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Fairford Gulf War 1 Ops
Upgrading a Legend

RAF MUSTANGS
Perfecting the P-51

SPECIAL REPORT

F-35 LIGHTNING II
Country-by-Country Analysis

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VULCAN TO THE SKY TRUST
HONOURING THE PAST, INSPIRING THE FUTURE

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Main image: **A Boeing B-52H Stratofortress from Barksdale AFB, Louisiana.** Frank Crebas. Inset (top right): **Artwork of a RAF Mustang Mk III from 259 Sqn.** Ted Williams. Inset (bottom left): **The USMC F-35B illustrated is from VMFAT-501.** Key-Jamie Hunter. Inset (bottom middle): **A Dan-Air HS 748 in August 1984.** AirTeamImages.com/Carl Ford. Inset (bottom right): **Jetstar Airbus A320, 9V-JSF, gets pushed back at Singapore Changi Airport.** Martyn Cartledge

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First E190-E2 Flies Ahead of Schedule

The Embraer E-Jet E2 programme reached an important milestone on May 23 when the prototype E190-E2 performed its maiden flight. The aircraft had originally been scheduled to fly during the second half of this year and this first flight took place less than three months after the airframe debuted at a rollout ceremony in late February.

The aircraft (PR-ZEY) took to the skies at 1.06pm from Embraer's facility in São José dos Campos and flew for 3 hours and 20 minutes. The inaugural flight marks the beginning of the certification campaign for the new version the E190-E2, the first of three new second-generation E-Jet models. A total of four prototypes will be used in the E190-E2 certification programme and these will later be joined by two aircraft assigned to the E195-E2 certification process and three E175-E2 aircraft.

Embraer Captain Mozart Louzada commanded the prototype E190-E2 on its maiden flight on May 23. He was joined by First Officer Gerson de Oliveira Mendes and Flight Test Engineers Alexandre Figueiredo and Carlos Silveira. Embraer

The E190-E2 is scheduled to enter commercial service in 2018, and the E195-E2 is due to follow suit in 2019, and the E175-E2 a year later.

"A first flight is always an emotional occasion, no matter how many you witness over the years," said Embraer President and CEO Frederico Fleury Curado after the airliner's safe landing. "In this particular case, we are not only keeping our promises to the market, we are going beyond by being a few months ahead of schedule."

Since the E-Jet E2s were launched in June 2013, the programme has logged 640 commitments from airlines and leasing companies, including 267 firm orders.

Saab Unveils Next-Generation Gripen E

Saab unveiled the latest version of its popular Gripen fighter during a special ceremony on May 18.

The so-called Gripen E has a significantly improved avionics system as well as the capability to carry more weapons over a greater range – the latter aided by larger fuel tanks and a more powerful, fuel-efficient powerplant.

The next-generation Gripen will have a highly integrated and sophisticated sensor suite including an active electronically scanned array (AESA) radar, infrared search and track (IRST), electronic warfare (EW) systems and new datalink technology.

"Nations need modern air defences to uphold national sovereignty. Meanwhile, the cost in relation to other investments in society needs to be reasonable. Therefore, Saab has developed design and production methods for the Gripen E to both increase capability and to reduce costs", said Håkan Buskhe, Saab's President and CEO.

Saab aims to begin deliveries of Gripen E airframes to Sweden and Brazil in 2019, but will still manufacture earlier versions of the jet for some time to come.

The Gripen E was unveiled in dramatic style by Saab during a special ceremony on May 18. Saab

Five nations currently operate the Gripen: Sweden, South Africa, Czech Republic, Hungary and Thailand. Brazil has the type on order, and it has been short-listed by Slovakia for a possible purchase. Saab is also in preliminary talks with Botswana over a possible purchase of eight Gripen C/D airframes. The aircraft would replace the Botswana Defence Force-Air Wing's remaining Canadair BF-5A/Ds, which are now over 40 years old.

Record-Breaking Canberra to Fly Again

Above: **WK163 has not flown for almost a decade but the 1954-built English Electric Canberra is perhaps the most historically significant classic jet that remains potentially flyable in the UK.** Vulcan to the Sky Trust

Inset: **Dr Robert Pleming (right) receives the paperwork for WK163 from Classic Air Force's Trevor Bailey during the handover ceremony on May 19.** Vulcan to the Sky Trust

The team that restored Avro Vulcan XH558 to flight is to return another iconic all-British jet to the airshow circuit after acquiring English Electric Canberra B.2/6 WK163 from the Coventry-based Classic Aircraft Trust.

This Canberra spent most of its life at the heart of British scientific and engineering innovation. The airframe played a central role in the development of advanced propulsion technologies followed by a period with the Royal Radar Establishment (RRE) in the 1960s and '70s, but it was in 1957 that she made headline news around the world.

Fitted with a Napier Double Scorpion rocket motor in the bomb bay, WK163 – with test pilot Mike Randrup and Napier's Deputy Chief Engineer Walter Shirley at the helm – achieved a world altitude record of 70,310ft (21,431m) on August 28, 1957.

A varied research flying career followed with the airframe used to test the Viper engine as well as infra-red linescan developments at the RRE. After retirement in the 1990s, the jet was acquired by Classic Aviation Projects, registered G-BVWC and returned to the skies for airshow duties. It eventually joined the Air Atlantique Classic Flight/Classic Air Force/ Classic Aircraft Trust but has not now flown since 2007 when an engine failed during take-off from Coventry Airport.

The aim is to return it to the airshow circuit in time to help celebrate the centenary of the RAF in 2018. Along with the aircraft, the Trust has acquired a considerable stock of spares, critically with the provenance necessary to permit their use in a flying aircraft. This includes six engines plus a complete set of documentation and RAF maintenance procedures. Cranfield Aerospace has agreed to act as design authority and WK163 will now be moved to the trust's engineering facility at Robin Hood Airport Doncaster Sheffield where the restoration will begin in 2017. A fundraising campaign will now be launched and details can be found at www.vulcantothesky.org

EDITORIAL

This issue includes a poster to mark Boeing's 100th anniversary, and one of its most enduring designs, the B-52 Stratofortress, is given special attention being the subject of three articles. The B-52 has proved its worth during the course of numerous conflicts over the decades and it is also used as a political tool to demonstrate US power and resolve. If B-52s are sent to a region where tensions are high, the world's media takes note, the same cannot be said of most other aircraft types. In the article 'Barksdale Bombers – Total Force Integration' a lieutenant colonel makes an interesting comment that piloting a B-52 today is akin to flying a B-17 in the Vietnam War. However, the B-52 has been continually upgraded and adapted for new roles. For example, close air support (CAS) was once the preserve of attack helicopters and fast jets, such as the Harrier.

The B-52 was designed as a strategic bomber and yet it has entered the world of CAS where coordination with ground forces is necessary to ensure the pinpoint accuracy of weapons as friendly forces can be in close proximity to the enemy. Also, while air defences have become more potent in high threat situations the B-52 can still play its part. While it would not be sent in to fly through a sophisticated air defence network, its stand-off weapons – such as the conventional cruise missile – can be launched from outside the engagement zone of surface-to-air missiles. The first flight of the B-52 took place in 1952, and the latest estimate is that it will continue in service until around 2040.

Finally, Assistant Editor James Ronayne is moving across to our sister magazine *Airliner World*. We wish him well in his new role and want to express our thanks for all his efforts and good work on the magazine.

Enjoy the issue.

Dino Carrara
Editor

F-35 Deployment to Leeuwarden

Two Royal Netherlands Air Force (RNLAF) Lockheed Martin F-35A Lightning IIs began their first much-anticipated deployment to Europe on May 23. The aircraft, F-001 and F-002, arrived overhead Leeuwarden Air Base in the Netherlands flanking RNLAF Gulfstream IV V-11, which had met up with them over the North Sea.

Pilots Col Bert 'Vidal' de Smit and Maj Pascal 'Smiley' Smaal conducted a flyby for the gathered crowd of nearly 2,000 base members, dignitaries and media before touching down at 9.00pm.

The Lightnings had departed Edwards AFB in California, where they were being used by the Dutch component of the F-35 Joint Operational Test Team, on May 21. The initial leg of their journey took them to NAS Patuxent River, Maryland, where they were readied for the transatlantic crossing.

Royal Netherlands Air Force F-35A F-001 comes to a halt in the fading light on the ramp at Leeuwarden as F-002 taxies in behind following their ferry flight from the USA. Dutch MOD

Refuelling support was provided by a pair of RNLAF KDC-10 tankers and the jets were followed by a USAF C-17A Globemaster III carrying spares and support equipment.

During a three-week stay in their home country, they will conduct test sorties and undertake so-called 'perception flights' accompanied by an F-16, flying practice circuits at Leeuwarden and Volkel air bases. These are intended to enable local residents to experience both aircraft types so they can make noise comparisons between the two.

Over the course of 2017, more detailed noise measurements will be undertaken, prior to the arrival of the first permanently based F-35As in the Netherlands in 2019.

A350 Joins Cathay

Cathay Pacific Airways has become the sixth airline to accept the Airbus A350 XWB into its fleet. The carrier has configured the A350-900 with 280 seats, comprising 38 in Business Class, 28 in Premium Economy and 214 in the main cabin. Initially the type will be used on regional routes before going on long-haul flights. The airline has ordered 22 A350-900s and 26 A350-1000s. Airbus - master films/A Doumenjou

Japanese Debut for E190

The first Embraer 190 has entered service in Japan. The aircraft, JA241J (c/n 19000708), is operated by J-AIR, a Japan Airlines subsidiary. The maiden flight was from Osaka/Itami to Kagoshima on May 10. "The E-Jets have proven their ability to help airlines maximise yield, and sustainably enter new markets, as in the case of Japan Airlines," Paulo Cesar Silva, President & CEO, Embraer Commercial Aviation remarked. "The E190 configured with 95 seats complements J-AIR's E170 operations. The extra capacity offered also reflects the steady growth of the domestic market. We are confident that our E-Jets will continue to add strong value to J-AIR's operations, and we are grateful to Japan Airlines for their trust and for the partnership we continue to enjoy."

The carrier's President Tetsuya Onuki added: "We are honoured to receive the first E190 in Japan. The combination of the existing E170s and new E190s in our fleet will give us greater flexibility to match our products and services to customer needs. We are confident the aircraft, with our new cabin interior and the addition of Class J service, will deliver a refreshing and comfortable in-flight experience to customers."

The arrival of J-AIR's first E190 increased the total E-Jet fleet operating in Japan to 28 examples. This includes 17 of the smaller E170s in service with the carrier, along with three E170s and seven E175s flying with Fuji Dream Airlines.

Congolese Q400

The first Bombardier Dash 8-Q400 (9Q-DKV) has been delivered to Congo Airways, based in the Congolese city of Kinshasa.

Claude Kirongozi, Chief Executive Officer, Congo Airways, commented: "Since our inception, we have been looking at aircraft that would allow us to access new routes and destinations that are not currently serviceable by the larger aircraft in our fleet.

"The technologically advanced Q400 turboprop will help us open routes, increase passenger traffic and contribute to the Democratic Republic of the Congo's overall economy and development.

"The Q400 aircraft complements our fleet portfolio, growth strategy and operations, while providing excellent passenger comfort."

Co-branded 777

Boeing and China Airlines have collaborated on the world's first co-branded Boeing 777, to mark the delivery of the carrier's tenth 777-300ER. In 2004, China Airlines became the first airline in the world to use Boeing's co-branded livery on a 747-400 – dubbed the 'Blue Whale' by the carrier. The specially painted Boeing/Air China 777-300ER also marks Boeing's centenary and the 50-year partnership between the two companies.

New Livery for Air Bucharest

Air Bucharest Boeing 737-300 YR-TIB visited Cologne-Bonn Airport on May 11 wearing the airline's new livery. The jet was operating a charter flight for Blue Air. Markus Altmann

Textron Launches SETP

Textron Aviation unveiled an artist's impression and details of its forthcoming single-engined turboprop business aircraft (SETP) at this year's European Business Aviation Convention & Exhibition (EBACE), held in Geneva from May 24 to 26. The aircraft's name and type number have yet to be announced.

According to Textron, the prototype will fly in 2018, powered by a 1,240shp FADEC-controlled GE Aviation Advanced Turboprop engine driving a five-bladed McCauley Blackmac propeller. The aircraft will have a 1,842 mile (2,965km) range and a maximum speed of 285kts with a full fuel payload of 1,100lb (500kg). It will also have a rear port-side cargo hatch.

The flight deck will be equipped with the Garmin touchscreen G3000 system and the main cabin will accommodate six passengers with an optional rear toilet. **Rod Simpson**

Textron says it has already received orders for the SETP, which will sell for $4.8m. Textron via Rod Simpson

CAA Clampdown on Airspace Infringers

Pilots who infringe controlled airspace could have their licences provisionally suspended while the incident is assessed, the UK Civil Aviation Authority has announced.

The decision is the latest bid to reduce such incidents in UK airspace, which remain frequent despite previous attempts by the CAA, NATS and general aviation (GA) representative bodies to tackle this serious safety issue. In 2015 more than 1,000 infringements were reported to the CAA.

Following a recent incident at the beginning of the flying season, when a Red Arrows aerobatic display was severely disrupted, the CAA has provisionally suspended the licence of the helicopter pilot involved.

Under a new process, a pilot identified as having infringed controlled airspace, a Danger Area or Restricted Area could have their licence or licences provisionally suspended while details of the incident are investigated and follow-up action considered.

The CAA says it is committed to "delivering a speedy resolution to any investigation and will only impose a suspension for as long as necessary".

The Authority acknowledges that most infringement events are unintentional, but some have a significant impact on operations inside controlled airspace, saying: "All events, however, carry some risk and some clearly show inadequate pre-flight planning, poor airmanship or insufficient pilot knowledge.

"In a few cases, a deliberate intention to fly into controlled airspace has been found and there have been instances of multiple infringements by the same pilot. It is likely that in these circumstances pilots will have their licences suspended."

David Smith

First 787-9 for Air China

Air China officially unveiled its first Boeing 787-9 Dreamliner to the public in Beijing on May 25. The national flag carrier is the first airline in the country to operate the 787-9 variant, which complements and extends the 787 family.

With its fuselage stretched more than 20ft over the earlier 787-8, Boeing claims it can fly 40-plus more passengers an additional 285nm while burning 20% less fuel and creating 20% less in emissions than similarly sized airliners.

Dreamliner BBJ at EBACE

An unusual arrival at Geneva on May 21 for the annual EBACE show was Boeing 787-8BBJ Dreamliner N28MS. It had previously been in storage at Moses Lake, Washington, pending sale to a new owner. Mark Empson

Bücker and Funk Clubman

The Bücker and Funk BF139 Clubman made its debut at the Aero 2016 exhibition at Friedrichshafen, Germany, on April 20.

The manufacturer (formerly B&F) has acquired the historic Bücker company and is now building the FK-131 scale version of the Bücker Jungmann, the FK14 Polaris and the FK9 light sport aircraft. It's also planning to launch the BF133, based on the Bücker Jungmeister.

The two-seat BF139, which has a tailwheel undercarriage, is of all-composite construction and has a retro look thanks to its 100hp seven-cylinder Vernier Scarlett radial engine.

The aircraft, to be manufactured in the Czech Republic, sports an elegant 1930s-style cockpit. **Rod Simpson**

Skyleader on Show

On display at the 2016 Aero exhibition at Friedrichshafen, Germany, was the Skyleader UL-39 Albi – which performed its maiden flight at Budějovice in the Czech Republic on April 4.

The example on show was registered OK-UUH 01. The aircraft is powered by a 1,000cc BMW S1000RR motorcycle engine driving a ducted fan in the rear fuselage.

The all-carbon fibre aircraft, designed at Prague's Technical University, has a projected top speed of 183kts.

Aimed at private flyers, the Skyleader UL-39 Albi is also being promoted as a low-cost basic military trainer. M Fillmore via Rod Simpson

Antarctic Ops for Volga-Dnepr

Volga-Dnepr Airlines recently completed its first-ever six-month season of flights to Antarctica. Since November 4 the airline has flown 12 return services from Cape Town to the Novolazarevskaya Antarctic Research Station, carrying 190 tonnes of cargo in the process. The flights were operated by the carrier's fleet of Ilyushin Il-76TD-90VDs and required significant preparation.

Georgy Sokolov, Sales Director of Volga-Dnepr UK, explained: "We did a great deal of work before we could commence commercial deliveries – including pre-flight tests in Ulyanovsk, a series of 'ice runs' in Antarctica to check the performance and thrust reverser application procedures – and to obtain an addendum to the airplane flight manual to enable it to operate to ice airfields and transport up to 90 people onboard."

Volga-Dnepr confirmed it will launch a second season of services this November.

Nesma's First ATRs

Saudi-based Nesma Airlines has taken delivery of two ATR 72-600 turboprops. The first of the type to join the airline, they have been leased from Dubai Aerospace Enterprise (DAE).

Nesma has also signed an eight-year global maintenance agreement with ATR that will see the manufacturer providing technical support, including a spare parts inventory on lease at the airline's premises. ATR will also undertake the 'C' checks and calendar inspections.

Faisal Al Turki, Chief Executive Officer of Nesma Airlines, said: "We're honoured to receive our first regional aircraft and start developing short-haul connectivity in Saudi Arabia with these versatile and efficient aircraft.

"The ATR 72-600s have proven their robustness and suitability for all types of regional operations worldwide, and have also become a reference in terms of comfort and leading-edge technologies."

UAE Debut for AW169

Leonardo-Finmeccanica has delivered the first of two AgustaWestland AW169 light intermediate twin-engined helicopters to Falcon Aviation of Abu Dhabi, UAE, the first operator in the nation to fly the new type – which has been configured for offshore use in support of the oil and gas industry.

Falcon Aviation has ordered two AW169s, with the example still to be delivered to be in VVIP transport configuration; it is scheduled for delivery in August.

ACJ350 XWB Launched

Airbus has launched what it claims is the world's most modern VIP widebody corporate jet.

The ACJ350 XWB comes complete with what the company calls 'Easyfit', a system of hundreds of attachment points which simplifies the work of cabin-outfitters personalising the interior to meet wealthy owners' demands.

The aircraft features 2,910sq ft (270m^2) of cabin space and this ultra-long-range variant can fly 25 passengers up to 13,670 miles (20,000km) or stay 22 hours in the air.

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Air Austral Gets First Dreamliner

Air Austral's first Dreamliner, F-OLRC, departs Everett Field on May 24. Boeing

The newest addition to the Air Austral long-haul fleet touched down at Roland Garros Airport in Saint-Marie, Reunion Island, on May 25 after a 10,500-mile delivery flight from the Boeing Everett Delivery Centre in Everett, Washington State.

The first of two Boeing 787-8 Dreamliners destined for the airline, it will initially be operated on the Dzaoudi (Mayotte) to Paris Charles de Gaulle route.

Founded in 1975, Air Austral currently operates nine aircraft – including Boeing 777s – to more than ten destinations in Europe and Asia.

Quick Change 737 for Air Algerie

As we went to print Air Algerie was about to receive its first 'Quick Change' Boeing 737-7D6C. The aircraft (s/n 61304/7T-VKS), which can be converted from passenger to freighter configuration in a matter of hours, is the first of three destined for the Algerian carrier. It is seen here landing at Boeing Field on May 9 at the end of a test flight. Joe G Walker

Drones Task Force

The European Aviation Safety Agency (EASA) is to create a task force to assess the risk of collision between drones and aircraft. It will review relevant incidents and analyse existing studies on impacts between drones and aircraft as well as studying the vulnerabilities of windscreens, engines and airframes on airliners, light aircraft and helicopters.

EASA will chair the task force, which will include representatives of aircraft and engine manufacturers, and will consult with European and foreign authorities along with other relevant stakeholders.

The results of its studies are expected to be published in late July and EASA says it will organise a workshop to discuss the findings and recommendations.

The regulatory framework for the safe operations of drones in Europe currently being developed by EASA already addresses the issue of collisions with aircraft, and a combination of measures is envisaged – including operation in visual line of sight; flying under 500ft (150m) above ground level; being equipped with identification and geo-limitation functions; and registration.

Operating drones close to airfields would require specific authorisation from the national aviation authority, based on risk assessments. **David Smith**

Vietnam's Biggest Airliner Purchase

VietJet Aviation placed an order on May 23 for 100 Boeing 737 MAX 200 airliners, the largest-ever single commercial aeroplane purchase in Vietnamese aviation history. His Excellency Mr Trần Đại Quang, President of the Socialist Republic of Vietnam, and US President Barack Obama witnessed the agreement being signed at the Presidential Palace in Hanoi. The order is valued at approximately $11.3bn at current list prices. The airliners will be delivered between 2019 and 2023.

ATR 72-600 on Tour

An ATR 72-600 embarked on May 2 on a two-week demonstration tour of the US and Canada – the first time the newest ATR -600 series aircraft had flown demonstrations in North America.

It stopped at Toronto, Chicago, White Plains, Hyannis, Washington DC, Charlotte, Dallas, Seattle and Cincinnati.

According to ATR, 400-plus regional routes have been cancelled across the US since 2006 and more than 30% of the remaining routes operated by regional jets are below 300 miles – a range where the operating costs and fuel-efficiency of the newest generation of ATR -600s are claimed to be far superior.

THE GUILD OF AVIATION ARTISTS 2016 EXHIBITION

The Guild of Aviation Artists will be holding its 46th 'Aviation Paintings of the Year' summer exhibition at the Mall Galleries in London next month, with *Aviation News'* sister magazine *FlyPast* among its sponsors.

This year, 142 artists will be exhibiting over 400 original works. Their labours depict a variety of subjects – both civil and military – from the early days of flight through to the present day using a wide range of styles and media.

Guild artists will be giving daily informal demonstrations of painting in oil, watercolour, pastel and acrylic.

The event is open to the public from Tuesday, July 19 to Saturday, July 23.

Entry to the exhibition is free and a full-colour catalogue costs £5.

'Return to Base' painted by Keith Woodcock.

'S.A.R Push-out' from Peter Lightfoot.

'Full Tilt' by Ronald Wong.

World Class Engines from Ukraine

Vyacheslav A. Boguslaev,
President, Motor Sich JSC

Motor Sich JSC specializes in the design, manufacture and after-sales service of gas-turbine flight engines for civil and military aviation, industrial gas-turbine drives, and gas-turbine powerplants powered by the drives mentioned. Recently, the company has been actively working on the development of helicopter manufacturing industry in Ukraine. The quality and reliability of the flight engines manufactured by this company have been proven by their decades-long powering aircraft and helicopters in more than 100 countries worldwide.

The list of currently manufactured Motor Sich flight engines includes turboprops and turbopropfans of 400 to 14,000 h.p. as well as bypass engines of 1,500 to 23,900 kgf, with the engines being under commercial production on various stages both for passenger and cargo aircraft.

Among the engines above, one should highlight the D-436-148 designed for the An-148 passenger aircraft family: the engine meets modern requirements of ICAO and can compete with its foreign competitor products due to its performances. Various An-148 aircraft variants can transport 68-89 passengers as far as 2,100-4,400 km and provide a high level of comfort.

Currently, Motor Sich JSC is collaborating with Ivchenko-Progress State Enterprise in the development of a new generation of the AI-28 bypass engine family of 7 to 10 MT thrust class. The family basic engine is developed on the basis of both research and development potential and advanced technologies, and it will have ultra-high bypass ratio, while its fan drive will work through the gearbox. The engine is designed to power prospective passenger and cargo aircraft, while high-performance turboprop and turboshaft flight engines may be built around its core engine.

Motor Sich JSC has developed a TV3-117VMA-SM1V engine to enhance helicopter performances and efficiency when it is operated in highland regions of hot countries. The engine power settings are optimally adapted to the operation conditions that various types of helicopters are operated in. The engine automatic control system allows adjusting one of the following takeoff power parameters: 2,500 h.p.; 2,400 h.p.; 2,200 h.p. or 2,000 h.p.; and it also ensures the engine rated power flat up to higher environment temperatures and higher flight altitudes.

The continuous takeoff power setting has been introduced allowing for the uninterrupted utilization of the takeoff power setting by both operational engines for more than 5 minutes (up to 30 minutes) to improve the helicopter flight performances (if necessary).

Currently, the company is upgrading Mi-24 and Mi-8 MTV helicopters within the programme launched by the Ministry of Defense of Ukraine. Motor Sich JSC is upgrading the helicopter powerplant by replacing standard engines with TV3-117VMA-SBM1V ones.

At present, powered by TV3-117VMA (VMA of 02 Series) engines, Ka-32 helicopters are widely used to carry external loads with numerous utilization of the take-off power setting during the flying cycle. Motor Sich JSC used the TV3-117VMA-SBM1V to develop a TV3-117VMA-SBM1V-02K model with its power performances adapted for Ka-32 helicopters and their gearboxes to improve helicopter consumer performance and competitive ability.

In late 2015, IAC Aviation Register certificated the engine model above. The service life of the TV3-117VMA-SBM1V-02K to the 1st overhaul in the flying cycle conditions with cargoes transported on external loads comprises 3,320 h with no need to replace parts of the engine hot section in service, which is 4 times as high as the service life of the hot section of TV3-117VMA (VMA of 02 Series) engines operated in the same conditions.

The company is developing a TV3-117VMA-SBM1V (Series 1) model with digital-numeric automatic control system to power new prospective helicopters. The use of the new automatic system will make it possible to improve helicopter and engine performances.

The TV3-117VMA-SBM1V Series 4 and 4E engines (with air- or electronic starting systems respectively) are versions of TV3-117VMA-SBM1V engines; they are designed to remotorize earlier manufactured Mi-8T-type helicopters to improve their flight performances.

In August 2013, upgraded by Motor Sich JSC and powered by TV3-117VMA-SBM1V (Series 4E) engines, the Mi-8MSB helicopter set a number of world records, including the reaching of the altitude of 9,150 meters, which is 300 meters higher than Mount Everest, the world's highest peak.

The TV3-117VMA-SBM1V (Series 5) engine is a new project. It is designed in collaboration with Ivchenko-Progress State Enterprise. The engine power is 2,800 h.p. at take takeoff operation mode and 3,750 h.p. at emergency operation mode.Two engine versions are planned: the turboshaft version of 15 to 16 MT of take-off weight for Mi-38-type helicopters; and the turboprop version (TV3-117VMA-SMB2) for the An-140T-type cargo aircraft.

Small aircraft are high on demand in the modern world; therefore Motor Sich JSC is an active participant of the works carried out by Ivchenko-Progress State Enterprise to design small-sized turboshaft engines of the AI-450 family.

On 15 April, 2015, the upgraded AI-450M engine with takeoff power of 400 h.p., 430 h.p. or 456 h.p. (its power depends on the adjustment of the automatic control system) successfully passed endurance and certification tests and obtained Type Certificate issued by IAC Aviation Register.

On 1 August, 2015, the company launched the commercial production of the AI-450M engine designed to remotorize earlier manufactured Mi-2 helicopters, with the AI-450M engine.

The company is simultaneously working on turbofan versions of AI-450S and AI-450S-2 engines whose takeoff power is within the range of 450 to 495 h.p. and of 630 to 750 h.p. respectively; the engine versions are designed to power general-purpose and training


Mi-8MSB

aircraft. Currently, the AI-450S is undergoing flight tests as a part of the DA50-JT7 aircraft manufactured by DIAMOND AI, the world's famous Austrian company. The AI-450S-2 is designed to power the Czech version of the EV-55 two-engine multipurpose aircraft.

Keeping in mind changes on the global helicopter market environment, this company is working on the development of the MS-500V turboshaft engine family of a new generation (with take-off power of 600 to 1,100 h.p.) designed to power helicopters of various purposes whose take-of-weight is within the range of 3.5 to 6.0 MT.

The MS-500V engine version whose takeoff power is 630 h.p. and the MS-500V-01 engine version whose take-off power is 810 h.p. successfully passed endurance and certification tests in May 2014 and in April 2016 respectively, and obtained Type Certificates issued by IAC Aviation.

In 2014, the company launched the development of MS-500V-02 and MS-500V-03 engines (direct and reversal design respectively). The engines will ensure takeoff power of 1,100 h.p.

The company is now working on turboprop versions of the MS500V-S engine family whose takeoff power is within the range of 950,0 to 1,100 h.p.; the engine is designed for the general-purpose aviation, training and passenger aircraft.

The D-136 is the most powerful helicopter engine manufactured by Motor Sich JSC: the engine is second to none on the global market in terms of its power and efficiency parameters. D-136 engines power various variants of Mi-26 helicopter, the world's largest cargo helicopter that set 14 world records.

Ivchenko-Progress State Enterprise has developed the D-136 upgrade engine project that is implemented in collaboration with Motor Sich JSC. The new upgraded engine has been denominated D-136-2; it is equipped with digital-numeric automatic control system and ensures the maximum takeoff power of 11,400 h.p. that is flat up to an environment temperature of 40°C. The contingency operation mode of 12,200 h.p. has also been introduced in the D-136-2. The engine is designed to power upgraded Mi-26T2 helicopters.

The company is working on the development of an AI-136T engine, keeping in mind potential customers' wishes. This engine is a D-136-2 engine version that has similar performances, except contingency power setting, though it is equipped with the hydraulic mechanical control system.

The MS-14 turboprop engine is designed to remotorize rather mature AN-2 aircraft, the veterans of Ukraine's aviation fleet. In August 2013, IAC Aviation Register issued Type Certificate for MS-14 propulsion engine manufactured by Sich JSC.

Antonov State Enterprise has successfully finalized flight tests of the An-2-100 aircraft powered by the MS-14 engine.

Motor Sich JSC makes efforts to build up the corporate segment that deals with helicopter development, repair, and upgrade within the implementation of its helicopter manufacturing programme.

Motor Sich JSC helicopter programme allows for several stages: from upgrading and replacing engines of the existing helicopters to developing and certifying the helicopter designed and developed by the company itself, followed by further helicopter commercial production.

Upgrading the Mi-8T helicopter type by bringing it to Mi-8MSB standards, allows for the installation of innovative TV3-117VMA-SBM1V 4E series engines on it. As a result, the helicopter will have new advantages:

- a 62% increase in service ceiling (up to 7,300 m) and a substantially increased altitude of stationing;
- a 14% decrease in fuel flow rate per hour;
- an increase in operational range with two ferry fuel tanks up to 1,210 km.


TV3-117VMA-SBM1V

Within the helicopter upgrade programme, the company re-equips the Mi-8MSB helicopter with a set of navigation instruments that meet fully requirements of EASA and ICAO.

The Mi-8MSB helicopter may be manufactured in a number of versions: cargo, passenger (including VIP configuration), search-and-rescue and medical versions.

The Mi-2 helicopter is another helicopter being upgraded currently by MOTOR SICH JSC by installing AI-450M new generation engines. The upgrade is carried out along with overhaul and reconditioning efforts to ensure a longer calendar service life of the helicopter and its accessories.

The advantages of the upgraded Mi-2 helicopter are as follows: a 30% decrease in fuel flow rate per hour; a 15% increase in service ceiling; and a 10% increase in the maximum takeoff weight. In December 2014, powered by an innovative propulsion unit, the helicopter completed successfully a company flight test.

One of the high-priority vectors of the company helicopter efforts is the development of a MSB-2 helicopter on the platform of the Mi-2 helicopter, which will possess higher flight and ergonomic performances.

The helicopter simulator has been built as a part of MOTOR SICH JSC to train and retrain air staff. Skilful instructors ensure the implementation of the methodological training concept that includes the whole range of the required stages, such as gaining theoretical knowledge and initial practical skills, drilling them on electrified simulators, and carrying out training flights on real helicopters.

Nowadays, MOTOR SICH JSC activities meet fully the world's economy criteria. The company strategy focus is on the following goals: an increase in the production volume and sales of products; commercialization of series production of innovative and prospective products; expansion of sales markets to make the maximum profit of company business activity.

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47 Sqn Centenary C-130J

The RAF's 47 Squadron has specially painted Hercules C5 ZH880 to mark the unit's centenary.
Crown Copyright 2016/Steve Lympany - RAF Brize Norton Photographic Section

Lockheed Martin C-130J Hercules C5 ZH880 has been painted in a stylish new special scheme to mark the centenary of the RAF's 47 Sqn.

The tail features a much enlarged version of the crane's head from the squadron's badge on a red, yellow and blue background with '100th Anniversary' titles. The badge appears behind the cockpit and the unit's unofficial emblem of the sun rising over a pyramid has been applied just forward of the wings.

The squadron was formed at Beverley, North Yorkshire, on March 1, 1916 with Royal Aircraft Factory BE2s, BE12s and FK3s. The squadron first flew the C-130 Hercules in 1968 based at RAF Fairford, then the unit moved to RAF Lyneham in 1971 and to its current home at RAF Brize Norton in 2012.

K-MAX Trials Continue at Yuma

The two USMC K-MAX unmanned helicopters manoeuvre at MCAS Yuma on May 7 during testing to prove their use to the service.
USMC/George Melendez

A pair of US Marine Corps Kaman K-MAX helicopters arrived at Marine Corps Air Station Yuma, Arizona, on May 7 for further test and development work with the USMC. The helicopters (169221 'FF-01' and 169222 'FF-02') will make use of MCAS Yuma's ranges in Arizona and California as work continues to develop additional capabilities for the type.

These helicopters had previously been operated in a cargo resupply unmanned aircraft system (CRUAS) configuration in Afghanistan for more than three years with Marine Unmanned Aerial Vehicle Squadron 1 (VMU-1) *Watchdogs* based at Camp Dwyer. They will now be used for trials with a variety of payloads to test for a range of possible new missions the USMC is considering for future unmanned systems.

£1.1bn UK MFTS Helicopter Contract

The British Ministry of Defence has awarded Ascent Flight Training a contract worth around £1.1bn to deliver the rotary-wing training element of the UK Military Flying Training System (UKMFTS) programme.

The contract will see delivery of 32 new aircraft from Airbus Helicopters, comprising 29 H135s and three H145s.

Aircrew destined for the Apache, Chinook, Merlin and Wildcat will be taught on the above helcopters first. They will be taught by a mix of instructors from the military and Ascent.

The contract also includes the installation of new infrastructure and ground-based equipment at RAF Shawbury, Shropshire, and runs until 2033.

DART-450 Takes to the Air

Diamond Aircraft's DAR-450 (Diamond Aircraft Reconnaissanc Trainer) performed its maiden flight on May 17. Diamond describes the new aircraft as the world's first all-carbon fibre tandem, two-seat civilian and military trainer with a side-stick and pneumatic ejection seats.

Stressed to +7/-5G the fully aerobatic aeroplane is powered by a 500shp Ivchenko-Progress/Motor Sich AI-450S turboprop driving a five-bladed MT propeller.

The first flight lasted for an hour and saw Company Chief Test Pilot Ingmar Mayerbuch and Flight Test Engineer Thomas Wimmer explore a speed range of 60-200kts – although an eventual top speed of 250kts is expected.

Diamond Aircraft Chief Designer Clemens Knappert said: "We achieved our target from the first drawings to the first flight in one year. I'm already excited about what comes next."

The first DART-450 powers into the sky on its maiden flight on May 17. Diamond Aircraft

Denmark Opts for Lightning II

Danish Prime Minister Lars Løkke Rasmussen confirmed on May 12 that the Lockheed Martin F-35A Lightning II had been selected as a replacement for the Royal Danish Air Force (RDAF) F-16 fighter fleet. At a joint press conference with Defence Minister Peter Christensen, he said the Government will recommend the purchase of 27 F-35As for the RDAF.

A group of defence ministry experts concluded that the F-35A was a more suitable option for the RDAF than the rival Boeing F/A-18E/F Super Hornet and Eurofighter Typhoon, which had also been shortlisted for Denmark's fighter replacement programme.

The aircraft are expected to cost around DKK20bn ($3.06bn), with each aircraft costing around DKK740m ($113.37m).

Denmark had originally been seeking to purchase 48 new fighters, but had to reduce this number due to budget cuts. Deliveries are expected to begin in 2022 and be completed by 2027. Following the announcement, the Danish public has a 30-day period for comment, while parliament will also have to review the recommendation before making a final decision.

Largest Ever Tiger Meet

The 2016 NATO Tiger Meet (NTM) held at Zaragoza Air Base in Spain in May was the largest in the event's history. A total of 17 of the extant 24 permanent Tiger members participated with 65 aircraft, many of which appeared in new schemes. Among the highlights were a Czech Republic Air Force Mi-35 *Hind*, which had an unconventional 'Alien Tiger' scheme applied, and this Turkish Air Force F-16C Block 50 from 192 Filo. both Brian Hodgson

Second Embraer KC-390 Takes Flight

Embraer flew the second prototype KC-390 for the first time on April 28 at Gavião Pexioto, Brazil. The aircraft, PT-ZNJ, will now join the first prototype in the flight test campaign for certification. The first prototype performed its maiden flight on February 3, 2015 but was then grounded until October 26 when the Brazilian Government cut funding due to the country's severe economic crisis.

