delft and KLM Royal Dutch Airlines flew their Flying-V scale demonstrator in the Netherlands, and Airbus released a flying wing design as part of its radical ZEROe concept for airliners powered by hydrogen, see 'ZEROe-ing in on cleaner flight', pages 58-64.

In supersonic civil aviation, NASA moved forward developing the X-59 QueSST (Quiet SuperSonic Transport). American start-up Boom Supersonic rolled out the first XB-1 Baby Boom demonstrator and announced a partnership with Rolls-Royce to develop an engine for Overture, its follow-on airliner design. Rolls-Royce also reported it is working with Virgin Galactic on a project to produce a Mach 3-capable passenger aircraft.

Fleet Logistics Multi-Mission Squadron 30 (VRM-30) the 'Titans' at Naval Air Station San Diego, California received the Bell/Boeing CMV-22B Osprey tiltrotor, which will replace the Grumman C-2A(R) Greyhound in the US Navy's Carrier Onboard Delivery role.

New frontiers

Urban air mobility (UAM) refers to manned and unmanned systems undertaking air taxi and cargo delivery flights. Technical feasibility, market size, supply chains and the regulatory framework are big issues for this emerging sector, but more major industry names were a part of it this year.

Honeywell and Embraer launched new divisions to develop electric vertical take-off and landing (eVTOL) systems, Bell flew its Autonomous Pod Transport and BAE Systems announced plans to supply flight control, power and electronics technologies for UAM.

They join Boeing (partners of developers Kitty Hawk and Wisk) and Airbus (with its CityAirbus and Vahana projects) in becoming involved in UAM, but names from outside aerospace are involved too – Hyundai and Uber announced plans

to develop a flying taxi called the SA-1. Plus, tests and demonstrations of eVTOLs already flying, such as Chinese developer EHang's systems, the five-seat Lilium jet and the Volocopter X2, continued.

The emergence of futuristic-looking UAM vehicles and the HAPS (high altitude platforms), give a sense there are new frontiers opening in aerospace.

Adding to the feeling of a shake-up in the established order was the US Air Force launching Agility Prime in June. This initiative seeks to support commercial investment into UAM and help develop and field eVTOLs for military applications.

Its launch shows that innovation and development continue across the aerospace industry, despite COVID-19. **AI**

Checking In

What were your top tech highlights of 2020 and what is your greatest aviation hope for the new year?

Share your views. Email us at airinternational@keypublishing.com under the subject heading *Checking In*.



Maintaining

SIA Engineering Company (SIAEC) is based at Singapore's Changi gateway
Key-Craig West

While airlines around the world are operating reduced schedules in response to the pandemic, proactive MRO providers are investing in their infrastructure and capabilities to meet demand when the industry recovers, as **Bernie Baldwin** discovers

Look at aircraft manufacturers' order books and delivery records and it quickly becomes clear that much of the pre-COVID transactional activity was generated by airlines and leasing companies in the Asia Pacific region. They all, of course, need maintenance.

While the pandemic has changed the overall dynamic of the industry for years to come, it is worth considering the enduring vibrancy of the Asia-Pacific MRO (maintenance, repair and overhaul) sector, particularly compared with its global counterparts.

SIA Engineering Company (SIAEC) is the maintenance arm of the Singapore Airlines Group and one of the largest MRO providers in the Asia-Pacific region

A company spokesperson outlined the firm's current strategic thinking, beginning

with an overall look at the country's standing throughout the region: Prior to the COVID-19 pandemic, various industry reports projected global MRO demand to grow, especially in the Asia-Pacific region. Airlines which outsource MRO work, including aircraft checks, consider Singapore favourably as [the city state] is a renowned and vibrant aerospace hub with prominent MRO service providers and multiple OEM [original equipment manufacturer] repair facilities.

"This is a key competitive factor and differentiator for Singapore as compared to MRO locations in other Asia-Pacific countries.

"SIA Engineering Company has been able to attract global flag carriers as well as key regional airlines for aircraft checks in Singapore. [The company] has capabilities to perform [airframe] checks on both current and new-generation narrowbody

and widebody fleets, including the latest Airbus A350 and Boeing 787. We also have our network of MRO subsidiaries and joint ventures with OEMs and strategic partners to support aircraft checks, providing integrated 'one-stop shop' solutions for customers.

"Our 24 MRO joint ventures and subsidiaries across seven countries deepen our service offerings to airlines worldwide, delivering services for engines, components, engineering, airframe maintenance, line maintenance and fleet management."

Fruitful partnerships

According to the company, key joint ventures include engine and component examples with Rolls-Royce and Pratt & Whitney and Safran and Moog, respectively, while further partnerships include design and services with Jamco

“The company has also invested in various areas to improve our efficiency, delivery and productivity, including development in digital platforms and innovation initiatives to improve our work processes”

SIA Engineering Company



the edge

and an in-flight entertainment (IFE) MRO shop with Panasonic Avionics.

“SIAEC is a leading and preferred MRO partner as customers are attracted to our promise of quality and safety,” the spokesperson stated. “Our heavy maintenance base, SIA Engineering Philippines (SIAEP), in Clark, the Philippines, also provides an alternative option to [carriers], including those operating in North Asia.

“With the onset of the pandemic, and with no clear signs of recovery, industry projections indicate that airline fleet growth has been curtailed and is not expected to recover in the immediate years. Correspondingly, the industry projections highlight that MRO demand is expected to decline in the near term. However, SIAEC and SIAEP are positioned competitively for a recovery in MRO demand as we continue to offer

airlines quality, safety, aircraft checks on both [the] classic and latest aircraft types, and MRO support from our network of MRO subsidiaries and JVs [joint ventures] with OEMs and strategic partners.”

Although growth is currently stymied, maintenance providers have been making major investments for airframe MRO in recent times that include new sites and aircraft types in the portfolio, larger hangar space and more processes. SIAEC continues to add to its portfolio of aircraft check capabilities, as well as investing in resources to handle the latest aircraft types.

“SIAEC has aircraft check capability on new-generation aircraft, such as the aforementioned A350 and 787, complementing existing capabilities on the A320, A330, A380, 737, 777 and 747. At Clark, SIAEP specialises in the A320, 737, A330 and the Embraer E-Jet family,” the spokesperson said. “The

company has also invested in various areas to improve our efficiency, delivery and productivity, including development in digital platforms and innovation initiatives to improve our work processes. Some of these initiatives include a pneumatic tube system [PTS] for delivery of spares, automated guided vehicles and 3D scanners for mapping of aircraft surface defects.”

SIAEC confirmed it will continue to invest in the latest technology to improve productivity: “We are working with several partners to implement technology to reduce check downtime without compromising safety and quality, for example using video/image analytics technology for inspection and surveillance. We will also continue to enhance our enterprise systems with digital platforms to increase operational efficiency and deploy data analytics for better operational performance.”



Highlighting challenges

On the physical side of structural maintenance, the metallic airframe still dominates across the industry and corrosion remains a threat. Consequently, developments introduced for corrosion prevention and repair are still important, as the SIAEC team noted:

“New-generation aircraft presently in operation have composite airframes that do not corrode, unlike current-generation aircraft that have airframes and mechanical components which are metal-based and subject to corrosion. Nevertheless, following experience gained from the operation of composite aircraft – including the high cost of manufacturing and repairs and insignificant weight-saving – airframers have now turned back to using a metallic fuselage, for example, on the [Boeing] 777-9 programme.”

Through feedback and collaboration with airlines and MROs, airframers have incorporated improved corrosion protection for the next generation of aircraft by selecting more appropriate metals, for example, using titanium

instead of aluminium alloy for the wet areas and providing insulation and drainage, as well as applying levels of protection during production.

“For ongoing corrosion control for aircraft, it requires the consideration of several factors, including material selection and finish, drainage, sealants, application of corrosion-inhibiting compounds and an effective corrosion control programme during service,” the SIAEC spokesperson said.

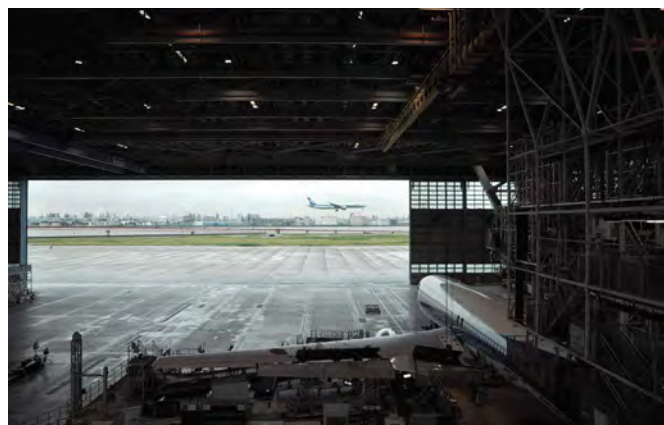
“Material selection is important for long-term corrosion control – for example the use of corrosion-resistant titanium or fibre-reinforced plastics. Finishing a surface with a protective coating such as the use of primers and topcoats on the exterior surfaces of the fuselage and vertical stabiliser is a practical means to protect against corrosion.

“Aircraft are designed with an effective drainage system consisting of drain paths and drain valves on the lower fuselage, to prevent accumulation of moisture and enable the fluid to be discharged out of the aircraft safely. To prevent ingress of moisture and eliminate

the potential for corrosion, joints and crevices are applied with a coat of sealant. Other corrosion-inhibiting compounds provide an additional layer of protection to the aircraft structure, in addition to the finishes and sealants that are already applied. To protect cabin and cargo floor structures, protective sealant tape is also applied where the floorboard meets the metallic floor structure. To provide operators with a basic inspection programme to minimise subsequent corrosion-related repairs or maintenance, airframers also include a comprehensive corrosion prevention and control programme [CPCP] into the aircraft’s maintenance programme.”

SIAEC pointed out that, should an inspection detect any sign of corrosion during maintenance, the engineers will perform a thorough visual check to evaluate the extent of damage and the condition of protective finishes (if any).

“Damaged areas are first repaired by removing all traces of the corroded material and then assessed [to establish] if the amount of remaining material is within OEM limits. If it’s within



limits, the repaired area is re-protected with a suitable protective coating and the part released for service. If the remaining material is found to be out of limits, the part is replaced with a new one and then released for service," the spokesperson explained.

Pandemic impact

Returning to the subject of the ongoing coronavirus pandemic, the company provided details about how it has been affected from the early part of 2020 and the ensuing months.

"Many of our customers' aircraft are parked [at present] and, as a result, planned maintenance schedules and check requirements have also changed," the spokesperson observed. "During this period, we are actively engaging our customers on their preservation check requirements, [and performing any] passenger-to-cargo modifications and cabin hygiene solutions."

"While maintenance work has been reduced to essential airworthiness tasks, many of our customers are also seizing this opportunity to embody reliability

modifications and inspections to prepare fleets for service upon resumption of air travel," the spokesperson reported. "SIAEC has also placed a higher level of resources to support the operations of our cargo airline customers as the pandemic has seen a rise in demand for air [freight] transportation. Special maintenance teams have been established to ensure maximum coverage and support for cargo airline customers during short layovers, to protect flight schedules and support any aircraft [on the ground].

"To ensure the safety and health of our customers as well as staff, we rolled out comprehensive safe management measures at the workplace in compliance with advisories from various government agencies. Our aircraft hangars in SIAEC and SIAEP continue to operate and perform aircraft checks for our valued airline customers."

The airframe maintenance market will continue to be tough for the foreseeable future, but companies such as SIAEC can set benchmarks from which others – with careful observation – can benefit. **AI**

CLOCKWISE FROM TOP LEFT:

The MRO company also has a presence in the Philippines, at the former US Air Force base at Clark International Flickr Commons/Ken H

SIAEC has check capability on a wide range of aircraft, from single-aisle Airbus A320s to widebody Boeing 747s Flickr Commons/Tomás Del Coro

Many analysts expect the Asia-Pacific aviation sector to bounce back from the crisis faster than other regions Flickr Commons/Yoppy

SIAEC is the maintenance arm of the Singapore Airlines Group and one of the largest MRO providers in the Asia-Pacific region SIAEC

Planned maintenance schedules have had to change during the COVID-19 crisis Flickr Commons/Yoppy

“The vision for the Bell Nexus remains the same, but by taking a mature system level approach to design for an objective market vehicle, we believe this configuration unlocks a capable, certifiable and commercially viable product”

Mitch Snyder, president and CEO of Bell

On January 6, 2020, helicopter manufacturing titan, Bell, revealed a full-scale mock-up of the second member of its innovative Nexus urban air mobility (UAM) family to journalists at the annual Consumer Electronics Show (CES) in Las Vegas, Nevada.

Known as the Nexus 4EX, the second iteration of this conceptual air taxi has evolved somewhat since the original design, which is now referred to by Bell as the Nexus 6HX and was unveiled at CES 2019.

The 4EX in the concept's name is representative of these major design changes: the '4' highlights the reduced number of ducted fans that will be used as the aircraft's propulsion system; the 'E' outlines the aim to provide it with an all-electric capability; and the 'X' stands for experimental.

For comparison, the 4EX will feature four ducted fans, a longer wing and will be a true electric vertical take-off and landing (eVTOL) aircraft. The Nexus 6HX features six ducted fans and is expected to be powered by a hybrid-electric power train. Bell has also noted that the 4EX can be operated as both an eVTOL or a hybrid-electric VTOL.

Despite unveiling the 4EX at CES 2020, Bell is keen to develop and market both iterations of the Nexus family. As an all-electric vehicle, the 4EX boasts a range of roughly 95km, which will localise its employment to more intra-urban areas. The hybrid-electric 6HX will be configured to operate at longer distances, with a maximum range of approximately 240km.

Discounting the ducted fans, Bell told *Air International* that both platforms will be roughly the same size. The exact dimensions of the 4EX and 6HX are “to be decided”, with both platforms now in the early conceptual design phase of development.

Each system will be able to carry four passengers in addition to a single pilot. According to Bell, the Nexus is “designed to solve delivery and commuter challenges [and] can carry goods, people and data to serve a business or city-wide demand”.

The Nexus family will feature a distributed electric propulsion (DEP) system to enhance the safety of flight operations. The term DEP is used when a thrust-producing device does not share a common mechanical driveshaft or power source with the power-producing components of the system. This is frequently used in all-electric or hybrid platforms that can source power from batteries, generators and fuel cells. In terms of how this enhances safety, hypothetically, if two ducted fans were to fail, the Nexus would still be able to land safely using the other two.

Bell has adopted the same safety standards used by commercial airliners – its goal is to maintain the statistical likelihood that a single failure occurs once in every one billion flight hours.

THIS IMAGE AND BELOW: An artist's digital rendering of Bell's innovative all-electric air taxi concept, the Nexus 4EX Bell



BellNexus





4EX

Khalem Chapman explores Bell's Nexus 4EX concept, an all-electric air taxi you could ride in the 'city of the future'



The 4EX will be a unique member of Bell's innovative Nexus family, having the ability to be configured as both an all-electric or a hybrid-electric vehicle. This set-up enables customers to operate the platform locally, as well as offering an extended range for those who want to travel further afield.

Both the 4EX and 6HX share a similar ducted fan diameter of approximately 2.5m, but the former's propulsion system is shallower in comparison with the latter. Both incarnations of the Nexus are essentially tiltrotors, with the aircraft's ducted fans mounted on nacelles on the sides of the platform's fuselage. The employment of tiltrotor propulsion systems is common in UAM development, as it provides air taxis with the vertical-lift capabilities of a helicopter, and the speed and increased range of a fixed-wing aircraft.

In the case of the 4EX, two of the ducted fans are located on either side of the cockpit on shorter nacelles, and the remaining two can be found on longer fixed wings at the rear of the aircraft.

The decision to reduce the number of ducted fan systems from six to four on the 4EX was taken to increase efficiency and reduce overall drag.

To accompany the Nexus, Bell will roll out its own UAM software application, known as AerOS. Developed in partnership with Microsoft, the system will serve as a digital backbone for UAM operations.

Bell reported on January 6 that this system will run on Microsoft's Azure platform and will be used to "manage fleet information, observe aircraft health and manage throughput of goods products and predictive data and maintenance". It will also combine with Bell's Mobility as a Service (MaaS) plan to integrate UAM into the community.

Because of this, the AerOS will also feature a booking engine, allowing members of the public to request a ride in a UAM vehicle or air taxi.

Mitch Synder, president and CEO of Bell, said: "[The company] continues to lead the conversation beyond the aircraft to offer multi-modal transportation solutions and experiences within an interconnected digital network that will excite consumers, earn their trust and make their lives easier."

Bell's 'city of the future'

The helicopter-manufacturing titan envisages that "nearly 70% of the population will be living in urban areas by 2050". It adds that cities are already outgrowing their current transportation systems and the need for new solutions has never been greater. Bell turning its attention to providing UAM solutions was part of the reason it dropped 'Helicopter' from its name.

The company is at the forefront of this innovation and outlines how new forms of transportation, such as the Nexus family, will be combined with artificial intelligence and multi-modal centres to form the future of urban travel – whether in the air or on the ground.

With Nexus, Bell has three goals: safety, accessibility and sustainability. By using a DEP system and associated sensors to manage the health of the aircraft, the company can enhance the safety of UAM operations.

The firm aims for the 4EX and 6HX to be affordable and for people of any age, weight or height to be able to use the system.

In terms of sustainability, Bell says the Nexus family will have low noise and is able to use clean power.

The Royal Navy is back, with a few VIP friends.
Alan Warnes reports on the debut of the UK's Carrier Strike Group
as it gets ready for its first operational cruise in 2021

For ten days in October 2020, the Royal Navy's new carrier strike group (CSG) assembled for the first time, to mark the beginning of an era of naval operations. Based aboard the flagship, 65,000 tonne HMS *Queen Elizabeth* aircraft carrier, were 14 F-35B Lightnings, making this the largest group of fifth-generation fighters at sea anywhere in the world.

In addition to Lockheed Martin's F-35Bs,

there were six Leonardo Merlin HM2 anti-submarine warfare (ASW) helicopters from 820 Naval Air Squadron (NAS) and two 845 NAS Merlin HC4s on board. Meanwhile two 815 Sqn Wildcat HMA2s were deployed to HMS *Defender* and HMS *Kent*. Around 3,000 personnel from the UK, the United States and the Netherlands were involved in the manoeuvres as part of Exercise Joint Warrior 20-2 in the North Sea.

The strike group is the largest and most powerful European-led maritime

force in almost 20 years – coming nearly ten years after the Royal Navy's aircraft carrier, the HMS *Ark Royal*, was retired prematurely in 2010 as part of the SDSR (Strategic Defence and Security Review). In the aftermath of this decision, the Royal Navy's morale sank to rock bottom, as did the relationship with the RAF, but that is no longer the case: the *Queen Elizabeth* and many of its new or rejuvenated air assets are showing the way.

Commodore Steve Moorhouse,



Cruise

All nine ships making up the Carrier Strike Group in the North Sea during the exercise Joint Warrior 20-2, October 2020 All images Royal Navy unless stated

Commander UK Carrier Strike Group, said: "The new UK Carrier Strike Group is the embodiment of British maritime power, and sits at the heart of a modernised and emboldened Royal Navy. With a sovereign British core, and our closest allies integrated throughout, the carrier strike group is not just a new capability for the United Kingdom; it is a new capability for NATO and for the United States too."

Of the 14 F-35Bs on board the flagship, only four of the short take-off

and vertical landing (STOVL) jets were from the UK's 617 Squadron 'The Dambusters', based at RAF Marham, Norfolk. The remainder came from the US Marine Corps' fighter attack squadron (VMFA) 211, land-based at Marine Corps Air Station (MCAS) Yuma, Arizona. They flew to Marham on September 3 after a stop at MCAS Beaufort, South Carolina. All 14 departed the RAF base for the carrier on September 22 while she was sailing in the North Sea.

It is not the first time, or the last, that American F-35Bs have flown from the vessel. Two F-35Bs from the F-35 Integrated Task Force, Naval Air Station (NAS) Patuxent River, Maryland, spent eight weeks on the carrier, during its first of class flight trials (fixed wing) work-up on the US eastern seaboard in October and November last year.

At the time, Admiral Tony Radakin, the Royal Navy's first Sea Lord and Chief of Naval Staff, said: "I look forward to this developing further, moving



annia



British F-35Bs

There is a requirement for 138 F-35s, and to date 48 F-35Bs have been approved. Of these fighters, 18 have been delivered, three to Edwards AFB, California, flying with 17 Sqn and 15 to RAF Marham operated by 617 Sqn 'The Dambusters' and 207 Sqn (F-35 OCU). Another three were expected by the end of 2020, but COVID-19 has had a significant bearing on this deadline.

to the point where we are not only talking about interoperability, but we are looking for interchangeability."

In April, Commodore Adrian Orchard, the then Commodore of the Fleet Air Arm, told the author: "The aim is to ensure we work as a combined force – the UK Lightning Force learning from the USMC experiences of working on LHDs (landing helicopter decks) while VMFA-211 will be very happy operating from a 'big deck'. I think the learning and the mutual benefit between the two services will be quite something for embarked F-35 ops. A lot of people, even the US Navy big decks, could learn a huge amount from the shared experience of Brits and Americans working together on the same platform."

And he added: "It is fascinating."

Captain James Blackmore, UK Carrier Air Wing Commander, echoed Cdre Orchard's sentiment: "We are going to learn a huge amount from operating F-35Bs at sea with the USMC, they have had them longer and we can share ideas and practices."

A transatlantic force

Capt Blackmore continued: "But this is much more than that – this is the transatlantic alliance in action, demonstrating that two close allies cannot only fly from each other's carriers, but can fight alongside each other, should we need to. This level of integration offers a decisive flexibility in times of crisis, conflict or war."

VMFA-211 took a lot of experience to

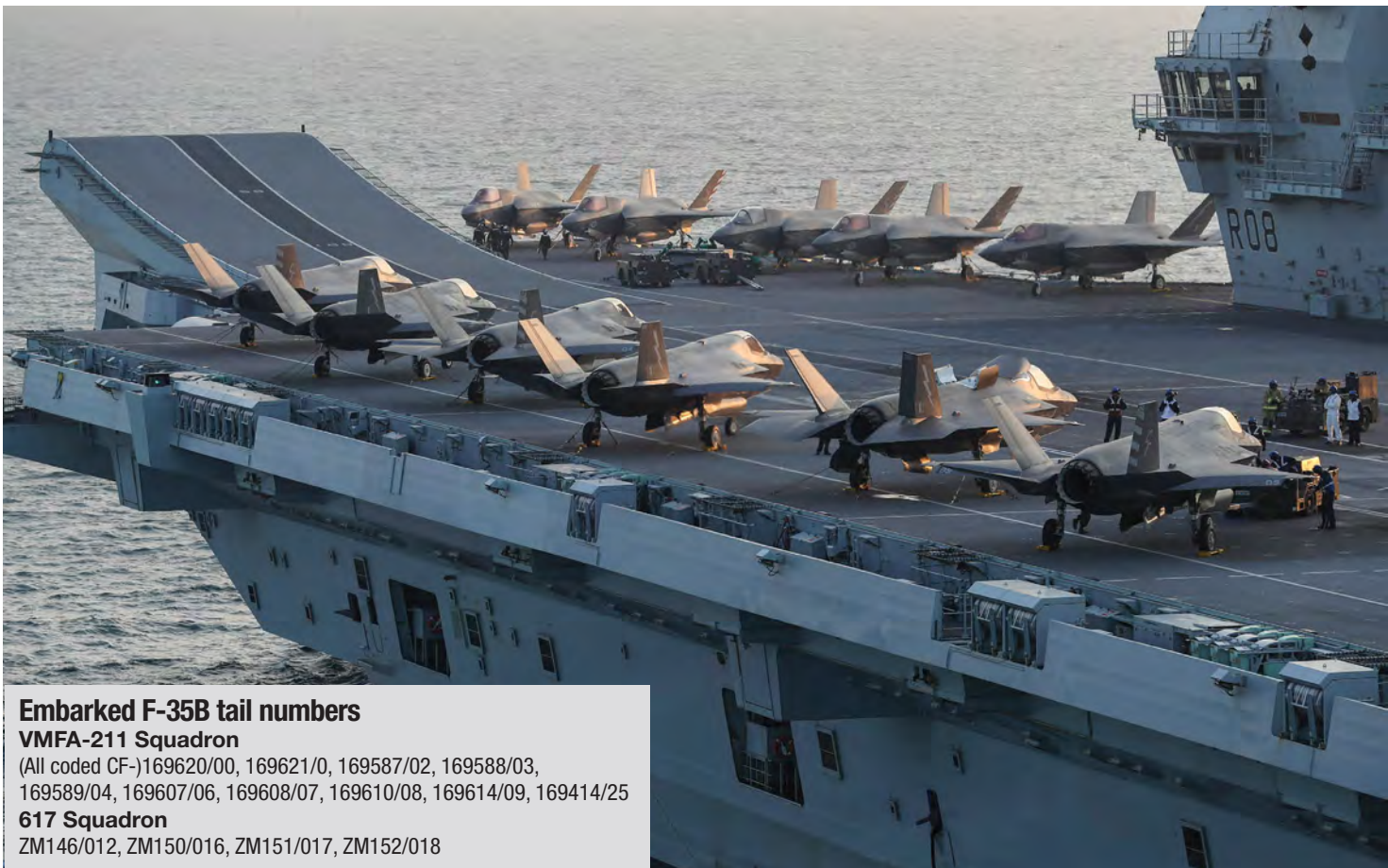
USS The Sullivans

The US Navy's Arleigh Burke-class guided-missile destroyer, USS *The Sullivans* (DDG 68) sailed as part of CSG during Exercise Joint Warrior 20-2. *The Sullivans* was commissioned April 19, 1997 and is today homeported in Mayport, Florida.

The ship is named in honour of the five Sullivan brothers, who served together aboard USS *Juneau* (CL 52) during World War II and lost their lives during the Battle of Guadalcanal on November 13, 1942, when *Juneau* was sunk by a Japanese submarine.

Commodore Steve Moorhouse said: "Fast, agile and well-armed, USS *The Sullivans* is a true greyhound of the seas. Her name bears testament to the heroic traditions of the US Navy, and the Royal Navy is fortunate to have her by our side. As the United States looks to its partners to help shoulder the burden of our shared security, the advent of the Queen Elizabeth-class carriers is proof that the United Kingdom is ready and able to do just that."

Other US Navy participants in Joint Warrior 20-2 included the Arleigh Burke-class guided-missile destroyers USS *Donald Cook* (DDG 75) and USS *Ross* (DDG 71), two P-8A Poseidon maritime patrol and reconnaissance aircraft, one Lewis and Clark-class dry cargo ship USNS *Medgar Evers* (T-AKE-13) and a detachment from 2nd Air Naval Gunfire Liaison Company embarked aboard HMS *Queen Elizabeth*.



Embarked F-35B tail numbers

VMFA-211 Squadron

(All coded CF-)169620/00, 169621/0, 169587/02, 169588/03, 169589/04, 169607/06, 169608/07, 169610/08, 169614/09, 169414/25

617 Squadron

ZM146/012, ZM150/016, ZM151/017, ZM152/018



CLOCKWISE FROM LEFT: F-35B 169608/CF-07 departs the Queen Elizabeth with the nozzle of its Pratt & Whitney F135 engine pointing downwards, providing the push to get it off the deck
3 MAW/1st Lt Zachary Bodner

Commodore Steve Moorhouse, Commander UK Carrier Strike Group, was responsible for the 14 F-35Bs while they were operating from the HMS 'Queen Elizabeth', the largest air group of fifth-generation fighters ever put to sea

All four 617 Sqn F-35Bs sit on the deck, with two VMFA-211 flanking them. Five more from the squadron sit opposite

A 617 Sqn F-35B taxis out, while an anti-submarine warfare Merlin HM2 hovers behind, probably tasked for search and rescue standby USMC



With a sovereign British core, the carrier strike group is not just a new capability for the UK; it is a new capability for NATO and for the United States too

Commodore Steve Moorhouse,
Commander UK Carrier Strike Group

the CSG, having been the first USMC F-35B unit to go to sea. In mid-2018, the 'Wake Island Avengers' squadron deployed aboard the Wasp-class amphibious ship, USS *Essex* for eight months. The aircraft operated over Afghanistan, Iraq and Syria from the LHD with the embarked 13th Marine Expeditionary Unit (MEU).

More importantly, the cruise would have tested the operational deployment doctrine, as the USMC worked out how to use the aircraft on such deployments. No 617 Sqn and the wider UK Lightning Force community will undoubtedly have learnt from this invaluable experience during the *Queen Elizabeth* cruise.

VMFA-211, commanded by Lt Col Kyle B Shoop, flew more than 50 days of combat, totalling 1,200 flight hours during its deployment. Shoop handed command over to Lt Col Joe Freshour in June 2019 who, before flying to HMS *Queen Elizabeth* on September 23, said: "The Wake Island Avengers are ready in all respects to work with the British sailors and aircrew on board HMS *Queen Elizabeth*. We are looking forward to deploying alongside our British counterparts over the next few months, and we will work tirelessly as a part of this transatlantic naval force.

"We are proud to play such an important role in the generation of allies' carrier strike capability."

The 617 Squadron's Commanding Officer, Royal Navy Commander Mark Sparrow, added: "This is an incredibly exciting time for 617 Squadron as we begin a new era of partnership with the US Marine Corps, building towards next year's operational deployment with HMS *Queen Elizabeth*.

"You need to go back more than three decades to find the UK operating anything on this scale or complexity, and this is a first for fifth-generation carrier capability. The era of big deck, fast-jet carrier operations is back."

During the time at sea, the CSG was tested for its survivability, which included Royal Navy Hawk T1s from 736 NAS simulating missile attacks, while Cobham/Draken Dassault 20s pitted their electronic warfare wizardry against ship systems. Garvie Island, off north-west Scotland, was used as a range by the F-35Bs for dropping live ordnance. After leaving the carrier for RAF Marham on October 13, the USMC and 617 Sqn had six days rest before both units participated in Exercise Crimson Warrior. This was hailed as one of the largest flying exercises in the UK in recent years,

and ran until November 4. Meanwhile, the Dutch HMLNS *Evertsen* (F805) was part of the nine-vessel CSG participating in this historic cruise. It is one of four De Zeven Provinciën-class frigates of the Royal Netherlands Navy.