Dutch PC-7s to be Upgraded

Royal Netherlands Air Force Pilatus PC-7 s/n L-01 arrived at Stans-Buochs Airfield in Switzerland on May 2 in readiness for upgrade work by Pilatus. The aircraft will be the first of ten aircraft to be upgraded as part of a contract signed on July 29 last year. Work will include a new glass cockpit, replacing the current analogue instruments, together with structural reinforcement of the wings and undercarriage to give the fleet a further 60,000 flight hours in total. **Stephan Widmer**

Final Year for Bundeswehr Bo-105s

Bölkow Bo-105 87+62 has been painted in a special 'Stars of Memory' scheme to commemorate the type's final months of service. Rene Köhler

December 31, 2016 sees the retirement of the German Bundeswehr's last Bölkow Bo-105C helicopters – 43 years after the first example joined Army Aviation Test Squadron 910 in Celle, Lower Saxony, on April 26, 1973.

A total of 312 helicopters joined the force (100 as liaison helicopters and 212 of the anti-tank version) and they served with 17 different squadrons.

After more than 40 years' service and more than one million flight hours, the final examples will retire at the end of the year – fittingly this will take place at Celle, bringing the German Bo-105 story full circle.

Special Scheme for Belgian F-16

Belgian Defence - Air Component Lockheed Martin F-16AM FA-129 has been painted in a special colour scheme to mark the 75th anniversary of 350 Sqn, which formed at RAF Valley, Anglesey, in November 1941. The scheme includes 1940s-era camouflage and the code 'MN-B', which was worn by Spitfire LF.IXc MH434 when it served with the unit in 1944. Tom Houquet

IN BRIEF

LEONARDO-HELICOPTERS has unveiled the TH-119, a new military training variant of the single-engine AW119 helicopter. Specifically designed for military training customers, it is primarily targeted at the US Navy and will be built at the company's Philadelphia, Pennsylvania, facility. The existing AW119 demonstrator (N499SM) has been painted into US Navy colours to represent the TH-119.

The eighth AIRBUS A400M ATLAS C1 for the RAF was delivered on May 11. Aircraft ZM407 landed at RAF Brize Norton at 2212hrs after a ferry flight from Spain and has now joined 70 Sqn.

The ROYAL THAI AIR FORCE has signed a deal to purchase Airbus A340-541 HS-TLC from Thai Airways. The aircraft has been stored at Bangkok since June 2012 but has been sold for $48.85m in a package that includes spares, an extra Rolls-Royce Trent 553-61 engine as well as repainting and crew training.

The first Royal Australian Air Force BOEING P-8A POSEIDON (A47-001) was delivered from Renton, Washington State, to Boeing Field, Seattle, on May 6 for final completion. The aircraft was rolled out of the paint shop on April 28 after painting in full Royal Australian Air Force (RAAF) colours, including 11 Squadron markings on the tail.

After 20 years in retirement former USAF MCDONNELL DOUGLAS C-9A NIGHTINGALE 71-0876 has been restored to airworthy condition at Joint Base Andrews, Maryland. The aircraft was last operated by the 89th Airlift Wing at Ramstein Air Base, Germany, as a VIP transport for the Allied Commander of NATO but has now been sold to Waterworld Jet Aviation in Texas and registered (as a DC-9-32F) as N10876.

No Injuries in Guam B-52H Crash

A USAF Boeing B-52H Stratofortress, s/n 60-0047, crashed during take-off at Andersen AFB, Guam on May 18, but all seven crew members escaped from the wreckage uninjured.

The aircraft was on a routine training mission and was taking off with a full fuel load when the crew aborted the flight. It crashed within the confines of the base and the cause of the accident is under investigation.

The aircraft, which was destroyed by the post-crash fire, was deployed from the 5th Bomb Wing's 69th Expeditionary Bomb Squadron at Minot AFB, North Dakota, as part of the United States' continuous bomber presence mission in the Pacific.

MILITARY AIRCRAFT ORDERS

Air Arm	Company	Number and Type	Contract Date	Delivery Date and Notes
Bolivian Air Force	Zlin	9 x Zlin Z242L Guru	May 12	Estimated completion date July 2016
Cameroon Air Force	Cessna/L-3	Cessna Caravan (number TBC)	May 9	Estimated completion date September 2019
Chadian Air Force	Cessna/L-3	Cessna Caravan (number TBC)	May 9	Estimated completion date September 2019
Royal Danish Air Force	Lockheed Martin	27 x F-35A Lightning II	May 12	Estimated completion date 2021-2027
Royal Netherlands Air Force	Lockheed Martin	8 x F-35A Lightning II	May 12	Estimated completion date March 2021
Niger Armed Forces	Cessna/L-3	Cessna Caravan (number TBC)	May 9	Estimated completion date September 2019
Government of Pakistan	AgustaWestland	AW139 (number TBC)	May 24	Estimated completion date 2017
Philippine Air Force	Cessna/L-3	Cessna Caravan (number TBC)	May 9	Estimated completion date September 2019
Royal Air Force/Ascent	Airbus Helicopters	29 x H135	May 20	Estimated completion date April 2018
Royal Air Force/Ascent	Airbus Helicopters	3 x H145	May 20	Estimated completion date April 2018
US Army	Sikorsky	8 UH-60M Black Hawk	May 18	Estimated completion date June 2017
US Marine Corps	Lockheed Martin	6 x F-35B Lightning II	May 2	Estimated completion date December 2019
US Navy	Lockheed Martin	4 x F-35C Lightning II	May 2	Estimated completion date December 2019
USAF	Lockheed Martin	3 x F-35A Lightning II	May 2	Estimated completion date December 2019

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‘Glamping’ 767 Takes to the Water

When former Transaero Boeing 767-200ER EI-CZD flew into Shannon Airport, Ireland, for temporary storage a decade ago, few could have imagined it would eventually be acquired for an upmarket campsite.

Scrapping began in July 2014 but the airframe remained largely intact and was still standing on its undercarriage when undertaker David McGowan approached the airport authorities with a view to purchasing it.

Transaero Boeing 767 EI-CZD is transported up the west coast of Ireland to a new ‘glamping’ site in County Sligo. Malcolm Nason

Mr McGowan is developing a transport-based ‘glamping’ site by the coast at Enniscrone, County Sligo, but to retrieve the aircraft it needed to be dismantled and moved by sea – local roads being deemed unsuitable.

On May 1 the fuselage was separated from the wings and craned onto a special lorry before being transported to Knockbeg Point on the shore of the airport lagoon, which was built in the 1940s for flying boats from Foynes to access the airport.

The aircraft was then lifted onto a barge and transported out into the Atlantic for the sea journey to Enniscrone. It will now be prepared for its new role alongside similarly converted trains, boats, buses and even London taxis. **Malcolm Nason**

Sea King for Display at Yeovilton

Following retirement from Royal Navy service, Westland Sea King HC4 ZA298 moved to the Fleet Air Arm Museum’s storage facility at Cobham Hall, Yeovilton, in April. Having survived damage during three different conflicts – in the Falklands, Bosnia and Afghanistan – the helicopter was last used by 846 Naval Air Squadron, and will undergo maintenance before being put on public display.

Exhibit Boost for Cosford

As part of the RAF Museum’s transformation ahead of the RAF’s centenary celebrations in 2018, several aircraft are currently being moved and refurbished.

The museum’s Junkers Ju 88R-1 will be migrating north from Hendon to RAF Cosford in Shropshire as will its unique Boulton Paul Defiant I (N1671) along with Gloster Gladiator I K8042 and de Havilland Tiger Moth II T6296. To make space, the former Afghani Hawker Hind at Cosford will be placed in storage at Stafford.

Westland Lysander R9125 will also be heading to Cosford, but will be placed in the Conservation Centre for its fabric to be replaced.

Dakota Taxi Trials

Douglas Dakota IV KN353 during a taxi trial at Elvington on May 7. via Ian Finch

Former Air Atlantique Douglas Dakota IV (G-AMYJ) carried out successful taxi trials at Elvington, Yorkshire, on May 7. It completed two tests, the first involving slow handling lasted about 20 minutes to check all the systems.

The second, longer run included two trips down the runway and revealed a few small snags that would not have been identified without the trials. All can easily be rectified, and it was reported that the aircraft handled very well.

The Dakota team at Elvington should now be able to get the aircraft – which is painted in its original RAF markings as KN353 – into a fully taxiable condition

Pioneer Jet Warbird Sale

Vampire T.11 G-VTII, the first British registered ex-military jet warbird, has now been offered for sale. Jamie Ewan

The British classic jet scene could lose one of its best loved aircraft following the announcement that the Vampire Preservation Group's de Havilland Vampire T.11 WZ507 (G-VTII) has been listed for sale. The jet is not currently scheduled to appear at any UK airshows this year.

The 1952-built trainer was restored by the Solway Aviation Society (SAS) at Carlisle in 1980 and became the first former RAF fast jet on the UK civil register. It later passed through various owners before arriving with the North Weald-based Vampire Preservation Group in 2005.

Top Spot for Air Force One at NMUSAF

Boeing VC-137C s/n 62-6000 is moved at Dayton on April 9. NMUSAF

The National Museum of the USAF's new, fourth building, which opens to the public on June 8, will house around 70 airframes. Taking pride of place in the hangar will be former presidential aircraft, including Boeing VC-137C s/n 62-6000 – a highly modified 707-320 airliner which carried President John F Kennedy on his final flight and also served Presidents Johnson, Nixon, Ford, Carter, Reagan, Bush and Clinton.

It will be displayed close to Douglas VC-54C Skymaster *Sacred Cow* – the first aircraft purpose-built for a US leader – which flew President Franklin D Roosevelt to the Yalta Conference in February 1945. Both aircraft moved to their new home at the Dayton, Ohio, attraction on April 9.

Pearl Harbor Cat'

After several years in open storage at Ocaña, Spain, Consolidated PBY-6A Catalina N24VP (formerly EC-FMC) has been sold by David Pajus to John T Sterling from Pacific Rim Catalinas of Hawaii.

David bought the former water-bomber in 2009 and returned it to airworthy status, but an intended ferry flight to his base in Sweden never took place.

After restoration work the amphibian will be ferried to Oregon in the US, where it is likely to be painted in US Navy colours before flying to its new home, Pearl Harbor in Hawaii.

Hampden Restoration Hastens

A team of skilled volunteers and apprentices at the RAF Museum Cosford's Michael Beetham Conservation Centre (MBCC) is making rapid progress with the restoration of Handley Page Hampden P1344.

Both ends of the rudders have been remade and the tailplane recreated along with most of the elevator parts. The rear fuselage is soon to be resprayed after repairs have been made to the bomb bay area. No completion date has been set for this complex project, though work on the fuselage could be finished in 2018.

F-35 LIGHT

COUNTRY-BY-COUN

Lockheed Martin has developed the Joint Strike Fighter (JSF) to fulfil multiple missions. It is produced in three basic versions: the conventional take-off and landing (CTOL) F-35A, the short take-off/vertical landing (STOVL) F-35B and the carrier-variant (CV) F-35C. So far 12 customers have announced plans to acquire the Lightning II, as **Tom Kaminski** explains.

US Marine Corps F-35Bs were the first Lightning IIs to reach initial operational capability in July 2015 and under current plans the F-35A will attain this level with the US Air Force before the end of this year. Production deliveries began in 2011 and by the end of March 2016, Lockheed Martin had delivered 162 aircraft comprising 92 F-35A, 28 F-35B and 22 F-35C models with 229 F-35s currently under contract.

More than 250 pilots and 2,400 maintainers from six nations have been qualified through the F-35 training units at Eglin AFB, Florida, Luke AFB, Arizona, and

The US Marine Corps' VMFAT-501 is the Fleet Replacement Squadron for the F-35B and received its first two examples in January 2012. The unit was initially stationed at Eglin AFB, Florida, but relocated to MCAS Beaufort, South Carolina. Key-Jamie Hunter

NING II

TRY ANALYSIS

MCAS Beaufort, South Carolina, and frontline Lightning IIs are currently flying from Hill AFB, Utah and MCAS Yuma, Arizona.

Deliveries to international operators are already under way and six of the original nine partner countries have already received their first Lightning IIs. Additionally, three foreign military sales (FMS) customers will receive their first aircraft in 2016.

AUSTRALIA

The Australian Government selected the F-35A as a replacement for its F/A-18A fleet under Project Air 6000 and purchased its initial two aircraft as part of the Lot 6 low rate initial production (LRIP) batch. The maiden Royal Australian Air Force (RAAF) F-35A was flown for the first time when AU-1 took to the air in Fort Worth, Texas, on September 29, 2014. The fighter was subsequently delivered to Luke AFB, in December 2014 and the first Australian pilot began training at the F-35 Integrated Training Center at Eglin AFB in January 2015. Deliveries to Australia will start at the end of 2018 and 3 Sqn will become the first operational unit when it achieves IOC at RAAF Base Williamtown, New South Wales, in 2020. Williamtown will eventually house two squadrons and the operational conversion unit (OCU) and a third operational squadron will be stationed at RAAF Base Tindal, Northern Territory. Australia's original plans included 100 F-35As, however a recent decision has reduced procurement to 72.

CANADA

Despite investing more than $300m in the JSF programme since 1997, Canada has not yet committed to purchasing the F-35. Canada's Conservative Party government had announced plans to purchase 65 F-35As at a cost of $33.6bn in 2010, however the plan was postponed in 2012 for financial reasons. The nation's current Liberal Party government had ruled out purchasing ▶

Australia's first Lighting II flight occurred when F-35A AU-1 took off on September 29, 2014. Australia's planned fleet of 72 Lightning IIs will be flown by three operational squadrons and a single training unit from two bases. Serial A35-001 is currently supporting training efforts with the USAF's 56th Fighter Wing at Luke AFB, Arizona. Lockheed Martin/Liz Kaszynski

the F-35A in 2015 but it recently indicated the aircraft will still be considered as the Department of National Defence (DND) investigates options for replacing its CF-188 Hornets. The DND is currently rewriting its requirements, and recently announced plans to extend the service life of its Hornets to 2025 enabling procurement of a new fighter aircraft to be pushed out beyond 2020.

DENMARK

Denmark became the latest nation to commit to the F-35A on May 12, when it announced plans to acquire 27 Lightning IIs pending approval by the Danish Parliament. The Lightning II was selected over the Boeing F/A-18F Super Hornet and the Eurofighter Typhoon after Denmark ranked it top in its evaluation process. Additionally, Denmark judged the Lightning II to have the lowest operating costs of the three types and offered the longest service life. Although it originally envisaged purchasing 48 JSFs, the Danish evaluation determined that only 27 aircraft would be needed for the missions that would be assigned. Acquisition of the fighters is expected to cost around $3.06bn and deliveries will likely take place from 2022-2026. The aircraft will be based at Skrydstrup, which is currently home to the F-16 fleet operated by 727 and 730 Eskadrilles. Denmark had already contributed around $291m to the JSF project, and the Royal Danish Air Force has supported testing at Edwards AFB.

ISRAEL

Israel became the first country to select the F-35 through the FMS process in September 2010. It has already contracted for 33 F-35As and holds options for another 17. The initial pair of F-35As, which are known by the Hebrew name 'Adir' meaning 'Mighty One', were included in the LRIP Lot 8 order and final assembly of aircraft AS-1 began in Fort Worth in January.

Four aircraft are currently in production and the initial example will be rolled out on June 22. Delivery of the first two F-35As to 140 Sqn at Nevatim AB is scheduled for December 12, 2016. Israeli purchase plans include 50 to 75 Lightning IIs, which will feature several unique locally developed systems including an electronic warfare system, external jamming pod plus air-to-ground and air-to-air weapons. In addition, the fighter's Electro Optical Targeting System (EOTS) may also be replaced by an Israeli-designed targeting and reconnaissance system. Israel confirmed in April that the aircraft will be equipped with command, control, communication and computers (C4) software developed by IAI's Lahav Division. Currently in use on Israeli F-15s and F-16s, it will be adapted for the F-35A. Israeli pilots will initially be trained in the US but subsequent instruction will take place locally at Nevatim.

F-35B test aircraft BF-04 conducts a vertical landing aboard the amphibious ship USS *Wasp* during the 70th test flight as part of Developmental Test Phase 1 (DT-1) on October 6, 2011. Lockheed Martin/Michael D Jackson

ITALY

The Italian Air Force accepted its first F-35A at the Cameri Final Assembly and Check Out (FACO) facility, near Milan, Italy, on December 3, 2015. Known as AL-1 and assigned the Italian serial number MM7332, the aircraft was the first Lightning II to be produced outside the US. It was flown for the first time by Lockheed Martin test pilot Bill 'Gigs' Gigliotti on September 7, 2015.

Italy originally intended to purchase 131 JSFs but in 2012 it revealed plans to acquire 60 F-35As and 30 F-35Bs (the latter will be evenly divided between the Italian Air Force and Navy). The initial batch of three F-35As was included in the Lot 6 LRIP batch and five F-35As followed in Lots 7 and 8. Two F-35As and the first pair of F-35Bs will be included with Lot 10. The second F-35A built at Cameri made its initial flight in January and a third example followed in March.

On February 5, AL-1 completed the Lightning II's first transatlantic flight when it arrived at NAS Patuxent River, Maryland, where it underwent Electromagnetic Environmental Effects (E3) testing before joining the international training fleet at Luke AFB in May. Deliveries to the Italian Air Force's 32° Stormo at Amendola AB, Italy, will begin at the end of the year, when aircraft AL-6 arrives. The F-35Bs will replace the navy's AV-8Bs and will be based at Grottaglie and operate from the aircraft carrier *Giuseppe Garibaldi* (C 551).

Italian F-35A pilots will undergo training with the 56th FW's multinational pilot training

centre at Luke AFB and its commitment to the training fleet will include five F-35As. Two Italian-built aircraft departed Cameri AB for Arizona on May 19.

The Cameri FACO facility is owned by the Italian Government and operated by Leonardo-Finmeccanica and Lockheed Martin. In addition to producing the Italian F-35As and F-35Bs the facility will deliver at least 27 Lightning IIs to the Netherlands.

JAPAN

The Japanese defence ministry announced the selection of the F-35A as the winner of the Japanese Air Self-Defense Force's (JASDF's) F-X next generation fighter competition in December 2011. Japan purchased four F-35As as part of LRIP Lot 8 and will add two more with Lot 9 and four with Lot 10. The first four F-35As are being produced at Fort Worth and roll-out of AX-1 is planned for September before being delivered to Luke AFB.

The remaining 38 F-35As will be assembled at the Mitsubishi Heavy Industries and Lockheed Martin-operated Nagoya FACO, which is located adjacent to the Komaki AB and Nagoya Airfield. Assembly of the first F-35A at the FACO began in December and completion is expected in November this year. Japan's Lightning IIs will initially replace the McDonnell Douglas F-4EJs in service with the JASDF's 301 and 302 Sqns and will be stationed at Misawa AB. The total cost for the 42 aircraft programme is expected to be $20bn.

REPUBLIC OF KOREA

Seoul was expected to order additional F-15Ks from Boeing but ultimately selected the F-35A to fulfil its Phase III F-X requirement in March 2014, setting aside $7bn for the project. The South Korean Government formally committed to the purchase of 40 F-35As in September 2014. Deliveries will begin in 2018 and conclude in 2021. The fighters will be based at Cheongju AB, near Seoul. Training of Republic of Korea Air Force pilots will be carried out at Luke AFB, where an undisclosed number of South Korean jets will be assigned.

The first Italian-built F-35A taxies at NAS Patuxent River at the conclusion of its transatlantic flight on February 5 this year. Known as AL-1 and assigned the serial number MM7332, the aircraft is the first to be assembled outside of Lockheed Martin's Fort Worth facility. Lockheed Martin/Andy Wolfe

NETHERLANDS

The Royal Netherlands Air Force (RNLAF) was the first international partner to receive the F-35A variant. The RNLAF's 323 Tactical Training Evaluation and Standardisation Squadron (TACTES) concluded operations with the F-16 at Leeuwarden AB on November 1, 2014 and then stood up as an F-35A unit at Eglin AFB.

Two aircraft were purchased as part of LRIP Lot 3 and 4 and the maiden flight occurred when AN-1 took to the air in Fort Worth on August 6, 2012. Although the initial pair arrived at Eglin in July 2013, the decision by the Dutch Parliament to cancel its participation in the programme resulted in both aircraft being placed in storage. By September 2013, the decision was made to continue with the programme but reduced the original requirement for 85 F-35As. Under current plans, the Netherlands will acquire 37 aircraft at a cost of $4.32bn. The Dutch F-35As joined the operational test fleet when they were delivered to 323 Sqn (TACTES) on January 16 last year.

In February 2015, the Dutch Parliament approved the purchase of eight aircraft that will be included in Lot 10 LRIP. The aircraft will be built in Fort Worth and six will be assigned to the training fleet at Luke. They will be joined by the initial pair of Dutch F-35As once Operational Test and Evaluation (OT&E) is completed. The remaining F-35As will be purchased from 2016 to 2018 and will be assembled at the Cameri FACO. The first deliveries to the Netherlands will begin in 2019 and the fighters will initially be assigned to 322 Sqn, which will achieve IOC at Leeuwarden AB in 2021. Lightning IIs will also be operated by 312 and 313 Sqns, and full operational capability (FOC) will be achieved in 2024. Ultimately five F-35As will support training at Luke and 32 will be assigned to the operational units.

Escorted by both RNLAF's KDC-10 tankers two Dutch F-35As crossed the Atlantic and touched down at Leeuwarden AB on May 23. Just three days later the aircraft conducted the first of a series of environmental "perception" flights around Leeuwarden and Volkel Air Bases. As part of the testing the aircraft are flying arrival and departure flight paths at the bases while noise is measured at assessment points around the bases.

The first international F-35A to be produced performed its maiden flight when AN-1 (serial F-001) took off from NAS Fort Worth Joint Reserve Base, Texas, on August 6, 2012. The aircraft is the first of 37 for the Royal Netherlands Air Force. Lockheed Martin/Liz Kaszynski

NORWAY

Norway formally selected the F-35A as the replacement for its F-16A/B MLU fleet in November 2008. Procurement of the first two fighters was included in LRIP Lot 7. Aircraft AM-1 was unveiled in Fort Worth in September but was preceded into the air by AM-2 which carried out its first flight on October 6. Two additional F-35As were ordered as part of LRIP Lot 8 with six being included with LRIP Lot 9. Under current plans, Norway will order six aircraft annually through to 2024.

Its first three Lightning IIs will support the international training effort and the initial pair arrived at Luke AFB on November 10, 2015. Norway will initially assign seven F-35As to the 56th FW but the number will be reduced to four by 2024. Delivery of the first fighters to Norway is scheduled for 2017 and the entire fleet will operate from the Ørland Main Air Station. Norway plans to replace its fleet of F-16A/Bs with F-35As by 2024 and has already funded the procurement of 22 of its planned fleet of 48-52 F-35As. In preparation for its transition to the F-35A, 332 Sqn ceased flying the F-16 in September. It is scheduled to begin flying the Lightning II in 2017. ▶

Norway ordered its first two F-35As as a part of Low Rate Initial Production Lot 7. The second Norwegian F-35A, which carries the serial 5088 was actually the first of the initial pair to fly at Fort Worth when it took to the air on October 8, 2015. USAF

Royal Norwegian Air Force (RNoAF) F-35s will be the first to be equipped with structural provisions for a drag chute capability that will aid in reducing the aircraft's landing roll on shorter or icy runways. The drag chute will be housed in a missionised aerodynamic pod that will be installed on the upper portion of the rear fuselage and flight testing of the system will be carried out at Edwards AFB, beginning in 2017. F-35A test aircraft AF-02, which is an instrumented loads aircraft, will support the tests. Norwegian F-35As will eventually be equipped to carry the long-range anti-ship Joint Strike Missile (JSM), which is being developed by Kongsberg and Raytheon. The missile is designed for carriage both internally and externally.

TURKEY

Turkish Air Force requirements for the F-35A originally totalled 100 aircraft, however it has recently indicated it could increase its order to 116. Turkey's Defence Industry Executive Committee (DIEC) selected the F-35A as the air force's future combat aircraft in December 2006.

The DIEC approved the purchase of two F-35As in May 2014 and four additional aircraft were authorised in January 2015. The first two fighters will be delivered in 2018. The follow-on batch of four F-35As will be included in Lot 11 production and delivered in 2019.

UNITED KINGDOM

The United Kingdom became the first international participant in the JSF programme in 2001 when it committed $2.1bn to the project. In fact, a British test pilot carried out the first test flight of the STOVL X-35B demonstrator at Edwards AFB. The British and American governments initially signed a memorandum of understanding on Royal Navy programme participation in 1995 and that was modified in 1999 to include the RAF.

After some indecision whether the UK would operate the F-35B or the F-35C; in May 2012, the Defence Secretary confirmed that the short take-off/vertical landing variant would be procured for the RAF and Royal Navy's Fleet Air Arm.

Plans for the acquisition of 138 F-35s were confirmed by the Strategic Defence and Security Review 2015, in November. The first two F-35Bs were purchased as part of LRIP Lot 3 and single examples followed in Lots 4 and 7. Four additional aircraft were added in Lot 8, six will follow in Lot 9 and the purchase of three more is planned as part of Lot 10.

The UK's first aircraft was rolled out of the final assembly facility in Fort Worth in November 2011 and BK-1 flew for the first time there on April 13, 2012. Training was initially carried out at Eglin AFB, however; British personnel moved to MCAS Beaufort, along with VMFAT-501 where they are currently embedded with the Marine Corps unit.

One of the 138 Lightning IIs the UK intends to buy. Key-Jamie Hunter

In February last year, 17 (Reserve) Sqn formally stood up as part of the Joint Operational Test Team (JOTT) at Edwards. Both RAF and Royal Navy personnel make up the squadron, which is responsible for the operational test and evaluation of the UK's F-35Bs. The first UK Lightning II arrived at Edwards earlier on January 13 when aircraft BK-1 touched down. Britain's fourth aircraft first flew on December 2, 2015 and it was delivered to NAS Patuxent River in February before being ferried to Edwards in March, increasing 17(R) Sqn's complement to three aircraft. Currently, BK-3, which arrived at Beaufort in February 2015, is the only aircraft supporting training. The next deliveries were due to begin in May when BK-5 is expected to arrive at Beaufort and three additional aircraft will follow by the end of the year.

The F-35B will be the backbone of Britain's future carrier operations providing strike capabilities to the Royal Navy's two new carriers the HMS *Queen Elizabeth* (R08) and HMS *Prince of Wales* (R09).

The first F-35B operational unit will stand up in 2016, when 617 Sqn is re-formed at Beaufort. The squadron will relocate to the UK beginning in June 2018 and should achieve IOC-land by December. Flight trials aboard the *Queen Elizabeth* are scheduled to begin in 2018 and IOC for carrier operations (IOC-maritime) will follow in 2020. Full operational capability (land and maritime) should be achieved in 2023.

Aviation Week report that Air Commodore Harvey Smyth, the commander of the UK's Lightning Force, said the operational fleet will include 48 aircraft that will be divided between four squadrons at RAF Marham, Norfolk. Additionally, Marham will house an operational conversion unit (OCU) that will begin training in 2019 and use 12 Lighting IIs. Three will continue to support operational testing at Edwards. The remainder will apparently be retained as a sustainment fleet that will provide for maintenance and attrition and to ensure the out-of-service date can be reached.

A UK Lightning II will be among the JSFs attending the Royal International Air Tattoo at RAF Fairford, Gloucestershire, and the Farnborough International Airshow in Hampshire this July when both the F-35A and F-35B will appear.

Although the UK F-35Bs will be delivered in the same configuration as the US Marine Corps versions, they will feature additional armaments including the Advanced Short Range Air-to-Air Missile (ASRAAM), Selective Precision Effects At Range Capability 3 (SPEAR 3) missile and 500lb (227kg) dual-mode Paveway IV precision-guided bomb. Release of the first Paveway IV took place over the Atlantic Test Ranges last June and testing of the ASRAAM began earlier this year.

UNITED STATES

The United States will purchase 2,457 JSFs at an estimated cost of $379bn. Its initial share of the 10-year System Development and

Demonstration (SDD) phase totalled more than $41bn. The US Air Force will be the largest operator of all the forces with a planned purchase of 1,763 F-35As. The US Marine Corps will operate 353 F-35Bs and 67 F-35Cs and the US Navy will acquire 260 F-35Cs.

Testing is currently underway at Edwards AFB, where the JOTT, which consists of the USAF's 461st Flight Test Squadron and 31st Test & Evaluation Squadron (TES), Marine air test and evaluation squadron VMX-22, the US Navy's air test & evaluation squadron VX-9, the RNLAF's 323 Squadron (TACTES) and the RAF's 17(R) Sqn, is carrying out developmental and operational testing with all three versions of the Lightning II.

The Marines received its first production F-35Bs when two examples were delivered to VMFAT-501 at Eglin AFB, in January 2012. Training started in May that year, however, the squadron began a planned relocation to MCAS Beaufort in July 2014. Instruction shifted to the Marine Corps Pilot Training Center at Beaufort beginning in October 2014.

The first operational F-35B was delivered to Marine strike fighter squadron VMFA-121 at MCAS Yuma in November 2012 and the squadron achieved IOC on July 31 last year. That milestone meant that the squadron had ten F-35Bs, equipped with Block 2B software, available for deployment. Marine attack squadron VMA-211 is scheduled to begin its transition from the AV-8B to the F-35B at Yuma in June 2016 and received its first two Lightning IIs on May 9. VMFA-121 will begin relocating to MCAS Iwakuni, Japan, in January. Transition of a third squadron will follow in 2018. Ultimately nine active duty Marine Corps squadrons will be equipped with 16 F-35Bs, and five will have ten F-35Bs.

Two Marine Reserve squadrons will each have ten F-35Bs and 25 examples will be assigned to each of two fleet readiness squadrons. In addition, four active duty Marine squadrons will each be equipped with ten F-35Cs that will support US Navy carrier air wing operations.

The first F-35A for the USAF's 33rd FW (a training unit) arrived at Eglin AFB in July 2011 and the 58th Fighter Squadron (FS) reached its full complement of 26 fighters when the last example arrived in May 2014. The wing's Operational Utility Evaluation (OUE) began in September 2012 and concluded in November. It was declared ready for training (RFT) by Air Education and Training Command (AETC) in December 2012 and the first class began in January 2013.

AETC's 56th FW at Luke AFB, welcomed its first F-35A in March 2014 and training began in May last year. Luke will serve as the primary training base for US and international F-35A training and will host six squadrons and 144 fighters by 2024.

As of late April, the wing has flown more than 7,000 hours, trained around 60 pilots and received 36 Lightning IIs. It expects to gain eight additional fighters in 2016, comprising two RNoAF, the first two Italian Air Force and four more USAF aircraft. Whereas all of the students trained thus far at Luke have transitioned from other fighter aircraft, the first 'B-Course' will train newly rated pilots from December. The wing first stood up the 61st FS, then 62nd FS and will also activate a third F-35A squadron in August, when the 63rd FS is established.

During 2012, Air Combat Command (ACC) approved a bed-down plan for 960 combat-coded F-35As that will be assigned to 44 squadrons at 31 operating locations. Whereas the Primary Aircraft Authorization (PAA) for the Active Component (AC) and the Air Force Reserve Command (AFRC) will be 24 aircraft, Air National Guard (ANG) squadrons will each get 18 fighters.

The 31st TES received its first two F-35As in March 2013 and operational testing began at Edwards that same month. The 422nd TES received its first four F-35As in March 2013 and flew its initial sorties at Nellis AFB in April. The squadron is primarily tasked with developing the tactics that will be used in air-to-air and air-to-ground combat and determining how the fighter is integrated into the USAF inventory. The Nellis-based USAF Weapons School's 16th Weapons Squadron, which will start its first student course in January 2018, also received its first F-35A in January 2015.

Six F-35As, flown by the 31st TES, engaged in 54 simulated combat missions alongside A-10C Thunderbolt II, F-15E Strike Eagle and AH-64D Apache aircraft, delivering ten 1,000lb GBU-31 and 20 2,000lb GBU-32 Joint Direct Attack Munitions (JDAM), while operating from Mountain Home AFB, Idaho, between February 8 and March 2. In addition to validating the aircraft's capability to deploy, the test scenarios included air interdiction, limited suppression of enemy air defences (SEAD) and basic close air support (CAS) missions that supported concept of operations development in advance of the planned declaration of IOC.

In December 2013, the USAF announced that ACC's 388th FW and the AFRC's 419th FW, which operates as an associate alongside the active duty wing at Hill AFB, would jointly operate the first combat-coded F-35As. It also revealed that the Vermont ANG's 158th FW would receive the Lightning II. Eielson AFB, Alaska, was selected, in August 2014, as the bed-down base for 48 Lightning IIs and in January 2015, RAF Lakenheath, Suffolk, was named as the first location in Europe. It will receive the first of 48 F-35As in 2020. Vermont's 134th FS expects to receive its first F-35A in late 2019 and deliveries to Eielson will follow in 2020. The first two F-35As arrived at Hill AFB on September 2 last year and the two wings are working toward declaring IOC with Block 3I software between August and December.

Known as the 'Grim Reapers', strike fighter squadron VFA-101 serves as the US Navy fleet replacement squadron (FRS) for the F-35C at Eglin AFB. The squadron was activated in 2012 and received its first F-35C on June 22, 2013. It currently has 20 fighters assigned. It is tasked with training instructor pilots and developing the training syllabus and will eventually reduce its complement to 15 aircraft.

A second FRS will stand up when VFA-125 is reactivated at NAS Lemoore, California, in January 2017. Under plans announced in ▶

The USAF plans to buy 1,763 F-35As including 144 that will be assigned to the 56th Fighter Wing at Luke AFB. Lockheed Martin/Darin Russell

The first production F-35C is assigned to VFA-101 'Grim Reapers' at Eglin AFB, Florida. Aircraft BuNo 168733 was accepted by the Navy in February 2013. Lockheed Martin/David Daris

May 2015, VFA-97 will be the first squadron to transition from the Super Hornet to the F-35C at Lemoore in January 2018 and it will achieve IOC with Block 3F software. By 2028, 100 of the Navy's planned complement of 260 F-35Cs will be assigned to Lemoore. Each of the seven operational squadrons will have ten F-35Cs assigned, and VFA-125 will be responsible for 30 Lightning IIs.

The F-35C has completed two at-sea developmental test (DT) periods and a final series of sea trials is planned for this year. VFA-101 is scheduled to conduct its first day carrier qualifications (CQ) in June.

FOLLOW-ON MODERNISATION

Although the Block 3F software is the culmination of the SDD, development of new and upgraded capabilities will continue. The JSF Program Office is currently working with customers to identify the capabilities to be added to the aircraft and approval of a Follow-on Modernization/Block 4 Capabilities Development Document by the Joint Requirements Oversight Council (JROC) is expected this summer. Lockheed Martin is already conducting research and development efforts under a Planning and Systems Engineering contract awarded in June 2015.

Block 4 development should begin in mid-2018 and the first software release will follow in 2020. Those efforts will likely include incorporation of a new processor and a new electro-optical sensor. Integration of the B61-12 nuclear weapon that will make the F-35A variant a dual-capable aircraft (DCA) is aligned with Block 4.

In addition to Canada, several air arms including the Republic of Singapore Air Force and the Belgian Defence - Air Component are currently considering the F-35A while the Spanish Navy is discussing the F-35B as a replacement for 12 Harrier IIs that operate from the aircraft carrier *Juan Carlos* (L61). Turkey is also building a 740ft (226m) multipurpose aircraft carrier that is based on the design of the *Juan Carlos* that could support the operation of F-35Bs.

A total of 229 F-35s are currently under contract. As production increases and the programme matures, the Lightning II will become more capable and less expensive to produce. Recent reports indicate the cost of the F-35A should be reduced to $80-85m by 2019. The F-35 Joint Program Office is currently exploring the possibility of entering into a Block Buy Contract (BBC) for LRIP Lots 12-14 that would achieve significant cost savings by allowing the contractors to order parts and materials in larger more economic quantities. Despite its price tag the Lightning II will likely dominate fighter sales in the coming years, much as the F-16, which preceded it, has for the past three decades. AN

F-35B BuNo 168723 conducted the first vertical landing by a production aircraft at MCAS Yuma on March 21, 2013. Although assigned to VMFA-121, the Lightning II was flown by a pilot from the Marine operational test and evaluation squadron VMX-22. Lockheed Martin/Molly Hauxwell Carroll

Not all fast computers reach Mach 2

Eurofighter Typhoon

BAE SYSTEMS

INSPIRED WORK

THE 748
A BRITISH SUCCESS STORY

Stephen Skinner examines the development of a turboprop that achieved success in both airline and military service.

Above: **Hawker Siddeley HS 748 G-BEBA flew with Dan-Air from 1976 until 1989 with leases to several operators during that time. It first flew in August 1967 and had been delivered to Fiji Airways as VQ-FAL. Registered as C-FKTL to Springer Aerospace, it was destroyed by fire in Ontario on August 14, 1991.** AirTeamImages.com/Carl Ford

The 748 came about as a result of cutbacks in British military spending following the 1957 Defence White Paper. At that time Hawker Siddeley's aircraft companies (which included Avro) were solely concerned with military aircraft manufacture, so Avro sought to re-enter the civil market; following its disastrous post-war experience with the Tudor, the company had stayed out of civil aircraft for almost a decade.

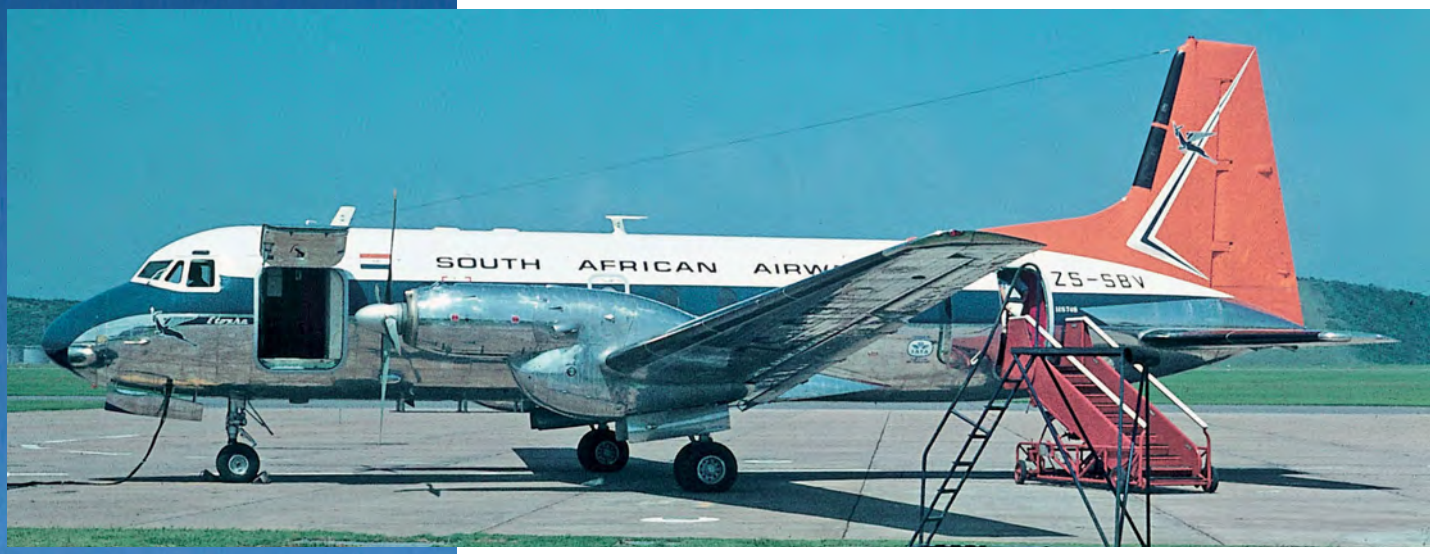
Rightly concluding that there was a huge demand for a DC-3 replacement, as some 3,000 were still in service, in January 1959 Avro introduced its 44-seat, low-wing, twin-Dart 748 as a direct competitor to the Handley Page Herald and Fokker F27 Friendship. To give it a competitive edge the manufacturer designed it to be of a rugged construction and have superior hot-and-high performance.

Six months later, in a fillip to the programme, the Indian Government signed a contract to licence-manufacture the 748 for the Indian Air Force and Indian Airlines.

The prototype, G-APZV, powered by 1,670shp Rolls-Royce Dart RDa.6 Mk 514 turboprops, made its first flight from Woodford near Manchester on June 24, 1960 piloted by Avro Chief Test Pilot Jimmy Harrison.

The second prototype, G-ARAY, was damaged during construction when a fire at Chadderton (also near Manchester) on October 3, 1959 caused a hangar roof to collapse on the fuselage, delaying its first flight until April 10, 1961.

Six months later G-ARAY was converted into the prototype 748 Series 2 fitted with higher-powered Dart RDa.7 Mk 531s (1,815shp later 2,100shp), enabling it to fly at heavier weights and higher altitudes – which translated into either greater payload or longer range. During testing the decision was taken to extend the 748's wingspan by 3ft 6in (1.1m), a modification also applied to the first prototype.



Above: **ZS-CBV was the fourth of South African Airways' fleet of five 748s which entered service in 1970.** Key Collection

The first production aircraft, G-ARMV, for Skyways Coach-Air, took its maiden flight on August 30, 1961, joining the other two aircraft in the flight test programme. In November it completed route-proving trials for the certification programme, and the following January the 748 was granted a Certificate of Airworthiness.

Aircraft G-ARAY was used as the 748 demonstrator, flying more than 91,000 miles (146,450km) on sales tours around the world. It was also leased for periods to airlines, resulting in sales of 30-plus aircraft. At the end of April 1967 it was sold to Flacks Flyvetjeneste of Denmark. Four years later it returned to the British register as G-ARAY to fly with Dan-Air before finally being broken up in 1990.

Following G-ARAY's sale, Hawker Siddeley used the first Series 2A, G-AVRR as a demonstrator.

FIRST AIRLINE SERVICES

The first airline sale came in January 1961 when Aerolineas Argentinas ordered nine aircraft, by which time a full-scale production line had been established at the Chadderton factory with final assembly at Woodford.

The 748's first airline service was with Aerolineas Argentinas on April 2, 1962 on a flight from Buenos Aires to Bahia Blanca. The carrier soon increased its order, buying 12 in all. One reason the carrier had purchased the type was its need for an aircraft offering airliner comfort but which could operate from undeveloped, rough airstrips – there were plenty of those on its network.

In May 1963 the Avro name was dropped and the aircraft became the Hawker Siddeley 748. That year the company was very busy with the 748, turning out around two a month. It had a large order backlog ▶

Below: **The two 748 prototypes, G-ARAY and G-APZV, together for the former's first flight on April 10, 1961.** Avro Heritage

from airlines and was also building thirty-one 748 Military Freighters (MFs) for the RAF.

Orders from other Latin American airlines included Avianca, LAN-Chile, Varig and LAV of Venezuela. On the other side of the world, Thai Airways started operations in 1964 with three 748s and continued adding aircraft to reach a total of nine. Philippines Air Lines followed suit as did Aden Airways, Air Ceylon, Leeward Islands Air Transport, Merpati, Fiji Airways, New Zealand's Mount Cook and many more.

The 748 sold well in Africa too, where there were eventually 21 operators. Canada also proved a strong market where 748s flew with operators such as Midwest, Air Gaspe and Quebecair.

Meanwhile, the 748 made headway in the very competitive market conditions of Europe, earning orders from BKS, Austrian Airlines, Channel Airways, Autair, British Airways and Dan-Air.

British Airways' fleet grew to 12, and among their uses were flying Highlands and Islands routes in the 1980s and 1990s. Dan-Air's 748 fleet began when it purchased the second prototype, G-ARAY, in 1971 and in total it operated 22.

VARIANTS

Production of civil market models covered two basic versions: the Series 1, certificated in January 1962, of which 18 were built; and

Above: **Originally delivered to Varig in 1968, this 748 was sold to Bouraq of Indonesia nine years later and became PK-IHJ.** Key-Alan Warnes

the Series 2, certificated in October that year.

The Series 2A then became the standard model, with the first delivery made to Avianca in September 1968. It used the more powerful 2,230shp Dart RDa.7 Mk 532-2 for improved airfield performance, but was otherwise similar to the Series 2. To take advantage of the benefits offered by this engine, most Series 2 aircraft were later modified to this standard.

By 1976, with more than 250 HS 748s in service, flying hours built up rapidly and were well past the 2 million-hour mark. Aerolineas Argentinas had the lead aircraft, which had clocked up more than 30,000 hours.

The 748 was still selling well, with production then around 18 aircraft a year, mainly for military customers and for governments' use. HS 748s had been sold to 60 military and civil operators, providing a firm base for reorders.

Below: **The 748 was required to undergo rough field take-off and landing trials for the RAF Military Transport contract. Aircraft G-ARAY is pictured at RAF Martlesham Heath, Suffolk on January 29, 1962. The 748 was competing against the Handley Page Herald.** BAE Systems

To keep the type competitive, a completely redesigned interior was developed for the latest passenger models, with enclosed overhead lockers and a new seat design giving greater comfort and space. Passenger seating configurations varied from 40 to 62 while providing ample space for baggage and freight.

Conversion from passenger to an all-freight layout could be achieved in 15 minutes with the removal of the seats and the introduction of lightweight glass-fibre screens to protect the cabin trim.

At the maximum take-off weight of 45,087lb (20,451kg), the 748 could carry a payload of slightly more than 11,580lb (5,253kg) over a distance of 540nm (1,000km), with fuel reserves for 188nm (348km).

ANDOVER

In the early 1960s the Royal Air Force had an urgent requirement for a short-range transport aircraft to replace its remaining Vickers Valettas, Blackburn Beverleys and Handley Page Hastings.

There were two main competitors – the proposed military variants of the Avro 748 and Handley Page Herald. The demonstrator G-ARAY took part in take-off, landing and taxiing trials against the Herald on a ploughed up field at RAF Martlesham Heath, Suffolk in January 1962.

Above: **Hindustan Aeronautics of India licence-built 89 HS 748s between 1961 and 1984. The Indian Air Force has now painted its 748s in an all-over grey scheme.** Key-Alan Warnes

Below: **One of the RAF's 31-strong Andover C.1 fleet with its kneeling undercarriage and rear ramp open.** Key Collection

The Herald had already been tested and would have won the contract. But Handley Page's failure to join either the British Aircraft Corporation (BAC) or Hawker Siddeley saw the contract awarded to Avro, which led to the 748MF. This had a redesigned, raised rear fuselage and tail for rear loading and air-dropping, a strengthened freight floor and increased gross weight.

It also had increased power from the Dart RDa 12 Mk 301, which could produce 2,970shp, and a 'kneeling' undercarriage to facilitate loading and unloading freight.

The first 748, G-APZV, was dismantled at Woodford and returned to Chadderton for conversion into the aerodynamic prototype of the 748MF. Re-registered as G-ARRV, it first flew in its new configuration from Woodford on December 21, 1963 piloted by Jimmy Harrison. The name Andover had been chosen that year, and a contract signed for 31 production aircraft.

In addition, six basic 748s equipped to VIP standard were ordered as Andover CC.2s for communications flying, three of which were delivered to the Queen's Flight at RAF Benson, Oxfordshire.

The first Andover C.1 to fly was XS594, which took to the air on July 9, 1965 and was delivered to the Aeroplane and Armament Experimental Establishment (A&AEE) at Boscombe Down, Wiltshire, before the end of the year.

Deliveries to Transport Command at RAF Abingdon, Oxfordshire, started in July 1966. In December the first two squadrons were formed: 46 Sqn and 52 Sqn, which were destined for service in the Far East Air Force. Late in August 1967, 84 Sqn of the ►

Below: **An Andover C.1 (left) next to an Andover CC.2 of the Queen's Flight.** Key Collection

Above: **Indian Air Force licence-produced 748 H-2175 was converted in the late 1980s into a testbed for a fuselage-mounted radome, which had a diameter of 24ft and a depth of 5ft. The aircraft crashed in January 1999.** Key-Alan Warnes

INDIAN 748s

The Indian Government assigned the 748 project to Hindustan Aeronautics.

The initial Indian 748, serial number BH572, flew for the first time on November 1, 1961 from Kanpur. The first four were Series 1s assembled from parts made in Britain, but as production developed in India a greater number (Series 2s) were made there.

The final 20 were built with the large freight door. Both the Indian Air Force and Indian Airlines took on the type and in total 89 were licence-built in India between 1961 and 1984. The Indian Air Force is possibly still operating as many as 50, but intends to replace them soon.

Middle East Air Force, later Air Forces Gulf, became the third and final squadron to re-equip with the type.

At the end of 1969, 52 Sqn disbanded, followed in October 1971 by 84 Sqn. This led to more Andovers being assigned to 46 Sqn, which reached a peak in 1972 with 19. This unit too disbanded, in August 1975, a victim of defence cuts.

In 1976, 20 aircraft were in storage with 5 MU at RAF Kemble, Gloucestershire, following the cuts. Ten Andovers were sold to the Royal New Zealand Air Force as a Bristol 170 replacement, but these were withdrawn in 1984.

A number were scrapped while nine were converted at Woodford to become Andover E.3s for radio and airfield navigation aid calibration. They were allocated to 115 Sqn at RAF Brize Norton, Oxfordshire from 1976. The unit moved to RAF Benson in 1983 and flew the Andovers for another ten years. Others were employed for communications flying at Boscombe Down and with the Empire Test Pilots' School (ETPS).

The last UK military example in service was the ETPS's XS606, which was only withdrawn from use in December 2012 before being sold to West Wind Aviation of Canada. It crashed in November 2015 in South Sudan while operating on behalf of the UN World Food Programme.

Besides the Andovers built for the RAF, a military freighter version of the standard HS 748 entered production in the 1970s with an optional strengthened floor; a large side-opening freight door which could be opened in flight for paratroop or supply dropping; and accommodation for up to 58 troops.

The first aircraft with the new door, G-AZJH, flew in this configuration on December 31, 1971. The aircraft already had rapidly interchangeable passenger, passenger/cargo and all-cargo role capabilities, but the large door enabled operators to load bulkier items and light vehicles.

Other military roles undertaken by the HS 748 such as aeromedical evacuation. The Royal Australian Air Force used eight as navigation and air electronics flying classrooms for training aircrew. The Royal Australian Navy also used two in a similar role.

Other military HS 748 operators were Argentina, Brunei, Belgium, Brazil, Colombia, Ecuador, Nepal, South Korea, Thailand and Zambia. The Royal Thai Air Force only retired its last five active aircraft in March 2016, the oldest having served for more than 51 years.

Several others are reportedly still in use, including a pair with the Republic of Korea Air Force and one with the Nepalese Army.

The HS 748 proved popular as a VIP and executive transport, seeing use as a personal aircraft by the heads of state of Argentina, Brazil, Chile, India, Thailand, Venezuela and Zambia as well as the UK.

COASTGUARDER AND MULTI-ROLE 748

The Coastguarder was Hawker Siddeley's answer to the challenge of providing low-cost maritime surveillance and search and rescue over large areas. The prototype, G-BCDZ,

Below: **The sole 748 Coastguarder G-BCDZ, a sensible development that surprisingly failed to make any sales. It flew in 1977 and was eventually converted back into a standard 748 in 1980.** Avro Heritage

Above: **One of the Emerald Airways fleet, G-OPFW, in Parcelforce livery. This aircraft was initially delivered to Polynesian Airways.** BAE Systems

first flew from Broughton, Flintshire, on February 18, 1977, where it had been rebuilt from a standard 748.

It had a radome beneath the forward fuselage and blister windows for observers in the rear fuselage. Normal crew complement was six: two pilots, navigator, radar operator and two observers/store dispatchers.

The Coastguarder could carry stores, flares and life rafts. It had the option for two hardpoints on each wing that could carry weapons, electronic countermeasures and a pylon-mounted searchlight.

The aircraft made demonstration tours of Europe and South America, and although Hawker Siddeley had estimated there was a market for 200 aircraft, no sales materialised. In November 1979 it was converted back to a normal 748 configuration.

Despite its lack of success the company still thought there were potential sales for the variant, and another aircraft, registered G-BDVH and dubbed the 'Multi-Role 748', also featured a large freight door and later received the radome and observer windows of the Coastguarder – but it too failed to sell.

REBRANDING

Just as the Avro 748 had become the Hawker Siddeley 748 following the group's rationalisation, it was rebranded again as the BAe 748 with the formation of British Aerospace in 1977.

In a competitive market place, development had to continue – and the basis for the new BAe 748 Series 2B was the uprated 2,280shp Dart RDa.7 Mk 536. Wingspan increased from 98ft 6in (30m) to 102ft 5in (31m), the avionics were upgraded and sound-proofing improved. The prototype 2B, G-BGJV, took its maiden flight in June 22, 1979.

Even this development was not the sturdy airliner's last, for in 1983 BAe announced the Super 748 with hush kits, greater fuel efficiency, an interior redesign and a more advanced flight deck. The prototype, G-BLGJ, flew for the first time on July 30, 1984 and displayed at that year's Farnborough airshow.

By this time the number of 748 orders had slowed to a trickle and the final delivery was to Makung Airlines of Taiwan on January 24, 1989. A total of 381 were built with all bar the first prototype delivered to customers.

The last UK operator was Emerald Airways, which ceased trading in 2006, its fleet having peaked at 17 HS 748s. There are 748s still flying in Canada, where Air North has three active on scheduled and charter services (see our sister magazine *Airliner World's* April 2016 issue for an article on the type with this carrier). Elsewhere in Canada, Wasaya Airways also has three while Air Creebec is still flying two and Air Inuit one. In Bangladesh, Bismillah Airlines still flies three examples.

The 748 was a successful example of continuous airliner development and refinement which maintained demand for the aircraft for as long as possible. AN

Below: **This HS 748 C-FCSE made its maiden flight in April 1970 and for the last ten years has been in service with Air North in Canada.** AirTeamImages.com/JHribar

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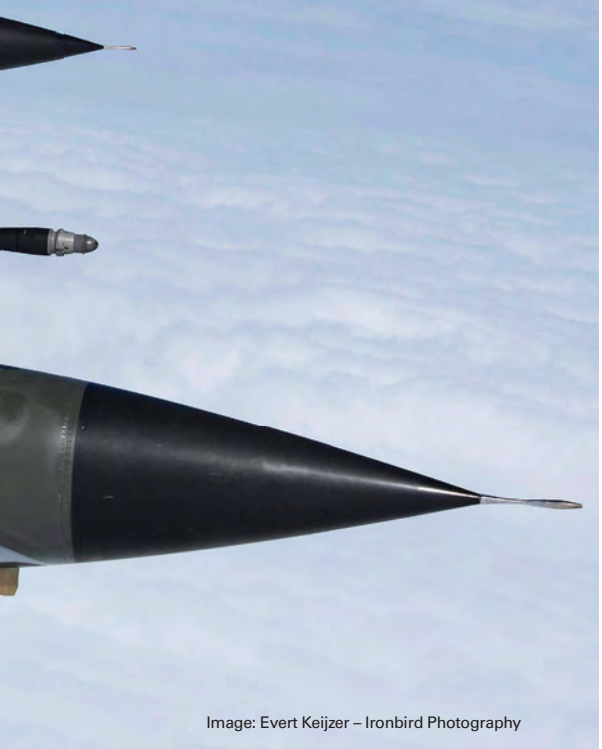

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AIRSHOW NEWS

Wings of Storm to Make RIAT Debut

When the Croatian Air Force's Krila Oluje display team appears at this summer's Royal International Air Tattoo (RIAT) it will mark the nation's debut at the event. In doing so it becomes the 56th nation to take part in the Air Tattoo.

Since its first public appearance in 2004, the Croatian Air Force's aerobatic display team – the name of which translates to Wings of Storm – has displayed its six Pilatus PC-9M turboprop trainers around the world, but it has never before appeared in the UK.

Another treat for RIAT visitors comes in the form of the Krila Oluje support aircraft, a Mil Mi-171 transport helicopter, which will be on static display at the event, scheduled for July 8 to 10.

Wings of Storm's UK debut has been eagerly anticipated by airshow enthusiasts but the wait is nearly over. via RIAT

RNAS Yeovilton Air Day Line-up Additions

Supermarine Seafire IIIC PP972 will pay its first visit to the RNAS Yeovilton International Air Day and will appear alongside an FG-1D Corsair from The Fighter Collection. Shaun Scholfield via RNAS Yeovilton International Air Day

In addition to an exciting line-up of modern military aircraft, this year's RNAS Yeovilton International Air Day 2016 on July 2 will host a number of rare restored naval fighters.

The UK's only active Chance Vought FG-1D Corsair (G-FGID) will take to the skies in its first Air Day appearance in many years, and its routine will include a formation flypast with Air Leasing's recently restored Supermarine Seafire LFIIIc (PP972/G-BUAR). The Seafire, which was originally built at the nearby Westland factory, is making its Air Day debut.

Other historic Fleet Air Arm aircraft in the flying display include Fairey Swordfish W5856 and de Havilland Sea Vixen XP924/G-CVIX.

Meanwhile, among the modern military hardware on display at the event will be a pair of French Navy Dassault Rafale Ms. The multi-role fighters are making their only UK appearance of the year, demonstrating the close relationship between both navies.

Flying Legends Attendees

This year's Flying Legends airshow will take place on July 9 and 10 at IWM Duxford, Cambridgeshire. Among the impressive line-up of historic aircraft attending will be Patrick Donovan's Lockheed 12 A Junior Electra, NC14999, which he is flying in for the show from the US. It was the first entirely designed by aviation genius Kelly Johnson in 1935. This example was built three years later.

The Classic Formation (which is made up of Douglas DC-3 N431HM and two Beech 18s, N21FS and N223CM) will also be attending. There will be three aircraft from The Flying Bulls. It is sending North American B-25J Mitchell N6123C, Lockheed P-38 Lightning N25Y and Chance Vought F4U-4 Corsair OE-EAS. For more details and updates check out https://www.flyinglegends.com/

Chipmunks Gather to Celebrate 70th Anniversary

The highlight of events at Old Warden to celebrate the 70th anniversary of the Chipmunk's maiden flight was a special '70' formation impeccably flown by 16 Chipmunks despite the gusty conditions. Raymond L Chick

The maiden flight of de Havilland DHC-1 Chipmunk prototype CF-DIO-X was marked with a special gathering of the type at Old Warden, Bedfordshire on May 22 – 70 years to the day from the historic first sortie on May 22, 1946.

Organisers had hoped to gather 70 of the breed together but serviceability and poor weather around the UK reduced numbers to a still impressive 48 airframes.

International visitors included three Chipmunks from Denmark, an example from Sweden (SE-XKU) and the oldest flyable DHC-1 G-AKDN – the latter shipped across from Canada.

AVIATION EVENTS CALENDAR

Boeing 787-9 Dreamliner N789EX performs an extraordinary take-off routine during the Farnborough International Airshow in 2014. The world of aviation descends on the Hampshire airport between July 11 and 17 for this year's edition. AirTeamImages.com/ Richard Deakin

UNITED KINGDOM

JUNE

18 Old Warden, Bedfordshire: At Home with Shuttleworth – 01767 627927 www.shuttleworth.org
18-19 North Weald, Essex: Air-Britain Fly-in – www.air-britain.com/flyin-about.html
18-19 Weston-super-Mare seafront, Somerset: Weston Air Festival – 01934 427225 www.westonairfestival.com
19 RAF Cosford, Shropshire: RAF Cosford Air Show – 01902 377922 www.cosfordairshow.co.uk
19 Wellesbourne Mountford, Warwickshire: Wellesbourne Wings and Wheels – 07595 191576 www.xm655.com/events.php
19 Welshpool, Powys: Bob Jones Memorial Air Show – www.welshpoolairshow.co.uk
25 Cleethorpes seafront, Lincolnshire: National Armed Forces Day Event – www.armedforcesday.org.uk/get-involved/afd-national-event
25 Stow Maries Aerodrome, Essex: Armed Forces Day – www.stowmaries.org.uk/events
25-26 The Hoe, Plymouth, Devon: Armed Forces Weekend – 01752 306330 www.visitplymouth.co.uk/whats-on/armed-forces-weekend-p1306823

JULY

01-03 Sywell, Northamptonshire: AeroExpo UK and HeliExpo – 020 8391 6770 www.aeroexpo.co.uk
02 RNAS Yeovilton, Somerset: RNAS Yeovilton Air Day – 0330 100 3654 www.royalnavy.mod.uk/yeovilton-airday
02-03 Ebbesbourne Wake, Wiltshire: Chalke Valley History Festival – www.cvhf.org.uk NOTE: the festival runs from June 27-July 03, the dates listed are those for the airshow
02-03 Bicester, Oxfordshire: Flywheel Festival – 01728 684410 www.flywheelfestival.com
02-03 Leeds East Airport, Church Fenton, North Yorkshire: Great Yorkshire AirFest – www.yorkshireairfest.co.uk CANCELLED
02-03 Swansea Bay, Swansea: Wales National Airshow – 01792 637300 www.walesnationalairshow.com
03 National Memorial to The Few, Capel-le-Ferne, Kent: Memorial Day – www.battleofbritainmemorial.org/events
03 Old Warden, Bedfordshire: Shuttleworth Collection Military Pageant Airshow – 01767 627927 www.shuttleworth.org
08-10 RAF Fairford, Gloucestershire: The Royal International Air Tattoo – www.airtattoo.com
09-10 IWM Duxford, Cambridgeshire: Flying Legends Air Show – 01223 835000 www.flyinglegends.com
11-17 Farnborough Airport, Hampshire: Farnborough International Airshow – www.farnborough.com – NOTE: Public days July 16-17
16 Old Warden, Bedfordshire: At Home with Shuttleworth – 01767 627927 www.shuttleworth.org
17 North Weald, Essex: North Weald Airfield 100th Anniversary Open Day
19-23 Folkestone Racecourse, Kent: War and Peace Revival – 01258 857700 www.warandpeacerevival.com
22-24 Sunderland seafront, Tyne & Wear: Sunderland International Airshow – www.sunderland.gov.uk/index.aspx?articleid=6454
23 National Museum of Flight, East Fortune, East Lothian: Scotland's National Airshow 2016 – 0300 123 6789 www.nms.ac.uk/national-museum-of-flight/whats-on/airshow
23-24 Felixstowe seafront, Suffolk: Felixstowe Carnival and Airshow – www.felixstowecarnival.org – AIRSHOW CANCELLED
28 RNAS Culdrose, Cornwall: RNAS Culdrose Air Day – 01326 552679 www.royalnavy.mod.uk/news-and-latest-activity/features/culdrose-air-day-2016-holding
30 Blackbushe Airport, Surrey: Air Day and Fly-in - www.blackbushearday.co.uk
30-31 Old Buckenham, Norfolk: Old Buckenham Airshow – 01953 860806 www.oldbuckenhamairshow.co.uk

EUROPE

JUNE

17-18 Meiringen AB, Switzerland: 75th Anniversary of Meiringen Air Base – www.lw.admin.ch/internet/luftwaffe/de/home/verbaende/einsatz_lw/flpl_kdo_mei/75jahreflpl.html
17-19 Kerb-Gelnhausen, Germany: Flugplatz-Kerb Air Show and Fly-in – www.flugplatzkerb-gelnhausen.de
18-19 BA702 Avord, France: Meeting de l'Air – www.meetingdelair.fosa.fr
18-19 Henri Coanda International Airport, Bucharest, Romania: Bucharest International Air Show – bias.aero
18-19 Kuopio, Finland: Tour de Sky 2016 – www.tourdesky.fi
18-19 Leszno, Poland: Leszno International Air Picnic – piknikszybowcowy.pl
19 Skrydstrup AB, Denmark: Danish Air Show – www.danishairshow.dk
25-26 Florennes AB, Belgium: Belgian Air Force Days – www.belgianairforcedays.be
25-26 Motril seafront, Spain: Festival Aéreo Internacional de Motril – www.aaao.es

JULY

03 Cuatro Vientos, Spain: Fundación Infante de Orleans Flight Demonstration Day – fio.es/Exhibiciones.html
09 Katwijk seafront, Netherlands: SAR Katwijk – www.sarkatwijk.nl
14 Paris, France: Bastille Day Flypast
14 Valenciennes-Prouvy, France: Meeting Aérien – meetingaerienprouvy.fr
16-17 Budapest, Hungary: Red Bull Air Race – www.redbullairrace.com/en_GB/event/budapest-2016
16-17 Jämijärvi, Finland: Jämi Fly-in and Airshow – www.jamiflyin.com/eng
16-17 Varaždin Airport, Croatia: Croatian International Airshow Varaždin – www.airshow-varazdin.com
23-24 Bray seafront, Republic of Ireland: Bray Air Spectacular – www.brayairdisplay.com
24 San Lorenzo beach, Gijón, Spain: Festival Aéreo Gijón – festivalaereogijon.com
24-30 Härjedalen, Sweden: Classic Aircraft Meeting – www.vemdaleninfo.se/hedlanda

AUGUST

05-06 Mollis, Switzerland: Zigermeet 2016 – www.zigermeet.ch
06-07 Kętrzyn Wilamowo, Poland: Mazury AirShow – mazuryairshow.pl
07 Sarlat-Domme, France: Fête de l'Air – www.aeroclubdusarladais.com
12-14 Bautzen, Germany: Flugtage Bautzen – www.flugtage-bautzen.de
13-14 Schaffen-Diest, Belgium: International Old-Timer

Fly-in – flyin.dac.be
13-14 Ursel, Belgium: Wings and Wheels – www.wingsandwheels.be
27 Sadournin, France: Meeting Aérien – www.asbes-sadournin.com/#!meeting-aerien/ckiy
27 St Stephan, Switzerland: Hunterfest – www.hunterverein.ch
27-28 Malmen AB, Sweden: Swedish Air Force 90th Anniversary Air Show
27-28 Sliač AB, Slovakia: Slovak International Air Fest – www.siaf.sk

NORTH AMERICA

JUNE

17-18 Indianapolis Regional Airport, Mount Comfort, Indiana: Warbird Expo – www.warbirdexpo.com
18 Municipal Airport, Boulder, Colorado: Boulder Airport Day – bouldercolorado.gov/airport/airport-day
18 Enterprise Airport, Denton, Texas: Denton Airshow – www.denton.schultzairshows.com
18-19 International Airport, Dayton, Ohio: Vectren Dayton Air Show – www.daytonairshow.com
18-19 Regional Airport, Gaylord, Michigan: Wings over Northern Michigan – wingsovernorthernmichigan.org
18-19 Hollister Airport, California: Hollister Airshow – www.hollisterairshow.com
18-19 Ocean City seafront, Maryland: OC Air Show – www.ocairshow.com
18-19 Regional Airport, Olympia, Washington: Olympic Airshow – olympicairshow.com
18-19 Municipal Airport, St Thomas, Ontario: Great Lakes International Airshow – greatlakesinternationalairshow.ca
24-26 Detroit River, Michigan: Tuskegee Airmen Detroit River Days Airshow
25 Greater Binghamton Airport, Binghamton, New York State: Greater Binghamton Airshow – binghamtonairshow.com
25 County Airport, Greenwood, South Carolina: Aviation Expo – www.aviationexpo.net
25 Spencer J Hardy Airport, Livingston, Michigan: Livingston County Airshow – livingstonairshow.com
25-26 Municipal Airport, Davenport, Iowa: Quad City Air Show – www.quadcityairshow.com
25-26 Evansville riverfront, Indiana: ShrinersFest Air Show – www.hadishrinersfest.org
25-26 Hill AFB, Utah: Warriors over the Wasatch Utah Air Show – theutahairshow.com
25-26 Municipal Airport, Vero Beach, Florida: Vero Beach Air Show – veroairshow.com
25-26 CFB Trenton, Ontario: Quinte International Air Show
29-Jul 04 W K Kellogg Airport, Battle Creek, Michigan: Battle Creek Field of Flight Air Show and Balloon Festival – www.bcballoons.com – NOTE: Airshow July 1-4 only
30 Gatineau Airport, Québec: Wings over Gatineau

JULY

02 Cedar Creek Lake, Texas: Thunder over Cedar Creek Lake – www.tocclairshow.com
02 Tulsa, Oklahoma: CAF Sky Parade Airshow – cafskyparade.com
02-04 West Grand Traverse Bay, Traverse City, Michigan: National Cherry Festival Air Show – www.cherryfestival.org/our-events/air-show
03 JFTB Los Alamitos, California: Wings, Wheels and Rotors Expo – www.wwrexpo.net
09 Truckee Tahoe Airport, Truckee, California: AirFair and Family Festival – www.truckeetahoeairfair.com
09-10 International Airport, Duluth, Minnesota: Duluth Air and Aviation Expo – duluthairshow.com
09-10 Marquette Park, Gary, Indiana: Gary Air Show – gary-airshow.com
09-10 Geneseo Airport, New York State: Geneseo Airshow – www.nationalwarplane.org/2016Airshow.aspx
09-10 Milwaukee lakefront, Wisconsin: Milwaukee Air and Water Show – www.milwaukeeairshow.com – CANCELLED
09-10 Yellowknife Airport, Northwest Territories: Yellowknife Airshow
13 Flin Flon Airport, Manitoba: Rotary Air Show

Budapest welcomes the Red Bull Air Race on July 16 and 17. AirTeamImages.com/Alexander Mishin

15-16 Pensacola Beach, Florida: Pensacola Beach Air Show – www.visitpensacolabeach.com/events/pensacola-beach-air-show.php
16-17 CFB Cold Lake, Alberta: Cold Lake Air Show – www.coldlakeairshow.com
16-17 Flying Cloud Airport, Eden Prairie, Minnesota: AirExpo 2016 – www.airexpo-mn.org
16-17 Express Airport, Toledo, Ohio: Toledo Air Show
20 Wetaskiwin Airport, Alberta: Wetaskiwin Air Show
21-24 Kinsman Beach, Red Lake, Ontario: Norseman Festival – www.norsemanfestival.on.ca
22-24 Southern Wisconsin Regional Airport, Janesville, Wisconsin: Heavy Bombers Weekend – heavybombersweekend.splashthat.com
22-24 County Memorial Airport, Sheboygan Falls, Wisconsin: Thunder in the Sky – www.ahcw.org/events.php
23 Boundary Bay Airport, British Columbia: Boundary Bay Airshow – www.boundarybayairshow.com
23 Clearfield Airport, Pennsylvania: Clearfield County Air and Car Show – CANCELLED
23 Vance AFB, Oklahoma: Vance AFB Open House and Air Show
23-24 Regional Airport, Sioux Falls, South Dakota: Sioux Falls Air Show – www.siouxfallsairshow.com
23-24 Whitecourt Airport, Alberta: Whitecourt Hometown Heroes Airshow – www.whitecourtairshow.com
25-31 Wittman Regional Airport, Oshkosh, Wisconsin: EAA AirVenture Oshkosh 2016 – www.airventure.org
27-28 Eielson AFB, Alaska: Eielson AFB Open House – www.alaskaairshow.org – CANCELLED
29-31 Columbia Park, Pasco, Washington: Tri-Cities Water Follies Over The River Airshow – www.waterfollies.com
30-31 JB Elmendorf-Richardson, Alaska: Arctic Thunder Open House – www.jber.af.mil/arcticthunder and www.alaskaairshow.org
30-31 Offutt AFB, Nebraska: 'Defenders of Freedom' Open House and Air Show – www.offuttairshow.com

AUGUST

05-07 Hillsboro Airport, Hillsboro, Oregon: Oregon International Air Show – www.oregonairshow.com
05-07 Genesee Park, Seattle, Washington State: Boeing Seafair Air Show – www.seafair.com
05-07 Municipal Airport, Warsaw, Indiana: Air Show of Warsaw – www.airshowofwarsaw.com – CANCELLED
12-14 International Airport, Abbotsford, British Columbia: Abbotsford International Airshow – abbotsfordairshow.com
12-14 Greenwood Lake Airport, West Milford, New Jersey: Greenwood Lake Airshow – www.greenwoodlakeairshow.com
13 Minot AFB, North Dakota: Northern Neighbors Day Airshow
13-14 Burlington waterfront, Vermont: Wings over Vermont Air Show – www.wingsoververmont.org
13-14 Miramichi Airport, New Brunswick: Atlantic Canada International Airshow – www.airshowatlantic.ca
17 Atlantic City beachfront, New Jersey: Atlantic City Airshow – airshow.acchamber.com
20-21 Roland-Désourdy Airport, Bromont, Québec: Eastern Townships Airshow – www.spectacle-aerien.com – CANCELLED
20-21 Camarillo Airport, California: Wings over Camarillo – wingsovercamarillo.com
20-21 North Avenue Beach, Chicago, Illinois: Chicago Air & Water Show – www.cityofchicago.org/city/en/depts/dca/supp_info/chicago_air_and_watershow.html
20-21 Willow Run Airport, Ypsilanti, Michigan: Thunder over Michigan – www.yankeeairmuseum.org/airshow
22-23 New Garden Flying Field, Toughkenamon, Pennsylvania: Festival of Flight Air and Car Show – www.newgardenflyingfield.com/index-8.html
26-27 Madras Airport, Oregon: The Airshow of the Cascades – www.cascadeairshow.com
27-28 JB Lewis-McChord, Washington: Lewis-McChord Air Expo
27-28 Erie-Ottawa International Airport, Port Clinton, Ohio: Wings and Warbirds over Port Clinton – www.rcwarbirdsopc.com
27-28 Rosecrans Memorial Airport, St Joseph, Missouri: Sound of Speed Airshow
27-28 Waukesha County Airport, Waukesha, Wisconsin: Wings over Waukesha Airshow – www.wingsoverwaukesha.com
28 Oakland County International Airport, Michigan: Open House – www.ociaopenhouse.org
31 Municipal Airport, Brantford, Ontario: Rotary Charity Airshow – rotarycharityairshow.ca

REST OF THE WORLD

JUNE

17-19 Mafikeng Airport, South Africa: Memorial Fly-in and Airshow – www.mafikeng-flyingclub.co.za/events/fly-inn-memorial.php

JULY

23 Middelburg, South Africa: Middelburg Air Show – www.middelburgaeroclub.com/airshow.html

AUGUST

21 Rand Airport, Johannesburg, South Africa: Rand Air Show – www.randairshow.co.za

Readers are strongly urged to seek confirmation that shows are definitely taking place before travelling – displays can move location, date or be cancelled, and this guide should only be used as an outline. For more information, check out individual websites, all of which are listed here where possible.