Cdr Rick Ongerig, Commanding Officer of HNLMS *Evertsen*, said: "The Royal Netherlands Navy and the Royal Navy have been very close maritime partners for decades. Our marines have been working together through the UK-Netherlands Amphibious Force for almost 50 years and our ships regularly undertake fleet operational sea training in the UK.

"However, the opportunity to accompany HMS *Queen Elizabeth* is a new experience and HNLMS *Evertsen* is excited to be working with the UK Carrier Strike Group during Exercise Joint Warrior this October."

Helicopter upgrades

Both HMS *Defender* and HMS *Kent* hosted a single 815 Sqn Wildcat HMA2 on board, normally to help protect the CSG from any surface threats, as well as fulfilling other vital roles, such as search and rescue and delivering the post.

For the CSG21 cruise next year, the Wildcats will field two new anti-surface



CLOCKWISE FROM LEFT: Eight Merlins deployed to HMS Queen Elizabeth, including six HMA2 anti-submarine warfare helicopters from 820 NAS. One prepares to land as another departs
3 MAW/1st Lt Zachary Bodner

HMS Queen Elizabeth with all 14 F-35Bs and two Merlins visible. Note the black spots on the landing pads where the F-35B engines have burnt the deck
USMC

The first five VMFA-211 F-35Bs to arrive at RAF Marham, on the evening of September 3, taxi to their parking slots
USMC

Interoperability and interchangeability are key words for future US-UK carrier operations. A VMFA-211 F-35B sits on the deck, while a 617 Sqn jet prepares to land with its engine already taking the strain

The HMS Queen Elizabeth aircraft carrier with some of the CSG vessels

weapons, even if the timescale does look a bit tight. Work is under way on integrating both the MBDA Sea Venom anti-ship missile (to succeed the Sea Skua short-range air-to-surface missile) and the Thales Martlet Lightweight Multirole Missile (LMM) on to the helicopters before they deploy mid-2021. Manufacturer MBDA successfully carried out the first qualification firing trial of this Sea Venom missile on February 20, albeit from a SA365 Dauphin, at the DGA Essais de missiles (DGA EM) test site at

Île Du Levant. And on May 24, the Royal Navy announced the Thales Martlet LMM had been fired from a Wildcat, in a range off the coast of Wales. A lower-cost weapon, the Martlet is for use against asymmetric targets such as suicide boats or unmanned surface vehicles – the kind of threats CSG21 could encounter while passing through the Persian Gulf or off the Gulf of Aden. Swarming by unmanned boats or air systems with low radar signature pose a real threat and the Royal Navy's solution

is to use the Wildcat's MX-15Di EO/IR laser turret to guide the Martlet. According to a 2019 UK Ministry of Defence equipment plan published in February this year, there was to be a 15-month development delay with Sea Venom due to 'design issues with sub systems', meaning initial operational capability (IOC) would not be reached until 2022. But as Cdre Orchard said in April: "While that's true, IOC is a wide ranging description to include full support contracts, spares, war stock, etc and not

CSG: The nine ships

In addition to the HMS *Queen Elizabeth* aircraft carrier, the Carrier Strike Group included the Royal Navy's Type 45s HMS *Diamond* and HMS *Defender*, and US Navy Arleigh Burke-class USS *The Sullivans*, as well as frigates HMS *Northumberland* and HMS *Kent* from the UK and the Dutch Navy's HNLMS *Evertsen*.

They protected the Queen Elizabeth-class carrier from enemy ships, submarines, aircraft and missiles, and were also capable of conducting a range of supporting missions, from maritime security to disaster relief. Two Royal Fleet Auxiliary ships, RFA *Tideforce* and RFA *Fort Victoria*, supplied fuel, food,

spares and ammunition to enable sustained operations from the sea without host nation support. Commander Vince Owen, Commanding Officer of HMS *Defender*, said: "Providing air and missile defence to a carrier strike group is exactly the task HMS *Defender* and the Type 45 has been designed to do."



You need to go back more than three decades to find the UK operating anything on this scale. The era of big deck, fast jet carrier operations is back

Royal Navy Commander Mark Sparrow, 617 Squadron



just the ability to shoot the missile. So, we will deploy Sea Venom ahead of IOC.

"The priority order for firing [from Wildcat] is Martlet first and then Sea Venom. MBDA has already risk-reduced the Sea Venom programme with a successful test-firing from a Dauphin, allowing the FAA [US Federal Aviation Administration] to be really comfortable, so, by the time the firing from Wildcat

occurs, that will be relatively low risk.

"Other rotary assets involved in CSG21 will include the Crowsnest Merlin, tasked to protect the air space around the carrier task group, alongside the air defence capabilities of the Type 45 destroyers. All 30 Royal Navy Merlin HMA2s will be modified to house the system, although only five will have the system at any one time." He added: "As part of the



Joint Warrior 20-2

The carrier strike group was put through its paces off the north east coast of Scotland as part of Joint Warrior, NATO's largest annual exercise. JW 20-2 ran from October 5-15, and, like any other JW exercise, incorporated surface, subsurface, airborne and land assets. This provided joint training in a multi-threat environment for NATO units, and forward-deployed naval forces (FDNF), preparing them to operate as part of a Combined/Joint Task Force. Unlike previous Joint Warriors, a huge contribution came from the HMS *Queen Elizabeth* and its deployed assets.

Crowsnest flight trials, we are going through radar powered flight. We are testing the hardcore mission system, and the data we have gathered has allowed us to refine it before going to sea next year.

"I have the option once all the hardware and flight clearances have been sorted, to work on the software during the deployment if required."

With the helicopters operational, the CSG will go through another work-up in early 2021, before heading off on its first operational cruise – undoubtedly with some great military pomp, if these latest manoeuvres are anything to go by. **AI**

Checking In

What are your thoughts on why the UK only mustered four of the 14 F-35B Lightnings deployed to the HMS *Queen Elizabeth*?

Share your opinions, email: airinternational@keypublishing.com under the subject heading *Checking In*.

"We're putting a stake in the ground.
This is an incredible ambition:
we are talking about delivering
emission-free flight to society"

Glenn Llewellyn,
Airbus's vice-president zero-emission aircraft



ZERO-

on cleaner flight

In line with the 2015 Paris Agreement, which seeks to hold the increase in the global average temperature to below 2°C, the aviation industry – through the International Civil Aviation Organization – has committed to halving carbon dioxide (CO₂) emissions by 2050 compared with the 2005 levels, and eventually move to zero carbon.

Even with the spectre of COVID-19, which has caused a near-complete collapse in air travel and means survival is the name of the game for the airline

industry, sustainability has been a key theme at various industry conferences and presentations this year.

When attending these events, the industry has been clear that it feels recovering from the effects of coronavirus and reducing aviation's environmental footprint are inextricably linked.

As Airbus's chief technology officer, Grazia Vittadini, remarked in September: "Even before the crisis it had become an acknowledged view that protecting our climate and environment are the key,

indispensable factors upon which we have to build the future of flight."

Bold vision

Vittadini made her comments at the launch of the Airbus ZEROe project, which is exploring three concept aircraft powered by hydrogen: a blended wing body, a turbofan airframe and a turboprop.

Hydrogen-powered aircraft constitute a new flank in the multifaceted efforts to reduce aviation's climate impact, which has seen efforts in various areas such as new



ing in

Is hydrogen the solution to a cleaner future for commercial aerospace? **Mark Broadbent** looks at Airbus's concepts for jet and turboprop airliners powered by a technology that it claims can significantly reduce aircraft emissions

Airbus is exploring three hydrogen-powered concepts Airbus

engines, sustainable aviation fuels, electric/hybrid-electric concepts and more efficient operational procedures and infrastructure.

Airbus believes hydrogen has huge promise. It stated: "Only the most disruptive zero-emission technology to reduce the aviation industry's climate impact will need to be rigorously tested and evaluated. Hydrogen certainly stands out from the pack: according to internal calculations, Airbus estimates hydrogen has the potential to reduce aviation's CO₂ emissions by up to 50%."

Vittadini explained: "Hydrogen has the same energy level as kerosene, granting the same type of range and performance [as a current-generation aircraft] with one third of the weight. Hydrogen can be combusted directly through modified gas turbines, converted into electric energy thanks to fuel cells and, combined with CO₂, can be used to produce synthetic kerosene.

As Airbus has noted, the perception of hydrogen has "undoubtedly been negatively shaped by incidents like the 1937

Hindenburg disaster." A World Economic Forum survey found less than half of respondents believed hydrogen is viable.

However, the same study found 73.2% of participants said they were willing to use hydrogen-powered modes of transportation. Airbus said: "As hydrogen increasingly becomes a mainstay in the development of new transport solutions like cars and buses, public perceptions on hydrogen are likely to change, which should positively influence hydrogen adoption in aircraft."





Striking concepts

Airbus's ambitious goal is to develop and introduce the world's first zero-emission commercial aircraft by 2035.

A blended wing-body airframe is the most striking and futuristic-looking of the ZEROe concepts. Building on Airbus's Maveric project, it is designed to carry up to 200 passengers on flights of

around 2,000nm. The other two designs are a narrowbody twin-engine airliner capable of carrying between 120 and 200 passengers on sectors of around 2,000nm, and a 100-seat twin turboprop with a range of around 1,000nm.

Airbus said: "These concepts each represent a different approach to achieving zero-emission flight, exploring

various technology pathways and aerodynamic configurations."

Broadly, there are two types of hydrogen propulsion for aircraft: combustion (burning liquid hydrogen as fuel in modified gas-turbine engines) and fuel cells (delivering extra electrical power to complement the gas turbine). All three ZEROe concepts are described

CLOCKWISE FROM TOP LEFT: An infographic showing the key attributes of each proposed aircraft Airbus

The blended-wing is the most striking concept Airbus

Before focusing on hydrogen, Airbus has explored hybrid electric flight alternatives. It partnered with Rolls-Royce and Siemens on the E-Fan X project, which would have involved the test-flying of an Avro RJ100, but this was later shelved Airbus

A World Economic Forum study found that the previously negative perception associated with hydrogen power by the general public has eased thanks to its increased use by other transportation, such as London buses

Flick Commons/citytransportinfo

Airbus has already developed electric-powered demonstrators, such as the CityAirbus urban mobility design. Flight research data gained from past electric projects can be transferred to ZEROe Airbus





by Airbus as being 'hydrogen hybrid' aircraft as they use both power sources, but the company noted: "Each option has a slightly different approach to integrating the liquid hydrogen storage and distribution system... that carefully take into account the challenges and possibilities of each type of aircraft."

The blended wing body's configuration,

with the wing merging into the main structure of the aircraft, creates what Airbus calls "an exceptionally wide interior, opening up multiple options for hydrogen storage and distribution. In this example, the liquid hydrogen storage tanks are stored underneath the wings." Both the narrowbody jet and the turboprop have liquid hydrogen powering their modified

gas turbine engines. The Hydrogen is stored and distributed from tanks located behind the rear pressure bulkhead.

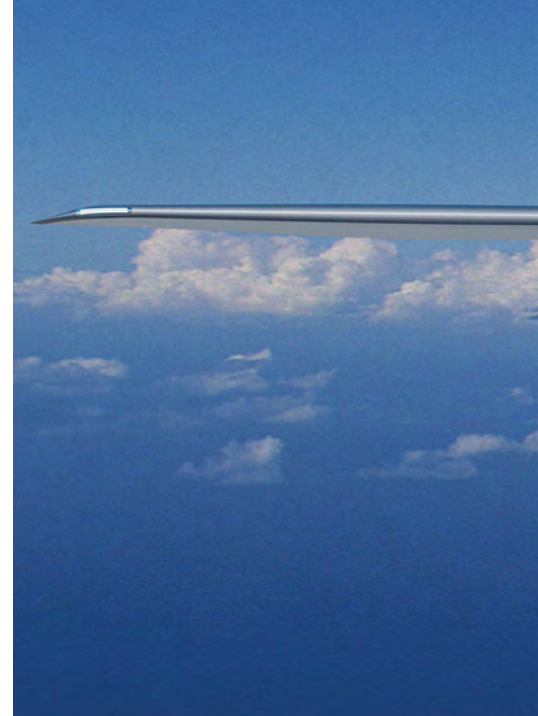
Exploring new ideas

During the briefing, Airbus's executive vice-president of engineering, Jean-Brice Dumont, emphasised that ZEROe is "not a programme, because we cannot say what the market is for these aircraft." Rather, the project is about advancing understanding of hydrogen technologies and de-risking promising solutions. Dumont noted: "This means the visual appearance of our future zero-emission aircraft will change. These three configurations provide us with some exciting options for further exploration."

Hydrogen does present challenges, said Vittadini: "The catch is in the volume, which is four times as much as kerosene, so tank design and integration onto an aircraft are fundamental. Hydrogen has one of the smallest molecules you can have. There is a question over storage. We have to study other options and aircraft architectures than existing ones."

Cryogenic characteristics are another "fundamental" to be studied, she added: ➔





"Hydrogen is a gas that turns into a liquid at -235°C , so it will be key to bring it to that temperature and keep it there throughout all phases of flight."

Technology demonstrators

To investigate all of this and still achieve the 2035 service-entry goal, Airbus will be conducting demonstrations to identify viable aspects of hydrogen technology and ensure that they meet what Dumont called "key parameters" including safety.

He said: "We need three to five years to mature our technologies, have done

The practicalities of using hydrogen will be important in any future take-up of the technology. With the aviation industry based around Jet A-1, Vittadini acknowledges any large-scale global transfer to hydrogen "will require a rethink of several elements of our intricate aviation ecosystem."

On this point, Airbus says it has already started collaborating with undisclosed airlines, energy companies and airports to address the complex infrastructure needed to support hydrogen propulsion for aviation. This work relates not only to aircraft, but also to research on how

shelved in April. Airbus also previously explored electric flight with its Vahana and CityAirbus urban mobility demonstrators.

Airbus's vice-president of zero-emission aircraft, Glenn Llewellyn, acknowledged the change of tack: "As recently as five years ago, hydrogen propulsion wasn't even on our radar as a viable emission-reduction technology pathway. But convincing data from other transport industries quickly changed all that."

Speaking during the ZEROe launch, Llewellyn added: "Our experience shows us that battery technology is not moving at the pace we want, and this is where



'Hydrogen certainly stands out from the pack: according to internal calculations, Airbus estimates hydrogen has the potential to reduce aviation's CO₂ emissions by up to 50%'

Grazia Vittadini, Airbus's chief technology officer

the homework on the concepts and be in a position to say 'This is the one we're going to launch'."

Airbus will test hydrogen fuel cell and hydrogen combustion technologies in the coming months. The company's objective is to have a hydrogen-powered ground demonstrator ready in 2021 to address the most complex technical issues such as storage and cryogenic characteristics.

A flying zero-emission demonstrator will then be developed for further tests, with a first flight projected for 2025. This will, Vittadini said, "de-risk fuelling and the safe storage and distribution of hydrogen on an aircraft" before a full-scale prototype arrives in the late 2020s.

ground transport such as cargo trucks, passenger buses and aircraft tugs might be decarbonised during the 2020s to help pave the way for hydrogen.

A new path

Hydrogen is a step away from Airbus's earlier efforts on advancing zero-emission air transport, which were focused on electric and hybrid-electric technologies.

The company had been preparing to test fly an Avro RJ100 fitted with a hybrid-electric engine from Cranfield Airport, Bedfordshire in its E-Fan X project, a partnership with Rolls-Royce. This venture, which followed earlier, smaller E-Fan demonstrators, was

hydrogen comes in. It's got several thousand times more energy per kilogram than batteries have."

Llewellyn believes "batteries have their place in aviation; they can definitely power small applications [such as] urban air mobility," but he said: "We don't believe that today it is a relevant technology for large commercial aircraft, and we see hydrogen having much more potential."

Vittadini said Airbus's new focus does not mean the previous electric flight research will go to waste. She noted that running gas turbine engines on hydrogen requires "new injection principles and new combustion chambers where we will have an embedded electric motor."



Knowledge about electrification gathered on the previous projects will therefore “flow seamlessly” into ZEROe and the company’s work on electric technology will continue, she confirmed.

Major goals

Despite the inevitable pressure on aircraft manufacturers’ revenues and profits due to COVID-19, Vittadini said Airbus is willing to invest “billions” in hydrogen technology and that its efforts will lower the entry barriers to using the fuel.

Llewellyn said: “This is what [aviation] needs to meet the Paris Agreement

targets and, as the scale is increased, the costs will come down. All the predictions show that the energy network needs to evolve significantly. We’re putting a stake in the ground. This is an incredible ambition: we’re talking about delivering emission-free flight to society.”

Vittadini acknowledged the sector needs “a united front across industry, the political arena and research institutes” to make the hydrogen transition happen, but added: “It is one of the most promising technology vectors to allow the human need for mobility in better harmony with our environment. Asking whether to

CLOCKWISE FROM TOP LEFT: The blended wing concept builds on Airbus’s Maveric project, which was launched earlier this year at the Singapore Airshow Airbus

The turboprop will accommodate 100 seats and have a 1,000nm range Airbus

Hydrogen fuel will be carried behind the rear pressure bulkhead on the twin-turboprop jet Airbus

Grazia Vittadini, Airbus’s chief technology officer Airbus





LEFT: All the ZEROe concepts present a different approach to achieving zero-emission flight Airbus

BELOW: If hydrogen power is chosen as a viable alternative to JET A-1 fuel, then a complex infrastructure will need to be developed at airports across the globe

AirTeamImages.com/Stuart Lawson

develop a new aircraft economically or environmentally is a false choice. We need to bring the two together and COVID-19 is dialling up the urgency. When it comes to environmental responsibility, we do not have a choice.”

Moving to a sustainable future

As the Air Transport Action Group’s Waypoint 2050 report, published in September 2020, noted, “a range of actions” is needed to help reduce emissions. Disruptive new technology such as the Airbus ZEROe concepts is only one way to reduce the sector’s climate impact. Others are electric and hybrid-electric aircraft, sustainable aviation fuels, operational and infrastructure improvements, such as more efficient flight paths and carbon offsetting schemes.

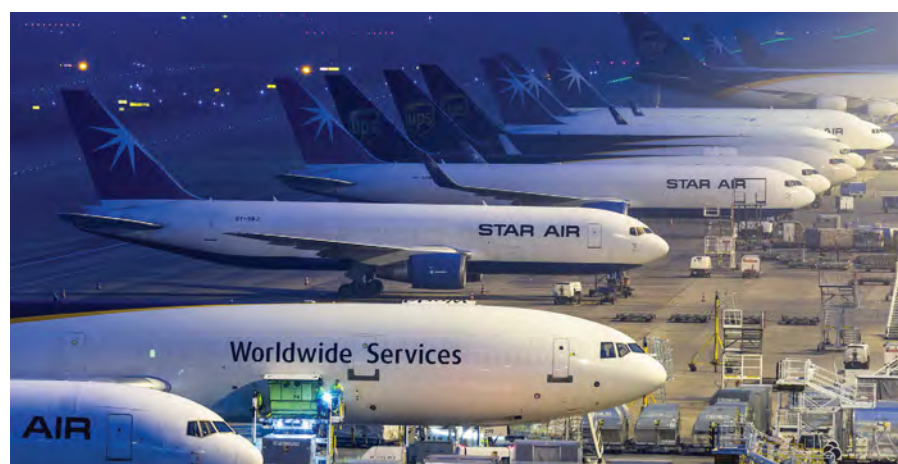
A wide collaboration will be required to make changes, the report said, involving not just the aviation industry’s airlines, airports and manufacturers, but governments, research organisations, the finance community and the energy sector.

Waypoint 2050 sounded a note of realism: “There are always trade-offs... Accelerating the development of new technology comes with a significant price tag that will need to be borne by players across the aviation system. This is already

going to be challenging enough in the context of the current 2050 goal of -50% CO₂ emissions. If airlines are investing in new aircraft, they may have less ability to also invest heavily in sustainable aviation fuel scale-up. Some significant decisions need to be made: does it make more sense to have a singular focus on traditional liquid sustainable aviation fuels or wait a decade for electric or hydrogen aircraft to be available? The sector will need to investigate all options and pursue those that make the most sense, but there is unlikely to be bandwidth, financing or resources to push all levers at once.”

Another factor highlighted by the report is the economy’s wider energy transition: “Public policy support, political willingness and early engagement with energy providers are needed to incentivise the mix of options the sector needs to transition towards ambitious goals.”

Financing the changeover is a further question: “Innovative solutions may need to be developed to support the sector with investments in key areas to push the mix of options the sector urgently needs.” Technology development has to “be maintained and even increased” and new policy may be required to incentivise the move to new technologies. **AI**



200
seats on blended wing body

2,000
nautical miles blended wing body range

120-200
passengers in the twin-jet

2,000
nautical miles twin-jet range

100
seater turboprop

1,000
nautical miles turboprop range

2035
service entry

AIRBUS A350 - A FULL-BODIED TWIN

KEY
PRESENTS

SPECIAL
EDITION

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AIRBUS A350



NEW

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In the midst of surging internal turmoil in Israel, caused by the effects of COVID 19, the 117 'First Jet Squadron' based in Ramat David Airbase has shut down.

On September 30, 2020, having operated continuously for 67 years, the Squadron landed its F-16C Block 30 'Barak' aircraft in the Jezreel valley for the last time. In what turned out to be an ad hoc ceremony, thanks to the harsh restrictions imposed due to an outbreak of COVID, a contingent of pilots were forced to conduct 'fini flights' several weeks earlier, in an effort to create a more effectively socially-distanced event.

18 F16Cs participated in the flight which included several airframes from the 115 Flying Dragons based out of Ovda AFB. There was also a single photoshop from

the neighbouring 109 'Valley' Squadron.

The closure of 117 Squadron comes as the first step in a widespread and in-depth re-organisation of the IAF's order of battle. The plan, codenamed 'Momentum' was conceived by Israeli Air Force Commander General Amikam Norkin, and it's intended to give the IAF flexibility towards planning for its future. Some of the plan's main objectives include:

- Closing Ramat David's 117 Squadron and moving Hatzor AFB's two F-16 Squadrons (101/105) to Ramat David.
- Moving Ramat David's 193 Squadron, which is set to transition from SA365 Panther helicopters to refurbished ex-USN Seahawk helicopters, to Palmachim AFB.
- Turning Hatzor AFB into a UAV-focused base, while also transferring the IAF's

light transport squadrons there.

- It's also planned that 117 Squadron will re-open as an F35 squadron in 2023.

Location. Location. Location

The Squadron's location, in Ramat David in Northern Israel near the border with Syria and Lebanon, provided it with a high operational tempo over the past decade.

With the Civil War in Syria turning into an Iranian entrenchment on Israel's borders, the 117 got up close to the action significantly more than other IAF frontline Squadrons, on a daily basis.

During the early stages of the civil war in Syria, when Israel's shadow war with Iranian forces was in its infancy, the IAF was extremely secretive about its cross-border strikes against weapons convoys



This dramatic shot shows F-16 number 307 of 117 Squadron taking off from its base on another sortie. Given its proximity to the Syrian and Lebanese borders, the Squadron is on constant alert All images Yissachar Ruas



The Israeli Air Force's First Jet Squadron Sundowns in the Valley, reports **Yissachar Ruas**



Last of the First



making their way from Iran to Hezbollah terrorists in Lebanon.

On April 25, 2013, in what would seem like a retaliation operation of sorts, a UAV operated by Hezbollah terrorists infiltrated the border between Israel and Lebanon. An F-16 from the 'First Jet' was scrambled to intercept it before it could reach Haifa, which is where it seemed to be vectored towards. The 'Barak' shot the UAV down, approximately five miles from Haifa, using a heat-seeking missile, though it was not reported at the time if it was a Sidewinder or a Python 4/5, both of which are employed by 117's Vipers.

The war in Syria, taking place on Israel's northern border, meant that the 117 had to be constantly on alert should the situation escalate. Since 2018, with the winding down of Civil War and Syria relinquishing sovereignty to the Iranian Quds Forces, the Squadron, along with the rest of the IAF, has seen more high-intensity action on the Northern Front. The constant threats from Hezbollah leader, Hassan Nasralla, along with potential retribution for the targeted killing of the head of the Quds Force, Kassem Suleimani, by an American drone strike, meant that the 117 is always poised to strike.

The 'First Jet' Squadron derives its name from its pioneering days as Israel's first jet-engine equipped Fighter Squadron. Established on June 17, 1953, with the arrival of two Gloster Meteor aircraft, nicknamed 'Sufa' and 'Saar', they stood as the IAF's vanguard, along with their tough-as-nails CO, Lt Col Menachem Bar. Bar was known for being a no-nonsense,





tough-to-please Commander at the time, in contrast to the 101 CO, the flamboyant, RAF veteran Ezer Weizman.

Record makers

Although the 117 is arguably considered less-famous than its F-16C sister squadron, the 101, the 117 has racked up quite a few firsts for itself in the IAF history books.

For example, the 117 scored the IAF's first jet kill in 1955, against Egyptian Vampires. In 1966, following their transition to the Mirage 3C, they were the first to score a kill with the Mirage in Israeli service. It would come as no surprise that, as the first operator of the F-16 in the IAF, it scored the type's first kill worldwide, against a Syrian Mil 8 that was in violation of the demarcation line in Lebanon. But, despite the 117's long list of air-to-air kills (120+), it is probably most well-known for its role leading the raid against the Iraqi Nuclear Reactor at Osirak, outside the capital of Baghdad.

A fleet of new F-16s originally intended for Iran, in a strange turn of events, found its way to Israel. These box-fresh Block 5 Vipers were nicknamed 'Netz', and they were to be the spearhead of that (in)famous attack. Led by their CO at the time, Zeev Raz, two formations of four aircraft undertook the mission, with the second four-ship belonging to the 110 Squadron.

117 Squadron upgraded its 'mount' in 1987, from the F-16A to the current F-16C. The aircraft they have flown over recent decades is significantly more advanced than the aircraft they initially received, and it's capable of employing a much wider array of weapons. The bulk of their new capabilities are Israeli-made, air-to-air missiles such as the Python and air-to-ground munitions such as the Spice 1000, more commonly known as the 'Baby Spice'.

The 117 and its aircraft also became something of an attraction in Europe in recent years, having participated in 2011 in Italy in the 'VEGA' exercise in Decimomannu AFB, and then the INIOHOS exercises in Greece in 2016, 2018 and 2019.

The closure comes at a time of severe economic crisis in Israel. While the plan to close the squadron was made prior to the worldwide COVID 19 crisis, it is unclear just how much the pandemic will affect the IAF, which has been operating without a planned budget for the past two years, and there's nothing in sight for the foreseeable future.

One thing is certain, the men and women of the 117 can look back with pride on the legacy they have created for the rest of the IAF to follow, and the enviable and fearsome reputation it has developed all around the world. **AI**

CLOCKWISE FROM TOP LEFT:

The F-35 may be coming, but the reliable and 'battle-hardened' F-16 will always have a place in Israeli hearts

Fully-armed, F-16 number 340 climbs on afterburner, while celebrating its shooting down of a Hezbollah UAS

The 117's tail livery originally had a lightning bolt, as can be seen on the rear aircraft. This compares with the current scheme, which applied until the squadron's closure

The 117 periodically supplied 'Blue Air' for various large-scale exercises in Israel. Here a 'fully-fuel-tanked' F-16 from 117 Sqn is pictured with a 'Red Air' F-16C from the Flying Dragons Squadron (115)



‘The F-35 has low drag but bleeds energy quickly. However, the engine is very powerful so you can get that energy back fast’

Lt Col Robert Peel, commander of the 158th Operations Support Squadron



Exercise Northern Lightning 2020 took place during late summer at Volk Field ANGB, Wisconsin. **Ivan Voukadinov** caught up with all the action

An F-35A Lightning II, assigned to the 158th Fighter Wing, Vermont Air National Guard, takes off from Volk Field Air National Guard Base, Wisconsin, during Exercise Northern Lightning
All photos by Ivan Voukadinov unless stated

Northern Lightning, a high-end exercise in the United States' Midwest, once again brought jet noise to the usually placid skies of Wisconsin. Although it has been held since the early 2000s, the exercise has been steadily growing and gaining popularity since being scaled up in 2015 with the integration of fourth and fifth generation platforms. Northern Lightning is one of seven Air National Guard jointly accredited exercises held at a Combat Readiness Training Center (CRTC), of which four are found on the US mainland.

The set-up

This year's Northern Lightning took place between August 10 -21 and, despite the current COVID-19 situation, still attracted around 50 aircraft and 1,000 military personnel from the Air Force, National Guard, Navy and Marines. Most deployed to Volk Field in central Wisconsin, usually quiet throughout the year since there are no permanently based flying units there. There is, however, a mobile radar/communications unit, the 128th Air Control Squadron (128th ACS) which supports air operations from the ground and provides command and control for airspace users during Northern Lightning.

A fistful of fighters



The Volk Field CRTC boasts a great training environment with first class air-to-air and air-to-ground opportunities and more than 30,000 cu miles of fully instrumented airspace – the perfect setting for this type of advanced training. The ranges provide a full spectrum of target sets that support live, laser, GPS-guided munitions, moving strafe and synthetic aperture radar (SAR) targets. There is also a state-of-the-art Electronic Warfare (EW) range with integrated stationary and mobile threat emitters capable of replicating enemy air defence systems.

Northern Lightning began as an annual exercise, but in 2018 and 2019 grew into a biannual event with a small edition in

the spring, followed by the larger one in August. In 2020, it again became annual, with the missions focused heavily around Opposed Air Interdiction (OAI) against a highly integrated air defence system composed of capable surface-to-air and air-to-air threats in a contested/degraded operationally limited (CDO) environment.

The missions and scenarios were heavily reliant on the execution of suppression/destruction of enemy air defence (SEAD/DEAD) and close air support (CAS). Offensive counter air (OCA) was also practised as the scenarios each day always involved a 'red air' component. The organisers built each day's scenario

based on the units' needs and what they wanted to achieve, so while the general 'blue air' versus 'red air' guideline was always followed, there were different components and mixes of each depending on the mission parameters. The scenarios take into consideration modern near-peer adversary capabilities in order to provide a complex and dynamic threat environment.