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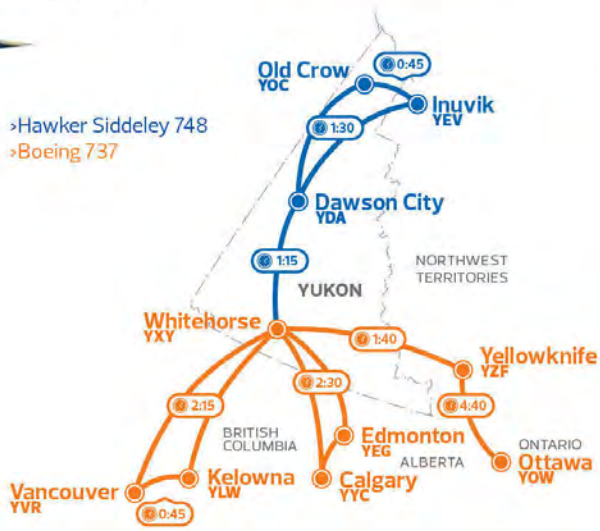

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OPENING TIMES: **8AM TO 4PM (NOVEMBER TO FEBRUARY), 6PM (MARCH-MAY AND SEPTEMBER-OCTOBER), 8PM (JUNE-AUGUST)**

Martyn Cartledge describes the excellent viewing area at Manchester Airport.

Manchester Airport is the third largest airport in the UK in terms of passenger numbers as well as being home to arguably the best viewing facility provided by any British airport. It welcomes a large variety of aircraft from widebody airlines to small private jets. Add aircraft visiting the local MRO and paintshop facilities, as well as ad-hoc charters connected to the city's local football teams, and Manchester is clearly well worth a visit.

Saudia has started using the Boeing 787-9 Dreamliner on its services to Manchester and Pakistani carrier Shaheen Air has begun flights using Airbus A330s. American Airlines and Delta Air Lines both connect the airport with the US while Etihad Airways, Qatar Airways and Emirates provide flights to the Middle East and Cathay Pacific and Singapore Airlines to the Far East.

Main photo: **Condor Boeing 757-300 D-ABOH lifts off from Runway 23R. This shot was taken at 180mm.** All photos Martyn Cartledge

Below: **Mounds have been created to enable spectators to get a better view.**

Low-cost carriers easyJet, Ryanair and Norwegian also serve the airport as do regional operators Flybe and Stobart Air.

Manchester's official viewing area is the Runway Visitor Park (RVP), on the north side of the runways adjacent to Taxiway Alpha, a main thoroughfare on the airfield.

The RVP is well signposted and is accessed off the A538 onto Sunbank Lane by the *Romper* pub (postcode WA15 8XQ).

There is plenty of onsite parking, with prices ranging from £5 for two hours to £12 for more than four hours. There is no charge for spectators entering the on foot or by bicycle. Visitors can reach it via public transport using the hourly 200 bus service that runs between the railway stations at the airport and nearby Wilmslow.

Manchester has two runways, both of which are visible from the park. Prevailing winds mean Runway 23 is predominantly in use although times of the operation of Runway 05/23L vary; currently in summer it is 0630hrs to 1030hrs and 1300hrs to 2000hrs. During these hours Runway 23R is for arrivals and Runway 23L for departures – under normal operating conditions Runways 05L and 23L are never used for arrivals.

Because of its position on the northern side of the runway, photography is into the sun until mid-afternoon. Three raised areas – each a different size – have been created

to assist photographers get a better view. All aircraft will come into photographic range at some point regardless of which runway is in use. A 300mm lens caters for aircraft on Runway 05L/23R although anything on Runway 05R/23L may need a little more.

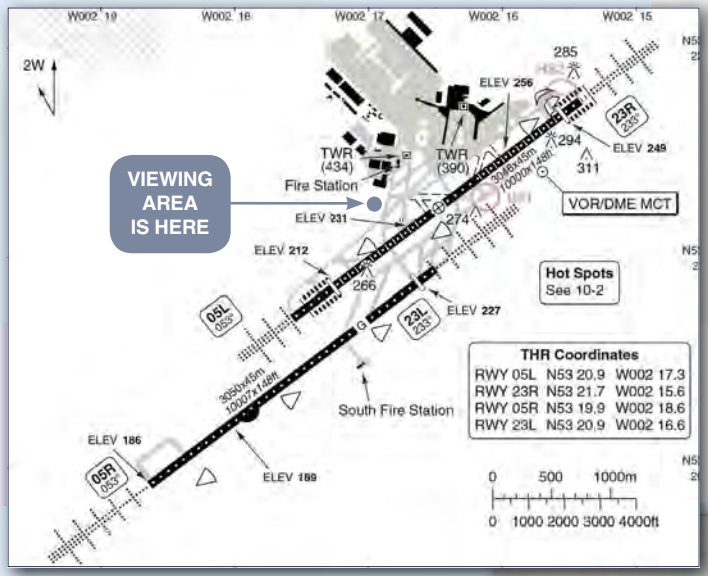
Very little of the airport's three terminals is visible from the RVP, however aircraft taxiing to and from them can easily be photographed using a 300mm lens. Those using Taxiway Alpha are so close that a 28mm lens may not be wide enough for the larger aircraft and additionally there will be fence visible at the bottom of any photo.

The two smaller mounds closest to the terminals also provide excellent views of the light aircraft parks and part of the bizjet ramp. Photographs of aircraft parked here will be least affected by the sun.

None of the viewing mounds have any shelter so visitors are advised to take protection from the rain or sun.

As well as excellent views of the airport, the RVP has much more to offer. The Avro RJX demonstrator G-IRJX, BEA Trident G-AWZK, Nimrod MR2 XV231and the nose section of a Monarch Airlines DC-10 are on permanent display around the site with at least two open to view for free at weekends. However, the prize exhibit is British Airways Concorde G-BOAC which is preserved inside its own hangar. Although visible through windows access into the hangar and inside the aircraft is by organised tours (car parking is free for all aircraft tours). ▶

Above: **Jet2.com has leased in Titan Airways Airbus A321 G-POWN for the summer season. It is shown taxiing in after arrival.**



Left: **An airport chart with the location of the RVP marked.** Not for airborne/operational use, Navtech Aerad

Below: **Flybe Bombardier Dash 8-Q400 G-PRPA heads to the terminal via Taxiway Alpha. This picture was taken with a 100mm focal length.**

Below: **Only a small portion of the airport's terminals can be seen from the RVP.**

Above: **British Airways Concorde G-BOAC is on display in the RVP complex.**

Right: **Two of Emirates' three daily flights to Manchester are flown using the Airbus A380.**

Adjacent to the Concorde hangar is a café and restaurant plus an aviation enthusiast shop selling all sorts of items from postcards to models.

The park is very family friendly and along with the aviation specific attractions there are a considerable number of picnic tables, a children's play area and temporary attractions such as bouncy castles. There are also information boards, to assist both enthusiasts and casual visitors alike, and toilets are provided on site.

With plentiful traffic levels all year round at this airport, a visit anytime to the RVP can be worthwhile. AN

Right: **CitationJet CJ2 G-TBEA taxies past the RVP on its way to the business aviation terminal.**

Below: **Spectators enjoy the sunshine while watching the activity at the airport.**

Flight Bag

The latest products for the discerning aviation enthusiast

PLANELY SCHMITZ: AN AIRLINE ANTHOLOGY

Book

Written by: Sebastian Schmitz

Price: £8.99

The German author is a well-known feature writer for a variety of aviation magazines. His forte is writing about airline travel and airports in remote or unusual parts of the world. A very readable compendium, it is described by the publisher as the best of Schmitz's work over the past 15 years. The 27 articles are each rounded off by a short background comment from the author, with perhaps an amusing anecdote and sometimes a sad reflection on the subsequent demise of the airline concerned.

His love of aviation shines through the text and many of the sections evoke a sense of far-flung adventure with such titles as 'Crossing the Strait of Magellan by Cessna 402', 'Il-76 to Antarctica', 'Congo's Airports' and 'By Ilyushin 18 to Mogadishu'.

It is difficult to pick a favourite, but I particularly enjoyed 'A Day Trip to the Arctic Circle' from Reykjavik to Akureyri (the latter started life as an RAF airfield) and then on to Grimsey Island, the northernmost inhabited territory of Iceland. Other stories maintain the theme of faraway places dependent upon air transport, ranging from the Canadian North to the fringes of the Gobi Desert. It is a pity there are no photographs, apart from on the covers, but the text is a fascinating read.

Published by Astral Horizon Aviation Press, ISBN 9780993260414, available from www.theairlineboutique.com

FLYING TO THE SUN: A HISTORY OF BRITAIN'S HOLIDAY AIRLINES

Book

Written by: Charles Woodley

Price: £19.99

The author has a considerable reputation for his authoritative studies of British commercial aviation and aircraft and so is well-placed to cover the subject of this book. It begins with a historical overview of how the industry developed from modest beginnings in the 1950s with tours to Majorca, then acquired larger aircraft with greater range, and finally jet equipment.

One chapter covers the legislation relating to the industry, another the airports specialising in holiday charter flights ranging from Blackbushe and Manston to Luton, Southend and Gatwick. The narrative moves on to potted histories of operators as Air Kruise, Skyways and BKS Aerocharter. A few, such as Derby Airways later renamed British Midland, survived to become major players in the industry.

The chapter 'Into the Jet Age' begins with Viscounts, Comets and BAC One-Elevens and moves on to the Boeing 737 and 757. Their numerous operators are described, and include Britannia Airways, Dan-Air, and Monarch Airlines.

In the 1970s and '80s as the package holiday market expanded, financial links were forged between the airlines and tour operators and this resulted in many mergers and the loss of familiar names. Long-haul and transatlantic services have their own chapters, as do so-called niche operators (such as Aquila Airways with its flying-boat services) and the cross-Channel car carriers. There are 131 black and white photographs, as well as eight pages of colourful timetable covers.

Published by The History Press, ISBN 9780750956604, available from www.thehistorypress.co.uk

THE BRIDGE TO AIRPOWER – LOGISTICS SUPPORT FOR ROYAL FLYING CORPS OPERATIONS ON THE WESTERN FRONT, 1914-18

Book

Written by: Peter Dye

Price: £29.68

Another work of solid historical research from the Naval Institute Press is contained in this 270-page hardback. Written by an ex-RAF senior logistician of 35 years' service, its content by far exceeds the expectations generated by its rather pedestrian title.

In his introduction, Dye notes a long-held interest in the logistics of maintaining and running an air force, a military construct with supply requirements like no other. His fascination with the subject and deep professional knowledge is evident.

This might have been a rather mundane subject, but the author adds interest with a broad description of industry and the wider supply chain, before discussing the subject at squadron and even aircraft level. He also explains how World War One helped shape many of the doctrines followed by modern military logisticians because its supply demands departed from those of previous conflicts.

Armies traditionally required food and water for their troops, and fodder for their animals as primary commodities, much of which could be obtained from the territory through which they marched. World War One introduced technological warfare, where the military relied on fuel for its vehicles and created huge demands for spare parts, specialist tools and new machines to replace those lost or damaged.

Dye's words bring tremendous insight and understanding to this easily overlooked aspect of combat. The book concludes with a small selection of relevant images, data tables, comprehensive source notes and a detailed index.

Published by Naval Institute Press, ISBN9781612518398, available from www.nip.org or www.eurospanbookstore.com

AVRO SHACKLETON

Book

Written by: Martin Derry and Neil Robinson

Price: £16.99

This is the latest volume in a series known as FlightCraft, which aims to provide modellers and aviation enthusiasts with a high standard of primarily visual references to both full-size aircraft and models. The Shackleton book does this within the series' standard 96 pages by presenting mainly photographs (68 of the more than 150 are in colour), along with 16 pages of excellent profile and plan view artwork by Mike Gauntlet.

Although there is no detailed history of the type a surprising amount of information is contained within the text that is interleaved with the photographs, plus there is comprehensive photo captions. The authors note that accurately dating every Shackleton photo proved impossible, hence they could not be arranged in chronological order. They decided a useful alternative would be to arrange them by serial number within the section that deals with each variant.

A further benefit is that if more than one photo of a specific aircraft is included, it allows those images to appear together, thus highlighting any change in appearance.

Appendices cover squadrons and other major units, code letter allocation, camouflage and markings, including those for South African Air Force aircraft, basic specifications, serial number allocations and an aircraft loss listing.

The book is rounded off with an 11-page 'Modelling the Shackleton' section that includes some interior views.

Published by Pen and Sword Aviation, ISBN 9781473862630, available from www.pen-and-sword.co.uk

BARKSDALE TOTAL FORCE

Frank Crebas visits Barksdale AFB, Louisiana, to find out how B-52H reservists are integrating with the active-duty force.

In the centre of the ArkLaTex area, on the outskirts of Bossier City, Louisiana, is the beating heart of the American heavy bomber world, Barksdale AFB. It is home to the headquarters of Air Force Global Strike Command, the Eighth Air Force, the 2nd Bomb Wing (BW), and the 307th BW of Air Force Reserve Command (AFRC).

The latter's main mission is training new Boeing B-52H Stratofortress aircrews. "Every pilot that flies the B-52 comes through the 307th BW," Colonel Rob Burgess, the 307th Operations Group commander, told *Aviation News* in an exclusive interview.

"Our 93rd Bomb Squadron 'Indian Outlaws' is the Formal Training Unit [FTU] for the B-52 and is responsible for training new crews. But we do much more. The 343rd BS 'Avengers' is also a reserve squadron that belongs to our wing but is combat coded."

The 343rd BS doesn't own its own aircraft, instead it uses the active duty – LA coded – aircraft (except for one example that wears the unit's markings). Maintenance support is also provided for the 49th Test and Evaluation Squadron (TES), an active-duty unit that owns two 'OT' coded airframes (60-0031 and 61-0028).

Col Burgess added: "Last but not least, we offer our airframes to the 340th Weapons Squadron. This unit, which is part of the active-duty 53rd Wing, is responsible for the advanced B-52 training and trains the new weapon instructors for the bomber."

Since last October the 307th BW also oversees the 489th Bomb Group, a reserve Rockwell B-1B Lancer operator at Dyess AFB, Texas. This group is similar to the 343rd BS, integrated within the active-duty squadrons and not owning its own aircraft.

COLLABORATION

At Barksdale the 307th BW works closely with its active-duty counterparts. "15 years ago in our B-52 community, you had the reserve and the active-duty units," Col Burgess explained. "We were completely separate; we had our own airplanes, own missions and our own training and we barely interacted with each other, unless there was a war where we work hand in hand. But those days are long gone.

E BOMBERS INTEGRATION

The mighty B-52H in all its glory over the North Sea during Exercise Polar Growl. All photos Frank Crebas

Under the pressure of budget cuts we need to work more efficiently and we now all work together. Most of the manpower, probably over 50%, that flies in our FTU comes from the active-duty 11th Bomb Squadron. They [active-duty squadrons] fly alongside us in our airplanes to train the new active-duty pilots and operators."

The need to make budgets work efficiently makes the use of reservists attractive because they can work out significantly cheaper than the active-duty personnel.

"We don't have the same retirement benefits as the active-duty member has," revealed Col Burgess. "Currently, an active duty-member can retire after 20 years of service and draw a retirement and start to receive a pay cheque for the rest of their life. A reservist cannot draw their retirement until age 60. A reservist may have another job while this is a part-time job. That is the way in which the reserve system is set up. And we are cheaper in that aspect."

B-52 SCHOOLHOUSE

The training of new crews for the B-52 is undertaken by both active duty and the reserve personnel, making it a fine example of the USAF's total force initiative. The reserve 93rd BS provides aircraft for the students to train in and 11 crews to teach them. Because the reservists are commonly not full-time, active-duty members must augment the 11.

Lt Col Wade Karren is the commander of the 11th BS, an active-duty squadron responsible for training new B-52 crews. The 11th BS does not own aircraft but flies with the reserves for their missions. "It's a unique relationship the way it is set up," he told *Aviation News*. "The 93rd BS commander is the lead commander and is overall responsible for the schoolhouse. I am, what we call, the supporting commander. I support him with manpower; this is really all I have."

For most new pilots the B-52 wasn't at the top of the list of aircraft they dreamt of flying when they entered the Undergraduate Pilot Training (UPT) programme. "We are aware of that when the new students arrive," Lt Col Karren explained. ►

"Fighters might make the news but what we tell would-to be B-52 crews here: yes, they make the news but the bombers make history. People are still talking about the impact the aircraft had in Vietnam, the impact it had in winning the Cold War and the number of crews that flew all over the world to keep the peace. That is writing history."

When new members arrive at Barksdale the first place they are taken to is the Linebacker room, named after the raids over Vietnam in the 1970s. The walls of the briefing room and the rest of the building are covered in plaques and memorabilia recounting the history of B-52 operations. Central to this are the names of those who flew more than 100 and even 200 combat missions in the B-52.

"We tell them all about the importance of the B-52 and how unique it is that they ultimately earn the responsibility to take up one of them and fulfil the order given by the President," continued Lt Col Karren, a B-52 pilot himself.

"We will make them feel proud and privileged that they were chosen to fly this great aircraft. It is an amazing 'plane and to get a sense of its age you can compare it with flying a B-17 in the Vietnam War; it is that old."

New crews begin with the academic side, learning all about the aircraft and its systems. "It is a pretty aggressive course as there is a lot of information to learn," said Lt Col Karren. "All of the birds are 1960-1961 airplanes and they are labour intensive. There is not a lot of automation and there are a lot of things that the students must understand. There are not a whole lot of computer systems with bells and whistles that go off in case something is wrong but a lot of switches, dials and gauges to look after instead."

Once they have graduated from ground

The B-52H always uses its huge chute to slow down after landing. As well as reducing the stopping distance it also prevents the brakes from overheating.

A crew member performs the final check on Mk-62 Quickstrike mines. They were dropped during a sortie for the weapons instructor course run by the 307th BW.

A B-52H from Air Force Reserve Command's 93rd Bomb Squadron takes off from Barksdale AFB for a routine training mission.

The pilots of a B-52H prepare for a training sortie.

One of the two weapons system officer positions that are side-by-side below the cockpit. This active-duty weapons system officer is instructing on the reserve 307th BW. A good example of the total force integration.

school, the new pilots and navigators move to the 93rd BS where the go flying and put all they have learnt to good use.

The last aircraft the students flew was the small and agile Northrop T-38C Talon during their UPT.

Lt Col Karren remembers the first time he taxied out with the bomber: "I noticed that it is a very heavy airplane to handle. And I wasn't even taxiing at maximum gross weight. It moves a lot slower and it takes a lot of thrust to get it moving. This airplane is all cables and some say after they flew it for the first time that it takes some serious muscle because you have to move all those cables around. It doesn't have auto-trim or fly-by wire like the modern 'planes. It is all old aviation. Most students have a difficult time wanting to fight the aircraft. Once you teach them they kind of accept what it is giving you."

The entire syllabus includes just 13 B-52 flights of approximately six hours each plus the time that is spent in the simulators. During their first flight new B-52 pilots immediately have to tackle aerial refuelling, commonly acknowledged by pilots as the most complicated task.

"It's a coordinated dance between two airplanes flying very close to each other," explained Lt Col Karren. "It usually takes a while before the students get used to it because all of the responses of the B-52 are a little bit delayed and because the aerodynamic forces coming off the tanker are a little bit different because our wingspan is wider compared with the tanker."

The pressure during the training is as high as in any other pilot training programme and students can still drop out if they don't meet the standards.

"There is a reason for that," continued the 11th BS commander. "Think about what we are asking them to do. When a student ▶

Eight Pratt & Whitney TF33-P-3/103 turbofans power the B-52H.

graduates from this syllabus we are asking them to go to a combat unit and to take this airplane, full of weapons, conventional or ultimately nuclear, and I need to be able to trust that this person can take this B-52 anywhere in the world and put weapons on a target on time and then fly all the way back home if needed. There are a lot of things that go into that and it is a huge responsibility. That is why our standards are so high."

WORKHORSE

The B-52 is now the oldest aircraft in the USAF inventory with its roots in the early 1950s, making it older than the KC-135 Stratotankers. But unlike the KC-135, soon to be replaced by the new Boeing KC-46A Pegasus tanker, the B-52 has to continue until around 2040 until it is fully replaced by the stealthy Northrop Grumman B-21 Long Range Strike Bomber. Despite its age the B-52H is still a very capable and reliable aircraft.

Col Burgess, who has logged more than 5,000 hours in the B-52, said: "The average flying hours per airframe is around 20,000 hours. There are different projections about how long the aircraft has to soldier on but the latest is that we will fly the B-52 up to the 2040s, which is another 24 years. But every time I have heard about a retirement date in my career, the date has pushed up further.

"Our Maintenance Effectiveness Rate [MER] fluctuates between 75 to 95% readiness, which is very good for a 60-year-old airplane. On average our MER is in the mid-80s. We even had days when we had 100% reliability, that's almost unheard of. Typically, our MER rates are a little higher than [those] of the active-duty squadrons and that is because of our group of very experienced maintainers. I have maintainers that are taking parts off the very same jet for over 25 years – they know everything inside out."

In the active-duty force crew chiefs rotate among jets whereas in the reserve units each individual aircraft has a dedicated crew chief (DCC). This group of highly experienced maintainers have a lot of pride

BARKSDALE AFB HISTORY

The base is named after pioneering experimental test pilot 2d Lt Eugene Hoy Barksdale, who died in a tragic accident while flying a Douglas O-2 biplane in 1926.

Locals found out in the 1920s that the armed services needed locations to host a new airfield and bombing ranges in support of the 3rd Attack Wing from Fort Crockett, Texas. The local community of Bossier City offered a former cotton plantation to the Army that could fulfil the requirements. The site was eventually selected to host an airfield and the construction of the infrastructure began in 1931.

The base, one of the most beautiful in the USAF, still breathes the history of its early days. Its scenic streets are lined with Oak trees and the old hangars, some of which are converted to offices, and base housing are maintained in their authentic French colonial style. The historic feel also extends to the flight line, which is filled with B-52s that have been based at Barksdale since 1957.

In April last year a pair of B-52Hs flew a 24-hour training mission called Polar Growl. The crews came from the active-duty 96th BS and reservists of the 343rd BS. Part of the sortie involved training with NATO members such as the UK and the Netherlands over the North Sea.

POLAR GROWL

On April 2 last year, two pairs of B-52Hs flew a simultaneous 24-hour mission from their bases at Barksdale and Minot AFB, North Dakota. This training mission was named Polar Growl and was intended to train the crews in long distance navigation and to provide training for allies. While the bombers from Minot AFB flew to the Pacific Ocean, the pair from Barksdale flew east via Canadian airspace to Europe. During the long flight the B-52s gave the Royal Canadian Air Force, RAF, Armée de l'Air and the Royal Netherlands Air Force (RNLAF) an ideal opportunity to practise their intercept skills. The RNLAF launched F-16s from Volkel and Leeuwarden to engage the 'intruders', while another pair of F-16s defended the B-52s, which were acting as Tupolev Tu-95 *Bears* in the scenario. The B-52s from Barksdale were crewed by active duty members and augmented by reservists of the 343rd BS. The mission showcased a fine example of the successful cooperation between the active duty and reserves units.

This view of a B-52H shows the massive 185ft wingspan.

in their work and they build up a good working relationship with their aircraft.

Tech Sergeant (TSgt) Jesse Brouillette has spent more than 29 years working with B-52s and has now been assigned to B-52H 61-0029/BD of the 93rd BS for more than five years. He talks about his aircraft as he might a close friend. "My jet has a little over 19,000 hours on the airframe and it is a good aircraft and doesn't break often," he told *Aviation News*. "Every 'plane has its own personality. Because we have our own jets we can identify growing issues at an early stage before they become major problems and we fix whatever is needed."

Six decades plus since the B-52 was first designed, TSgt Brouillette says the B-52 is still very robust. "As far the airframe and the parts that are designed for the aircraft [are concerned] it all works very well," he explained. "The one problem we do have is with generators. They get old and have a lot of wear and tear on them. We have to rebuild them a lot [at the 309th Aerospace Maintenance And Regeneration Group at Davis-Monthan AFB, Arizona] but they tend to go on and off [the aircraft]. As for the electronic countermeasure parts, we have some equipment that needs to be updated as well. Also the radios could be updated but for the most part, for their age and what they are used for, it all works pretty well. ▶

"...to get a sense of its age you can compare it with flying a B-17 in the Vietnam War; it is that old."

Also the engines are reliable and we don't have a lot of trouble with them; they are very durable and forgiving for what they have to go through."

In newer aircraft technology plays a vital role but if something small breaks it can affect the whole system; with old aircraft like the B-52 you don't have that problem.

"#61-0029 is a very reliable airplane that usually has very little minor problems when it lands," TSgt Brouillette added. "Also with pre-flights it usually stays good and I'm lucky to be on this airframe. This isn't always the case. *Christine* (B-52H s/n 60-0041/BD) for example is a much harder 'tail' to maintain. All of them have their own characteristics, what will leak? What will break? My jet has a number two engine that is slow to run in idle mode after start up. But after it is in idle and it warms up a little it runs fine. It's those small things that are different."

According to TSgt Brouillette the biggest challenge the maintainers – both active duty and reserve – face is lack of replacement parts.

"In the reserve we have more personal time for the aircraft. We make time to fix all the little things and keep it as nice as possible. We are having trouble getting parts. You may order something to fix and it might take up to six months to get that specific part. It all gets older and thus harder to get. They don't manufacture parts [on a large scale] anymore for the B-52 and some we need are regenerated from AMARG while some will be produced on request."

NOSE ART

Most of the B-52s have nose-art or names applied to them and this is also the responsibility of the DCC. When they get a new aircraft assigned to them they can apply new art of their choice.

"We used to have *SAC Time* drawn with a defiant looking female on our jet," explained TSgt Brouillette. "But new Air Force standards and regulations make these kinds of expressions on aircraft not possible anymore and we are looking for a new one right now. We can pick a nose art ourselves but it then has to be approved by our commanders to make sure it is not offensive and [is] politically correct. To pick a new nose art you can come up with a new design or you look at one with an historical background."

Despite their age the legacy bombers are still one of the most visual and capable symbols of American air power. They are regularly called to demonstrate a show of force or ultimately, mobilise into action, around the globe. The bombers are crewed by people who sometimes fly in the very same tail number as their dad or even their grandfather did when they served in the Air Force, generations ago. And with the B-52 expected to serve until at least around 2040 it is likely that the last pilot to fly the iconic bomber hasn't been born yet. AN

A B-52H taxiing at Barksdale AFB during a downpour.

The reserve 343rd BS is integrated with the active-duty squadrons at Barksdale. Aircraft 61-0010 is the only bomber that has the full markings of the squadron applied.

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FAIRFORD'S B-52 DESERT STORM OPS

During Operation Desert Storm the USAF's B-52G Stratofortresses flew only 3% of sorties but delivered 30% of all US ordnance. **Dr Kevin Wright** looks back at the type's deployment to RAF Fairford in 1991.

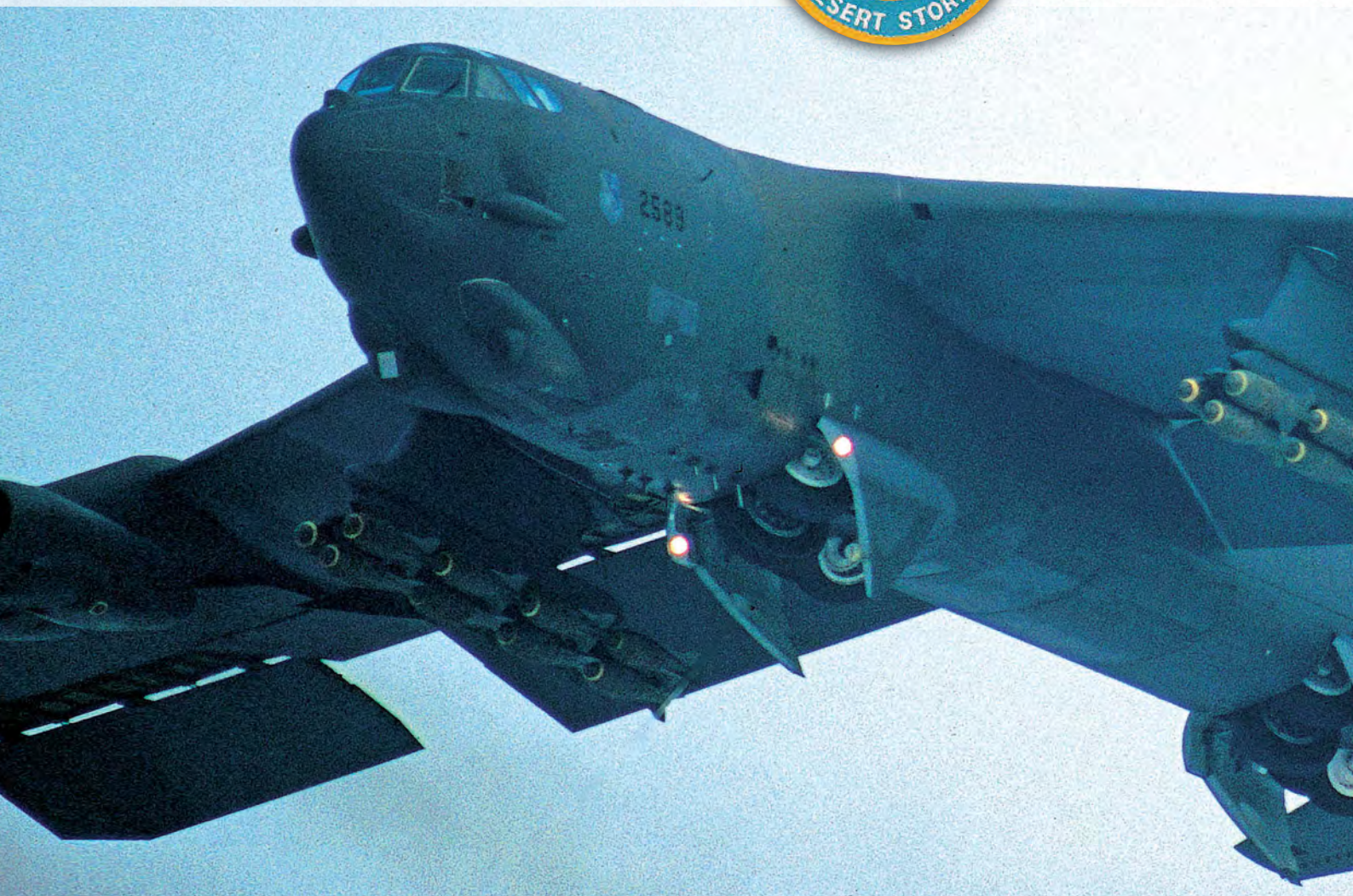
Following Iraq's invasion of Kuwait in August 1990 – and the US decision to mount Operation Desert Shield – aircraft, men and materiel poured into the region in preparation for the defence of Saudi Arabia. The USAF's Boeing B-52G Stratofortress fleet would become one of the major participants in the subsequent Coalition air war against Iraqi forces when Operation Desert Storm began in earnest on January 17, 1991.

General Norman Schwarzkopf, head of US Central Command (CENTCOM), insisted that Iraqi Republican Guard (IRG) forces should be hit extremely hard to degrade their fighting ability prior to the start of the ground assault – and he believed USAF B-52s could be employed to considerable effect to achieve this within the Kuwaiti Theater of Operations (KTO).

Air Boss Lieutenant General Charles Horner and USAF planners examined how to most effectively use the Stratofortress against ground troops, and Schwarzkopf insisted that after the first 48 hours of operations B-52Gs should strike IRG positions every three hours.

Such mission intensity would have ideally required the aircraft to fly from in-theatre air bases, but these were scarce. An early preference to use the

A 806th Bomb Wing (Provisional) patch. The Latin is the RAF Fairford base motto of 'I Strike by Carrying'. via Jeremy Flack/API



Cairo West base had to be quietly dropped after Egyptian objections. Prince Abdullah Air Base in Jeddah was another B-52 capable airfield, however the Saudi Government was particularly sensitive to the likely media images of the massive bomber based so close to Mecca. A compromise involved B-52Gs operating from the Saudi base, but only after the air campaign had begun.

Among the Coalition air forces, only the Jeddah-based B-52Gs of the 1708th Bomb Wing (Provisional) could strike targets anywhere in Iraq without air refuelling and during the air war these machines dropped half of the 72,289 munitions released by all Stratofortresses, demonstrating the importance of close proximity operations.

OUT OF THEATRE OPS

However, to maintain the intensity of bombardment that Schwarzkopf required in the early days of the conflict, considerable numbers of B-52s would have to be stationed out of theatre. As well as finding suitable runways, key planning factors included large fuel supplies and access to massive ordnance stocks for extended operations.

Diego Garcia, in the Indian Ocean, had been a B-52G base from the very first days of US mobilisation in August 1990, but the distances involved placed it at the limit of practicality. Morón AB in Spain also was nominated early on and 24 B-52s, three KC-135s and 2,800 personnel would soon deploy to the base as the 801st Bomb Wing (Provisional).

RAF Fairford in the UK was also highlighted as a suitable operating base. However, the Gloucestershire airfield had been reduced to 'standby' status in 1990 after many years as a Boeing KC-135 Stratotanker station and flying operations had ceased in January 1991.

Fairford was an obvious choice for the B-52G as not only did it possess suitable airfield infrastructure to manage the heavyweight bomber but it was also close to the RAF Welford weapons store.

However, use of a British airfield for Gulf War missions was only practical if the French Government permitted the bombers to transit its airspace to reach Iraqi targets. That agreement finally came on February 1 – some 15 days after the main air assault had begun. Two days later US Secretary of Defense, Dick Cheney, ordered the B-52Gs to be deployed to RAF Fairford.