Who took part

With slightly fewer participants than the 2018 and 2019 editions of Northern Lightning, the most important ones this year were the F-35A Lightning II aircraft from the 158th Fighter Wing (158th FW),

Fourth against fifth

Commander Peel explained the nuances of flying with and against the F-22:

"We were able to use our sensors to negate them as a threat. There are definitely some distinct advantages of the F-22 even against the F-16, which is considered a dogfighting machine. But it comes down to the pilot a lot of the times. If you can negate some initial shots and/or get an F-22 outside of their power and energy advantage, the F-35 does quite well."

He continued: "I've seen F-35s going out and beating F-16s and F-22s and also losing to both of those platforms. A lot of that comes with the pilot – the machine obviously helps, but if the pilot doesn't know how to fly that machine it doesn't do much good. There are definitely some distinct advantages in the sensors and capabilities of the F-35 that the F-22 doesn't have, so taking advantage of that in the BFM fights is crucial."

"The F-35 has low drag but it bleeds energy rather quickly. However, the engine is very powerful so you can get that energy back pretty fast. For BFM [basic fighter manoeuvres] in the F-16 you always wanted to stay fast, whereas the F-35 has some great slow speed manoeuvring that the F-16 didn't have, such as being able to fly at a high AOA [angle of attack]. Again, it all depends on the pilot. You have to know the strengths and weaknesses, and capitalise on them."

Lt Col David Delmage, an F-22 pilot and commander of the 27th FS, tells his side of flying with and against the F-35: "The F-35 is much more survivable than legacy aircraft. Their situational awareness is much higher due to their advanced systems and they are better protected based on their stealth. They are easier to protect from enemy air threats and they can get closer to the surface threats the same way we can."

On the downside, Delmage said: "The F-35 is more limited on weapons. They are a smaller aircraft and carry less, and since everything has to be internal it further restricts the number of missiles especially if carrying air-to-ground ordnance as well. So, we have to be careful about weapons allocation and when/where to use them in the air-to-air role."

"As far as flying against them, it can be very tricky to try to run our normal tactics versus a stealth adversary. The F-35 integration is newer and we've had less experience with that type of fighting so it's a bit more valuable at this point. It's an emerging tactic that is going to be a factor for a long time into the future."

also known as the 'Green Mountain Boys', from Burlington, Vermont. A total of 12 F-35As, 24 pilots, and more than 100 supporting personnel deployed to Volk Field for the exercise. This is a significant milestone as it was the first deployment ever of an ANG squadron equipped with the F-35. It was also the first major deployment of the squadron since the transition to the F-35.

The flying component of the 158th FW is the 134th Fighter Squadron (134th FS), which took its first deliveries of the F-35 in September 2019 and until the start of the exercise had a total of 16 jets on strength. Almost all of the squadron's available F-35s were deployed, demonstrating the high level of readiness already achieved. Lt Col Robert Peel, commander of the 158th Operations Support Squadron said: "Right now, we're in conversion so we're trying to go through a phased approach of getting our pilots up to speed and we haven't even accepted all of our airplanes yet. This is our first opportunity

A difference this year was that the 27th FS deployed eight F-22s and 20 pilots to Volk Field for the duration of the exercise; in previous years bad weather on the route to/from Volk Field had sometimes caused cancellations.

All the 27th FS F-22s had received the Block 3.2B software update, which allows the use of AIM-9X Block 2 and AIM-120D missiles. Use of both was simulated during manoeuvres. Also flying from Volk Field each day were T-38s from the 71st FTS (Fighter Training Squadron) as well as civilian contracted L-159E 'Honey Badgers' from Draken International.

The US Navy participated with five VFA-151 'Vigilantes' F/A-18E Super Hornets from Naval Air Station Lemoore, California. Additional participants flew from their home bases in the vicinity including F-16Cs from the 115th FW in Truax Field ANGB, Madison, Wisconsin, the 148th FW from Duluth ANGB, Minnesota and the 114th FW resident at Joe Foss Field ANG, Sioux Falls,



to go on the road and exercise our basic functions, being able to fly on the road with operations, maintenance, execute a daily schedule and gain exposure of these missions and understand the nuances of working with several different platforms both with the USAF and the Navy."

The 134th FS previously flew F-16C/D Block 30 aircraft primarily in the CAS role. With the change of aircraft also came a change of primary mission as the 158th FW is now a SEAD-focused squadron, using the F-35A in the 'Wild Weasel' role.

Most other participants were 'regulars' that have been coming to Northern Lightning for the past few years, including F-22s from the 1st Fighter Wing/27th Fighter Squadron. As in previous editions, the Raptors flew from Joint Base Langley-Eustis each morning, refuelling en route. They would join the fight, then land at Volk Field to refuel and swap crews before doing it all again in reverse order.

South Dakota. Supporting the exercise were tankers from various units, mainly KC-135Rs of the 128th ARW, which flew direction from their home at General Mitchell Air National Guard Base in Milwaukee, Wisconsin.

Blue against red

During the two-week exercise, 658 sorties were flown, consisting of a morning and afternoon wave each day. The scenarios varied but always featured 'red air' and 'blue air' components. Missions typically required the 'blue' team to eliminate targets in the 'red' airspace, which were heavily contested and defended not just by the 'red' aircraft but also by various ground-based enemy air defences.

The F-35 and F-22 units were usually working together flying 'blue air', with the F-22 trying to achieve air dominance and protect the strike assets. The main platform driving the scenarios was



the Vermont F-35s, so the majority of missions were heavily SEAD-focused.

An F-35 pilot, Commander Peel said: "We're trying to gain experience with the SEAD role as well as integrating with other 5th/4th-gen platforms and practising multi-role air-to-air dissimilar air combat training (DACT). We try to work in conjunction either with other assets or other F-35s in order to take out critical nodes of integrated air defence systems and/or tactical SAMs that are a threat to strikers or coalitions assets in the AOR (area of responsibility).

"The F-35 has a pretty capable EW suite built into the airplane itself. If you were a Block 50 F-16 squadron, they have an HTS (HARM targeting system) pod and that allows them to detect threats

on the ground, and that's all internal to the F-35. We're able to detect and find SAM [surface-to-air missile] sites just with the F-35 itself and the EW system built into the airplane and we will use our bomb and missile load-out or our internal jamming to negate those threats. We're also integrating with the F-22s on 'blue air' to perfect tactics and our fighter integration, so we understand everybody's strengths and weaknesses and work together to negate threats."

It is worth noting the F-16s from the 148th FW in Duluth as well as the F/A-18Es from VFA-151 also sometimes flew SEAD during the exercise, integrating their tactics and strategies with the F-35. One technique was to use the advanced EW capabilities of the F-35 to penetrate the

CLOCKWISE FROM ABOVE:

Pilots of five F-35A Lightning IIs from the Vermont ANG prepare to put their helmets on for another mission. The unit had a 'Wild Weasel' role

The 1st Fighter Wing/27th Fighter Squadron flew F-22A Raptors from Joint Base Langley-Eustis each morning. Clearly evident here are the stealthy lines of the jets parked on the ramp for a turnaround and participation in the afternoon's proceedings

A VFA-151 F/A-18E Super Hornet from NAS Lemoore, California, departs Volk Field ANGB in full afterburner





air defence systems and provide targeting information to the older fourth generation aircraft which can then use their AGM-88 HARM missiles to eliminate the threats. The F-35 cannot carry HARM missiles. However, the F-35 (not surprisingly) held its own in the air-to-air game. The 'red' team with its T-38s and L-159s were always supplemented by other aircraft, such as F-16s and F/A-18s depending on the particular day's manoeuvres.

One of the more interesting scenarios included the Langley F-22s acting as 'red air' and simulating a near-peer adversary using fifth generation stealth aircraft. Impressively during this particular scenario, the F-35s flying with the other 'blue' players didn't take any losses, despite more than 30 adversaries.

Lessons learned

The 158th FW achieved another milestone in the course of the exercise, flying their 1,000th F-35 sortie since the conversion to the F-35 began last year. The challenges and learning opportunities still remain, however, as Lt Col Peel explained: "We're hoping that a year from now to be fairly well versed in all of the different types of missions we're expected to employ the airplane, in different theatres. We are still on the first third of that training window. Just gaining exposure and reps – this is the first time a lot of our pilots have been working into large force exercises in the F-35.

"The basic flying of the aircraft, we have at a high level coming out of training. It's the employment of the airplane that you

have to get exposure to, and this is our first step in the conversion process. There are things we have done with our tactics that haven't been perfect. The airplanes are performing great and I'd say it's more of our learning curve on our side. We're trying to figure out how we're going to work and employ with each other so there's more things that the operators themselves have done that haven't been efficient but nothing that can't be fixed with proper tactics."

It sounds like Northern Lightning was the ideal playground for the 'Green Mountain Boys' from Vermont as they approached the first anniversary of flying the F-35A. **AI**

CLOCKWISE FROM TOP:

Gear up and away! A 1st Fighter Wing F-22A Raptor departs on an afternoon mission. The Raptors worked with the F-35A as part of the USAF's 4th/5th generation aircraft integration

Another 'red air' asset was this two-seat AT-38B of the 71st Fighter Training Squadron 'Ironmen' from Joint Base Langley-Eustis

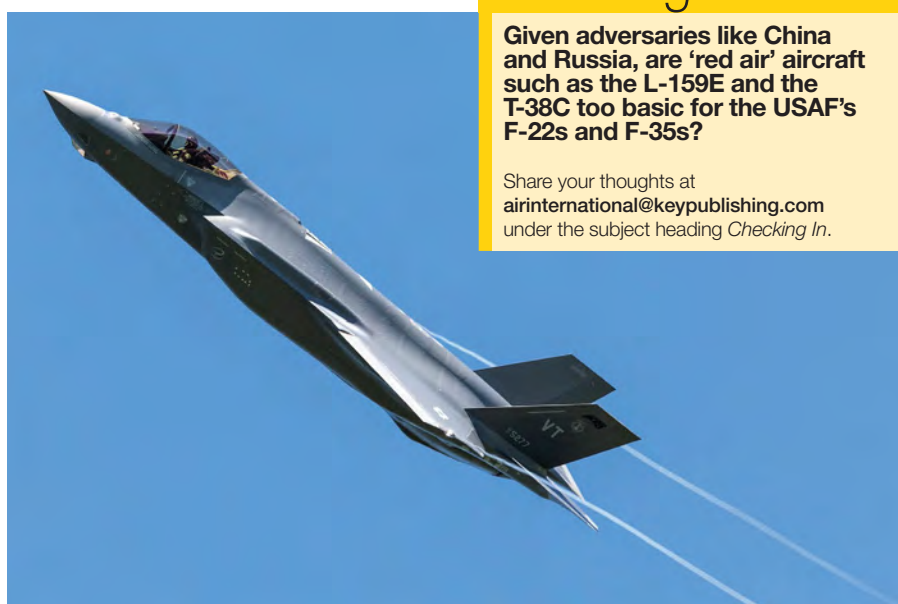
With contrails coming off the wings, a Vermont ANG pilot breaks his F-35A into the circuit to land

Draken International L-159E ALCAs were used as 'Red Air' during the manoeuvres

Checking In

Given adversaries like China and Russia, are 'red air' aircraft such as the L-159E and the T-38C too basic for the USAF's F-22s and F-35s?

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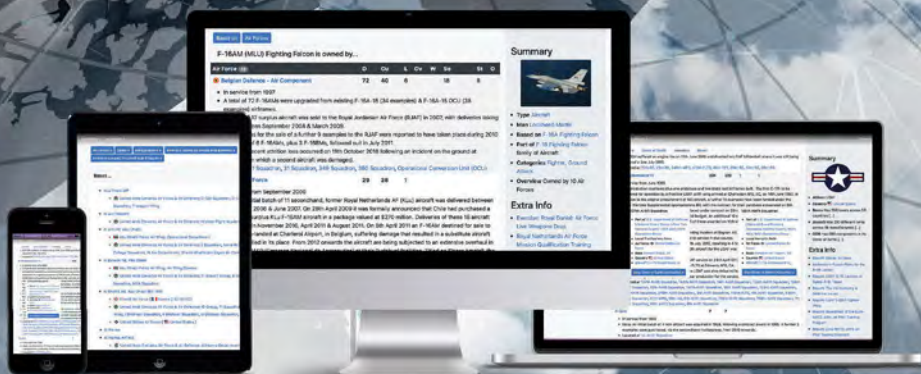
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race to the edge of space

Two rival companies are in an ambitious race to take commercial passengers into sub-orbital space.

Nick Spall investigates the craft and characters behind an incredible vision



Richard Branson's Virgin Galactic and Jeff Bezos' Blue Origins have their sights set on commercial spaceflight, with both of them moving ever closer to launching operations within months. Both companies foresee simultaneously flying six fare-paying private astronauts, who will be able to float freely in a micro-gravity environment within their cabins at sub-orbital altitudes on the edge of space.

But what approach does each organisation have to access space, how will they provide sustained flights to this next frontier and what will be the cost of a ticket to ride?

Ways to space

Sub-orbital space is generally considered to be 82-100kms above the Earth. Reaching it is easier than achieving orbit. Firing a rocket at Mach 3 or about 3,700k/ph will take a craft to a sub-orbital arc, while achieving the much tougher Mach 25, around 29,000k/ph, enables an astronaut to go into full orbit at a 200km altitude.

The two contenders, Virgin and Blue Origin, both have similar backgrounds

Virgin Galactic was set up by Virgin Group founder Sir Richard Branson in 2004 at Mojave, California. Forming The Spaceship Company (TSC), Branson

OPPOSITE: SpaceShipTwo 'VSS Unity' fires its RM2 rocket engine to reach Mach 3 speeds and fly to above 295,00ft altitude Virgin Galactic

TOP: New Shepard lifts off on its 12th mission last December, with its then uncrewed capsule Blue Origin

made use of the successful technology of aerospace engineer Burt Rutan's sub-orbital Ansari X Prize winner, the small spaceplane SpaceShipOne.

By then, Amazon founder and CEO Jeff Bezos had already started his own spaceship company, Blue Origin, formed in 2000. With the corporate motto *gradatim ferociter* (step by step ferociously), from 2015 this business has been successfully launching uncrewed sub-orbital New Shepard rockets at Van Horn in West Texas, overseen by the experienced aerospace engineering head Rob Meyerson.

Like SpaceX's Elon Musk, both Branson and Bezos have made use of their impressive personal wealth to achieve their goals. In Branson's case, pre-COVID-19, this was at an estimated US\$4.5 billion, while Bezos was believed to be worth at least US\$117 billion.

Bezos is inspired by the dream of enabling humanity to expand into space and eventually colonise the solar system. He is quoted as wanting the Earth to one day become a pollution-free world park, with a much smaller and sustainable population.

Early financial security enabled crucial start-up investment, in Virgin's case into a sophisticated reusable spaceplane design based on Rutan's 'feathered' wing approach, which allows you to rotate the wing to increase aerodynamic drag, much like the feathers on a badminton shuttlecock.