806TH BOMB WING (PROVISIONAL)

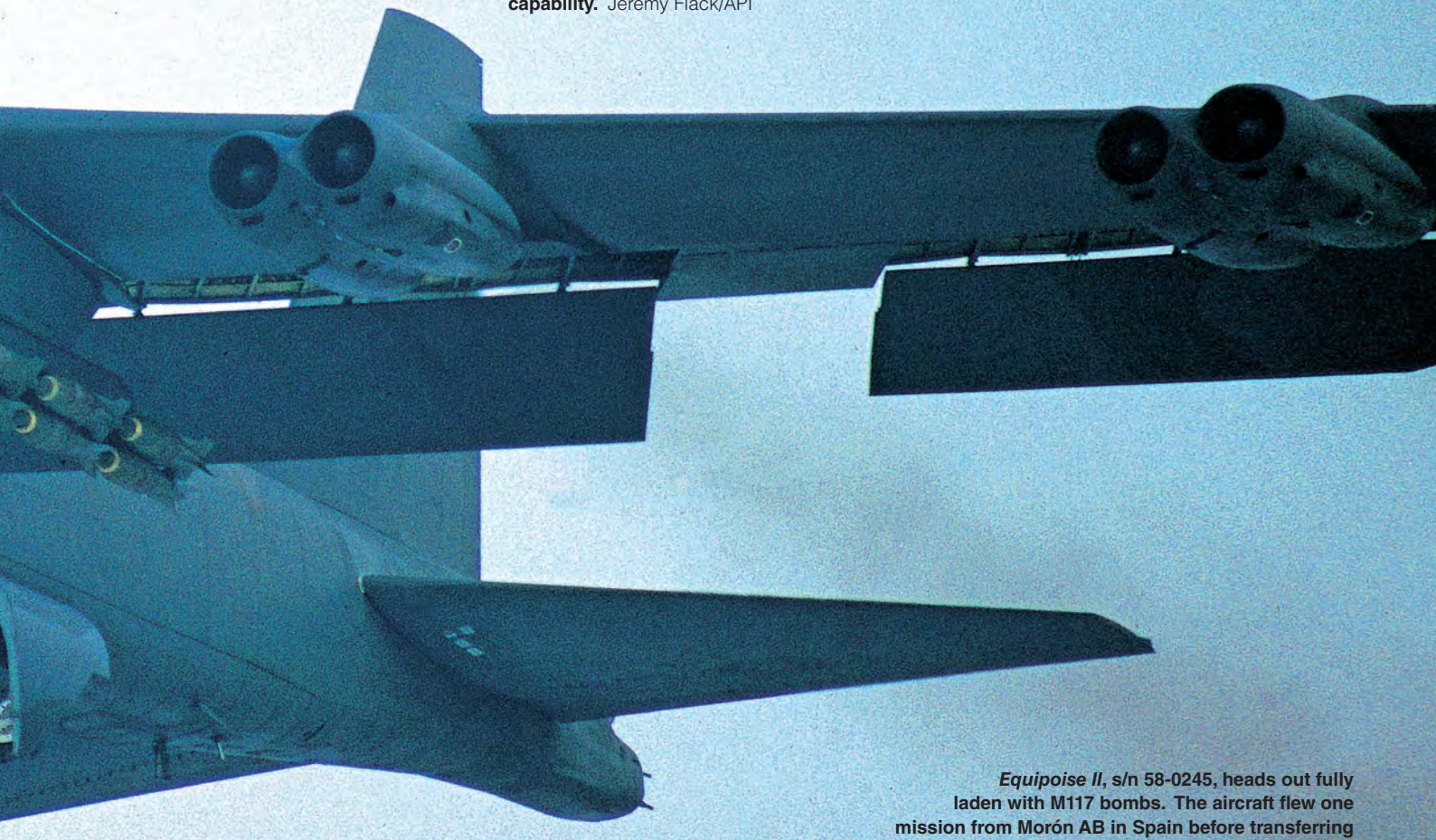
The 806th Bomb Wing (Provisional) was activated on February 5, 1991 to manage Fairford B-52G ops – it would be the smallest of the provisional B-52G wings created for Desert Storm and was commanded by 97th Bomb Wing (BW) CO Colonel George Conlan.

At a press day held at Fairford on March 7, 1991, after the end of operations, Col Conlan explained to *Washington Post* reporter Glenn Frankell that he was "ordered to improvise a bomber wing to work out of Fairford."

He went on to explain that he had "requisitioned B-52Gs from bases across the US plus 52 support aircraft to transport 370 tons of equipment and 1,157 crewmen and support staff from more than 20 different bases."

The 806th BW(P) was allocated to Strategic Air Command's 7th Air Division at Ramstein AB in Germany and was initially assigned eight aircraft – which arrived on February 5-6, 1991. These were drawn from the 2nd BW at Barksdale AFB, ▶

Two trailers of M117 bombs next to this B-52G give an idea of the type's load-carrying capability. Jeremy Flack/API



***Equipoise II*, s/n 58-0245, heads out fully laden with M117 bombs. The aircraft flew one mission from Morón AB in Spain before transferring to Fairford where it undertook two more.** Jeremy Flack/API

Stratofortress 58-0182 *What's Up DOC?* wears eight red bomb mission marks denoting operations from Fairford. It flew a further 16-hour mission from Morón AB and accumulated over 121 combat hours supporting Desert Storm. Jeremy Flack/API

Louisiana, the 379th BW at Wurtsmith AFB, Michigan, the 416th BW, Griffiss AFB, New York State and the 97th BW at Eaker AFB, Arkansas – the latter being where Col Conlan was normally based.

"By February 5, the 'planes and 2,500 tons of bombs had arrived here," continued Col Conlan. The 806th BW(P) became operational on February 8 with the first mission launched against strategic Iraqi installations the following day, employing both a three- and four-ship formation.

CONSTRAINED

The US Department of Defense's Gulf War Air Power Survey (GWAPS) describes how the 806th BW(P) B-52Gs participation in the full range of coalition air operations was significantly constrained from the start.

The USAF's Computer Assisted Force Management System (CAFMS) – used to generate mission planning, and necessary to receive Air Tasking Orders from US CENTCOM in Riyadh – was not available at RAF Fairford and this meant that integrating the wing's aircraft into the large, complex mission packages of Middle East-based aircraft was just too cumbersome.

For the same reason, during the early weeks of the air war, Spanish-based B-52Gs were restricted to missions against northern Iraq. However, when CAFMS capability was extended to Morón in mid-February the 801st BW(P)'s B-52Gs switched to bombing Iraqi ground forces in the KTO and the newly arrived Fairford aircraft assumed missions previously assigned to the Morón-based wing in Northern Iraq.

PROVEN FORCE

Missions mounted against Northern Iraq were managed by Joint Task Force (JTF) Proven Force and built around the 7440 Composite Wing (Provisional) at Incirlik AB in Turkey.

Controlled by US Air Forces Europe, JTF Proven Force maintained pressure on the Iraqi troops and targets in Northern Iraq that were difficult for coalition aircraft based in the southern Gulf region to hit, thus ensuring the Iraqis had no breathing space.

JTF Proven Force mounted around 1,620 sorties, 98 of them by B-52Gs from Morón and Fairford. Its main area of operations was north of the 35th parallel, encompassing the northern third of Iraq, but in the latter phase of the war operations slowly pushed further southwards reaching just short of Baghdad.

The Fairford-based B-52Gs mostly hit targets in conjunction with nightly strikes by F-111Es – sharing the suppressive Wild Weasel support packages provided by F-4G Phantoms and F-16 Fighting Falcons from Incirlik.

A major focus of Proven Force attacks was a military research and development complex located near the River Tigris, north of Mosul. In addition to suspected nuclear production facilities, there was a missile plant, SAM support facility and a signals intercept station. Proven Force attacked these targets around the clock in an area where the unusually heavy air defences had been rendered largely ineffective – an area pilots named 'Happy Valley.'

On February 14, at the conclusion of several days of heavy attacks, four F-111Es led four B-52Gs in a raid on the missile production facility. A day later F-117A Nighthawks struck Tarmiyah, a suspected rocket and nuclear facility, and were quickly followed by a flight of Proven Force B-52Gs.

LONG RANGE

The 806th BW(P) Stratofortress crews at Fairford faced targets that were around 2,750 miles (4,425km) and seven or eight hours' flying time away from their base.

En route to Iraq each bomber would also need to refuel from KC-135 tankers from the 807th Air Refueling Squadron (Provisional)/ AREFS(P) – at Mont-de-Marsan in France. The return leg would involve another refuelling hook-up with a KC-135, this time from the 803rd AREFS(P) at Athens-Hellinikon Airport.

In all, each bomber would regularly exceed 16 hours in the air – all to spend between two and five seconds dropping its bomb load.

An 806th BW(P) B-52G departs RAF Fairford on February 9 as part of the first wave of operational missions from the base during Gulf War 1. Stuart Freer-Touchdown Aviation

Above: **Stratofortress 58-0204 *Special Delivery* from the 379th BW taxiing out for a mission on February 17, 1991 with another B-52G on its take-off run in the background. The former flew six missions, which involved 87 hours in the air.** Bob Archer

Below: **From snow to desert. Aircraft 58-0231 *High Roller* taxies out bombed up on one of the missions that partly made up its 61.5 hours of combat flying. Note that the 'Lady Liberty' tail emblem has been partially painted out on this bomber, which was operated by the 416th BW out of Griffiss AFB in New York State.** Richard Cawsey

Above: **This B-52G has been loaded with M117 750lb bombs, 27 of which could be carried internally, with the two wing pylons able to take another 24.** US Air Force

Most missions departed in the afternoon so they could arrive over their targets in darkness, although later in the conflict daylight raids were also planned.

In cells of three or four aircraft, the bombers crossed French airspace, flying eastwards out over the Mediterranean. Then they headed north-eastwards and entered Iraqi airspace via Turkey. Later missions from Fairford into the KTO would also transit via Egyptian and Saudi Arabian airspace.

Captain Kevin St Mary, an electronic warfare specialist on board one of the Fairford B-52Gs, flew seven missions during the conflict. His job was to locate, identify and defeat SAMs and other threats to the aircraft from his position in the enforced darkness of the bomber's windowless fuselage. He spoke to the Washington Post's Glenn Frankel after the missions had ceased and described it as "14 hours of boredom and 10 minutes of terror."

Col Conlan also spoke to *New York Times* reporter Craig Whitney and explained that: "among the targets our 'planes hit in northern Iraq were power plants, nuclear research installations and Scud missile assembly plants. Later, as the allied ground offensive drew closer, B-52s hit Republican Guard infantry and armoured units, and their fortifications in the sands of Kuwait."

SECRET SQUIRREL

During Operation Desert Storm B-52Gs undertook 1,741 sorties (around 3% of the total missions) and delivered 27,000 tons of munitions.

Apart from the first night's 'Secret Squirrel' operation over Iraq on January 17, which involved B-52Gs flying round-robin missions from the US firing then classified AGM-86C Conventional Air-Launched Cruise Missiles (CALCMs), almost all the B-52G missions used 'dumb' iron bombs. In a high-tech war of laser-guided smart bombs and cruise missiles, flying a B-52 was a decidedly low-tech experience.

Whilst the B-52s were not counted upon to destroy equipment, they were the prime resource for attacking area targets, breaching defensive berms, minefields, ammunition stockpiles, troop concentrations and field headquarters.

Fairford-based aircraft dropped 3,008 bombs alone, including 2,193 M117 750lb bombs, 560 Mk 82 500lb (227kg) bombs and 255 CBU-71, CBU-87 and CBU-89 munitions. As a Department of Defense report recounted: "even without precision munitions, the B-52s became one of the most sought-after aircraft by the ground commanders for strikes against Iraqi ground forces."

Just one of the 29 million leaflets dropped on Iraqi troops during the 1991 Gulf War. The translation reads: "This is the first and the last warning! We are going to bombard the Seventh Infantry Division tomorrow. Flee your location immediately!" On the reverse there was no photo, just the words: "Tomorrow we are going to bombard the Seventh Infantry Division and it will be heavy. So if you want to live, flee your location and do not allow any person to prevent you from escaping! Save yourself and head towards the Saudi border and you will find someone who will welcome you as a brother." via SGM Herb Friedman (Ret) Psywarrior.com

Speaking at the post-conflict press conference, B-52 pilot Col Randall Wooten – also from Eaker AFB – explained to the *New York Times* the decision to switch to high-level bombing tactics that the B-52s had last used in Vietnam. "Since that war, Strategic Air Command had emphasised training in radar-evading, low-level operations for the bombers' other conventional and nuclear missions" he said.

Indeed, for the first few days after the start of the air war, up until January 17, B-52G missions were flown at low level. "As soon as Iraq's air force had vanished, and its air defences were minimal, the B-52s abandoned low-level flights for 30,000ft-plus bombing raids," Col Wooten continued. "Virtually all the Iraqi anti-aircraft and surface-to-air missile fire seemed to taper off before reaching that height."

Fairford-based navigator First Lieutenant William Noble told the *Washington Post*: "On our first couple of missions we had several SAMs come up against us, the co-pilot would see them and tell us to bank left or bank right, and we could see a lot of tracers and triple-A."

HIGH-ALTITUDE DEFICIENCY

However, as a Government Accountability Office (GAO) report later revealed, switching to medium/high altitude created difficulties for B-52G operations.

Firstly, it was a role they had not specifically trained for, and the increased altitude meant bombing accuracy declined. This was also complicated by further factors, for example within theatre different military units often communicated geographic ▶

coordinates in different ways. If not accurately adjusted these created minor targeting errors.

Additionally, until detected on February 18, coordinates generated by Advanced Synthetic Aperture Radar System (ASARS) radar data – mainly gathered by Lockheed TR-1s operating in theatre prior to Operation Desert Storm – contained an in-built error of around 700 yards (640m). For B-52G crews this did not always present a serious problem as their radar-controlled bombsights enabled them to adjust their heading slightly using information detected by their on-board targeting equipment. Most of their missions did not require total precision anyway.

However, B-52Gs were frequently re-tasked in the air and the crews were often given only new bombing coordinates. The crews later said that without additional information about the target, they could not always be exactly sure what they were supposed to be aiming for and therefore weapons accuracy was likely to be reduced. Even so 806th BW(P) officers told journalist Glenn Frankel that: "damage assessments showed we had success against both strategic targets and caused extensive damage to the Republican Guard units,

"In a high-tech war, flying a B-52 was a decidedly low-tech experience"

shattering their supply lines, communications and morale, even when the troops were widely dispersed and well dug-in."

Another post-war GAO report on B-52 performance during the conflict highlighted that: "Perhaps the most significant and widely discussed B-52G training deficiency was the almost exclusive focus on low-altitude operations. Both prior to the invasion of Kuwait and in the months preceding the war, Strategic Air Command emphasised low-altitude training as the best way to increase bomber survivability."

It pointed out that SAC also assumed that "B-52s would operate autonomously, flying alone or with a few other bombers. Thus, there was no emphasis on operating with fighter support packages provided to help defeat the threat. The first time that many SAC crews were exposed to airborne warning aircraft or air force and navy tactical fighters was during the war. Even within a B-52 strike package, SAC's approach tended to view each bomber in the package as independent. SAC lacked standardised procedures for attacking in formations."

The 416th BW, which operated out of Griffiss AFB, deployed B-52G, 57-6498 *Ace in the Hole* to Fairford. It has been adorned with ten red bomb symbols and a small Iraqi flag denoting its Desert Storm missions. Jeremy Flack/API

PSYCHOLOGICAL BOMBING

At certain stages during the conflict the US Army's 4th Psychological Operations Group sought USAF support for a leafleting campaign to warn specific Iraqi frontline units that they were going to be bombed. Leaflets were printed and dropped on the Iraqi units and this was often reinforced by coalition radio broadcasts.

Those positions would be attacked the next day, usually by a 'cell' of three B-52Gs. This was followed by another day of leaflets and broadcasts indicating that they would be bombed again and advising surviving soldiers to defect or desert. CENTCOM would then bomb the unit for a second time before a final leaflet was dropped containing another warning of an upcoming attack, with the ominous threat that they would not receive another warning as the next bombing would be so intense, no one would survive!

As a result, it was not unusual for whole units to desert, and 98% of Iraqi POWs later said they had seen, or possessed, some of the total 29 million leaflets dropped on them.

The B-52G's M117 and Mk 82 iron bombs were sometimes bolstered by the use of cluster munitions. The emphasis was not so much on destroying equipment, but the impact that ceaseless air attacks had on the minds of enemy soldiers.

When the war was over, many POWs suggested that the B-52s had the greatest impact on their morale. One prisoner, apparently a veteran of the Iran-Iraq War claimed the Coalition bombing had been "the worst thing he had ever experienced in combat" and went on to assert that the B-52s were most devastating of all. Another Iraqi officer said he surrendered because of B-52 strikes. Told that his unit was never hit by B-52s, he is quoted as stating "but I saw one that had been attacked."

SCUD HUNTING

The GWAPS also detailed how B-52Gs were used to support the Scud-hunting campaign from February 19 until the end of hostilities. The Stratofortresses were used to provide suppressive measures that required arming assigned B-52s with CBU-58 cluster bombs. They would then make pre-emptive attacks at intervals in the designated Scud missile 'kill boxes', largely in Western Iraq. The report stated that: "Dropped from high altitude, the high-explosive and fragmentation effects of the bomblets scattered over a wide area, putting thin-skinned mobile Scud vehicles and fuelled missiles at risk."

Using the Stratofortress in this way freed up five Boeing F-15E Strike Eagles – that were flying Scud CAP missions – to attack other targets, and the B-52Gs were "deemed to have done the same suppressive job equally well."

None of the Fairford-based B-52Gs sustained battle damage, however there were incidents. On February 17, for example, one aircraft suffered major hydraulic problems soon after take-off and was forced to jettison its bomb load into the Mediterranean before diverting to Palermo in Italy.

Severe winter weather in the UK also caused some diversions to other UK airfields, including Mildenhall, and a four-ship cell was sent to RAF St Mawgan on February 24.

A ceasefire was eventually ordered on February 28, 1991 and the B-52Gs began to leave RAF Fairford on March 1. By the end of the deployment the 806th BW(P) had flown 62 operational sorties and accumulate over 900 combat flying hours.

In just 19 days the unit's B-52Gs dropped more than 1,158 tons of bombs and only one mission had to be cancelled because of mechanical problems. With the departure of the final B-52 on March 9, the wing deactivated and within months the veteran B-52Gs were withdrawn from service and mostly passed to what at the time was called the Aerospace Maintenance and Regeneration Center (AMARC) at Davis-Monthan AFB for destruction. At least they had a highly successful swansong. AN

Aircraft 58-2589 *Darkest Hour* retracting its undercarriage as it leaves Fairford heading off to hit Iraqi military positions. In total UK-based B-52s flew 62 operational sorties and completed over 900 combat flying hours. Jeremy Flack/API

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DIGITAL 'DINOSAUR' UPGRADING A LEGEND

Tom Kaminski considers the latest developments and plans to improve the capabilities of the B-52H.

Between 1955 and 1962 the US Air Force acquired 744 B-52s in eight major versions, including 102 B-52Hs.

The current plan calls for maintaining 76 operational B-52Hs for the foreseeable future. Although it is no longer assigned to penetrate enemy air defences and directly attack heavily defended targets, the B-52H serves as the US's main stand-off weapon delivery platform and is also capable of deploying with a wide variety of direct attack munitions.

The operational fleet is currently flown by two active duty bomb wings (BWs) and another from Air Force Reserve Command (AFRC). The active duty aircraft are assigned to Air Force Global Strike Command (AFGSC), and the reserve wing has also come under its control since February 2010.

Until the recent aircraft loss, 44 combat coded and four back-up bombers were evenly distributed between the 2nd BW at Barksdale AFB, Louisiana, and 5th BW at Minot AFB, North Dakota.

The formal training mission is assigned to the AFRC's 307th BW at Barksdale, which has 16 primary mission aircraft and two back-up jets. Four bombers support testing at Edwards AFB, California, and Barksdale as part of the 412th Test Wing (TW) and the 53rd Wing.

Originally developed as a long-range high-altitude strategic bomber, the Boeing B-52 Stratofortress has been adapted for multiple missions including strategic attack, air interdiction and maritime operations, and more recently it has taken on a new role as a close air support (CAS) platform.

The USAF recently selected Northrop Grumman to build its new B-21 Long Range Strike Bomber, which will eventually replace both the B-1B Lancer and the B-52H. It is expected to achieve initial operational capability (IOC) sometime around 2025, but under current plans the B-52H will remain in service until around 2040.

To ensure the B-52 can continue to complete its assigned missions until its well-deserved retirement, AFGSC has embarked on a series of modifications to provide the USAF's oldest combat aircraft with new capabilities and weapons.

GOING DIGITAL

Boeing delivered the first operational B-52H equipped with the Combat Network Communications Technology (CONECT) modifications to Barksdale in April 2014.

Intended as the basis for other planned upgrades, the $1.1bn CONECT programme gives the B-52H new multifunctional colour displays (MFCDs), computer architecture, digital workstations, multiple data links and enhanced communications capabilities, including a new digital intercommunication system designed to survive and function through the nuclear environment.

The new equipment provides the aircraft with a network-centric operations (NCO) capability and enables the crew to receive and send real-time digital information – ▶

Above: **Airmen secure a cruise missile to a B-52H Stratofortress pylon during an alert-generation exercise at Minot AFB. The exercise tested cruise missile loading and aircrew response procedures.** USAF/Staff Sgt Jocelyn Rich

Main photo: **This B-52H is showing its age, however the Stratofortress is still a vital part of US air power and continues to be upgraded. It is from the 96th Bomb Squadron at Barksdale AFB and is practising air-to-air refuelling from a 100th Air Refueling Wing KC-135R.** Key-Dino Carrara

Above: **A B-52H in the cruise. One of the strengths of the Stratofortress is range, it can fly 8,800 miles, and this can be extended further by air-to-air refuelling.** USAF/Staff Sgt Andy M. Kin

Below: **The USAF has considered re-engining the B-52H a number of times but no contracts have ever materialised and the Pratt & Whitney TF33-P-3/103 turbofans soldier on.** USAF/Master Sgt Val Gempis

Munitions in the B-52H's arsenal shown in an impressive photo from a few years ago. The USAF is continuing to expand the weapons capabilities of the Stratofortress. USAF/Tech Sgt Robert J Horstman

including intelligence, mapping and targeting information – and communicate with other platforms via satellite.

The integrated suite supports in-flight mission re-tasking and weapons re-targeting for the AGM-86C/D Conventional Air-Launched Cruise Missile (CALCM), AGM-158 Joint Air-to-Surface Standoff Missile (JASSM) and Joint Direct Attack Munition (JDAM).

It also enables real-time intelligence feeds to be overlaid on moving maps, enhancing its ability to conduct CAS missions. Development began in March 2005 when Boeing received a four-year, $217m system design and development contract. Modification of a prototype aircraft began at Boeing's Wichita, Kansas, facility in October 2007 and the upgraded bomber took its first test flight there on May 21, 2009.

It was formally handed over to the 412th Test Wing on August 5, 2009 for development testing and conducted its first test flight at Edwards on January 17, 2010. Testing was completed in December 2011 and modifications of the first production example began in July 2013.

Modifications are being carried out during the bomber's normal programmed depot maintenance (PDM) cycle at the Oklahoma City Air Logistics Complex (OC-ALC) at Tinker AFB, Oklahoma. Two Ground Instructional Training Aircraft (GITA) will also have the CONECT modifications.

The aircraft's operational effectiveness will be further enhanced by additional communications upgrades, which include a Tactical Data Link (TDL) as well as new Communication Navigation Surveillance/Air Traffic Management (CNS/ATM) capabilities under development.

WEAPONS CAPABILITIES

The B-52H has a weapons payload of more than 70,000lb (31,751kg) and can carry a more diverse range of nuclear and conventional weapons of any USAF combat aircraft.

For its nuclear mission, it can be armed with up to 20 AGM-86B Air-Launched Cruise Missiles (ALCMs) equipped with W80-1 warheads: six can be mounted on each of the two wing pylons and eight in the bomb bay on the Common Strategic Rotary Launcher (CSRL). The aircraft can also carry B61-7 and B83 nuclear bombs.

For conventional missions, the CSRL and wing pylons can hold up to 20 AGM-86C/D CALCMs, and the bomber can employ a range of conventional munitions both internally and externally. The B-52H's two wing pylons can have the Heavy Stores Adapter Beam (HSAB) installed to facilitate carriage of a range of conventional ordnance, including up to 16 Wind-Corrected Munitions Dispensers (WCMDs), 12 AGM-154 Joint Standoff Weapons (JSOWs), 12 AGM-158 Joint Air-to-Surface Standoff Missiles (JASSMs) or 12 JDAMs.

Internal conventional weapons are limited to twenty-seven 500lb (227kg) free-fall

An 'MT' tail code identifies a B-52H from Minot AFB in North Dakota. Along with Barksdale in Louisiana the two bases are the last to house frontline Stratofortress units. USAF/Airman 1st Class Rachel Loftis

general-purpose bombs and naval mines on three cluster racks, each with nine weapon stations.

Alternately, up to eight 2,000lb (907kg) class weapons including Mk-84 general purpose bombs, and Mk-60 Encapsulated Torpedo (CAPTOR) and Mk-64/65 Quickstrike naval mines. The $313m Internal Weapons Bay Upgrade (IWBU) integrates MIL-STD-1760 digital weapons bus capability with the internal weapons bay by installing the same integrated weapons interface unit (IWIU) already incorporated on the aircraft's wing pylons as part of the Advanced Weapons Integration (AWI) programme.

The IWBU also enables communication between installed precision-guided weapons and the aircraft over the weapons bus.

Incremental upgrades will meanwhile enable the bomber to carry up to eight precision-guided JDAMs, JSOWs or ADM-160B Miniature Air Launched Decoys (MALDs) internally, greatly increasing its smart weapons payload.

Modifications to 44 CSRLs that are 'excess' to nuclear requirements are currently under way. The modified launchers are no longer capable of deploying nuclear weapons and are referred to as Common Rotary Launchers (CRLs).

Boeing handed over six CRLs to the 2nd BW at Barksdale in January this year and deliveries should be completed by October 2017.

The IWBU Increment 1.1 configuration will see the CRL carry up to eight JDAMs or Laser JDAMs (L/JDAMs) and facilitates carriage of up to 16 L/JDAMs on the HSABs.

Increment 1.2 will enable the CRL to carry the JASSM and the extended range AGM-158B JASSM-ER as well as the MALD and the ADM-160C MALD-Jammer (MALD-J). It also adds the facility for external carriage of the JASSM-ER on HSABs.

Integration of the JASSM-ER on the B-52H began in November 2015 when Lockheed Martin received a $9.1m contract – the Stratofortress becoming the fourth combat aircraft to carry the turbofan-powered cruise missile which has a range of 500nm (926km).

Future increments will provide for carrying the family of WCMDs, laser-guided bombs (LGBs) and additional weapons such as the 2,000lb (907kg) GBU-56 Laser JDAM on the CRL.

The bomber's flexibility as a CAS platform will be further improved when it is able to carry and deliver multiple weapon types simultaneously, while incorporating 250lb (113kg) GBU-39 and GBU-53 Small Diameter Bombs will raise its value as a CAS platform by being able to attack a greater number of targets.

To support future nuclear missions, both the B-52H and the Northrop Grumman B-2A Spirit will carry the Long-Range Stand-Off (LRSO) weapon, planned as a replacement for the ALCM. The USAF intends to release the formal request for proposals associated with the development of this stealthy nuclear-capable cruise missile sometime this year.

A B-52H radar navigator inspects a 2,000lb JDAM. USAF/Airman Tabitha Wininger

A conventionally armed version of the missile, planned as a replacement for the CALCM, will ensure the B-52 can continue to carry out strikes deep in enemy territory from stand-off ranges.

As required by the New Strategic Arms Reduction Treaty (New START) with Russia, 30 operational B-52Hs are being converted to a conventional-only status by removing their ability to deliver nuclear weapons; 12 B-52Hs in storage at Davis-Monthan AFB, Arizona, will be similarly modified.

The first conversion was completed at Barksdale when B-52H 61-0221, operated by the 307th BW, was returned to service in September 2015. All conversions are scheduled for completion by early 2017.

Under New START, the United States will retain 454 Minuteman III intercontinental ballistic missiles (ICBMs), 280 Trident II submarine-launched ballistic missiles (SLBMs) and 66 nuclear-capable bombers (20 B-2As and 46 B-52Hs).

PODS

The B-52H can carry either the AN/AAQ-28 Litening or AN/AAQ-33 Sniper advanced targeting pod. The first type integrated on the B-52H was the Litening, which underwent a combat evaluation during Operation Iraqi Freedom in April 2003 when it was used to target 500lb (227kg) GBU-12 LGBs against targets in northern Iraq.

The pods enable the acquisition of real-time intelligence, surveillance and reconnaissance (ISR) and have a long-range, positive target identification capability. A video downlink also allows for ISR information to be transmitted to other platforms and receivers.

Control, display and target geo-location abilities of the pods are fully integrated with the bomber's Offensive Avionics System (OAS) via the CONECT's new MFCD and a digital-integrated hand controller at the navigator's station.

AFGSC's Bomber Requirements Division carried out a demonstration that evaluated the installation of a Northrop Grumman ▶

A Stratofortress from the 2nd Bomb Wing at Barksdale AFB drops a JDAM. USAF/ Lt Col Tim Pfeifer

The US maintains what is called a continuous bomber presence in the Pacific at Andersen AFB on Guam. This tasking is undertaken by B-52Hs (as well as B-1Bs and B-2As), illustrated here with aircraft from both Barksdale and Minot AFBs. USAF/Senior Master Sgt Don Perrien

AN/ASQ-236 Dragon's Eye pod, on a B-52H from the 307th Bomb Wing's 93rd Bomb Squadron at Barksdale AFB beginning in April 2014. First deployed aboard USAF F-15Es in 2009, the system was developed to allow aircrew to geo-locate points of interest, and conduct surveillance activities during day or night, in adverse weather. In addition to a Ku band active electronically-scanned array (AESA) radar, the self-contained pod is equipped with an antenna, inertial navigation system (INS) and environmental cooling system. The system's synthetic aperture radar (SAR) can quickly scan large areas and is very effective as a sea-search sensor. According to AFGSC, the radar's high-resolution mapping enables target detection, tracking and subsequent engagement in situations where existing electro-optical targeting pods cannot be used.

Testing was conducted at Barksdale by the 49th Test and Evaluation Squadron and Detachment 1, 53rd Test Management Group, and was primarily intended to evaluate the pod's use in the maritime role. The pod was of potential interest to Pacific Command, due to the vastness of the ocean in its domain, however, there is currently no funding for its use on the B-52.

The USAF's budget request for 2017 includes funding to cover a radar modernisation programme for the B-52. Its Northrop Grumman AN/APQ-166 mechanically scanned array (MSA) radar, last upgraded in 1985, has become increasingly unserviceable and is nearing the end of its useful life, while diminishing manufacturing sources and obsolescent technologies have made it increasingly difficult to support.

The replacement radar will use advanced capabilities already available, and the USAF intends to maximise commonality with other systems.

"...under current plans the B-52H will remain in service until around 2040."

NEW ENGINES

Air Force Global Strike Command is eager to re-engine the Stratofortress fleet to reduce fuel consumption and improve performance and reliability – and as recently as July 2015, the USAF requested information from industry regarding the replacement of the Pratt & Whitney TF33 engines.

Its requirements included a 20% reduction in fuel consumption and a 10,000-hour service life between overhauls, and it has been seeking ways to fund the project. However, the commanding officer of Air Force Materiel Command recently said that, because of competing priorities, the USAF has not "figured out a way to put it in the budget".

Pratt & Whitney is developing a TF33 upgrade that would reduce maintenance costs and cut the bomber's operating costs, but no funding has been earmarked for this option either.

The B-52 recently went into action again as aircraft from the 2nd BW at Barksdale arrived at Al Udeid AB, Qatar, on April 9 for operations against Daesh. The bombers and crews have been assigned to the 380th Air Expeditionary Wing and flew their first operational mission against a weapons storage facility around 35 miles (60km) south of Mosul in northwestern Iraq on April 18.

As well as supporting Operation Inherent Resolve and the Continuous Bomber Presence mission in the Pacific, recent exercises have seen the bombers conduct visits to Morón AB in Spain in February and long-range and round-robin missions to South America and Jordan in April and May.

Despite being the USAF's oldest combat aircraft, the B-52H continues to demonstrate its versatility, and continued upgrades will ensure its viability for at least two more decades. AN

The B-52H has once again been called into action, this time against Daesh. Bombers from Barksdale AFB are pictured arriving at Al Udeid AB, Qatar on April 9 at the start of this new mission for the type. USAF/Staff Sgt Corey Hook

THE WORLD'S BEST AIRPORT?

Martyn Cartledge visited Singapore Changi Airport to see why it is so highly regarded.

Aviation came to Singapore in 1930 when the first commercial flight landed at Seletar Air Base. The colonial government then decided to build a new airport at Kallang Basin, which welcomed its first aircraft five years later.

Officially opening on June 12, 1937, it operated for 15 years with a hiatus during the Japanese occupation from 1942-1945. When it closed in 1955, operations moved to Paya Lebar, a new airfield built on reclaimed marsh land, which required the relocation of a number of local residents.

With the growth of global aviation transport, the airport soon faced congestion problems that by the 1970s, became critical – annual passenger numbers had risen from 300,000 in 1955 to 1.7m in 1970 and to 4m in 1975.

Concerned the airport could be hemmed in by urban growth, in 1975 the government decided to build a new one through land reclamation at Changi Air Base on the eastern tip of the main island – where aircraft could fly over the sea, avoiding noise pollution in residential areas like those at Paya Lebar, which was later converted for military use.

The government sent a team to Taiwan to see the newly built Chiang Kai-shek International Airport (later renamed Taiwan Taoyuan International Airport) and adopted its design, making Changi initially look identical.

CONSTRUCTION

To make room for construction, much land needed to be reclaimed and around 500 acres (2km²) of swamp was cleared and filled with 15,700,000 cubic yards (12,000,000m³) of earth from nearby hills. Another 52,300,000 cubic yards (40,000,000m³) of sand were used to fill up the seabed and canals were built to drain water from three existing rivers.

In total, 870 hectares (2,150 acres) were reclaimed, bringing the total site area to 1,300 hectares (3,212 acres).

The first phase, which cost $1.3bn, included a single terminal and one runway; 45 aircraft parking bays; support facilities and structures, including a large maintenance hangar, fire station, workshops and administrative offices; an airfreight complex; two cargo buildings; in-flight catering kitchens; and a 262ft-high (80m) control tower.

Operations at Singapore Changi Airport began on July 1, 1981 with a Singapore Airlines flight from Kuala Lumpur though it was not offically opened until December 28 that year.

By July 1982, 12.1m passengers had passed through and close to 200,000 tonnes of air freight handled across 63,100 aircraft movements.

Phase two added a second runway, 23 new stands, a second fire station and a third cargo facility.

Terminal 2 opened in 1990, way ahead of traffic demand. This was added to with Terminal 3 accepting passengers in 2008.

CURRENT OPERATIONS

Last year Changi welcomed 55.4m passengers and registered 346,330 landings and take-offs, a year-on-year increase of 2.5% and 1.4% respectively.

Last December was the airport's busiest month ever, accounting for 5.29m ▶

Jetstar is one of the busiest operators at Changi. This A320 was photographed from the viewing gallery in Terminal 1. All photos Martyn Cartledge

Above: **The Sunflower Garden on top of Terminal 2 doubles as a viewing terrace for checked-in passengers.**

Right: **The Orchid Garden in T2 has this Koi carp pond (there is another Koi pond in T3).**

Left: **A fun feature is the 12m 'Slide @T3'.**

Below: **All three terminals are linked by the Skytrain that is accessible to passengers after check-in.**

A Nok Scoot Boeing 777-200ER arriving on the three-times weekly service from Bangkok.

Above: **Terminal 3 opened in 2008 and features a roof made up of hundreds of computer-controlled reflectors that allow natural light into the departure hall while keeping the tropical heat out.**

Below: **One of the two Solari clicker boards in Terminal 2 – the airport is keen to keep them in use.**

passengers, a 3.9% increase on the same period the previous year. Changi's daily record was broken on December 19 when more than 192,000 passengers passed through the airport in 24 hours.

On the cargo front, the airport handled 1.85m tonnes, a slight increase on the previous year.

The airport is connected to 320 cities worldwide by more than 100 airlines. The top three most popular passenger destinations are the Indonesian capital, Jakarta, Hong Kong and Kuala Lumpur. One in ten passengers using Changi travel in First or Business Class.

Garuda Indonesia, Malaysia Airlines, Sriwijaya Air, Xiamen Airlines, Lion Air and Shenzhen Airlines are among some of the Far Eastern operators which use the airport, while based carriers are Singapore Airlines, SilkAir, Scoot, Tigerair and Jetstar Asia.

Aircraft at Changi are many and varied, but almost exclusively jets. Malaysian carrier Firefly is the exception, operating ATR 72s into the airport.

Changi currently has three terminals with a total capacity of 66m passengers per annum (mppa). Of the airport's 96 aircraft parking stands, 18 are Airbus A380-compatible.

Terminal 1 was upgraded in 2012 to improve passenger flow and experience with its 'tropical city' concept. Terminal 2 also utilises lush greenery and a considerable amount of glass to introduce natural light, reducing the cost of lighting.

It retains two of the few remaining Solari clicker departure boards which, although expensive to maintain, the airport is determined to keep running for as long as possible because of their iconic status.

Below: **Air Asia is a major player at Changi. Airbus A320s registered in Malaysia, Indonesia and Thai frequent the airport.**

Widebody aircraft, such as this Finnair Airbus A340, visit Changi from all over Europe.

Terminal 3 takes the use of glass further, featuring a unique roof architecture made up of hundreds of computer-controlled reflectors which let natural light into the departure hall while keeping the tropical heat out.

FUTURE DEVELOPMENTS

A new Terminal 4 is currently under construction replacing one that was housing low-cost carriers (LCCs). With a floor area of 2.1 million sq ft (195,000m²), it will feature 25 airbridge-connected gates and raise Changi's capacity by 16m passengers.

Its design is in line with the current trend of self-service options now used worldwide, including numerous kiosks for check-in, bag-tagging and dropping. Immigration and security will be centralised for speedier transit and cost-effectiveness.

A mixed-use facility, T4 will also have more hotels, shops and entertainment, making Changi even more of a destination attraction than it already is. The new Terminal 4 is due to open next year.

A brand new facility designed by Moshe Safdie, named the Jewel Changi Airport, will be built as a new facade to Terminal 1. A ten-storey glass domed building, it will cover 1.4 million sq ft (134,000m²).

Its centrepiece will be a large indoor garden complete with a 131ft-high (40m) 'rain vortex' – expected to be the world's tallest indoor waterfall – while 236,806sq ft (22,000m²) of space will be landscaped and include 'Forest Valley', a five-storey garden where you'll be able to hike up the valley, all in air-conditioned comfort.

The airport's capacity will have risen to 85mppa when the Jewel Changi Airport facility opens in 2018.

CHANGI EAST

The largest project on the horizon, the 'Changi East' development, will add a fifth terminal and a third runway. The extra runway – 02R/20L – is already in place but currently used exclusively by the military. It will be upgraded and lengthened from its existing 9,000ft (2,750m) to 13,000ft (4,000m) to handle larger passenger aircraft. A fire station will be built along with almost 25 miles (40km) of new taxiways to connect this runway with the current airport and allow for the efficient ground movement of aircraft. The third runway will be opened to civil traffic by the early 2020s.

At 1,080 hectares, the Changi East development will be larger than the current terminals. Set to be one of the biggest of its kind in the world, Terminal 5 will be capable of handling 50mppa even in its initial phase. The Changi East part of the airport is due to open in the second half of the 2020s.

TERMINAL ARRANGEMENTS

Most airports assign flights to a particular terminal based on certain criteria, be they home airline, low-cost, domestic/

The front of Terminal 3 with the air traffic control tower in the background.

international or airline groupings – but, by design, this doesn't happen at Changi. There are no domestic flights from the airport, so the separation of international traffic is simply not required.

Unlike resident airlines at many of the world's other airports, Singapore Airlines doesn't have its own terminal at Changi, operating mainly from T3 but also from T2; and flights are not distributed between terminals based on airline alliances.

The original Terminal 4 was used by LCCs, but this proved an issue for Changi's management which prides itself on the facilities it provides and is very much part of the whole business model.

It was felt passengers flying in on budget airlines were not getting the whole 'Changi experience' and were often going away disappointed. So the airport decided to close T4 and distribute the LCCs throughout the three main terminals.

The airport is very proud of its efficient operations, something the author can attest to. Immigration and baggage retrieval is speedy, enabling passengers to be on their way soon after arrival.

The airport offers a facilitated transfer service called Changi Connects. It is especially useful to passengers travelling with LCCs, enabling them to make connecting flights without having to pass through immigration or collect their checked bag during transit.

INNOVATIONS

Changi is well known for its innovative architecture and facilities, which is where it differs from the rest, and is the world's most awarded airport: of the 480 accolades it has won, it has been voted Best Airport in the world by Business Traveller (UK) magazine for 27 consecutive years; and six times by Skytrax, including last year.

Facilities on offer include transit hotels, lounges and five themed gardens. In Terminal 1 passengers can walk around the Cactus Garden, enjoy the rooftop swimming pool, relax in a hot tub or have a full body massage. Guests can even enjoy a manicure or pedicure, have their hair cut or take a shower. For the more energetic there is a well-equipped gym.

Terminal 2 has the Orchid Garden, featuring 30 different species, while the Enchanted Garden has four glass bouquets hand-adorned with more than 56,000 reflective and stained glass mosaic pieces, each pieced filled with seasonal flowers.

Outside on the roof, the Sunflower Garden comprises 500 sunflowers and provides shaded areas out of the tropical sunshine. The area doubles up as a viewing deck overlooking the aircraft stands and adjacent runway.

Terminal 3 includes the Butterfly Garden where more than 1,000 butterflies reside and the impressive 984ft (300m)-wide wide, 49ft (15m)-high Green Wall made up of plants.

TECHNOLOGY

Passengers' technology needs are well catered for at Changi which boasts 550 free internet terminals, free Wi-Fi throughout and 880 charging points.

Social media-savvy travellers can post on one of 64 42in (107cm) high-definition screens attached to the 30ft (9m) 'social tree' in Terminal 1. Everything posted there is designed to remain in perpetuity.

"In Terminal 1 passengers can walk around the Cactus Garden, enjoy the rooftop swimming pool, relax in a hot tub..."

For those looking for entertainment, the airport has everything from 24-hour movie theatres and PlayStation/Xbox game consoles to cosy music corners and TV lounges.

The needs of younger passengers are well catered for, with play areas in every terminal and colouring stations where they can draw using the paper and crayons provided or make rubbings from plaques of Singaporean sights and animals. The ultimate, though, must be the three-storey slide.

Passengers are not limited to the terminal their flight departs from. As security screening is done at the gate areas, once they are through immigration checks they are straight into the shopping area – and with the terminals linked by the frequent automated Skytrain system it's possible to travel between them to see what each has offer.

The airport has more than 350 retail and service outlets, featuring many well-known and high-end names as well as souvenir shops and local brands.

When it comes to food, the choice is simply mind-boggling. Changi boasts more than 120 outlets, including leading fast-food brands and full-service restaurants serving different world cuisines.

Food courts are meanwhile full of street vendors serving Singaporean cuisine in a controlled environment (mirrored in the city to maintain hygiene standards) – and travellers on a limited budget can even use the staff canteen.

ART AT CHANGI

Art installations throughout the terminals are designed to provide relief from the stresses of travel. The most interesting has to be 'Kinetic Rain' in Terminal 1's departure hall. It consists of 1,216 bronze droplets, each suspended on a thin wire and computer-controlled to move up and down, transforming elegantly into 16 different shapes and patterns.

Passengers in transit don't have to stay in the terminals: the airport offers a sightseeing tour of the city for those with a layover of more than five hours.

Meanwhile travellers can even have a free foot massage at one of the many machines or take a nap in a 'snooze area' where noise is kept to a minimum. The airport is very amenable to people sleeping there when required – and an online blog regularly votes it 'the best airport to sleep at'.

For the aviation enthusiast this is a great airport, with many places from which to view and photograph – from Changi Beach to the various viewing galleries (only the one in T1 is open to visitors not boarding a flight) and departure areas in the airport's terminals.

For those with limited time in Singapore, or without transport, the best place is the viewing gallery in Terminal 1. From here you will see most of the traffic on both the runways, with a large proportion taxiing in front of the deck either on arrival or departure.

Although seen through glass, the photographic results are more than acceptable.

Singapore Changi is not just a transport facility, it's a destination in itself, not only for passengers but for Singaporeans too – one they hold dearly in their hearts. AN

Changi is Singapore Airlines' hub and uses both Terminal 2 and 3.

AIR BASE MOVEMENTS

A selection of the most interesting aircraft to visit air bases in the UK recently.

RAF Fairford hosted B-52H 61-0001/MT from the 69th BS, 5th BW at Minot AFB over April 20 and 21. The aircraft conducted a flypast over the Lafayette Escadrille Memorial on the outskirts of Paris on the day it arrived in the UK to mark the centenary of the formation of that squadron on April 20, 1916. Liam Daniels

RAF BRIZE NORTON

1/4 99-0003 C-32A 1st AS, 89th AW, USAF. 3/4 075/F-RAJA A340-311 ET03.060, French AF. 6/4 CS-TRJ A321-231 15 Wg, Belgian Defence - Air Component. 7/4 240/F-RARF A330 ET03.060, French AF o/s. 11/4 G-988 C-130H 336 Sqn, Royal Netherlands AF; MM62221/46-85 C-27J 46 BA, Italian AF; 00-9001 C-32B 150th SOS, NJ ANG n/s, also 14th-16th. 27/4 418/F-RADC A310-304 ET03.060, French AF. 29/4 03 C-17A NATO Heavy Lift Wing; RN-08 NH90-TTH BD 18 Sqn, Belgian Defence - Air Component.

RAF CONINGSBY

1/4 078/YE Xingu EAT00.319, French AF. 7/4 51+14 Transall LTG63, German AF n/s. 8/4 50+55 Transall LTG63, German AF. 18/4 082/YG Xingu EAT00.319, French AF. 19/4 083/ZE Xingu EAT00.319, French AF. 20/4 E93/705-RZ Alpha Jet E EAC00.314, French AF. 21/4 67 Xingu EPV/28F, French Navy.

RAF FAIRFORD

20/4 61-0001/MT B-52H 69th BS, 5th BW, USAF n/s. 27/4 80-1080/BB U-2S 99th RS, 9th RW dep 28th; 80-1067/BB U-2S 99th RS, 9th RW dep 29th.

RAF LAKENHEATH

2/4 84-0015/MA & 85-0122/MA F-15Cs 131st FS, Ma ANG both dep 4th; 84-0014 & 85-0129 F-15Cs 194th FS, Ca ANG both dep 4th. 5/4 84-0083 C-21A 76th AS, 86th AW, USAF. 6/4 59-1504 KC-135T 171st ARW, Pa ANG; 62-3545 KC-135R 22nd ARW, USAF n/s; 59-1495 KC-135R 173rd ARS, Ne ANG n/s; J-013 & J-509 F-16AMs 322 Sqn, Royal Netherlands AF both o/s. 11/4 04-4081/TY, 05-4095/TY, 05-4101/TY & 05-4106/TY F-22As 95th FS, 325th FW, USAF; G-985 C-130H 336 Sqn, Royal Netherlands AF. 12/4 04-4072/TY, 04-4080/TY, 05-4094/TY & 05-4107/TY F-22As 95th FS, 325th FW, USAF. 17/4 05-4084, 05-4086, 05-4089 & 05-4091 F-22As 95th FS, 325th FW, USAF (F-22 departure dates to follow next month). 23/4 82-0192 KC-10A 60th/349th AMW, USAF n/s. 26/4 FA132 & FA127 F-16AMs 10 Wg, Belgian Defence - Air Component.

RAF LEEMING

Exercise Griffin Strike 2016 took place between April 11 to 22. Participating French aircraft operating from Leeming were: 105/4-HE & 119/4-IX Rafale Cs EC01.007, French AF; 113/30-IR & 136/30-GO Rafale Cs EC03.030, French AF.

RAF LOSSIEMOUTH

26/4 163591/RU KC-130T VR-55; USN; 130605 CC-130J-30 436 TS, RCAF. 27/4 165161/BD C-130T VR-64, USN; 165836 C-40A VR-57, USN. Between 10/4 and 23/4 Exercise Joint Warrior 16-1 took place: 5/4 69-021 Transall 221 Filo, Turkish AF n/s. 6/4 140114 CP-140 from 407 Sqn, RCAF n/s. 7/4 60+06 P-3C MFG3, German Navy, dep 14th; 168764/LD P-8A VP-10, USN dep 22nd; 07-1002, 07-1005, 07-1013 F-16Cs & 07-1020 & 07-1025 F-16Ds 181 Filo, Turkish AF, all dep 22nd; 51+14 Transall LTG63, German AF; 54+02 A400M LTG62, German AF; 69-026 Transall 221 Filo, Turkish AF n/s; 62-3563 KC-135R 101 Filo, Turkish AF n/s; 165830 C-40A VR-59, USN; 69 Xingu EPV/28F French Navy n/s. 8/4 168763/LD P-8A VP-10, USN, dep 22nd; 89-26205/LN, 89-26208/LN & 89-26212/LN HH-60Gs 56RQS, 48th TFW, USAF all dep 22nd; 128/62-IK CN235-200 ET01.062, French AF n/s. 10/4 3296 P-3C 333 Skv, Royal Norwegian AF, dep 22nd; 5601 C-130J 335 Skv, Royal Norwegian AF n/s; 84005 Tp-84 71 Sqn, Royal Swedish AF also 17th. 11/4 140104 CP-140 413 Sqn RCAF dep 22nd; 0125 Falcon 20ECM 135 Luftving, Royal Norwegian AF. 12/4 164995/AX C-130T VR-53, USN n/s. 18/4 85 Xingu EPV/28F, French Navy; 167872/BR-33 MH-60S HSC-33, USN also 19th. 21/4 5699 C-130J-30 335 Skv, Royal Norwegian AF n/s; 14-0013 A400M 221 Filo, Turkish AF n/s; 58-0110 KC-135R 101 Filo, Turkish AF n/s. 22/4 50+55 & 50+61 Transalls LTG63, German AF; 54+03 A400M LTG62, German AF; 163591/RU KC-130T VR-55, USN; 168981 C-40A VR-61, USN.

RAF MARHAM

25/4 FA127, FA139, FA132 & FA133 F-16AM & FB-22 F-16BM 1 Sqn, Belgian Defence - Air Component all dep 29th.

RAF MILDENHALL

8/4 161530 C-9B VMR-1, USMC n/s also 14th. 10/4 85-0001 C-5M 436th/512nd AW dep 12th. 13/4 900530 C-26D AOD Sigonella, USN. 15/4 165151 C-20G CFLSW ETD SIG, USN; 165737/BH, 165810/BH & 166764/BH KC-130Js VMGR-252, USMC all dep 17th also 24th-26th; 168284/02, 168332/10 & 168339/12 MV-22Bs HMX-1, USMC all dep 26th. 17/4 00-9001 C-32B 227 SOF, AFSOC; 159352 & 169356 VH-3Ds HMX-1, USMC. 18/4 05-4101/TY & 05-4106/TY F-22As 95th FS, 325th FW, USAF. 19/4 84-0061 & 87-0045 (also 25th & 29th) C-5Ms 436th/512nd AW, USAF. 20/4 E83/705-TZ Alpha Jet E AJeTS, French AF. 21/4 85-0008 C-5M 436th/512nd AW, USAF dep 24th; 09-0017 C-32A 1st AS, 89th AW, USAF dep 24th; 07-8614/RS C-130J-30 37th AS, 86th AW, USAF. 23/4 85-0004 & 87-0036 C-5Ms 436th/512nd AW, USAF. 25/4 167112/BH KC-130J VMGR-252, USMC.

Key: n/s night stop; o/s overshoot

Lockheed Martin EC-130J Commando Solo II, s/n 00-1934 of the 193rd SOS, 193rd SOW Pennsylvania ANG departing RAF Mildenhall on May 13. Ryan Dorling

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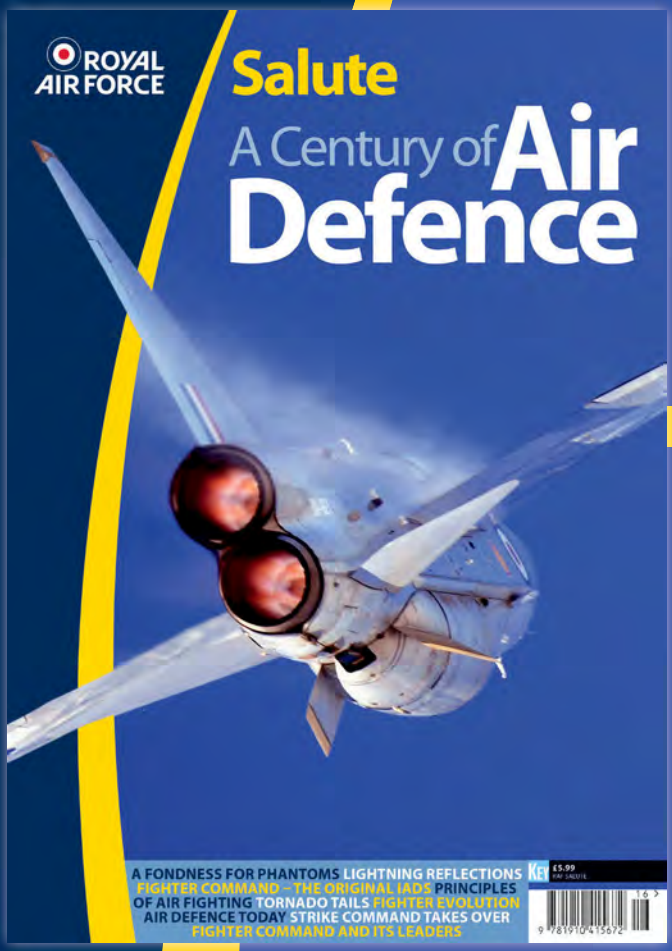

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AIRPORT MOVEMENTS

A round-up of notable aircraft visiting UK airports.

Air India Express Boeing 737-800, VT-GHB arrives at Birmingham on its delivery flight on April 30. Apron Media courtesy of Paul Ferry

BELFAST INTERNATIONAL

1/3 EI-LEO Citation 750 X dep 14th; N295GA Gulfstream G280. 2/3 D-CNMB Learjet 45. 7/3 UR-ALG SAAB 340 Aerojet Ukraine. 12/3 N812MX A319-112 on delivery to Olympic Airways, to become SX-BHN n/s. 13/3 EI-FEJ Pipistrel Virus 912; N296GA Gulfstream G280. 17/3 N71592 Cessna 208EX on delivery to Turkey. 19/3 9H-BOO Challenger 850 Air X Charter; 95-00123 UC-35A 52nd AVN, US Army dep 23rd; N339PH Do.328-110 Berry Aviation dep 23rd. 23/3 EI-ICR S-92A Irish Coast Guard. 24/3 P2-MCY Dash 8-102A Dynamic Avlease n/s. 27/3 S5-AAL CRJ900 Adria Airways also 28th; N297GA Gulfstream G280; OE-GBD Astra SPX. 29/3 D-CBBB Citation 560XLS+; N930TB TBM 900 c/n 1111 n/s. 30/3 D-CDDD Citation 560XLS+. 31/3 A9C-ACE Challenger 605 dep 2/4.

BIGGIN HILL

1/3 YR-DDM Phenom 100. 4/2 F-HBGB TBM 700. 7/2 LX-JFV PC-12; OE-FBD Citation 510 Mustang. 8/2 OE-IMZ Gulfstream G450 n/s. 10/2 2-GODD Cirrus SR-22T. 13/2 D-EPRS Cirrus SR-22T; D-IDAZ CitationJet 525 CJ1; OO-OCJ OC-12; XA-FLY Learjet 60 dep 15th; 2-JFJC Challenger 601-3A. 16/2 D-CFAN Learjet 60 n/s. 18/2 9H-SRT Global Express dep 21st. 19/2 D-IRIZ Citation 510 Mustang dep 21st. 20/2 D-AFAD Challenger 604 n/s; T7-AFP CitationJet CJ2. 21/2 OE-HLL Challenger 300; OE-ICA Global Express. 24/2 D-CDAS Phenom 300; D-GMOH PA-34-200T. 25/2 F-GJZX Diamond DA-42; HB-LUT Avanti; OO-NRG Robinson R-44. 28/2 D-AHOI Legacy 650 Air Hamburg.

BIRMINGHAM

1/4 A6-EPK 777-31HER Emirates f/v; A7-BCW 787-8 Qatar Airways f/v; TC-JVL 737-8F2 Turkish Airlines f/v. 2/4 A7-BCA 787-8 Qatar Airways f/v; YR-BME 737-86N Blue Air f/v; A6-EOR A380-861 Emirates f/v. 3/4 A7-BCH 787-8 Qatar Airways f/v; HS-VSK Gulfstream G650 f/v; D-CJOS CitationJet 525B CJ3. 4/4 A7-BCQ 787-8 Qatar Airways f/v. 5/4 SP-SPC ATR 72-202 SprintAir also 26th; UR-CBG An-12BP Cavok Air; D-CAWU Citation 560XLS; OE-GBE Astra SPX; OK-ESC Nextant 400XT. 6/4 F-HJCD Falcon 2000LX. 7/4 A6-EOS A380-861 Emirates f/v. 8/4 A7-BCJ 787-8 Qatar Airways f/v; EW-378TG An-26B Vulcan Air; SP-KPK SAAB 340A SprintAir; UR-CNN An-12B Cavok Air. 9/4 A7-BCG & A7-BCX 787-8s Qatar Airways both f/v. 10/4 A7-BCY 787-8 Qatar Airways f/v; D-ASTP A321-211 Germania f/v also 13th; TC-JVO 737-9F2ER Turkish Airlines f/v. 12/4 YR-BAQ 737-4D7 Blue Air f/v; D-IBBS CitationJet 525A CJ2+. 13/4 D-AOLG Fokker 100 Avanti Air; 9H-BOO Challenger 850 Air X Charter also 14th & 15th; D-BOOK & F-HLPM Falcon 2000LXs; D-CDOC Learjet 45. 14/4 C-GXNW Gulfstream G150; D-CTIL Learjet 35A also 29th; D-ITMA CitationJet 525A CJ2+. 15/4 D-CFOR Learjet 35A also 19th. 18/4 EI-LEO Citation 750 X. 19/4 LN-LNA 787-8 Norwegian Long Haul to MAEL; C-FEMT Learjet 36A. 20/4 A7-BCK 787-8 Qatar Airways f/v. 21/4 A7-BCP 787-8 Qatar Airways f/v; N284DH 767-304ER/W DHL dep to Tel Aviv for freighter conversion; LX-LAR Learjet 35A. 22/4 9H-AJW 737-3U3 Maleth-Aero also 25th; D-CHIO CitationJet 525B CJ3. 25/4 OK-GFR ATR 72-212A CSA f/v; D-CONU Learjet 55. 27/4 LN-LNF 787-8 Norwegian Long Haul to MAEL; HB-JSG Challenger 604. 28/4 OK-SWT 737-7Q8 Smartwings op for CSA. 29/4 LX-LAA Learjet 45; OY-RIB Avanti EVO. 30/4 VT-GHB 737-86N Air India Express on delivery; YR-BAR 737-4Q8 Blue Air f/v.

BRISTOL INTERNATIONAL

1/3 N588LQ Global 6000. 8/3 D-COBI Citation 560XLS n/s. 9/3 LX-JFH PC-12. 10/3 LX-TAI PC-12. 11/3 HB-JGL Gulfstream G200; TC-CLH Challenger 605 n/s; TC-KRM Global 5000 n/s; TC-SHE Hawker 850XP dep 13th; 9H-BBJ 737-7BC BBJ1 dep 18th also 25th - 6/4. 12/3 PH-LSR Lazer Z.200. 13/3 D-ETKN Cessna 182T; VP-BSI Gulfstream G550 also 23rd. 14/3 D-FKAE TBM 850. 15/3 VP-BJD Gulfstream G550. 18/3 F-HALM Falcon 50. 19/3 N761LE Gulfstream G650 n/s. 21/3 LX-GVI Gulfstream G650. 25/3 9H-BBJ 737-7BC dep 6/4. 29/3 G-HARG Legacy 500 new resident on delivery; OO-INN Beech 200.

CAMBRIDGE

15/4 EI-SVX A321-211(SL) ex Transaero to Marshalls, noted 26th in Aeroflot colours. 18/4 11-5731 MC-130J 67th SOS, 352nd SOW, USAF. 19/4 EI-LED A321-211(SL) Aeroflot to Marshalls. 22/4 D-CGGG Learjet 31A. 25/4 OK-PPP Beech 400XP; 2-FIFI PA-46-500TP. 26/4 VQ-BBE A330-243 Aeroflot to Marshalls. 27/4 C-FVWA 737-8K5 Thomson Airways, to Marshalls, received UK registration G-TAWA on 28th. 29/4 G-FDZZ 737-8K5 Thomson Airways, dep ex Marshalls.

DONCASTER SHEFFIELD

2/3 A6-EFF 777-F1H Emirates. 7/3 D-IRAR Beech 200. 9/3 LX-DCA CitationJet 525B CJ3 n/s. 10/3 M-EXPL AS355N. 17/3 N173PA Gulfstream III n/s; UR-CJN An-12B Cavok Air. 19/3 144615 CC-144B 412 TS, RCAF n/s. 21/3 VP-BIG 747-46NFER Air Bridge n/s. 23/3 D-CAAM Do.228-212 Arcus Air n/s. 28/3 5Y-PAA Citation 680 Sovereign. 29/3 LX-TWO Learjet 35A.

DURHAM TEES VALLEY

2/3 ZM400 Atlas C1 70 Sqn, RAF o/s. 3/3 D-CAAM Do.228-212 Arcus Air n/s. 9/3 D-CAST CitationJet 525B CJ3 n/s. 10/3 D-COKE Learjet 35A; D-CEFO Citation 560XLS+; ZZ174 C-17A 99 Sqn, RAF o/s. 11/3 F-GULY Beech C.90B. 14/3 D-CJET CitationJet 525B CJ3. 22/3 OO-TFA 757-28A/SF TNT Airways also 27th. 23/3 D-CHIC Phenom 300. 27/3 D-CFGG Learjet 36A n/s. 29/2 D-AOLG Fokker 100 Avanti Air also 30th n/s.

Pilatus PC-6/B2-H4 D-FIPS of KIAS Airlines at Glasgow Prestwick Airport on May 12. The aircraft was undertaking survey work. David Townsend

EAST MIDLANDS

1/4 D-CMED Learjet 55 also 8th. 2/4 OY-PSA 737-8Q8 Primera Air for painting. 4/4 VQ-BCO A319-112 Aeroflot for painting into Rossiya c/s; HB-ALL ATR 72-202 for painting for Zimex, ex SP-LFG of Eurolot. 5/4 ZZ176 C17A 99 Sqn, RAF; OY-CKN Falcon 2000 also 7th. 7/4 N415MC 747-47UF Atlas Air. 8/4 I-AFOI Premier 1A; N419MC 747-48EF Atlas Air. 9/4 OY-PSE 737-809 Primera Air for painting. 10/4 9A-DWA CitationJet 525A CJ2. 12/4 I-NEOS 737-86N Neos. 13/4 LX-ECV 747-4R7F Cargolux; OE-FZE Citation 510 Mustang, 14/4 OK-PCD PC-12; OE-FIS Citation 510 Mustang. 15/4 UR-11316 An-12BK Motor Sich Airlines; YL-PSB 737-8Q8 Primera Air for painting; OE-FXM CitationJet 525A CJ2. 17/4 TF-SIS A320-232 Wow Air for painting. 18/4 N571EE Phenom 300. 21/4 UR-CJN An-12B Cavok Air. 22/4 F-HBXB E170STD Hop!. 23/4 B-3028 Challenger 605. 24/4 F-HBXD E170STD Hop!; OY-VKD A321-211 Thomas Cook Scandinavia for painting. 25/4 OY-YBF ATR 72-212A for painting; RA-82042 An-124-100M Volga-Dnepr Airlines; D-CCCA Learjet 35A. 26/4 HB-IGV Falcon 50; A7-AFI A330-243F Qatar Airways Cargo; EC-ISQ Citation 560XL. 27/4 EW-328TG An-26B Genex. 28/4 RA-82043 An-124-100M Volga-Dnepr Airlines; D-CFLY and D-CAWM Citation 560XLS+. 29/4 EW-259TG An-26B Genex

EXETER

21/4 ZM405 Atlas C1 70 Sqn, RAF. 24/4 M-MHDH Citation 510 Mustang. 26/4 N119SX AW119. 28/4 N623CT Falcon 2000EX; ZZ178 C17A 99 Sqn, RAF. 29/4 69 Xingu 28F, French Navy. 30/4 F-HOLI PC-12; OY-INS Vulcanair P.68C.

1/5 F-HSHA Citation 510 Mustang. 3/5 YL-RAG SAAB 340/F RAF-Avia. 4/5 ZZ176 C17A 99 Sqn, RAF. 5/5 N430PR Bell 430. 9/5 ZZ173 C17A 99 Sqn, RAF also 13th; N711WT Gulfstream G280; LX-ABB Global 6000. 11/5 D-EARL Cessna T.210M; ZS-PLJ Beech 200. 13/5 EI-ABI DH.84 Dragon 2 Aer Lingus. 15/5 ZJ-THC CitationJet 525C CJ4. 16/5 ZM406 Atlas C1 70 Sqn, RAF. 16/5 ZM405 Atlas C1 70 Sqn, RAF.

Flybe Aviation Services
22/4 F-ZBMC Dash 8-Q402MR Sécurité Civile dep. 27/4 G-BFXE ATR 72-600 Flybe on delivery, to be operated for SAS.

1/5 4O-AOC E190LR Montenegro Airlines. 2/5 G-NSEY E195SR Aurigny Air Services dep 3rd. 8/5 EC-KSS ERJ 145MP Air Europa. 11/5 OY-GRH Dash 8-Q202 Air Greenland dep. 12/5 G-PRPE Dash 8-Q402 Flybe on delivery.

Bright Airlines ATR 42 LZ-ETM was present at Manchester on the evening of May 12. Nik French

GLOUCESTERSHIRE

1/3 F-GULY Beech C.90B. 2/3 LX-LAB PC-12. 3/3 ZM404 Atlas C1 70 Sqn, RAF o/s. 11/3 LX-JFJ PC-12 dep 13th. 12/3 EI-BUF Cessna 210N. 14/3 D-EKHW PA-28RT-201T. 15/3 D-CJET CitationJet 525B CJ3 also 16th; EI-LEM SOCATA TB-9. 18/3 2-GOOD PA-32R-301T; EI-LIM AW139 n/s; OO-GDF Phenom 300. 24/3 9H-SNT PA-28RT-201T; OO-CIV CitationJet 525A CJ2. 29/3 740/F-RACA DHC-6-300 ET03.061, French AF dep 31st.

GUERNSEY

1/3 D-FNAH PC-12; 078/YE Xingu EAT00.319, French AF o/s. 2/3 HB-VYS Phenom 300. 4/3 F-GKVZ SOCATA TB-20; M-SMKM Cirrus SR-20 dep 24th as 2-SMKM. 7/3 F-HMYY Robin DR.500/200i. 8/3 LX-TAI PC-12. 10/3 LX-NEW PC-12; OY-CLP Citation 650 VII. 11/3 F-HPYB Diamond DA-40D. 12/3 SE-MAN BAe ATP/F West Air Sweden. 13/3 EC-KTC Do.28G-92. 16/3 D-IAAY Phenom 300. 17/3 F-GINM Robin DR.400/180, 18/3 G-POWF 737-33AF Titan Airways op for Aurigny Air Services. 20/3 G-ZAPW 737-3L9 Titan Airways op for Aurigny Air Services. 21/3 2-KOOL PA-28-181. 24/3 OO-GJP CitationJet 525B CJ3. 28/3 G-SMLA BAe 146-200 Jota Aviation op for Aurigny Air Services. 30/3 ZS-XCE ATR 72-202; HA-VOC Do.28G-92. 31/3 SE-MHD BAe ATP/F West Air Sweden.

INVERNESS

1/4 OY-EKC Falcon F7X dep 3rd also 18th. 2/4 F-WWQC Falcon 8X type f/v; PH-STB Falcon 900C. 3/4 D-IAAT Phenom 100 dep 7th; SE-RGX CitationJet 525A CJ2. dep 7th. 6/4 OY-FWO Falcon 7X n/s. 7/4 N360HP Global XRS; OH-RBX Citation 560XL dep 10th. 8/4 OY-JBJ Hawker 800XP2 also 26th. 10/4 9H-CLG Challenger 850 n/s. 11/4 LN-HSC Beech F90. 15/4 OO-PCJ PC-12 dep 17th. 16/4 Hawker 850XP n/s. 19/4 167872 MH-60S HSC-28, USN o/s; D-EBHE Beech 36TC n/s. 25/4 OE-GBD Astra SPX n/s. 27/4 OE-ITH Challenger 604. 29/4 C-FFIJ Global 5000; OO-FPC CitationJet 525B CJ3. 30/3 OY-SWO Falcon 2000S; OK-CAA Citation 560XL.

An unusual visitor to Glasgow Airport over May 7 to 9 was this EC-130H Compass Call 73-1592/DM from the 41st Electronic Combat Squadron/55th Electronic Combat Group at Davis-Monthan AFB. Chris Melaisi

JERSEY

2/4 08-NW/F-JUIM Vanessa Air VL-3 Evolution; N3110J Maule MX-7-160. 4/4 OO-ALW Cessna F.177RG. 6/4 SP-EAR Citation 680 Sovereign. 9/4 PH-2X3 TL Ultralight TL-232 Condor. 10/4 N1943S Stinson V77 Reliant; ZZ174 C-17A 99 Sqn, RAF. 11/4 D-EAFE Mooney M.20K. 12/4 5490/VY AS555AN EH03.067, French AF. 19/4 9H-GMT Falcon 900LX. 20/4 OK-EMA Citation 680 Sovereign; OY-NDP CitationJet 525A CJ2+. 23/4 N43472 Air Tractor AT802. 25/4 F-WVXB Aerospool WF-9 Dynamic; N9018Z Cessna 208B. 26/3 F-HOLI PC-12. 27/4 EC-JVM Learjet 60. 28/3 LN-NCC U-6A Beaver. 29/4 2-AWBN PA-30-160; VP-BZE Falcon 7X. 30/4 HB-AER Do.328-110 Skyworks Airlines f/v, start of summer Berne service.

LIVERPOOL

3/3 VP-DFM Falcon 900LX dep 5th; D-CFTG Learjet 35A. 7/3 EC-IVJ CitationJet 525 CJ1 dep 9th. 8/3 F-HIJD CitationJet 525A CJ2+ dep 10th; N571EE Phenom 300 dep 14th also 15th. 10/3 EI-WXP Hawker 800XP. 11/3 2-GNSY Commander 114B; OO-PRM Citation 510 Mustang. 12/3 OK-RDA LET L-410UVP-E9 Van Air Europe. 14/3 D-ASTR A319-112 Germania n/s; D-IMAX CitationJet 525 CJ2 n/s also 19th-24th. 15/3 D-IKBO CitationJet 525A CJ2+ n/s; D-IHEB CitationJet 525 CJ1 n/s. 19/3 LX-USM Falcon 7X. 21/3 D-ISUN CitationJet 525A CJ2 also 24th. 22/3 SE-LRA SAAB 2000 SAAB Aircraft n/s; D-IAHT Mu-2B-26A. 25/3 EC-LML A320-216 Vueling Airlines. 28/3 OK-REQ A319-112 CSA start of summer Prague flights; EC-KDX A320-216 Vueling Airlines. 29/3 YR-BAS 737-430 Blue Air new Bacau service. 30/3 D-CDAS Phenom 300. 31/3 D-CFIV Learjet 35A.

LONDON GATWICK

2/4 CS-TKQ A320-214 Azores Airlines f/v. 3/4 EI-JFL 737-8JP Norwegian Air International f/v; OM-HTE 838-8AS Go2Sky op for Norwegian f/v; D-CJOS CitationJet 525B CJ3. 8/4 TC-JVM 737-8F2 Turkish Airlines f/v. 10/4 EC-MIN A330-343E Air Europa f/v; OE-LEN A320-214 Niki f/v; UR-PSM 737-8FZ Ukraine International Airlines f/v; TC-JTH A321-214 Turkish Airlines f/v. 11/4 LY-MCA ATR 72-201 Danu Ora op for Aurigny Air Services; TC-JTF A321-231 Turkish Airlines f/v. 12/4 EI-FJM 737-8JP Norwegian Air Shuttle f/v. 13/4 F-HFKE ERJ 145LR Enhance Aero Maintenance; TC-JVN 737-8F2 Turkish Airlines f/v. 14/4 A6-EOW A380-861 Emirates f/v. 15/4 EI-LNJ 787-9 Norwegian Long Haul f/v. 16/4 UR-PSN 737-8FZ Ukraine International Airlines f/v; 9H-VJO Global 6000 VistaJet. 17/4 TC-CRA 737-8HC Pegasus Airlines f/v. 18/4 EC-MKO A320-232(SL) Vueling Airlines f/v. 20/4 G-JOTR RJ85 Jota Aviation op for Aurigny Air Service; OM-GEX 737-8AS Air Explore op for Iraqi Airways f/v. 22/2 EI-FMR 767-304R Meridiana f/v; EI-FGX 737-3Q8 Air Mistral op for Meridiana f/v.

25/4 D-ABXC A330-223 airberlin f/v. 28/3 TC-JTI A321-231 & TC-JVO 737-8F2 Turkish Airlines both f/v. 29/4 LN-NLH 787-8 Norwegian Long Haul f/v.