The basic SpaceShipTwo (SS2) flight sequence makes use of a four-engine carrier mothership jet, White Knight Two (WK2), to lift the pilot-flown eight-seater SS2 sub-orbital/low aspect-ratio winged

spacecraft to 45,000ft before releasing it. The SS2's hybrid RocketMotorTwo (RM2) engine then blasts the craft into a near vertical climb, reaching Mach 3 speeds of 4,02km/h during its 60-second burn time, before it reaches a height of at least 50 miles (82km), which is what the US Federal Aviation Administration and NASA define as being the boundary of space. After making use of a feathered wing re-entry, the SS2 glides back to a runway landing.

Blue Origin's approach to sub-orbital access is very different.

Named after Alan Shepard, the first American astronaut to venture into space in 1961, the 18m tall New Shepard launcher fires a single BE-3PM rocket engine, fuelled by high performance liquid oxygen and liquid hydrogen. The engine burns for 110 seconds to lift a six-seat capsule to 250,000ft. Separating in near-space, the capsule continues on to sub-orbital space, with an apogee (highest point) of 66.3 miles (106.7km), this is above the Kármán line at an altitude of 62 miles (100km) – the international definition of the height at which space begins. Passengers in their couches in the capsule momentarily touch 5g on descent, before making a parachute/retro-cushioned touchdown on land, while the booster stage reignites to settle vertically onto a landing pad two miles from the launch, thus achieving a vertical take-off and vertical landing (VTVL) flight.

Both the Virgin carrier aircraft/SS2 combination and the New Shepard launcher/capsule are reusable, both



CLOCKWISE FROM LEFT: The 'VMS Eve' carrier aircraft and 'VSS Unity' spaceplane combination fly over their new Spaceport America base in New Mexico Virgin Galactic

After a dramatic flight, the BE3 rocket engine lowers the booster stage to a soft touchdown Blue Origin

The 'Mannequin Skywalker' test dummy on board the capsule on its return from its flight to 100km sub-orbital space Blue Origin

Blue Origin founder and CEO Jeff Bezos at Van Horn base in West Texas Blue Origin

Richard Branson and his son Sam celebrate after SpaceShipTwo achieves sub-orbit Virgin Galactic

achieve approximately Mach 3 velocity to reach sub-orbit and both will go through at least 3g acceleration/deceleration. Each is capable of carrying six passengers, who can unstrap from their seats and float free, being effectively weightless for three to four minutes in the micro-gravity environment.

Spaceplane or rocket?

For budding astronauts, the sub-orbital experiences offered by Virgin and Blue Origin will be quite different.

Virgin's ride lasts for approximately one-and-a-half hours, with one hour being the slow climb of the WK2/SS2 combination to the 45,000ft release point. The ride is then dramatic, with launch-drop acceleration similar to NASA's X-15 rocket-plane ride in the 1960s, involving the 60-second rocket burn, a 3g pull up, followed by microgravity, then a gradual peak to 4g on re-entry. A gentle aircraft-like gliding landing follows.

Using its different rocket ascent approach, Blue Origin's ride and return from sub-orbit

only takes a total of 11 minutes from launch to landing. The experience is reminiscent of the first two US manned space missions – the early Project Mercury flights in 1961. Using a Redstone single stage launcher, NASA astronauts Alan Shepard and Gus Grissom flew in their capsules to sub-orbital altitudes of 623,000ft, before returning with parachute-assisted landings, albeit in the Atlantic Ocean rather than on land. Using the more powerful Atlas rocket booster, the four subsequent Mercury capsule flights became full orbital missions.

The main differences with the pioneering Mercury flights is, of course, that New Shepard is a fully reusable system, the passengers can unstrap and float about in their capsule, and the spacecraft will return for a parachute retro-assisted landing in the Texas desert close to its launch point.

Testing times

Virgin's current SS2 spaceplane, VSS Unity, is soon to be tested for future commercial operational flights with

passengers, including more company personnel test flights at the end of this year, with Sir Richard Branson himself taking a trip early next year.

Its two previously crewed flights reached an altitude of approximately 56 miles (90km). Virgin's chief astronaut, Scotland-born David Mackay, had his first spaceflight experience in February 2019, when he, co-pilot Michael Masucci and chief astronaut instructor Beth Moses flew to 295,007ft, enjoying unrivalled views of planet Earth and experiencing almost four minutes of microgravity. All three have now been awarded their FAA 'astronaut wings' in the US and Mackay became the 569th astronaut and the first native Scot in space.

Although relatively secretive about flight details in their early years of rocket testing up to 2015, Blue Origin has always said it would fly to the full Kármán line height. Its performance has been consistent and, at Van Horn last December, the New Shepard launcher blasted off to a 62-mile altitude using an unmanned test capsule ➔





Focusing on flight safety

Virgin

Virgin Galactic had a high-profile setback in October 2014 when the *VSS Enterprise* spacecraft broke up during a drop test/rocket burn, killing one of the two crew members. An accident inquiry gave the cause as human error along with systems procedure issues.

SS2 design modifications were subsequently made and the company is determined to maximise passenger safety and enjoyment, during what is still the early pioneering days of commercial spaceflight. A key feature of the SS2 craft is the 'feathering' of the tail-plane, a system originally conceived by SpaceShipOne designer Burt Rutan. This 'feathering' operation uses two actuators that provide redundancy, even though David Mackay notes that the system is extremely unlikely to ever need this. SS2 can return from a sub-orbital height with a 'feather-down' configuration and its pilots practise in their flight simulator for this eventuality.

What of cabin safety and the dangers of accidental depressurisation at sub-orbital heights? David Mackay observes that the double-layer hull and window construction is very sound and that engineers verify their integrity before launch. The two crew members can flood the spacecraft with reserve air from multiple sources if ever needed, plus both crew and passengers have their own emergency oxygen supply, as in an airliner.

The Virgin space participants will have had three days' training at Spaceport America to maximise safety and their enjoyment of the

flight. At the time of the flight, they will be able to unstrap and strap back in easily and the crew can monitor procedures from the cockpit. The seats are articulated in the upright mode from the 3g ascent following the 60-second rocket motor burn as the SS2 goes vertical, then in reclined mode for the weightless and 2g re-entry phase, then back to upright again for the return glide and landing.

Some Virgin Galactic flight participants have already undergone zero-g parabola flights, flown aboard an aerobatic aircraft experience, or even tried the NASTAR centrifuge in Philadelphia — David Mackay advises that this should add to their enjoyment of the actual flight.

Virgin Galactic has decided not to equip its passengers with launch and re-entry suits, but is providing close-fitting flight suits designed by Under Armour to maximise comfort in flight. The rationale is that there is so much structural margin built into the SS2 cabin, safety and redundancy in the pressurisation system and numerous airborne verifications before launch that suits are unnecessary, making the extremely small and only brief decompression risk at high

altitude acceptable. NASA's Space Shuttle, the new *Crew Dragon* and *Starliner* spacecraft and the venerable Russian Soyuz spacecraft include pressure suits, of course, for launch and re-entry periods.

It is understood that Virgin Galactic may be considering providing passenger parachutes on the flights as a possible safety measure; the US Space Shuttle operated with this safeguard.

Blue Origin

Reusable rocket flight is still in its early testing days and, like Virgin Galactic, Blue Origin has had its own experience of in-flight failure. In April 2015, the booster stage of New Shepard 1 was lost at 45,000ft while descending at Mach 1 during a development test landing sequence. However, the unmanned crew capsule was recovered safely.

Astronaut Nick Patrick, UK-born and a veteran of two NASA Shuttle spaceflights, is the 'Human Integration Architect' for the New Shepard vehicle system. In this position, he and the design team will be planning for all the likely safety issues involved. It should be remembered that there are no crew

flying in the New Shepard capsule and the spacecraft procedures, including stability at sub-orbital heights, RCS systems functions, re-entry stabilisation, parachute release and soft-landing retros, are controlled entirely automatically, with no passenger intervention.

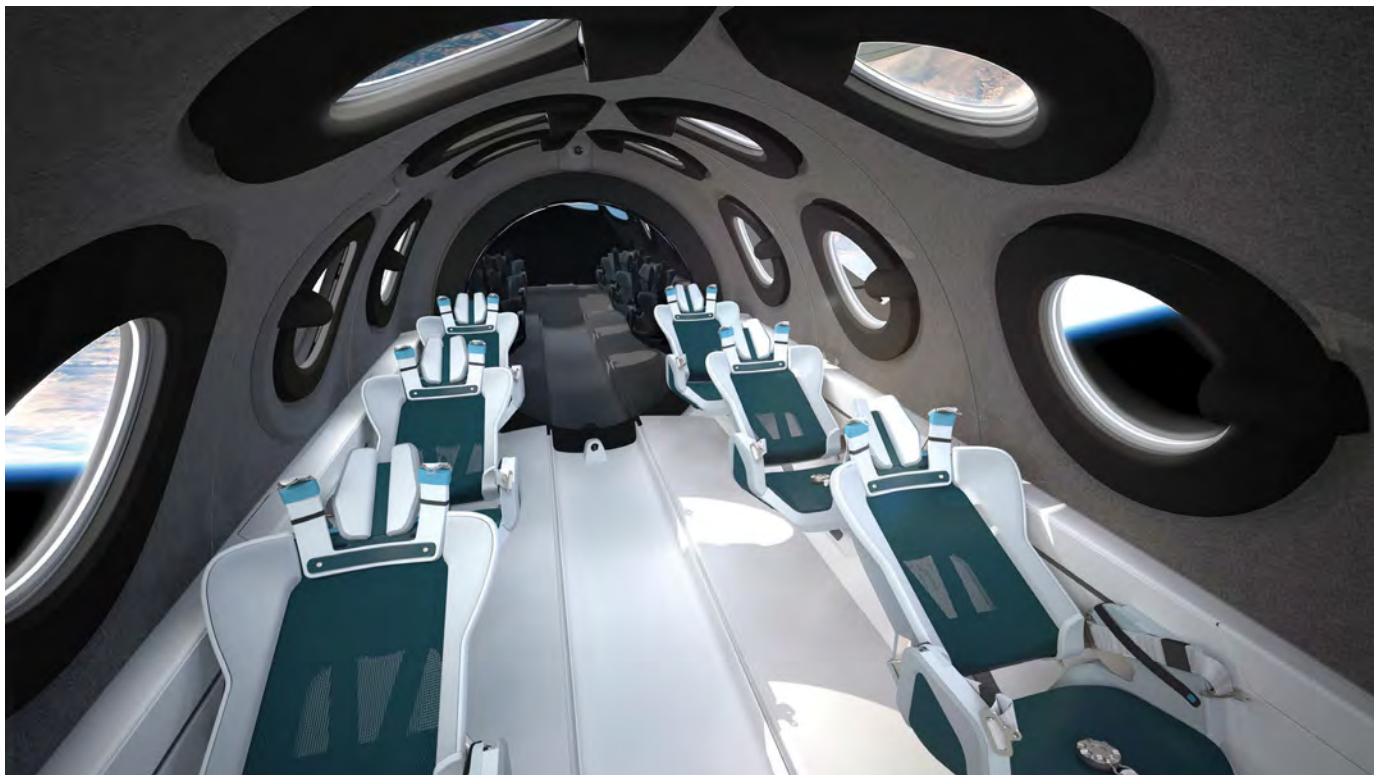
As with Virgin Galactic's SS2 flight, passenger training and cabin management procedures will be most important for New Shepard operations — the ability to clip back into the couches correctly after floating free in the allotted zero-g period of three to four minutes, for example, will be a key safety measure for the flights.

It is not known at present whether the passengers on board New Shepard will have access to any emergency oxygen or indeed parachutes. This aspect of passenger safety is no doubt being considered in great detail. Like Virgin's SS2, it is understood that Blue Origin will not be providing launch and re-entry pressure suits for the passengers.

Blue Origin has consistently tested the New Shepard emergency escape retro-rocket system. This solid rocket motor, built by Aerojet Rocketdyne, sits at the centre of the bell-shaped passenger capsule. It could rapidly boost the capsule away from any malfunctioning launcher and this has been tested from the ground and during max-q (maximum dynamic pressure) on ascent. Similarly, the capsule parachute system has received years of testing, including one safe flight return where only two of the three available parachutes were deployed.

The capsule's soft-landing system allows for a 1-3km/h touchdown speed and Blue Origin is confident of a gentle return for its passengers.





CLOCKWISE FROM ABOVE: Interior of Virgin's SpaceShipTwo, including rear bulkhead mirror, large cabin windows and reclining seats Virgin Galactic

Crew members David Mackay, Michael Masucci and Beth Moses reach US-defined sub-orbit in February 2019 aboard SpaceShipTwo Virgin Galactic

The Blue Origin recovery team at work after the New Shepard capsule touched down in the Texas desert, close to its launch point Blue Origin

more than a dozen times. A 2017 flight took a test passenger, cheekily known as Mannequin Skywalker, to sub-orbit and returned it safely to the Earth. Spectacular cabin videos of that flight subsequently became YouTube hits.

In the meantime, both companies claim that they will soon be flying commercial passengers to 'space', albeit with their differing definitions of where sub-orbital space truly begins.

Ticket prices and the future

Both Virgin Galactic and Blue Origin had planned to conduct more test flights in the coming months, though the current COVID-19 pandemic restrictions may well delay the early flight sequence involving paying passengers.

Virgin Galactic completed its first test flight from Spaceport America, New Mexico, on May 1 of this year, marking the first free flight in the state's airspace. The company operated this flight with COVID-19 protocols in place for employee safety.

Virgin Galactic and Blue Origin both state that they are continuing test flights this year. Virgin recently completed its gliding flights from Spaceport America, New Mexico, and has now shown the new SS2 teal-coloured cabin layout to the public, with six individually reclining seats controlled by the pilots, a large circular mirror on the aft bulkhead, 16 cameras, 12 windows with halo edging and seat-back displays.

It is likely Blue Origin will undertake its first sub-orbit flights with in-house test personnel,

with experience of perhaps three to four test missions may be required before confidence in full passenger flights is secure.

In terms of prices, Virgin has already sold approximately 600 advance tickets for its 'pioneer' private astronauts, initially costing US\$200,000 each, rising subsequently to US\$250,000.

In February, under its new One Small Step process, Virgin Galactic announced registrations were being accepted for future flight tickets, with a refundable deposit of US\$1,000. It recently reported receiving more than 400 new deposits, creating a new community of Spacefarers who are first in line for seat reservations when available. Future ticket prices are anticipated to reduce in time with more flights and as the SS2 fleet expands.

Sir Richard Branson is apparently still confident in joining the first VSS Unity commercial flight at an early date, launching from its new Spaceport America base in New Mexico.

Blue Origin has still not yet announced its likely flight costs, though Bob Smith, the company's CEO, said in March that New Shepard ticket prices are not likely to be cheap. Many speculate that, like Virgin's, they could be in the US\$200,000-300,000 range.