LONDON LUTON

1/4 G-EZPF A320-214(SL) easyJet on delivery. 2/4 OO-LMS Falcon 900LX; B-3011 CRJ200ER Shanghai Airlines. 3/4 D-BHGN Challenger 350. 4/4 N271DV Gulfstream G650ER; VP-BCT Gulfstream G650. 6/4 D-CBBS Phenom 300; N850TR Global Express. 7/4 VH-FGJ Global Express XRS; VP-CCD Learjet 60; UR-CNN An-12BK Cavok Air; SE-RMR Citation 560XLS. 8/4 N121GZ Learjet 45. 10/4 N929AW Gulfstream G200; N6453 Gulfstream G650. 13/4 F-HJLM Phenom 300; C-GQWM 737-8K5 Thomson Airways return from lease to Sunwings. 14/4 N650HH Gulfstream G650. 16/4 17/4 9H-AVE Falcon 50EX; OM-BJB CitationJet 525A CJ2+. 18/4 C-GWVB 737-8K5 Thomson Airways return from lease to Sunwings. 19/4 5Y-SIR Citation 550 Bravo; YL-LCO A320-214 SmartLynx op for Blue Air; N789SB Gulfstream G200; F-GOFX Falcon 900B; N613CL Citation 680 Latitude; VP-BSX Hawker 750. 20/4 OY-MGA Falcon 2000LX. 21/4 D-ASTT A319-112 Germania. 22/4 OO-GEE PC-12; F-GZHU 737-8K2 Transavia France, new service to Paris-Orly; ES-SAK A320-214 SmartLynx Estonia op for Blue Air; SP-ENU 737-83N Enter Air; G-EZPH A320-214 on delivery to easyJet. 23/4 YL-LCK A320-214 SmartLynx op for Blue Air; D-ATYG 767-304ER to Thomson Airways reverting to G-OBYG. 25/4 SE-KSI SAAB 340B SAAB Aircraft; B-3028 Challenger 605. 26/4 C-FAWC 737-8K5 Thomson Airways on return from lease to Sunwings. 27/4 N98FG Citation 750 X; F-HIPK Falcon 7X. 28/4 LX-GLS Legacy 600. 29/4 OK-JUR Citation 680 Sovereign. 30/4 D-AONE Challenger 604.

LONDON SOUTHEND

3/4 F-GBPL Mooney M.20K; EC-CXA PA-28-181 f/v. 5/4 N28141 Bellanca 17-30A Super Viking; G-JOTR RJ85 Jota Aviation on delivery, now resident; D-CAAL Do.228-202K Arcus Air dep 8th. 6/4 OY-HIL AW139 Atlantic Airways on delivery, dep 7th. 8/4 VQ-BCP A319-111 Aeroflot to Air Livery, dep 26th in Rossiya livery. 12/4 D-HKMG AS350BA dep 13th. 13/4 HS-KPI Gulfstream G550 dep 18th; LX-TAC Phenom 300 dep 15th. 15/4 D-BMAD Do.328J Sun-Air, London City diversion. 16/4 VP-BWL A319-111 Aurora to Air Livery, dep 26th. 22/4 PH-COM PA-30-160 n/s; OO-ASL Beech 200 dep 24th. 25/4 D-IAAW Phenom 100 n/s. 27/4 D-EDNY AA-5B Tiger. 28/4 EC-KFI A320-216 Vueling Airlines f/v, to Air Livery, rolled out 11/5 in Aer Lingus livery with registration EI-FNJ taped over.

MNG Cargo Airlines Airbus A300, TC-MCG visited Doncaster Sheffield Airport on June 1. Clive Featherstone

MANCHESTER

4/4 ZH106 Sentry AEW1 8 Sqn, RAF for painting at Air Livery. 5/4 OY-RUS A320-231 Danish Air Transport op for SAS f/v. 6/4 OY-FWO Falcon 7X f/v; F-HJCD Falcon 2000LX f/v. 7/4 TF-ISJ 757-256 Icelandair f/v; M-SEAS Global Express f/v. 10/4 TC-JOM A330-302 Turkish Airlines f/v; OE-LEN A320-214 Niki f/v. 12/4 F-HJUL 737-8Q8 XL Airways France f/v, Paris Saint-Germain supporters; ZM404 A400M 70 Sqn, RAF type f/v; D-BETI Falcon 50 f/v; F-HBFK Citation 550 II f/v; F-HDLN Beech 200GT f/v; OY-RIB P180 Avanti f/v. 13/4 YR-BMB 737-85R Blue Air Liverpool diversion. 14/4 D-ABFA A320-214 airberlin f/v, Borussia Dortmund fans for match against Liverpool FC; F-HFKE ERJ 145LR Enhance Aero Maintenance f/v; TC-ACG 747-481BDSF Saudia Cargo; M-YSIX Gulfstream G650ER f/v. 16/4 AP-BML A330-203 Shaheen Air f/v. 18/4 D-ASTW A321-211 Germania f/v; EC-LCZ A340-642 Iberia f/v, for painting at Air Livery; 15+01 A319-133X FBS, German AF f/v, o/s; N503PQ Falcon 50EX f/v. 20/4 OY-PSA 737-8Q8 Primera Air op for Jet2 f/v. 22/4 B-8297 Gulfstream G550 f/v. 24/4 OE-FDT Citation 510 Mustang f/v. 25/4 LY-VEI A320-233 Avion Express f/v, for Thomas Cook summer lease; EC-JLI A321-211 Iberia & EC-ILO A321-211 Iberia both f/v, for match between Manchester City FC and Real Madrid; EC-GNK Falcon 2000 f/v. 26/4 EC-MIA 777-22EER Privilege Style f/v, Real Madrid fans; EC-IJN A321-211 Iberia & EC-JZM A321-211 Iberia both f/v, Real Madrid fans; XA-DFN Falcon 2000LX f/v; TC-MJB Challenger 604 f/v; OO-PCI PC-12 f/v. 28/4 OE-GWS Citation 560XLS+ f/v; 108/YW Xingu EAT00.319, French AF. 29/4 A6-EOV A380-861 Emirates f/v; G-TCXC A330-243 Thomas Cook on delivery. 30/4 YL-LCP A320-232 SmartLynx op for Monarch f/v.

NORWICH

1/3 TC-FBH A320-232 Freebird Airlines to Air Livery dep 12th; SE-MDA ATR 72-212A Golden Air Flyg dep ex Air Livery; CS-TKQ A320-214 Azores Airlines to Air Livery dep 3rd. 2/3 D-AYSM Gulfstream G650. 3/3 F-GZHM 737-8K2 Transavia France to KLM Maintenance dep 8th. 8/3 OY-CVW Beech 350; D-AEWX A320-214(SL) Eurowings to Air Livery dep 15th; F-GZHF 737-8K2 Transavia France to KLM Maintenance dep 25th. 9/3 EI-RJO RJ85 to KLM Maintenance dep 13th. 10/3 LN-OBX AS332C Airlift AS. 11/3 D-ATUG 737-8K5 Tuifly to Air Livery dep 17th. 13/3 EI-RJN RJ85 to KLM Maintenance dep 1/4. 14/3 PH-HSA 737-8K2 Transavia to KLM Maintenance dep 22nd. 18/3 G-JOTR RJ85 Jota Aviation to Air Livery dep 30th. 20/3 N609AA 757-223 American Airlines to Air Livery dep 4/4. 22/3 OO-FYS CitationJet 525B CJ3 also 25th. 28/3 PH-ROD PA-46-350P. 30/3 QQ101 RJ100 QinetiQ. 31/3 N104CJ WSK-PzI SBLim-2 (MiG-15UTI).

PRESTWICK

1/4 KAF342 C17A 41 Sqn, Kuwait AF also 24th; 130605 CC-130J 436 TS, RCAF also 24th. 2/4 12-5769 HC-130J 71st RQS, 23rd Wing, USAF dep 4th. 3/4 N998GA Gulfstream G280. 4/4 130606 CC-130J 436 TS, RCAF n/s; HB-FRF PC-12 c/n 1613. 6/4 85-0030 KC-10A 305th/514th AMW, USAF; 91-1231 C-130H 165th AS, Ky ANG n/s. 7/4 166673 C-40A VR-57, USN also 16th & 29th; N930F TBM 900; 91-1237 C-130H 165th AS, Ky ANG n/s; 140114 CP-140 405 LRPS, RCAF dep 9th. 8/4 UR-CBG An-12BP Cavok Air; N-324 NH90-NFH 860 Sqn, Royal Netherlands AF also 21st. 11/4 240/F-RARF A330-304 ET03.060, French AF. 12/4 15+02 A319-133X FBS, German AF o/s. 13/4 HB-FRA PC-12 c/n 1608; HB-FRH PC-12 c/n 1615. 15/4 168205 UC-12W VMR-4, USMC; UR-CNN An-12BK Cavok Air. 17/4 T-264 KDC-10 334 Sqn, Royal Netherlands AF; ZM406 Atlas C1 70 Sqn, RAF also 19th. 18/4 15+01 A319-133X FBS, German AF o/s. 19/4 11-5736 C-130J-30 61st AS, 19th AQ, USAF. 20/4 VP-BAT 747SP-21 training; HB-FRI PC-12 c/n 1616; N622AF PC-12 c/n 1622. 21/4 T-235 KDC-10 334 Sqn, Royal Netherlands AF. 22/4 163591/RU C-130T Vr-55, USN n/s; 900531 C-26D Naples AOD, USN n/s. 25/4 58-0045 & 59-1523 KC-135Rs 171st ARW, Penn ANG. 27/4 HB-FRM PC-12 c/n 1620; HB-FRK PC-12 c/n 1618. 29/4 165161:BD C-130T VR-64, USN; LY-RAA An-26B RAF-Avia.

SOUTHAMPTON

1/4 HB-JKL Falcon 2000EX. 11/4 F-HKRA CitationJet 525 CJ1+. 15/4 SX-ATF 737-406 GainJet. 20/4 CS-CHA Challenger 350 NetJets Europe. 21/4 D-FTOM PC-12. 26/4 9H-VCK Challenger 350 VistaJet. 30/4 LX-LGF Dash 8-Q402 Luxair.

Dassault Falcon 2000EX XA-DFN visiting Manchester on April 26. Rob Skinkis

Key. f/v first visit; n/s night stop; o/s overshoot.

With thanks to: D Apps, D Banks, D Bougourd, S Boyd, J Brazier, N Burch, P Claridge, A Clarke, I Cockerton, KW Ede, M Farley, N French, P Gibson, D Graham, A Greening, J Gregory, I Grierson, D Haines, M Harper, K Hearn, G Hocquard, B Hunter, S Lane, G Morris, S Morrison, R Richardson, R Roberts, E Russell, RJ Sayer, M Shepherd, A Smith, D Turner, JA White, G Williams, Blackpool Aviation Society, Manston Movements, Solent Aviation Society/'Osprey', South Wales Aviation Group, CIAN, GSAE, The Aviation Society, EGPE ATC, www.dtvmovements.co.uk, Aerodata Quantum Plus and RHADS.

REGISTER REVIEW

The latest changes on the UK, Irish, Isle of Man and Guernsey registers.

New easyJet Airbus A320, G-EZPH, on finals to Jersey Airport on April 22 operating a flight from London Gatwick. Graham Hocquard

RESTORATIONS

REG'N	MODE(S)	TYPE	C/N	OWNER
G-ANBZ	4070A3	de Havilland DH.82A Tiger Moth	85621	D Shew, (Preston Candover, Hampshire)
G-AOFR	4070A4	de Havilland DH.82A Tiger Moth	86356	D Shew, (Preston Candover, Hampshire)
G-AVHD	407095	Mooney M.20F Executive	670260	SAS DLP Finance, Cannes-Mandelieu, France
G-BGEH	401D7A	Monnett Sonerai 2 (built by RE Finlay)	PFA 015-10254	EC Murgatroyd, (Bromham, Bedfordshire)
G-BMMJ	407093	Siren PIK-30	720	IB Kennedy, Trustee of LRU Group, (Cardiff, South Glamorgan)
G-BPMU	402D93	Nord 3202	70	EC Murgatroyd, (Bromham, Bedfordshire)
G-BRCD	407098	Cessna A152 Aerobat	A152-0796	DJ Hockings, (Herstmonceux, East Sussex)
G-CDVC	400DFE	Agusta A109E Power	11664	AgustaWestland Ltd, Yeovil, Somerset
G-FDZZ	40660E	Boeing 737-8K5	37262	Thomson Airways Ltd, London Luton, Bedfordshire (NB)
G-FERV	4052F2	Rolladen-Schneider LS4	4257	RA Johnson, Long Mynd, Shropshire
G-GUAY	405AB7	Enstrom 480	5036	Slemensek d.o.o., (Ravbe na Koroskem, Slovenia)
G-OBYG	400756	Boeing 767-304	29137	Thomson Airways Ltd, London Luton, Bedfordshire (NB)
G-TAWA	406660	Boeing 737-8K5	37264	Thomson Airways Ltd, London Luton, Bedfordshire (NB)
G-TAWB	40665F	Boeing 737-8K5	37242	Thomson Airways Ltd, London Luton, Bedfordshire (NB)
G-TAWC	40665E	Boeing 737-8K5	39922	Thomson Airways Ltd, London Luton, Bedfordshire (NB)
G-TAWM	4067F0	Boeing 737-8K5	37249	Thomson Airways Ltd, London Luton, Bedfordshire (NB)
G-TWST	404C83	Silence Twister (built by PM Wells)	PFA 329-14211	Zulu Glasstek Ltd, Bailey's Farm, Long Crendon, Buckinghamshire

NEW REGISTRATIONS

REG'N	MODE(S)	TYPE	C/N	OWNER
G-CIUJ	406F5F	Airbus A330-243	967	ACG Acquisiation (Cayman) 967 Ltd, (re-registered as G-TCXC a week later)
G-CIXD	406FFA	Cameron A-105	11971	KR Karlstrom, (Northwood, Greater London)
G-CIXY	406FF5	Comco Ikarus C42 FB80 Bravo (assembled by Red Aviation)	1601-7435	SGHM Services Ltd, (Woodford Green, Greater London)
G-CIZH	40708D	Airbus Helicopters AS350B3 Ecureuil	8219	Airbus Helicopters UK Ltd, Oxford, Oxfordshire
G-CIZN	4070A5	Piper J/5B Cub Cruiser	5-1133	M Howells, Manchester City, Greater Manchester
G-CJBG	40709C	Cameron Z-225	11965	Charbonnier di Diego Charbonnier E.C. Snc, (Quart, Italy)
G-CJBP	4070AF	Flylight Foxcub	DA134	Flylight Airsports Ltd, Sywell, Northamptonshire
G-CJCL	4070C2	Evektor EV-97B Eurostar	LAA 315B-15305	F Omaraie-Hamdanie, (New Barnet, Greater London)
G-CJDO	4070C3	Cameron Z-120	10652	GB Davies, (Thorney, Cambridegshire)
G-CJPK	4070BF	Lorimer Sgian Dubh (built by H Lorimer & PJ Kelsey)	PJK001	PJ Kelsey, Trustee of Sgian Dubh Flying Group (Edinburgh)
G-CLSG	4070C5	Rolladen-Schneider LS4-B	4923	C Taunton and C Marriott, Dunstable, Bedfordshire
G-CLSL	4070A1	Glaser-Dirks DG-500 Elan Trainer (built by Elan Flight Ltd)	5E120T51	Needwood Forest Gliding Club Ltd, Snitterfield, Warwickshire
G-CLSO	4070B8	Schempp-Hirth NImbus -3T	7	RS Rose, Currock Hill, Northumberland
G-CODA	407063	Hughes 369E (built by MD Helicopter Inc)	0590E	Studwelders Holdings Ltd, (Mathern, Monmouthshire)
G-DDPJ	4070A0	Grob G.102 Astir CS 77	1641	AM George, Trustee of DPJ Syndicate, (Twyford, Berkshire)
G-DELE	4070C0	Schleicher ASK-21	21065	Planeurs Pyrenees Comminges, Saint-Gaudens-Montrejeau, France
G-DHKF	406459	Boeing 757-236	29945	DHL Air Ltd, Liepzig/Halle, Germany
G-DSOO	4070AC	Glaser-Dirks DG-500M	5E61M26	R Jackson, Trustee of Twin Astir Syndicate, (Bradford, West Yorkshire)
G-EDGK	4070B3	Cessna TR182 Turbo Skylane RG	R182000941	A Hasenmuller, Stuttgart-Esslingen, Germany
G-EEKI	406F5C	Sportine Aviacija LAK-17B FES	239	MG Lynes, Lasham, Hampshire
G-EZPF	40701B	Airbus A320-214	7067	easyJet Airline Company Ltd, London Luton, Bedfordshire (NB)
G-EZPH	40701C	Airbus A320-214	7093	easyJet Airline Company Ltd, London Luton, Bedfordshire (NB)
G-FBXE	40704A	ATR 72-600 (officially registered as an ATR-72-212A)	1322	Flybe Ltd, Stockholm-Arlanda, Sweden (operated for SAS Scandinavian Airlines)
G-GAEE	40709B	Tecnam P2010	037	Khair BV, Hoeven-Seppe, Netherlands
G-GLAB	405C76	Airbus Helicopters EC135T2+	0712	PLM Dollar Group Ltd, Dalcross Heliport, Highland
G-GOMS	407015	Robinson R66 Turbine	0705	Bri-Stor Systems Ltd, (Hixon, Staffordshire)
G-IDTO	407073	Piper PA-28RT-201T Turbo Arrow IV	28R-8331051	Aeronautix BV, Drachten, Netherlands
G-LAUD	40704C	Cessna 208 Caravan I	20800582	Laudale Estate LLP, Cameron House Hotel, Loch Lomond, West Dumbartonshire
G-LGNT	407038	SAAB 2000	2000-039	Loganair Ltd, Glasgow, Renfrewshire
G-LIKY	407080	Aviat A-1C-180 Husky	3254	LWH Griffith, (Fernhill Heath, Worcestershire)
G-LITO	40706E	Agusta A109S Grand	22015	Castle Air Ltd, Trebrown Heliport, Liskeard, Cornwall
G-MAXT	40706F	Piper PA-28RT-201T Turbo Arrow IV	28R-8031102	M Toninelli, Cremona-Migliaro, Italy
G-ONVG	407088	Guimbal Cabri G2	1141	Vantage Aviation Ltd, Blue Barn Farm, Lamberts Marsh, Wiltshire
G-PERU	407041	Guimbal Cabri G2	1140	M Munson, Wycombe Air Park, Buckinghamshire

G-PIFZ	407081	Agusta AW109SP Grand New	22355	Alba Aviation LP, Wycombe Air Park, Buckinghamshire
G-POLC	404715	Eurocopter EC135T2+	0209	Police and Crime Commisioner for West Yorkshire, City Airport (Barton), Greater Manchester
G-PRPE	406F9A	Bombardier Dash 8-Q402	4209	Flybe Ltd, Exeter, Devon
G-RFCA	40709E	Tecnam P2008-JC	1061	The Waddington Flying Club, RAF Waddington, Lincolnshire
G-RNFR	40703F	Bombardier Challenger 605	5983	TAG Aviation (UK) Ltd, Farnborough, Hampshire (operated for Renault-Nissan Alliance, Paris-Le Bourget, France)
G-RNJP	40703E	Bombardier Challenger 605	5980	TAG Aviation (UK) Ltd, Farnborough, Hampshire (operated for Renault-Nissan Alliance, Tokyo-Narita International, Japan)
G-SCFC	4070A9	UltraMagic S-90	90/148	JS Russon, (Cheadle Hulme, Cheshire)
G-SKBH	40707D	Agusta AW109SP Grand New	22216	Sky Border Logistics Ltd, Carlisle, Cumbria
G-SNGZ	407097	The Airplane Factory Sling 2	LAA 399-15395	TDR Hardy, (Renhold, Bedfordshire)
G-STZA	40708B	Piper PA-34-200T Seneca II	34-7670196	S Zanone, (Tronzano Vercellese, Italy)
G-TADS	4070B6	Mead BM-77	DS01	DJ Stagg, (Spixworth, Norfolk)
G-TCXC	406F5F	Airbus A330-243	967	Thomas Cook Airlines Ltd, Manchester, Greater Manchester (NB)
G-TNIK	406FEF	Dassault Falcon 2000	25	Blu Halkin Ltd, Cambridge, Cambridgeshire
G-ULCC	406F07	Schleicher ASH-30Mi	30011	Viscount Cobham, Trustee of G-ULCC Flying Group, (Hagley, Worcestershire)
G-XVIP	405200	Beech 200 Super King Air	BB-588	Patriot Aviation Ltd, Coventry, Warwickshire
G-ZBAU	407029	Airbus A320-214	3293	Monarch Airlines Ltd, London Luton, Bedfordshire (NB)
G-ZBKJ	406F76	Boeing 787-9	38626	British Airways PLC, London Heathrow, Middlesex
EI-FJM	4CA606	Boring 737-8JP	42074	Norwegian Air International Ltd, Oslo-Gardemoen, Norway (NB)
EI-FLU	Not allocated	Piper PA-22-108 Colt	22-8484	M Bergin, Ballyboughal, Co. Dublin
EI-FNA	4CA607	ATR 72-600 (officially registered as an ATR-72-212A)	1325	Comhforbairt (Gailimnh), Dublin, Co. Fngal (operated by Stobart Air for Aer Lingus)
EI-FNC	Not allocated	BRM Land Africa Citius	0119/KIT/08-CT	P Higgins, Limetree, Portarlington, Co. Laois
EI-FND	TBA	Boeing 737-86J	37742	SMBC Aviation Capital Ireland Leasing 3 Ltd, (leased to Pegasus Airlines/Izmir Airlines, Turkey)
EI-FNI	4CA633	Boeing 777-2Q8ER	28688	Aercap Ireland Ltd, (operated by Alitalia, Rome-Fiumicino, Italy)
EI-FNM	TBA	Boeing 737-838	30734	Aercap Ireland Ltd, (stored at Shanghai-Pudong International, China)
EI-FNO	Not allocated	Aeropro EuroFox 912	12902	A Donnelly, Carrickmore, Co. Tyrone
EI-FNP	TBA	ATR 72-500 (officially registered as an ATR-72-212A)	715	Aircraft International Renting (A.I.R) Ltd, (stored at Dinard-Pleurtuit, France)
EI-FNS	Not allocated	Comco Ikarus C42	9904-6147	Ikarus Aviation Ireland Ltd, Tibohine, Co. Roscommon
EI-FNU	4CA682	Boeing 737-86N	28608	ECAF 1 28608 Designated Activity Company, (operated by Meridiana, Milan-Malpensa, Italy)
EI-FPD	4CA66F	Bombardier Regional Jet 900	15401	CityJet Ltd, Stockholm-Arlanda, Sweden (operated for SAS Scandinavian Airlines)
EI-FPE	4CA65F	Bombardier Regional Jet 900	15402	CityJet Ltd, Stockholm-Arlanda, Sweden (operated for SAS Scandinavian Airlines)
EI-FPF	4CA660	Bombardier Regional Jet 900	15403	CityJet Ltd, Stockholm-Arlanda, Sweden (operated for SAS Scandinavian Airlines)
EI-FRD	4CA5DC	Boeing 737-8AS	44738	Ryanair Ltd, Dublin, Co. Fingal (NB)
EI-FRE	4CA5E1	Boeing 737-8AS	62691	Ryanair Ltd, Dublin, Co. Fingal (NB)
EI-FRF	4CA5E2	Boeing 737-8AS	44732	Ryanair Ltd, Dublin, Co. Fingal (NB)
EI-FRG	4CA658	Boeing 737-8AS	44737	Ryanair Ltd, Dublin, Co. Fingal (NB)
EI-FRH	4CA659	Boeing 737-8AS	44736	Ryanair Ltd, Dublin, Co. Fingal (NB)
EI-FRI	4CA65A	Boeing 737-8AS	44733	Ryanair Ltd, Dublin, Co. Fingal (NB)
EI-FRJ	4CA65C	Boeing 737-8AS	44734	Ryanair Ltd, Dublin, Co. Fingal (NB)
EI-FRK	4CA65D	Boeing 737-8AS	44735	Ryanair Ltd, Dublin, Co. Fingal (NB)
EI-LNJ	4CA581	Boeing 787-9	37308	Torskef Jorden Leasing Ltd, Oslo-Gardermoen, Norway (NB) (operated by Norwegian Long Haul)
M-ABJF	43EA92	Boeing 737-86N	32742	Celestial Aviation Trading 9 Ltd,
M-ABJH	43EA3B	Boeing 737-8Q8	30628	Aercap Ireland Ltd, (for Ukraine International as UR-PSO)
M-ABJI	43EA95	Boeing 737-8Q8	28241	Aercap Ireland Ltd, (for Ukraine International as UR-PSP)
M-MSVI	43EA97	Cessna 525B CitationJet CJ3	525B0361	JPM Ltd, Brighton City, West Sussex
M-NAME	43EA99	Bombardier Global 6000	9706	Blezir Aircraft Leasing (IOM) Ltd, TBA
M-RTFS	43EA8B	Dassault Falcon 7X	207	Panther Jets, Farnborough, Hampshire
M-TECH	43EA96	Bombardier Challenger 350	20621	Primelock Investments Ltd, Tel Avia-Ben Gurion, Israel
M-TINK	43EA8A	Dassault Falcon 7X	266	Stark Ltd, Moscow-Sheremetyevo, Russia
2-HELO	43EB58	Agusta A109C	7630	Helicopter (Seychelles) Ltd, Trebrown Heliport, Liskeard, Cornwall
2-LNOA	43EB6B	ATR 42-500	532	Phoenix Aircraft Investment (Labuan) Bhd, (stored at Saarbrucken, Germany)
2-SALA	43EB63	Piper PA-32-300 Cherokee Six	32-7940106	JWA Portch and RMJ Harrison, Jersey
2-SRCB	43EB69	Airbus A320-212	466	ACG Aquisitions 33 LLC, (stored Newquay, Cornwall)
2-TGHE	43EB67	Embraer ERJ 145LR	14500928	Airbus SAS (stored Alverca, Portugal)

Gulfstream G550 G-CGUL has joined the US register as N7325.
AirTeamImages.com/Darryl Morrell

CANCELLATIONS

REG'N	TYPE	C/N	REASON
G-ARRI	Cessna 175B Skylark	175-57001	Cancelled by CAA (CofA expired 19.09.14, last noted in open storage at Pembrey, Carmarthenshire 06.12)
G-ARUV	Piel CP301-1 Emeraude	PFA 700	Cancelled as Temporarily WFU (Permit to Fly expired 11.05.13)
G-BDGH	Thunder AX7-77	049	Cancelled as Permanently WFU (CofA expired 30.06.83)
G-BGEH	Monnett Sonerai 2	PFA 015-10254	Cancelled by CAA (but restored again later in the month)
G-BHEM	Bensen B.8MV	PFA G/01-1016	Cancelled as Permanently WFU (Permit to Fly expired 05.10.00)
G-BIKP	Boeing 757-236	22188	Cancelled as Destroyed (Flown to Madrid-Barajas, Spain 24.12.15 for parting out)
G-BKZI	Bell 206B JetRanger	118	To USA
G-BNWT	Boeing 767-336	25828	Cancelled as Permanently WFU (flown to Orlando-Sanford International, Florida 23.03.16 for parting out)
G-BPMU	Nord 3202	70	Cancelled by CAA (but restored again later in the month)
G-BSBI	Cameron O-77	2245	Cancelled as Permanently WFU (CofA expired 21.05.14)
G-BTTO	BAe ATP	2033	To Sweden as SE-MHK
G-BUZC	Everett Gyroplane Series 3A	034	Cancelled as Permanently WFU (no UK Permit to Fly issued, believed not completed)
G-BWMV	Colt AS-105GD	3775	Cancelled as Permanently WFU (CofA expired 01.07.09, was based in Germany)
G-BXTH	Westland SA341D Gazelle HT.3	WA1120	Cancelled by CAA (crashed on a canal tow path and struck the function room of the Rustic Inn Bar, near Abbeyshrule, Republic of Ireland 16.07.15 and was substantially damaged)
G-BYIL	Cameron N-105	4591	Cancelled as Permanently WFU (CofA expired 18.11.12)

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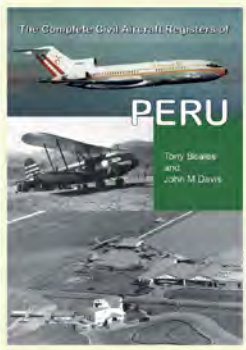

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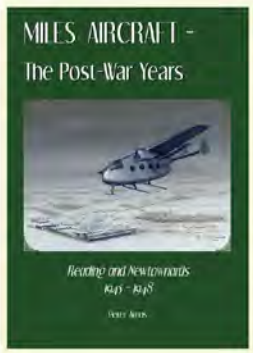

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Peter Amos

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Thomas Cook Airlines has added this former-Avianca Airbus A330 to its fleet. For a short while it had the UK registration G-CIUJ, but was then allocated G-TCXC. It is shown at Manchester Airport taxiing for departure on May 9. Rob Skinkis

G-CBLX	Air Creation Kiss 400-582(1)	BMAA/HB/208	Cancelled as Destroyed (Permit to Fly expired 19.02.1, accident circa 04.12)
G-CCDW	Best Off SkyRanger 582(1)	BMAA/HB/268	Cancelled as Destroyed (struck trees and crashed at Old Warden, Bedfordshire 12.02.16)
G-CDNR	Ikarus C42 FB100	0507-6696	Cancelled as Destroyed (crashed in a field near Burrows Lane, Middle Stoke, Kent 20.03.16)
G-CDUE	Robinson R44 Raven I	1549	Cancelled by CAA (CofA expired 03.04.16)
G-CEEE	Robinson R44 Raven II	10005	To USA
G-CGUL	Gulfstream G550	5176	To USA as N7325
G-CGVM	Lindstrand LBL 35A Cloudhopper	1364	To Austria
G-CICH	Sikorsky S-92A	920209	To Nigeria as 5N-BTI
G-CIGO	Cameron C-90	11631	To Denmark
G-CIOT	Airbus Helicopters EC155B1	6991	To San Marino as T7-ALF
G-CISP	Vickers-Supermarine Spitfire IX	6S-223772	To Norway as LN-AOA
G-CIUJ	Airbus A330-243	967	Re-registered as G-TCXC
G-CIYJ	Hughes 369E	0590E	Re-registered as G-CODA
G-CJHD	Schleicher Ka.6E	4307	To Republic of Ireland
G-CPSH	Airbus Helicopters EC135T2+	0209	Re-registered as G-POLC
G-DAWZ	Glasflugel 304CZ	33	To Finland
G-DCLA	Schempp-Hirth Standard Cirrus	63	Cancelled as Destroyed (CofA expired 18.06.16)
G-DPJR	Sikorsky S-76B	760352	To USA
G-ECMC	Robinson R22 Beta 2	3671	Cancelled as Destroyed (substantially damaged when it rolled over at Goodwood 12.02.15)
G-ERED	Beech C90GTi King Air	LJ-1902	To Canada
G-ERJC	Embraer ERJ 145EP	145253	To France as F-HFKG
G-ERSE	Beech 350i King Air	FL-931	To USA as N189MD
G-FIRM	Cessna 550 Citation Bravo	550-0940	To USA as N125JJ
G-HELV	DH.115 Vampire Mk.55	975	To Royal Jordanian Air Force as 711
G-HOWE	Thunder AX7-77	1340	Cancelled by CAA (CofA expired 15.08.95)
G-ITAA	Reims Cessna F172P	2233	To Switzerland
G-KLNB	Beech 350 King Air	FL-631	To Germany as D-CPRS
G-MAPP	Cessna 402B	402B0583	Cancelled as Permanently WFU (badly damaged when left main undercarriage collapsed on landing at East Midlands, Leicestershire 14.01.16)
G-MAUK	Colt 77A	901	Cancelled as Permanently WFU (CofA expired 04.06.92)
G-MCAI	Robinson R44 Raven II	10423	To USA as N107EH
G-MKKA	Boeing 747-212B	21940	Cancelled as Permanently WFU (broken up at Bristol-Filton 09.04.10)
G-MNJN	Solar Wings Pegasus Flash	SW-WF-0010	Cancelled by CAA (Permit to Fly expired 09.06.13)
G-MNKZ	Southdown Raven X	SN2232/0102	Cancelled as Permanently WFU (Permit to Fly expired 31.05.07)
G-MRAP	Bombardier Challenger 300	20023	To USA as N39ER
G-MTGC	Thruster TST Mk.1	837-TST-012	Cancelled as Destroyed (fuselage pod only noted at Little Gransden, Cambridgshire 31.04.16)
G-MTWG	Mainair Gemini Flash IIA	631-288-6-W420	Cancelled as Permanently WFU (Permit to Fly expired 28.07.00)
G-MVBF	Mainair Gemini Flash IIA	662-688-6-W452	Cancelled as Permanently WFU (Permit to Fly expired 01.06.13)
G-MZDP	AMF Chevvron 2-32C	020	To Lithuania
G-OCEG	Beech 200 Super King Air	BB-588	Re-registered as G-XVIP
G-ODDY	Lindstrand LBL 105A	042	Cancelled as Permanently WFU (CofA expired 27.09.09)
G-OFMC	BAe Avro 146-RJ100	E3264	Cancelled as Destroyed (CofA expired 07.12.09. Parted out at Southend, Essex 03.16)

PREVIOUS IDENTITIES

REG'N	P.I.	REG'N	P.I.
G-ANBZ	ex D-ELYG	G-TWST	ex G-ZWIP
G-AOFR	ex OY-BAK	G-UKCS	ex N45NH
G-AVHD	ex F-BOSJ	G-USCO	ex G-CECO
G-BMMJ	ex 4X-GMM	G-VWET	ex D-EARS
G-CDVC	ex ZR322	G-VYGL	ex ZZ341
G-CIUJ	ex N967CG	G-VYGM	ex EC-332
G-CIZN	ex N40701	G-WPNS	ex G-GMPB
G-CJDO	ex OE-ZSK	G-XLEK	ex F-WWSG
G-CJPK	ex G-MEXP (unofficial registration)	G-XVIP	ex G-OCEG
G-CLSG	ex PH-1009	G-ZAST	ex I-ASKY
G-CLSL	ex D-5488	G-ZBAU	ex M-IBAK
G-CLSO	ex D-KHRG	EI-DGU	ex N109CL
G-CODA	ex G-CIYJ	EI-FJC	ex LN-NOR
G-DDPJ	ex BGA2269	EI-FJE	ex LN-NOZ
G-DELE	ex BGA2764	EI-FJF	ex LN-NOH
G-DHKF	ex G-TCBB	EI-FJG	ex LN-NOX
G-DSOO	ex D-KVRS	EI-FJH	ex N1786B
G-EDGK	ex D-EDGK	EI-FJI	ex LN-NOW
G-EZPF	ex D-AVVE	EI-FLU	ex G-ARND
G-EZPH	ex D-AVVI	EI-FMM	ex B-2690
G-FBXE	ex F-WWEE	EI-FMT	ex 9H-AEG
G-FDZZ	ex C-FHZZ	EI-FNA	ex F-WWEH
G-GLAB	ex EI-ILS	EI-FNB	ex ES-AEA
G-GOMS	ex N70551	EI-FNC	ex I-9885
G-GSFS	ex C-GSFS	EI-FND	ex D-ABKD
G-GUAY	ex LZ-VIM	EI-FNI	ex VN-A141
G-HSDL	ex XW909	EI-FNM	ex YJ-AV1
G-IDTO	ex EC-DTQ	EI-FNO	ex PH-3S1
G-IPPL	ex OY-PPL	EI-FNP	ex HS-PGC
G-ITAA	ex I-GRIS	EI-FNS	ex PH-3F3
G-JBRD	ex PH-VDS	EI-FNU	ex HL8214
G-JZHF	ex PH-HZF	EI-FOG	ex N1786B
G-KSST	ex I-RAIS	EI-FOK	ex N1795B
G-LAUD	ex N697ZZ	EI-FON	ex N1786B
G-LGNT	ex HB-IZW	EI-FPD	ex C-GZSJ
G-LIKY	ex N254WY	EI-FPE	ex C-GZYJ
G-LITO	ex I-AWCC	EI-FPF	ex C-GZVR
G-MAXT	ex I-FRIZ	EI-FRH	ex N1786B
G-NDIA	ex G-CCGE	EI-FRI	ex N1781B
G-NJOY	ex OK-JOY	EI-LNJ	ex N10187
G-NKEL	ex I-HPGF	M-ABJF	ex B-5077
G-OBYG	ex D-ATYG	M-ABJH	ex B-2961
G-ONVG	ex F-WZEA	M-ABJI	ex B-2692
G-PERU	ex F-WWHG	M-ISTY	ex N208GA
G-POLC	ex G-CPSH	M-MAXX	ex N968DW
G-PRPE	ex N209WQ	M-MSVI	ex N361EV
G-RDDM	ex N387D	M-NANE	ex C-FIFK
G-RIOT	ex G-SWIP	M-RBIG	ex N145JP
G-RNFR	ex N605ZK	M-RTFS	ex F-HGHF
G-RNJP	ex N605BD	M-TECH	ex C-GOXB
G-RRIA	ex OO-JPC	M-TINK	ex F-WWUL
G-SKBH	ex N109LW	2-GJSA	ex A4O-AS
G-SPVI	ex D-EDMH	2-GJSB	ex A4O-AT
G-STZA	ex I-SBGJ	2-HELO	ex ZS-HJD
G-TAWA	ex C-FVWA	2-JFJC	ex G-JFJC
G-TAWB	ex C-GWVB	2-LNOA	ex HK-4827
G-TAWC	ex C-FAWC	2-MELO	ex N763AM
G-TAWM	ex C-GQWM	2-PAOL	ex PH-AOL
G-TCDL	ex D-AZAU	2-SALA	ex G-SALA
G-TCDM	ex D-AYAG	2-SRCB	ex HS-RCB
G-TCMC	ex N665PF	2-TBXI	ex B-2341
G-TCXC	ex G-CIUJ	2-TBXK	ex B-5221
G-TNIK	ex T7-NIK	2-TGHE	ex B-3056