To the future

Both companies are seeking the use of their spacecraft for micro-gravity science research and it is anticipated that universities and institutes will be interested

Sub-orbital spacecraft compared

Virgin Galactic's SpaceShipTwo spaceplane

Launch configuration: carrier aircraft White Knight Two (VMS Eve), detachable spaceplane (currently VSS Unity)

Reusability: both carrier and spaceplane

Rocket engine: RocketMotorTwo (RM2), hybrid liquid/solid fuel (polyamide plastic and nitrous oxide), thrust 60,000lbs force (270kN), 60-70 second burn time

Passengers: total 8, comprising 2 crew members and 6 passengers

Flight altitude: More than 50 miles (80km)

First sub-orbit flight: December 12, 2018

Launch location: formerly Mojave, California, now Spaceport America, New Mexico

Ticket price: currently US\$250,000

Blue Origin's New Shepard spacecraft

Launcher: New Shepard rocket (vertical take-off/vertical landing), plus passenger capsule (parachute landing)

Reusability: both launcher rocket and capsule

Rocket engine: BE3, liquid hydrogen/liquid oxygen fuel, 110,000lbs force (490 kN), 110 second burn-time

Passengers: 6 passengers, no crew

Flight altitude: more than 62 miles (100km)

First sub-orbit flight: November 23, 2015 (unmanned mission)

Launch location: Van Horn, West Texas

Ticket price: as yet unconfirmed, but likely to be US\$200,000-US\$300,000



The view from space

Both Virgin and Blue Origin plan to allow their six passengers in the cabin to unbuckle themselves unassisted and float freely for three to four minutes, taking in the extraordinary views from space.

This is how David Mackay described the view as he looked down from his sub-orbital height on board *VSS Unity* in 2019: “We manoeuvred the spaceship into an upright position, in order to give the experiments in the cabin as much micro-gravity time as possible — for passengers, we would normally position the SS2 on its back, to maximise the viewing experience. The views were quite incredible. There was no haze to affect the appearance of the Earth below and we could see way across the US to the north and east, out to the Pacific Ocean to the west and into Mexico to the south. We could see so much of the curvature of the Earth that we could sense the scale of the planet. The sky was a deep black and the line of the Earth’s atmosphere so thin.”

To maximise this impressive experience of sub-orbital space, both Virgin and Blue Origin have adhered to the challenging demands of large window design in the spacecraft hulls, with the New Shepard capsule fitted with what are described as the “six largest windows to go into space.” The experience on both vehicles promises to be extraordinary.

in flying astronaut-tended and unmanned instruments over the coming years.

At present, just 20-second periods of micro-gravity can be achieved for research via parabola flying, while operations on the International Space Station (ISS) are highly costly. Already, Blue Origin’s uncrewed New Shepard and Virgin Galactic SS2 test flights have included NASA research instruments and NASA has recently set up a Suborbital Crew Office (Sub-C) to organise its science and astronaut training activities via both companies.

NASA is also using Blue Origin’s launcher to test the vertical landing system technology for the forthcoming Artemis missions to the Moon. This involves ground recognition sensors to provide pinpoint touchdowns on the lunar surface. The latest New Shepard uncrewed test flight – largely to test NASA’s lunar research – successfully launched on October 13 from the company’s West Texas facility.

Virgin Galactic hopes to one day fly from the UK, with the emerging spaceport at Newquay, Cornwall, keen to accept horizontally launched spacecraft operations. Blue Origin could, in theory, use the planned Scottish vertical launcher facility in Sutherland, though operations at coastal locations may be challenging.

So who is destined to win the sub-orbital race? Many would say that there is room for both competitors to operate in parallel. The two approaches offer a different flight experience to gain private access to space, one appealing to spaceplane ride enthusiasts and others providing more of a Redstone-style rocket-ride.

Whatever the case, passengers will enjoy a trip that’s literally out of this world. **AI**



Unleash the Lynx

The Portuguese Navy Lynx has been a powerhouse since being delivered in 1993. Now, the multi-role military helicopter is set for a new lease of life, as **Jose Matos** explains

Portuguese marines exit a Lynx Mk 95 helicopter during Exercise Seaborder 2013
Ministério da Defesa Nacional





Portugal's Naval Helicopter Squadron is undergoing a transformation: the unit's five Super Lynx Mk.95 helicopters are currently undergoing modernisation work at the Leonardo Helicopters' facility in Yeovil, UK, to extend their service life until 2030.

This is an extremely important step for Portugal's naval capacity, which initially operated aboard the Vasco da Gama and Bartolomeu Dias-class frigates to perform anti-submarine warfare (ASW) functions, but ended up diversifying the tasks. As a result, these navy veterans, in service since 1993, have been carrying out new missions with NATO partners. Now though, with all five helicopters in the UK, there is a capability gap.

In addition to the lack of availability for missions, the navy is unable to provide enough flight hours to maintain the qualifications of its 14 pilots. Without qualifications, they cannot fly. And for this reason, Portugal will send pilots to the





German Navy for two or three years, to train until the Lynx helicopters return.

The navy says the pilots who are in Germany are fulfilling the same mission as the Germans, but they have “reserved the participation in operational missions on a case-by-state authorisation basis”.

Lynx history

Modernisation was essential for Portugal, to ensure it didn’t lose its capability, on which the country had prided itself for almost three decades. Before then, Portugal had no helicopters to support naval operations beyond the direct area of influence of the ships. It was only with the arrival of the new Meko 200 ASW frigates – renamed Vasco da Gama-class – that the process to acquire naval helicopters was initiated.

The three Meko 200 frigates, ordered from Germany in 1986, were equipped to operate light helicopters and the Portuguese Navy considered, along with the Westland Lynx, three other models: the Agusta-Bell AB212,

the Kaman SH-2 Seasprite and the Aérospatiale SA365F Dauphin.

The final decision rested between the Seasprite and the Lynx, and in December 1989 the Portuguese defence ministry favoured the Lynx, thus beginning negotiations for the acquisition contract that would be signed the following year.

The first helicopters arrived in Portugal during August 1993. By this time, Westland was introducing improvements on the first-generation helicopters to advance to the Super Lynx standard, allowing Portugal the possibility of buying a second-generation model, designated the Mk 95.

The Royal Navy supplied two surplus Lynx HAS3 helicopters that were rebuilt to Super Lynx standard by Westland and the remaining three were new aircraft. The Portuguese version was very similar to the Mk 8 (HMA8) operated by the Royal Navy and was equipped with a Bendix RDR 1500 radar and an AQS-18V dipping sonar, manufactured by L-3 Ocean Systems, which could be removed during

missions with a more flexible scope.

Montijo Air Base – officially known as Air Base No 6 – was selected as the Lynx’s home as it was the nearest air base to the Lisbon Naval Base. Construction began inside the base’s perimeter for a maintenance and repair hangar, a warehouse for spares, a building for the maintenance of the turbines and support equipment, barracks for the crews and also an apron and a helipad. It is in these installations that the navy helicopters are stationed when not at sea.

Training the pilots

The relationship with the air force is not limited to operating from Montijo Air Base, because the facility is also used by the navy to select and train officers who can volunteer to become pilots.

After undergoing physical, medical and psychological tests similar to those that air force pilots take, the applicants go to Beja Air Base, in southern Portugal. There they undergo basic helicopter training with the Alouette III – a type that had been used



for 57 years until June 2020, when it was finally replaced by the new-generation AW119Kx Koala.

At the end of the course, which takes up to two years, the pilots return to Montijo – where the navy's Helicopter Training Centre (HTC, Centro de Instrução de Helicópteros) is located – to convert to the Lynx, completing around 150 flight hours.

Currently, about 30% of the training is performed through a simulator in the Joint Lynx Simulator Training Establishment (JLSTE), which was originally located at Naval Air Station de Kooy in Den Helder, Netherlands, and is now based at Naval Air Station Nordholz, in Germany.

The JLSTE has provided training to Lynx aircrews from Germany, Denmark, Norway, Netherlands and Portugal. It allows them to sharpen their skills in a great variety of scenarios, many of them impossible to replicate in an actual flight, which greatly improves the capacity of the crews.

Now, the helicopter squadron accounts for 124 service personnel, of whom 108 are specialised in aviation. They are not always deployed to Montijo, but are sometimes aboard the frigates. Usually, a detachment comprises 13 service personnel and one helicopter, and only in extraordinary circumstances is a second helicopter deployed, when the detachment is reinforced with six more crew members.

The squadron always has two active detachments aboard the two frigates when operational at sea. Beyond the personnel of the detachment, there are also elements of the frigates' crews trained to operate on the flight deck or even inside the hangar, who ensure mission control, the landing and lift-off of the helicopters, refuelling, re-arming and crew search and rescue (SAR) in case of accidents.



TOP:

Preparing to land on a navy ship in the Tejo river
Lusia Agência



LEFT: A Portuguese Navy Lynx Mk 95 helicopter during a MEDVAC operation Portuguese Navy

A merchant ship in Somali waters reported a pirate attack. Some 30km away on a Portuguese frigate, the Lynx was dispatched



CLOCKWISE FROM ABOVE:

NRP 'Corte-Real' (F332), a Meko 200 frigate of the Portuguese Navy, with a Lynx onboard Portuguese Navy

Portugal's five Naval Helicopter Force Super Lynx Mk 95s are currently being upgraded. Among the work is the integration of new avionics Leonardo

A soldier of Portugal's Special Action Detachment, an elite navy force, sets his sights on a vessel suspected of carrying drugs, while a navy Lynx watches over in the background Nuno Botelho

On the flight deck of the Spanish Navy's 'Juan Carlos I' during Contex-Phibex 15, a Portuguese maritime exercise Euromar

The Portuguese Lynx proved their worth as early as 1995, when they took part in the naval blockade of the former Yugoslavia, in the Adriatic Sea.

International missions

At the time, the frigate *Vasco da Gama* was mobilised to the region with ships from NATO Standing Naval Force Atlantic, as part of Operation Sharp Guard to enforce economic sanctions and an arms embargo. During the five-month mission, the *Vasco da Gama* engaged with 220 merchant ships and inspected 91, the onboard helicopter making 255 flight hours in several operations to oversee and control vessels suspected of trafficking weapons.

It was the first time a Portuguese ship

used naval helicopters in an international mission, carrying alongside the regular crew and the helicopter detachment a marine security group specialised in inspection operations.

In July 1998, the Portuguese Lynx were in warmer waters, on West Africa's Atlantic coast, more specifically in Guinea-Bissau, an ex-Portuguese colony. The country was in the midst of civil war and Portugal sent a small naval force comprising the *Vasco da Gama* with two Lynx Mk 95s onboard, along with two corvettes and a supply ship.

Their objective was to support operations, and to repatriate the Portuguese and European citizens living in Guinea. Under conditions that were unusually favourable, the two helicopters aboard the frigate flew several flights carrying and distributing humanitarian aid to several locations in Guinea.

In late-1999, the *Vasco da Gama* was sent to Timor island, at the southern end of Maritime Southeast Asia, to take part in a multinational UN task force called INTERFET (International Force East Timor), which supported the ex-Portuguese colony's transition to independence. Once more, the two Lynx proved to be valuable assets in supplying medical and humanitarian assistance on an island, where some areas had very difficult access.

Fighting piracy

In late 2001, the navy's Lynx on board the frigate *Corte-Real* began security operations in the Mediterranean. Since then, Portuguese Navy maritime security operations have expanded, stretching across to India to combat piracy.



The first contact with Somali pirates came in the summer of 2007, when the frigate *Álvares Cabral*, part of the NATO naval force SNMG-1, took part in the initial international efforts to oversee Somali waters. It was only from 2009 onwards that Portuguese helicopters were properly equipped to fight piracy, with the installation of door-mounted fully automatic FN Herstal M3M 12.7mm machine guns.

Instructors from the German Navy helped train crews to operate the weapon, leading to the first certification flights aboard the *Corte-Real* in 2009, when this ship commanded SNMG-1 (Standing NATO Maritime Group One).

During early 2009, the NATO force took part in a counter-piracy mission named Operation Allied Protector, in the Gulf of Aden, and it was here the helicopters and crews had their 'baptism of fire'. On May 1 that year, some 160km north of Somalia, a merchant ship with a Bahamian flag reported a pirate attack. The ship was approximately 30km away from the Portuguese frigate.

The Lynx was dispatched to fend off the ongoing assault. After a short, ten-minute flight, the crew sighted the merchant vessel trying to avoid a small boat moving in at high speed. At this instant, the pirate boat aborted the attack and headed back to what was later identified as its mothership.

The helicopter kept its pursuit of the suspicious boat, and confirmed weapons were on board, maintaining its surveillance as the pirates boarded the mothership. When the *Corte-Real* reached the area, a team of marines bordered the mothership to apprehend and identify the pirates. Again, the Lynx was used to provide surveillance and protection of the boarding party. The operation resulted in the apprehension of AK-47 machine guns, one RPG grenade launcher, with grenades, several rounds of ammunition, explosives and mobile phones, a handheld GPS device and other suspect equipment.

In reconnaissance missions over possible pirate camps along the Somali coast, the helicopter also proved to be invaluable. The objective of those missions was to identify sites for logistical support, communication facilities and materials connected to piracy; then to confirm the positions of the raid ships, observe the routines of the selected locations, track movements of the pirates and their transportation and to take pictures for future analysis.

It was while on another mission to fight piracy in the Indian Ocean during July 2013 that a Lynx with serial number 19205, nicknamed 'Playboy', and operating from the frigate *Álvares Cabral*, passed 4,000 flight hours.

That same year, 2013, saw the Portuguese Lynx fleet mark 20,000 incident-free flight hours, highlighting the



Ongoing upgrades include introducing the integrated full glass cockpit characteristic of the Super Lynx 300

readiness of the Portuguese servicemen in operating the helicopter. By mid-2017, navy helicopters had flown a total of 22,385 flight hours.

Now, after 27 years of service, the Portuguese helicopters are finally being modernised at the Leonardo facility in Yeovil.

A new life

The work includes the replacement of the current engines with new Rolls-Royce/Honeywell LHTEC CTS 800-4N with Full Authority Digital Engine Control (FADEC). It also includes the replacement of the avionics, introducing the integrated full glass cockpit characteristic of the Super Lynx 300.

The new cockpit will be compatible with night-vision goggles (NVGs) and have four

liquid crystal displays (LCDs) to minimise the crew's workload, offering day and night capabilities. The radar and the dipping sonar will also be updated, as will the communications system to meet 2018 European flight standards.

Modernisation is important to operate the two Bartolomeu Dias-class frigates (ex-Karel Doorman-class) that form the core of the navy's surface oceanic capacity. These frigates are also being subjected to a midlife upgrade (MLU) in the Netherlands.

The first of five helicopters involved in the modernisation process carried out its initial experimental flight in February 2020 and was expected to return to Portugal by the end of December. The whole process is to be complete by the end of 2021, ensuring another decade of service. **AI**



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A General Electric GENx-powered
Boeing 787-9 of Vistara, VT-TSD
(c/n 66526), at Everett in February
[AirTeamImages.com/Dipankar Bhakta](http://AirTeamImages.com/DipankarBhakta)

As both Vistara and SpiceJet launch scheduled non-stop services between India and London, **Tom Batchelor** analyses the technology and equipment each carrier plans to use for their new flagship routes

Indian

The commercial aviation industry continues to battle the worst crisis in its history, yet two plucky airlines from India have spied an opportunity to gain a foothold at one of the world's most prestigious airports. Vistara and SpiceJet have each revealed they are bucking the trend and launching new long-haul services to London/Heathrow, unveiling their plans to evolve from transcontinental to intercontinental carriers in August after securing coveted slots at the west London hub. Vistara successfully launched its new flagship link that same month, while SpiceJet intends to begin scheduled operations in December.