G-OMSV	Beech 200GT King Air	BY-96	To Germany as D-CDKE
G-OWEL	Colt 105A	1773	Cancelled as Permanently WFU (CofA expired 16.03.98)
G-OXKB	Cameron Sports Car-110	3941	Cancelled as Permanently WFU (CofA expired 08.08.13)

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Piper PA-32-300 Cherokee Six G-SALA has joined the Guernsey register as 2-SALA. Graham Hocquard

G-RVRD	Piper PA-23-250 Aztec E	27-4634	Cancelled as Permanently WFU (CofA expired 17.07.13, Broken up at Liverpool John Lennon, Merseyside 04.16)
G-RVVY	Van's RV-10	PFA 339-14599	To South Africa
G-SALA	Piper PA-32-300 Cherokee Six	32-7940106	To Guernsey as 2-SALA
G-SOOA	Cessna 172S Skyhawk SP	172S10928	To Switzerland
G-SRVO	Cameron N-90	3551	Cancelled as Permanently WFU (CofA expired 29.07.04)
G-TCBB	Boeing 757-236	29945	Re-registered as G-DHKF
G-UTSY	Piper PA-28R-201 Cherokee Arrow III	28R-7737052	To France as F-HFKG
G-VEIL	Airbus A340-642	575	To USA (flown to San Bernardino International, California 06.04.16 for storage)
G-YPRS	Cessna 550 Citation Bravo	550-0935	To Thailand
G-ZWIP	Silence Twister	PFA 329-14211	Re-registered as G-TWST
EI-CZD	Boeing 767-216ER	23623	Cancelled by IAA - Permanently WFU (ferried Shannon to Enniscrine, Co. Sligo by sea 05-07.05.16 for use in a 'Glamping' site)
EI-DBF	Boeing 767-3Q8ER	24745	To USA as N275AG
EI-DOH	Boeing 737-31S	29056	To Kyrgystan
EI-DUC	Boeing 757-256	26248	To Iceland as TF-ISR
EI-DYT	Boeing 737-8AS	33634	To South Korea as HL8062
EI-EAR	Boeing 767-3Q8ER	27616	To Bermuda as VP-BLG
EI-EBB	Boeing 737-8AS	37519	To South Korea as HL8063
EI-EBT	Boeing 737-8AS	35000	To South Korea as HL8069
EI-EDZ	Boeing 737-8K5	27980	To USA as N980CS
EI-EEA	Boeing 737-8K5	27989	To USA as N798CS
EI-EEZ	Bombardier Challenger 850	8085	To Malta as 9H-YOU
EI-EPT	Airbus A319-111	3054	To Spain as EC-MKX
EI-ETI	Airbus A330-322	171	Cancelled at Owner's Request (flown Perpignan-Zürich-MoD St. Athan 27.02.16 for storage)
EI-FHF	Boeing 737-8FZ	34954	To Mexico
EI-FMM	Boeing 737-86N	29889	To Bermuda as VP-BVE
EI-FMN	Airbus A320-214	984	To Latvia as YL-LCR
EI-FMW	Airbus A320-232	5158	To India as VT-IDT
EI-ILS	Airbus Helicopters EC135T2+	0712	To United Kingdom as G-GLAB
EI-LNH	Boeing 787-8	36526	To Norway as LN-LNH
EI-RUL	Boeing 737-7K9	34320	To USA as N7878A
EI-RUM	Boeing 737-7K9	34321	To USA as N7879A
EI-RUX	Boeing 767-36N	30109	To USA as N532GT
EI-RUZ	Boeing 767-3Q8ER	30048	To Germany as D-ABUP
EI-STC	Boeing 737-476(F)	24446	To Hungary as HA-FAZ
EI-UNE	Boeing 737-3Q8	29383	To Germany as D-ABUT
EI-UNK	Boeing 767-86J	36119	To Belgium as OO-TUK
M-ABGX	Boeing 737-8AS	29925	To Slovak Republic as OM-GTE
M-ABIS	Boeing 737-76N	30133	To USA as N7884G
M-ABIU	Gulfstream G650	6150	To USA as N968FA
M-ABJC	Airbus A320-214	3325	To France as F-HZDP
M-ABJG	Boeing 737-86N	32739	To Thailand
M-ABJH	Boeing 737-8Q8	30628	To Ukraine as UR-PSO
M-BEAR	Embraer Phenom 300	50500187	To USA as N157AF
M-BIGG	Bombardier Challenger 605	5722	To Greece as SX-SHC
M-ERIL	Pilatus PC-12/47E	1240	To USA as N371LL
M-GDRS	Raytheon RB390 Premier 1	RB-35	To Germany as D-ISKO
M-IBAI	ATR 72-212A	767	To India as VT-CMA
M-IBAK	Airbus A320-214	3293	To United Kingdom as G-ZBAU
M-JIGG	Gulfstream G550	5346	To Turkey as TC-ATA
M-LCFC	Dassault Falcon 2000S	707	To Thailand as HS-KPA
M-SHEP	SOCATA TBM 850	767	To USA as N969PR
M-SMKM	Cirrus SR20	1662	To Guernsey as 2-SMKM
M-STEP	Gulfstream G150	245	To USA as N162RU
M-TINK	Dassault Falcon 900LX	277	To France as F-HDDP
M-YGIV	Gulfstream GIV	1080	To USA as N108GS
M-YNNG	Dassault Falcon 7X	82	To USA as N317SK
2-MELO	Boeing 767-346	24498	Cancelled at Owner's Request (WFU Rayong-U-Taphao International, Thailand 27.12.15 and parted out)
2-PAOH	Airbus A330-203	811	To Pakistan as AP-BMI
2-PAOI	Airbus A330-203	819	To Pakistan as AP-BMJ
2-PAOL	Airbus A330-203	900	To Pakistan as AP-BML
2-RLAG	Fokker 50	20214	To Democratic Republic of Congo as 9Q-DAB
2-TBXI	Airbus A320-232	551	Cancelled at Owner's Request (flown to Phoenix Goodyear 06.02.16 for parting out)
2-TBXJ	Airbus A320-233	556	Cancelled at Owner's Request (flown to Phoenix Goodyear 16.03.16 for parting out)
2-TBXL	Boeing 737-71B	29367	To USA as N7849A
2-VBAO	Boeing 737-4Q8	25114	To United Kingdom as G-JMCY

Key: NB – Nominal Base

A place name in brackets relates to the owner's address as where the aircraft is based is unknown.

UPDATES & CORRECTIONS

REG'N	DETAILS
G-ANHZ	Became HB-EZJ 15.02.16 (actually cancelled as sold in Switzerland 18.01.95)
G-ARND	Became EI-FLU 13.04.16
G-AZBU	Became N139AG 17.02.15
G-BAZT	Became TC-TUM 01.16
G-BERC	Became F-HARP 26.04.16
G-BIIV	Became F-HIIV 17.02.16
G-BIMU	Became N7563W 29.03.16
G-BKEP	Became HA-KLB 02.15
G-BMNL	Became F-HMNL 17.03.16
G-BOXU	Became YL-BOX 08.05.15
G-BRWP	Type officially changed to a Streak Shadow (Modified) 20.01.16
G-BUGE	Became EI-FMF 10.03.16
G-BVWD	Became C-GVFT 15.02.16
G-BWXG	Became 437 of Royal Jordanian Air Force 02.15
G-BWXH	Became 443 of Royal Jordanian Air Force 02.15
G-BWXI	Became N987FT 03.16
G-BWXK	Became 442 of Royal Jordanian Air Force 02.15
G-BWXN	Became 444 of Royal Jordanian Air Force 02.15
G-BWXR	Became 438 of Royal Jordanian Air Force 02.15
G-BWXX	Became 441 of Royal Jordanian Air Force 02.15
G-BWXY	Became 439 of Royal Jordanian Air Force 02.15
G-BWXZ	Became 440 of Royal Jordanian Air Force 02.15
G-BZMG	Became F-HKPG 08.04.16
G-CBHG	Type officially changed to a Mainair Blade (Modified) 26.04.16
G-CBIU	Became PH-DEX 24.02.16
G-CBZU	Became I-CBZU 12.15
G-CCSU	Became SP-YSU 12.11.15
G-CFIB	Became OE-6142
G-CGGJ	Became SP-AYA 09.12.15
G-CGMB	Became 5N-BSM 06.15
G-CGMC	Became 5N-BSN 06.15
G-CGRL	Became F-HGAR 11.02.16
G-CHBN	Became RA-2501G
G-CHLX	Became F-CLMR 12.04.16
G-CHYN	Type officially changed to a Harvard 4M 06.01.16
G-CHYZ	Type officially changed to a Skystar Kitfox Vixen 26.01.16
G-CIKY	Became EI-FLO 21.03.16
G-CILA	Type officially changed to a EuroFOX 912 29.01.16
G-CIOF	Builder officially changed to RA Cole, J McLean, J Morris & J Tayler 01.03.16
G-CION	Became C-ICKD 14.03.16
G-CIRC	Type officially changed to a Such BM60-20 05.02.16
G-CIUG	Builder officially changed to Eurofox Aviation 03.03.16
G-CJFK	Became SP-3880 17.12.15
G-CJWF	Became D-9279 13.10.15

RAF MUSTANGS
PERFECTING THE P-51

Most readily associated with the US Eighth Air Force, the Mustang was designed against a British requirement and speedily delivered. The RAF eventually received more than 2,300 Mustangs, using them extensively over Europe, as **Paul E Eden** explains.

Tasked with sourcing aircraft from US manufacturers for Britain's desperate struggle against Nazi Germany, Sir Henry Self identified only the Bell P-39 Airacobra and Curtiss P-40 Warhawk as worthy fighters with which to equip the RAF. Working with the British Purchasing Committee (BPC) during 1939, he considered neither to be as capable as the Hurricane or Spitfire, but US industry could produce them in quantity; the superior British fighters would be tasked with air combat while the US machines would take on ground targets.

France was also shopping for warplanes and, between them, the BPC and French Government ordered 1,740 P-40s. But Self was concerned that Curtiss had insufficient production capacity to meet his demands. He and his French colleagues had already ordered large quantities of NA-16 advanced trainers from North American Aviation (NAA), a small and relatively new company that was already impressing with the quality of what became the Harvard in British service.

Self approached NAA with a proposal that it produce the P-40 under licence for Curtiss against British requirements. James H 'Dutch' Kindelberger, NAA's President, was less than impressed. Of course the company would build P-40s, but it would prefer to produce something better, even though it had yet to tackle a fighter type in the five years of its existence.

Mustang Mk I, AC633 'XV-E' of 2 Squadron. EN-Archive

Returning to NAA's Inglewood, California, facility in December to order more NA-16s, Self was convinced by the design team's NA-73X proposal and commissioned the aircraft. Company Vice-President Lee Atwood worked closely with the customer on refining the design – and, the British insisted NAA take advice from Curtiss since it had no fighter experience.

Curtiss had been working on the XP-46, perhaps the ultimate extrapolation of the P-40 line. It was aerodynamically and technically advanced, and Atwood received all the documentation on this and other P-40 developments. When the NA-73X was rolled out on September 9, it bore some similarity to the Curtiss prototype, especially in its radiator and carburettor intake configurations and in featuring an inline engine.

The engine choice probably owed more to Kindelberger's tours of the Heinkel and Messerschmitt factories during 1938 than it did to Curtiss, however, while both intake arrangements were considerably refined as the NA-73X evolved into the Mustang.

Where the aircraft differed dramatically was in their aerodynamics. In a bold move for a nascent fighter builder, NAA chose a laminar wing profile for its design, resulting in superior high-speed performance and efficiency to the detriment, albeit marginal, of low-speed handling. It was the first application of the technology to a production aircraft.

Progress on the fighter was extremely rapid. The BPC requested that NAA proceed with its design in April 1940, and on May 9 a team, including Self, approved the aircraft's drawings. It flew for the first time on October 26.

Flight testing was conducted at pace – turning up a variety of issues that were quickly rectified – and focused especially on the carburettor and radiator intake configurations. The former was extended to the front of the aircraft's nose and the latter modified to stand proud of the fuselage, which prevented sluggish, turbulent ▶

The Mustang Mk IVs of 442 Sqn, including KH668 'Y2-T', at RAF Digby provided long-range escort to Bomber Command attacks in 1945. A J Mallandaine

RAF MUSTANG VARIANTS

Mk I: 1,150hp Allison F3R (V-1710-39); two 0.5in (12.7mm) Browning machine guns in the nose and one in each wing, plus four 0.3in (7.62mm) Brownings outboard (two on each wing), for a total of eight. F24 oblique camera installed to port behind cockpit, soon supplemented by a second camera mounted ahead of the tailwheel and installed to look vertically downwards. 520 delivered

Mk IA: Essentially similar to the Mk I, but with two 20mm Hispano-Suiza M2 cannon replacing the machine guns in each wing and fuselage guns deleted. 93 delivered

Mk II: As the Mk I, but with 1,120hp V-1710-81; provision for one 500lb bomb or a drop tank under each wing. 50 delivered

Mk X: Five Mk Is experimentally modified by Rolls-Royce to take the Merlin 65 engine for increased power at high altitudes

Mk III: 1,680hp Packard V-1650-7 Merlin; two 0.5in Browning machine guns in each wing plus provision under each wing for a 500lb bomb. 946 delivered

Mk IV: 1,680hp Packard V-1650-7 driving Hamilton Standard propeller; bubble canopy; three 0.5in Browning machine guns in each wing plus provision under each wing for a 1,000lb bomb. Built at Inglewood, California; 281 delivered

Mk IVA: As Mk IV, but with Aeroproducts propeller. Built at Dallas, Texas; 594 delivered

Mk V: Unused designation for the lightweight P-51K, had it entered RAF service

boundary layer air from entering, increasing efficiency.

With a change of test pilot on November 20 came an accident following a fuel-feed switching error. The programme was delayed while the NA-73X was rebuilt and the first Mustang for the RAF, serialled AG345, did not fly until May 1, 1941. After considering Apache as the aircraft's name, in December 1940 the RAF settled on Mustang.

Since it was devoting its production to a foreign order, NAA was obliged to seek US Army Air Corps (USAAC) permission to proceed. Inevitably this was granted, but with the proviso that two aircraft were supplied for evaluation. So the fourth and tenth production Mustangs went to the USAAC, which designated them XP-51.

LOW-LEVEL STAR

The Mustang reached Britain when the initial aircraft came off its ship at Liverpool. It flew for the first time at RAF Burtonwood, Lancashire, on October 24, 1941 and passed to the Aircraft and Armament Experimental Establishment at Boscombe Down, Wiltshire, the next day. Here it gained various items of British equipment, including VHF radio, gunsight and oxygen system components, but the cockpit and armament remained to US standards.

Boscombe's pilots were impressed. In almost every aspect of performance the Mustang was superior to the contemporary Spitfire Mk V up to 20,000ft. Its only deficiency was in the climb, where it took 11 minutes to reach 20,000ft, trailing four minutes behind the Spitfire.

In range and endurance, it was immensely superior, able to remain airborne for up to five hours – compared to the Spitfire's two – and to cover more than 1,000 miles (1,600km) versus the Spitfire's 400 (640km).

Above 20,000ft the Spitfire prevailed, however. With its supercharger configured for low-level operations, the Mustang's Allison F3R engine lost power rapidly above 13,000ft. The latest Bf 109 models and the Fw 190 were already superior to the British fighter at altitude and, with the air-to-air war moving inexorably higher, the Mustang was clearly not survivable as a fighter.

Its combination of speed and agility low down was ideal for the army co-operation role, however, and the Lysanders and Tomahawks then in service with the RAF's Army Co-Operation Command were sorely in need of replacement. By this time the role was essentially a tactical reconnaissance mission, with fighter sweeps and ground-attack also relevant: in all three the Mustang was superlative.

INTO SERVICE

Now equipped with an oblique camera mounted behind the pilot's seat, the Mustang entered service in Mk I form with 26 Sqn at RAF Gatwick in February 1942. Now, when a Messerschmitt or Focke-Wulf challenged an army co-operation pilot, he could turn the tables and fight back on equal or even superior terms.

An Fw 190 was the first aircraft to fall to the Mustang's guns. Pilot Officer Hollis H Hills, a US volunteer with 414 Sqn, Royal Canadian Air Force, used his Mustang Mk I to down

The RAF also exploited the Mustang's endurance to escort Coastal Command strike aircraft during the last year of the war. Here Mustang Mk III FB123 'PK-W' of 315 Sqn escorts a 489 Sqn, RNZAF Beaufighter Mk X off Norway on July 30, 1944. RNZAF

the aircraft on August 19, 1942. That date marked the infamous Dieppe raid – commonly regarded as a rehearsal for the D-Day landings of 1944 – in which 414 Sqn, along with other Mustang units, was heavily involved.

Deliveries continued with the Mk IA and Mk II, while low-level operations over occupied Europe kept the Mustang squadrons busy. In October 1942, Mustangs were involved in an attack on the Dortmund-Ems canal, becoming the first single-engined RAF fighters to operate over Germany.

Command changes in late 1943 in preparation for the June 1944 invasion saw the Mustangs fall under the newly created 2nd Tactical Air Force (2TAF). Now the pace of operations increased, although five squadrons continued to use the Mustang Mk I/IA beyond D-Day.

considered using the Packard-built Rolls-Royce Merlin as an alternative to the Alison. Built under licence in the US as the V-1650, the Packard had been primarily scheduled for Canadian Hurricane, Lancaster and Mosquito production, however, and in any case would not be available until 1942.

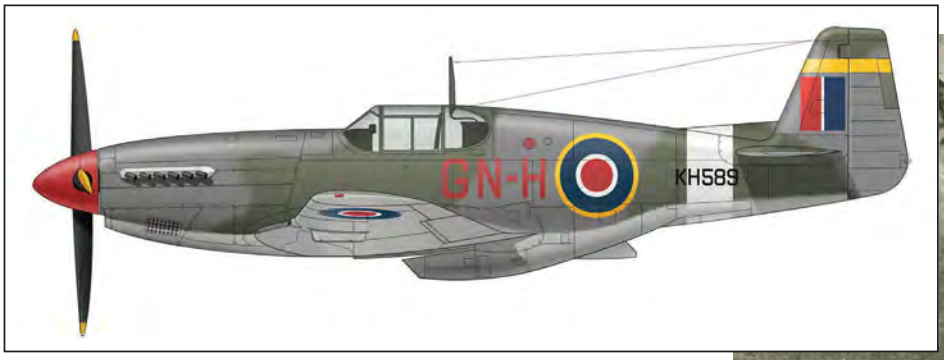
Installation of a turbosupercharger was considered, as Lockheed had done with the P-38's Alison V-1710, but NAA opted against it. Simultaneously, Rolls-Royce had produced the two-stage supercharged Merlin 60 for the high-flying Wellington Mk VI bomber. Only 63 of the bombers were produced but, modified as the Merlin 66, the engine transformed the Spitfire in its Mk IX and VIII forms.

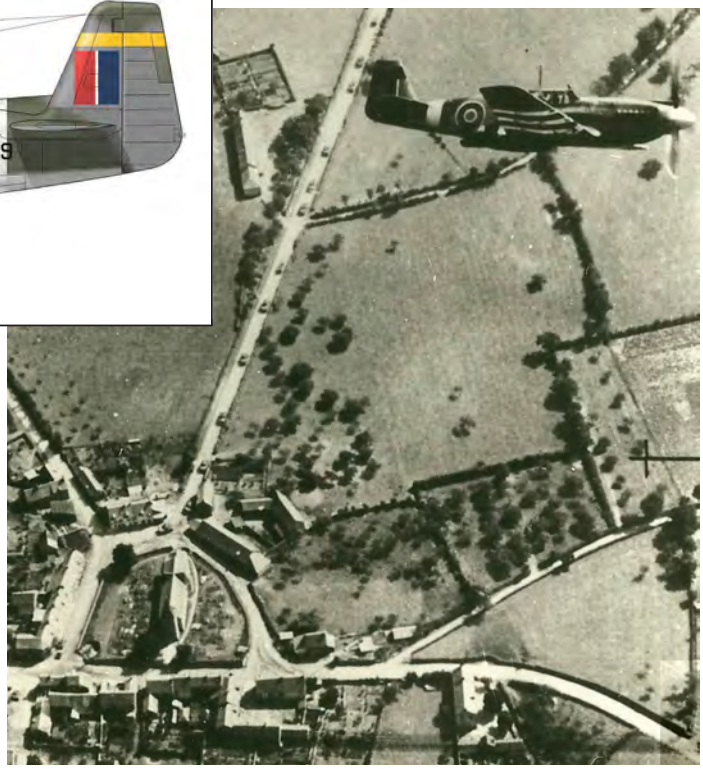
Visiting the Air Fighting Development Unit at RAF Duxford, Cambridgeshire, to fly a Mustang on April 30, 1942, Rolls-Royce test

Two Merlin 65s were sent to power a pair of XP-78 conversions for the USAAF in July 1942, the first of them flying on November 30 with the revised designation XP-51B; it was 70mph (113km/h) faster at 24,000ft than any Alison Mustang.

Convinced by the performance improvement predicted by NAA, the USAAF ordered 400 P-51B Mustangs in August and production was under way by the end of January 1943. Lessons from the Rolls-Royce tests were incorporated ready for the USAAF P-51B and RAF Mustang Mk III to begin rolling off the line. In December, 65 Sqn became Britain's first Merlin Mustang unit.

The aircraft now began to shine as an escort fighter, accompanying bomber formations deep into Europe. After D-Day, some Mk III units deployed onto the Continent with 2TAF and others began escorting





Above: **A 259 Sqn Mustang Mk III as it appeared in Italy during 1944. Note the early application of a dorsal fin more commonly seen on P-51Ds.** Ted Williams

Right: **A Mustang Mk I of the 2nd Tactical Air Force's 34 Wing reconnoitring a road junction in Normandy during July 1944.** via C H Thomas

Below: **Mustang Mk IVs of 65 Sqn taxi at RAF Peterhead prior to another mission to escort coastal strike aircraft in April 1945.** R Freeman

The Mk II went to 2 and 268 Sqns in 2TAF, with which the Alison Mustang saw out its RAF service. Soon after D-Day, 2 Sqn took its Mustangs onto the Continent, specialising in tactical reconnaissance (TacR) and soon receiving Spitfires to complement the US fighters. Its final Mustang was withdrawn in January 1945 in favour of the Spitfire FR.Mk XIV.

On D-Day, 268 Sqn was active over the invasion beaches, spotting for Royal Navy gunfire. In August it took its Mustangs Mk IAs into Continental Europe, and although it had received Typhoons in July it relinquished them in November, just as the first Mustang Mk II arrived to complement and eventually replace the Mk IA.

Spitfire Mk XIVs subsequently came on strength, but the Mustang continued in service until August 1945, 268 Sqn's aircraft becoming the final Alison examples in RAF service.

MERLIN MUSTANG

The Mustang's high-altitude shortcomings came as no surprise to NAA, which had pilot Ronald Harker realised it would do the same for that aircraft.

The company was allocated five Mustang Mk Is for prototype conversion and, although completed to different standards, all were redesignated Mk X. The first was ready for flight on October 13, and after the fourth and fifth were flown by US Army Air Force (USAAF) pilots in January and February 1943, combined UK/US development continued apace.

Plans were made to convert 500 RAF Mustangs with the Merlin 65, modified to deliver its full power at slightly lower altitude than the '66', but significantly higher than the Alison. But there was simply no production capacity for the additional engines in the UK.

Separately, Packard and NAA had been aware of the two-stage Merlin's potential for some time. The former had already applied to extend its production licence to include the new motor, while NAA began design studies for its Mustang installation in 1941.

massed Bomber Command daylight raids into the heart of Germany.

The Mustang had never lost its performance low down and now it became useful in yet another role: chasing V-1 flying bombs over South East England. By September 5, 1944 the type had accounted for 232 'Divers'.

The Mk III also served the Desert Air Force in Italy, with 260 Sqn relinquishing its Kittyhawks for the new aircraft from March 1944.

The Mustang Mk III was in production when the RAF abruptly decided it was unhappy with its cockpit glazing, which afforded the pilot a less than adequate view; it had remained unchanged since the Mk I, making this sudden deficiency rather puzzling.

The British R Malcolm company produced an aft-sliding bulged Perspex hood to replace the hinged arrangement used previously. The result was immediately successful and many Mustangs were retrofitted. ▶

Above: **Mustang Mk I AM104 'L' of 268 Sqn was damaged by flak during a recce mission on June 16, 1943 but managed to get back to RAF Odiham.** Gp Capt L W King

Below: **A 19 Sqn Mustang Mk III – photographed in May 1944 – with the 'Malcolm Hood'. This aircraft, FB201 'QV-D', was the regular mount of the CO, Sqn Ldr 'Mac' Gilmore who was flying it when he claimed his first Mustang victory.** J D Oughton

Regardless of its success in British service, the Mustang is perhaps best known as the USAAF's 'bubble-topped' P-51D, escorting B-17s and B-24s on daylight raids from British bases. The P-51B had been developed into the 'D (and very similar 'K) after a USAAF colonel visiting Britain flew a Spitfire and Typhoon, both with teardrop canopies. Enthused, he returned to the US and began the process of having the P-47 and P-51 similarly modified.

As production moved over to the P-51D which, like the late-model 'B, also featured six-gun armament, it was inevitable the RAF should take deliveries. It had made no differentiation between the P-51B and 'C in its Mk III designation, but now labelled its P-51Ds Mustang Mk IV and its 'Ks as Mk IVAs.

The D model came on strength from March 1945, missing much of the war, although 611 Sqn Mk IVs were the first RAF aircraft to meet Soviet aircraft over Berlin. Among the Mustang's final RAF operators, 64 Sqn flew its last wartime mission on May 4, 1945, but retained the Mk IV for another year before adopting de Havilland Hornets in 1946. The very last frontline RAF Mustangs flew with 213 Sqn from Nicosia, Cyprus, until early 1947, when the Hawker Tempest VI replaced them.

Ordered by a desperate nation hoping it might turn out a little better than the lacklustre P-40, the Mustang matured as arguably the finest fighter of World War Two. In its early marks it excelled as a tactical fighter at low level before the superlative Merlin turned it into a machine that excelled at all levels.

Its contribution to victory in the war over Europe, in US and British hands, should not be underestimated. AN

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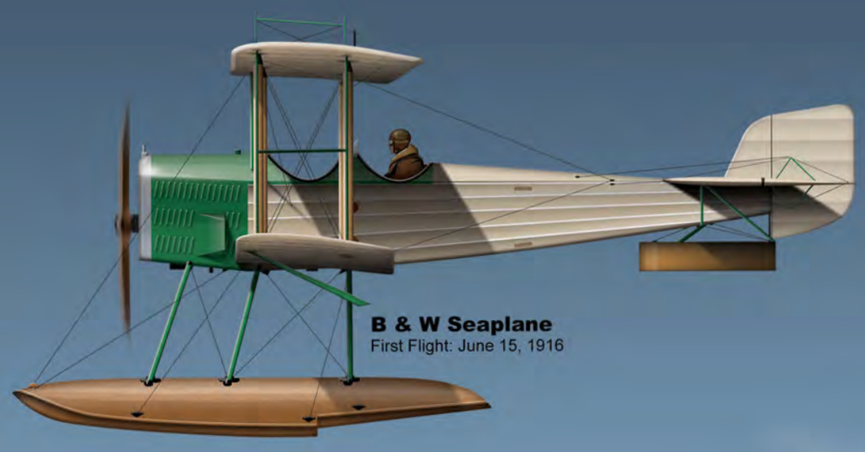

B & W Seaplane
First Flight: June 15, 1916

Model C Trainer
Variants: 2; 3; 5
First Flight: November 15, 1916

B-1 Seaplane
First Flight: December 27, 1919

PW-9/FB NB Fighter
First Flight: June 2, 1923

Model 40
Variants: Model 40A; Model 40B
First Flight: May 20, 1927

P-12/F4B Fighter
Variants: Model 83/F4B (US Navy); Model 89/P-12 (US Army Air Corps)
First Flight: June 25, 1928

Model 80
Variants: Model 80; Model 80A
First Flight: July 27, 1928

Monomail
Variants: Model 200; 221; 221A
First Flight: May 6, 1930

B-9 Bomber
Variants: YB-9; Model 214; 215
First Flight: April 13, 1931

P-26 Peashooter
Variants: 248; 266
First Flight: March 20, 1932

Model 247
Variant: C-73
First Flight: February 8, 1933

Stearman Kaydet Trainer
Variants: Model 73; Stearman 75; Stearman 76; PT-13; PT-13A; PT-13B; PT-13C; PT-13D; PT-17A; PT-17B; PT-18A; PT-27; NS; N2S; NA-75
First Flight: November 26, 1934

B-17 Flying Fortress
Variants: B-17A; B-17B; B-17C; B-17D; B-17E; B-17F; B-17G; Fortress I; II; IIA; III; PB-1
First Flight: July 28, 1935

Model 314 Clipper
Variant: C-75
First Flight: June 7, 1938

Model 307 Stratoliner
First Flight: December 31, 1938

B-29 Superfortress
Variants: Model 345; A; B
First Flight: September 21, 1942

C-97 Stratofreighter
Variants: C-97A; C-97B; C-97C; C-97E; C-97F; C-97G; C-97K; KC-97A; KC-97E; KC-97F; KC-97G; KC-97H; KC-97L; VC-97D; EC-97G; HC-97G
First Flight: November 9, 1944

Model 377 Stratocruiser
First Flight: July 8, 1947

B-47 Stratojet
Variants: B-47A; B-47B; B-47E; RB-47E; RB-47H; ERB-47H; RB-47K
First Flight: December 17, 1947

B-52 Stratofortress
Variants: B-52A; RB-52A; B-52B; RB-52B; NB-52B; B-52C; RB-52C; B-52D; B-52E, B-52F; B-52G; B-52H
First Flight: April 15, 1952

The aircraft illustrated on this poster have been selected as significant types in Boeing's history.
Aircraft are not to scale - Information correct as of May 29, 2016

OF BOEING

Model 367-80
First Flight: July 15, 1954

KC-135 Stratotanker
Variants: KC-135A; KC-135B; KC-135D; KC-135E; KC-135Q; KC-135R; KC-135T; NKC-135A; NKC-135E; C-135A; C-135B; C-135C; C-135E; C-135F; EC-135A; EC-135C; EC-135G; EC-135H; EC-135J; EC-135K; EC-135L; EC-135Y; NC-135A; NC-135B; NC-135W; OC-135B; RC-135A; RC-135B; RC-135C; RC-135D; RC-135E; RC-135M; RC-135S; RC-135T; RC-135U; RC-135V; RC-135W; RC-135X; TC-135S; TC-135W; WC-135B; WC-135C; WC-135W
First Flight: August 31, 1956

707
Variants: -120; -120B; -120BF; -120F; 220; -220F; -320; -320B; -320C; -320F; -330B Aguila; -351C Santiago; -385C Condor; -420; -420F; C-18A; CC-137; CT-49A; E-6A; E-6B; EC-18B; EC-18D; EC-137E; EC-707; KC-137; KC-707; KC-707A; KE-3A; RC-707; VC-137A; VC-137B; VC-137C; VC-707 (720: -B; -BF)
First Flight: December 20, 1957

CH-47 Chinook
Variants: CH-47A; CH-47B; CH-47C; CH-47D; CH-47E; CH-47F; CH-47J; CH-147D; CH-147F; HC1; HC2; HC2A; HC3R; HC4; HC4A; HC5; HC6; MH-47D; MH-47E; MH-47G; Model 234; Model 234UT; Model 234LR
First Flight: September 21, 1961

CH-46 Sea Knight
Variants: CH-46A; CH-46D; CH-46E; CH-46F; UH-46A; UH-46B; UH-46D; HH-46A; HH-46D; HH-46E; VH-46F; CH-113 Labrador; CH-113A Labrador; Hkp4A; Hkp4B; Hkp4D; 107-II
First Flight: August 1962

727
Variants: -100; -100C; -100QC; -100QF; -200; -200A; -200FA; -200QC; C-22A; C-22B
First Flight: February 9, 1963

737
Variants: -100; -200; -200(A); -200(A)(F); -200C; -200C(A); -200(F); -300; -300(BDQC); -300(BDSF); -300QC; -300(SF); -400; -400(BDSF); -400(C) -400(SF); -500; -600; -700; -700(BDSF); -700ER; -800; -800(SFP); -900; -900ER; BBJ1; BBJ2; BBJ3; MAX 7; MAX 8; MAX 9; MAX 200; 737-2X9 Surveiller; CT-43A; NT-43A; VC-96; C-40A; C-40B; C-40C
First Flight: April 9, 1967

747
Variants: -100; -100B; -100F; -100(SCD); -100(SF); -200B; -200F; -200(M); -200(SF); -200(SCD); -200(SUD); 747SR; 747SP; -300; -300(M); -300(SF); -400; -400(BCF); -400(BDSF); -400D; -400ER; -400F; -400FER; -400(M); Dreamlifter; -8 Intercontinental; -8F; -8BBJ; E-4A; E-4B; YAL-1A
First Flight: February 9, 1969

E-3 Sentry
Variants: A; B; C; D Sentry AEW1; F; G; JE-3C; RE-3A; RE-3B
First Flight: February 5, 1972

AH-64 Apache
Variants: AH-64A Apache; AH-64A+ Apache; AH64A Peten; AH-64D Apache Longbow; AH-64DJP Apache; AH-64D Saraf; AH-64DHA Apache; AH-64E Guardian; WAH-64D Apache AH1
First Flight: September 30, 1975

767
Variants: -200; -200ER; -200(BDSF); -200ER(BDSF); -200(PC); -300; -300ER; -300ER(BDSF); -300FER; -300(BCF); -300ER(BCF); 400ER; 767-200MMTT; E-767; KC-767A; KC-767J T/T
First Flight: September 26, 1981

757
Variants: -200; -200(PCF); -200(SF); -200PF; -200(C); -200(PCC); -300; C-32A; C-32B
First Flight: February 19, 1982

F-15 Strike Eagle
Variants: I Ra'am; K Slam Eagle; S Strike Eagle; SA Strike Eagle; SE Silent Eagle; SG Strike Eagle (other Eagle variants: A Eagle; B Eagle; C Eagle; D Eagle; DJ Eagle; J Eagle)
First Flight: December 11, 1986

VC-25A
First Flight: May 16, 1987

E-8 Joint STARS
Variants: E-8A; E-8C; TE-8A
First Flight: December 22, 1988

V-22 Osprey
Variants: V-22A; CV-22B; MV-22B; CMV-22B
First Flight: March 19, 1989
The V-22 is produced in collaboration with Bell.

C-17A Globemaster III
Variant: CC-177
First Flight: September 15, 1991

777
Variants: -200; -200ER; -200LR; F; -300; -300ER; 777X
First Flight: June 12, 1994

F/A-18 Super Hornet
Variants: E; F; EA-18G Growler; NEA-18G
First Flight: November 29, 1995

717
First Flight: September 2, 1998

737 Airborne Early Warning and Control
Variants: Peace Eagle; Peace Eye; E-7A Wedgetail
First Flight: May 20, 2004

P-8 Poseidon
Variants: P-8A; P-8I
First Flight: April 25, 2009

787 Dreamliner
Variants: -8; -9; -10
First Flight: December 15, 2009

KC-46A Pegasus
First Flight: September 25, 2015

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UK RAF Wing Commander in Libya

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