Vinamra Longani, an aviation analyst based in New Delhi, described London as "the ideal destination for any Indian airline wanting to launch long-haul services." Longani, who is head of operations for Sarin & Co, an Indian law firm specialising in aviation regulatory services, said there was considerable business and leisure traffic between the two countries and that the gap left by the closure of Jet Airways in April of last year meant there is room in the market for new players. Prior to the suspension of its flights, Jet Airways operated up to four services a day between India and Heathrow – three between the UK capital and its hub in Mumbai, and a further rotation to Delhi. Longani explained to *AIR International*

that the demise of Jet Airways was an opportunity for its partners to grow their presence in India, but Vistara and SpiceJet's entry into the market may have come too late to fully capitalise on the defunct firm's withdrawal. He noted: "Virgin Atlantic returned to Mumbai, Delta Air Lines added non-stop flights from New York/JFK to Mumbai, Air France added capacity to all its Indian routes, KLM increased frequencies to Mumbai and added Bangalore to its route map. "British Airways, too, added a daily flight to Mumbai to cash in on pent-up demand. As such, the demise of Jet Airways has little to do with the launch of long-haul flights by Vistara and SpiceJet between India and London. Airlines operating



aviators heat up Heathrow

between the two countries target various segments of travellers – while Air India and Vistara use their hub in New Delhi to connect passengers to the rest of the country, British Airways and Virgin Atlantic capitalise on transfer traffic to North America through their hub at Heathrow.”

The Vistara proposition

Vistara started commercial operations in January 2015 as a joint venture between Tata Group and Singapore Airlines, connecting dozens of destinations across India and the region with a fleet that has grown to 42, including 32 Airbus A320s (ten CEOs and 22 NEOs), a pair of A321neos, six Boeing 737-800s and two 787-9 Dreamliners. In fewer than six years of

operations it has flown more than 20 million customers. Until Vistara’s London launch, the furthest its route network stretched from the Indian subcontinent was to Dubai, Bangkok and Singapore.

The firm’s foray into Europe has been disrupted – but not entirely derailed – by the coronavirus pandemic. As we go to press, the airline continues to operate special flights on the Delhi-London route under the recently formed ‘travel bubble’ agreement between India and the UK, but it hopes to make the service part of its regular, scheduled operations.

Vistara’s management initially put two 787-9s to work, VT-TSD (c/n 66526) and VT-TSE (c/n 66527) – with four more on order – on the thrice-weekly rotation. The

first flight, UK15, touched down in London on August 28 after a journey lasting eight hours and 53 minutes. The Dreamliner, VT-TSD, returned to the Indian capital eight hours later, completing the airline’s first round trip to the UK. The carrier has since confirmed that the rotation is to rise to five-times-weekly and eventually daily before the end of the year. From December 1, UK17 is scheduled to depart Delhi at 1:45pm each day and arrive in London at 5:45pm. The jet will return to India as UK18, leaving Heathrow at 8:50pm and touching down at 10:25am the following day. The aircraft are fitted in a three-class layout, including a business class option with flat beds, plus premium economy and economy cabins. ➔

Vistara had applied for slots at both Heathrow and Gatwick, but initially missed out at the former. However, it was assigned slots at Gatwick for its summer 2020 schedule. Had COVID-19 not struck, Vistara is likely to have made its long-haul debut with flights to the West Sussex gateway. In reality, the massive fall in air traffic following the outbreak allowed Vistara to snap up some temporary slots at Heathrow, which was Europe's busiest airport until the pandemic (it lost that title to Paris/Charles de Gaulle Airport, according to air traffic figures published by CAPA - Centre for Aviation).

"As an airline with a vision to be a global carrier from India, adding London to our network had always been part of our expansion plan," a Vistara spokesperson explained to *AIR International*. "Launching

services to one of the world's most-connected airports – London/Heathrow – is a significant milestone for any airline, given the importance that the airport and city holds in a global context.

"The UK is also home to millions of Indians and, therefore, Heathrow is quite a natural fit in the route network of a full-service carrier like Vistara."

With ambitious long-term plans to expand beyond London to other European hubs, Vistara bosses hope to establish as a major competitor to the likes of Air France and Lufthansa on Asian routes. "We are reviewing the opportunity to operate similar flights to Paris and Frankfurt," the spokesperson revealed. "Other destinations are also being reviewed from an operational and commercial perspective."

Talking numbers

So just how much demand is out there?

According to travel data and analytics expert Cirium, there were **600** Indian passenger jets in storage in the March lockdown, compared with **136** in September, suggesting a dramatic uptick in operations after a dismal start to the year.

In terms of actual flights flown between the UK and India, from the beginning of January to the end of September, **1,623** passenger services were tracked by Cirium, with the most being operated by BA (**818** flights). Air India was responsible for **566** links during the nine months, with **178** rotations operated by Virgin Atlantic, **45** by TUI and **16** by Vistara. Only one SpiceJet flight – repatriating Indian nationals – was operated. Most flights used 787s (a total of **904**), followed by 777s (**543**), A350s (**100**) and A330/A340s (**76**).



CLOCKWISE FROM ABOVE:

SpiceJet has suffered from more exposure to the 737 MAX grounding than many of its competitors

AirTeamImages.com/Bastian Ding

The economy class cabin of Hi Fly's A330neo, soon to be in service with SpiceJet Airbus

The wet-leased A330neo also boasts an impressive premium cabin Airbus

The interior of Vistara's Airbus A321neo Vistara

Within existing markets, Vistara is renowned for being a full-service carrier Vistara



Beyond point-to-point

In 2018, Vistara agreed a codeshare deal with British Airways which opened up the regional networks of both carriers to passengers in India and the UK. It meant British Airways customers travelling on codeshare flights were able to check their bags straight through to their final destination. In addition, both airlines use the same terminals at Delhi and Mumbai airports, making it easier for customers to connect onto domestic services to cities such as Amritsar, Chandigarh, Goa, Kolkata and Kochi, which had previously been more difficult to access from the UK.

The Vistara spokesperson said: “Our codeshare and bilateral interline partnership with British Airways particularly helps us to offer an extended network to Vistara customers from India flying to other parts of the UK, Europe and beyond, as well as to inbound BA customers who wish to travel within India across the Vistara network.”

It is fair to assume that an airline launching a new, long-haul route during a pandemic might expect to see dampened demand, at least in the early days. However, less than a month after the first flight touched down at Heathrow, Vistara said it was already “delighted at the very positive response” to its services between the two countries: “Our load factors on the route have been gradually and consistently increasing since we launched. We will observe the demand and mount more flights if required, once operationally and commercially viable.” Such was the early demand for their sole European connection that the airline announced that it was increasing the frequency of flights – see previous.

All rostered crew on rotations to and from London are based in India, with pilots and cabin crew on the UK-bound legs requiring a layover in London until the next departure.

Asked about the arrival of SpiceJet in the London-India market in the coming months, the Vistara spokesperson rebuffed the looming competition: “Quite frankly, comparison with a low-cost carrier would not be fair, especially in the context of longer-haul international operations where the FSC [full service carrier] service is mostly preferred by the customers due to comfort and convenience.”

Indeed, Vistara's positioning as a more premium option (at least compared with SpiceJet) is clear in its provision of onboard Wi-Fi on the Dreamliner, making it the first Indian airline to offer it. Longani argued that Vistara had a significant advantage over the flag carrier, Air India, the only other Indian company currently operating flights to the United Kingdom, which is that Vistara “is known for its outstanding and consistent customer service.”

He went on to explain: “Even though the carrier has continued to lose money since its inception, the promoters of the airline are committed to the joint venture, which would ensure that they continue to operate to the UK despite the poor passenger numbers



due to the pandemic. Vistara will invest in building its brand on this very important route which might not be profitable in the short-term, especially given the pandemic and the unending competition. However, its hub in New Delhi, connections from the rest of the country and their loyal fan following in India will help them make their mark and

hopefully win over passengers originating in the United Kingdom, too.”

Spicing things up

SpiceJet's entry into the London market looked, initially at least, a little less certain than that of rival Vistara. Last year, the low-cost carrier applied for daily slots



at both Heathrow and Manchester, but couldn't secure either due to booming pre-coronavirus demand. Fast-forward to August this year and the airline gained the approval it needed to begin operations. This was made possible in part by the India-UK 'transport bubble'. On August 20, SpiceJet flew its maiden long-haul charter flight from Heathrow to repatriate 329 Indian and British nationals.

Despite the early fanfare, this was followed by weeks of silence, sparking

speculation whether a scheduled service would ever materialise. To the surprise of some analysts, the airline confirmed during an October video press conference that it would connect to London. This is set to be a weekly and twice-weekly service to Mumbai and Delhi, respectively from December 4.

The carrier noted that its Heathrow slots, which were initially allotted for the summer months, had been extended to cover the entire winter schedule. Ajay

Singh, SpiceJet's chairman and managing director described the move as a "huge milestone" for the carrier: "I am proud that SpiceJet will be the first Indian low-cost airline to operate non-stop flights to the UK. London is one of the busiest long-haul destinations from India and our convenient flight timings should suit the convenience of our passengers perfectly.

"While the last few months have been the worst-ever period for the global aviation industry, I am proud of the





determination and resolve shown by 'Team SpiceJet'. From repatriating over 130,000 Indian nationals from across the globe, to operating widebody passenger and cargo links, to now starting flights to Heathrow, the last few months have been very significant for us.

"Providing non-stop connectivity from India to different parts of the world and strengthening our own airport hubs has been a long cherished dream and with our London operations we have taken a

CLOCKWISE FROM TOP LEFT: The air traffic control tower at Delhi/Indira Gandhi DIAL

The London to Delhi route is currently dominated by flag carriers Air India and British Airways DIAL

The entry of two new firms into the market should help drive competition and reduce fares Heathrow Airports Limited

Vistara crew celebrate the airline's inaugural flight to London in August of this year Vistara

SpiceJet's core fleet comprises 57 Boeing 737NGs and 32 De Havilland Canada Dash 8-400s
AirTeamImages.com/Felix Gottwald



small step in that direction. We hope our passengers, both business and leisure, make the most of this opportunity of creating fond memories forever with us.”

SpiceJet operates a significant fleet of 737-700s, -800s and -900ERs alongside De Havilland Canada Dash 8-400s, yet none of these are able to offer a non-stop connection between India and the UK. To mitigate this, the company recently agreed a deal with Portuguese wet lease specialist, Hi Fly, for an A330-900 to facilitate efficient links to Europe – the same type that flew its repatriation links. The widebody will be outfitted in a two-class configuration featuring 371 seats (353 economy and 18 business).

SpiceJet is due to connect Delhi with London – the carrier’s 10th international destination – with a departure at 1pm every Friday and Sunday, reaching London at 5.30pm the same day. From Mumbai, the flight leaves on Mondays at 12.45pm to arrive in London at 5.30pm the same day. Flights from London to Delhi will depart Mondays and Fridays at 7.30pm arriving in Delhi at 7.55am the next day. Flights from London to Mumbai will depart on Sunday at 7.30pm, arriving in Mumbai at 8.45am the next day.

SpiceJet faced well-documented financial difficulties even before coronavirus, with the company posting a pre-tax loss of Rs8.07bn (£85m) in the three months to March 2020; in the same quarter in 2019, it had posted a Rs563m (£6m) profit. “The company has accumulated losses and its net worth has been fully eroded,” auditors noted on the carrier’s financial statement for the year ended March 31, 2020. “The company has incurred a net loss during the current and previous year and the company’s current liabilities exceeded its current assets as at the balance sheet date. These conditions indicate the existence of a material uncertainty that may cast significant doubt on the company’s ability to continue as a going concern.”



MAX woes continue

Part of SpiceJet’s problem has been the continued grounding of Boeing’s 737 MAX. The airline has 13 MAX 8s in its portfolio, with a further 123 examples on order, along with 20 MAX 10s and another dozen of an unspecified variant, making it one of the world’s biggest customers of the beleaguered jet.

Unsurprisingly, SpiceJet suffered a significant financial hit both from the MAX crisis and COVID-19. However, as the only Indian airline with a dedicated freighter fleet, it was also able to alleviate at least some of the financial impact of the global lockdown by transporting tens of thousands of tonnes of cargo. Kiran Koteshwar, SpiceJet’s chief financial officer, sounded a more upbeat note in July when he said: “Our cash balance has not changed much compared to March due to various actions like negotiation with lessors, salary restructuring, deferment of payment to partners and suppliers through mutual negotiations.”

As long-haul routes can take time to mature and turn profitable, Longani considers Vistara to be better placed to weather the pandemic and deliver returns on their UK investment: “Given the ambitions of its promoters, Vistara is likely to continue to fly to the UK and build on its debut. SpiceJet, on the other hand, is an Indian low-cost airline which has been significantly impacted by COVID-19

and is in dire need of recapitalisation.

It [also] does not have any long-haul aircraft in its fleet. SpiceJet wants to capitalise on the availability of cheap wet lease/charter deals due to the pandemic and use its route authority to the UK to earn some quick cash. In my opinion, a low-cost carrier with no widebody jets and none on order has no future in the UK-India market.”

Whether the launch of regular London flights by both Vistara and SpiceJet proves successful will partly depend on how deep-rooted the impact of coronavirus is on long-haul air travel. Both firms will be hoping to prove that it can be done in the short term, contrasting with the fortunes of fellow low-cost firm IndiGo’s proposed London connection, which was scrapped in October last year before it ever took off.

Will long-haul ambitions of Vistara and SpiceJet prove to be realistic? For Vistara, success may be judged on whether other European destinations can be added, utilising its expanding Dreamliner fleet. For SpiceJet, launching the London route at all will be seen as a huge achievement. **AI**

TOP: SpiceJet is scheduled to deploy a wet-leased Hi Fly A330-900 to service the London route Airbus

BELOW: Heathrow is widely considered to be one of the world’s most prestigious gateways and a key city for travellers from India Heathrow Airports Limited



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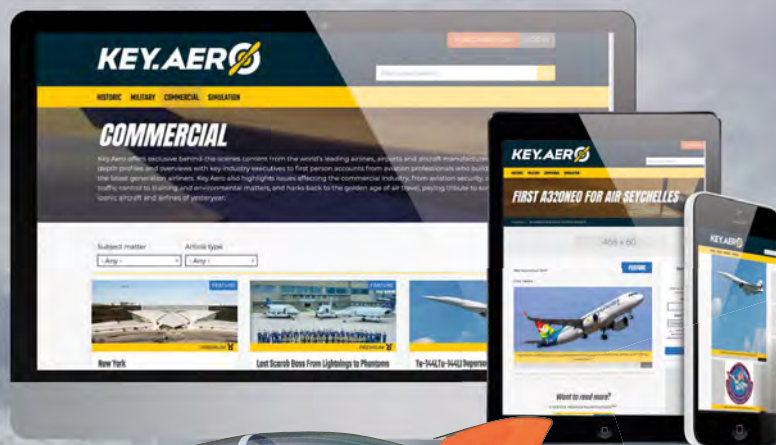
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s/n 167 as it taxis at Pleso, Croatia, after returning from a training flight in August 2020
Chris Lofting

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