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REGULARS

Main image: **Lockheed F-104S ASA-M Starfighter, MM6930, of 9° Stormo in a special scheme to mark a tie-up with Ducati. The '999' is a famous motorbike built by the company that sported a similar scheme. Soon after this photo was taken a dot was put between the first and second number of the code so it tied in with the standard Italian Air Force system.** David Cenciotti. Inset (middle left): **Air Transat TriStar 500, C-FTSW at Shannon Airport.** AirTeamImages.com/Derek Pedley. Inset (bottom right): **An RAF Boeing C-17A on approach to Gibraltar.** William Jardim

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Third Runway for Heathrow

Heathrow's third runway would necessitate bridging or tunneling the nearby M25 motorway. Heathrow Airport

The British Government has officially backed London/Heathrow's proposal for increasing runway capacity in the southeast of England. Announcing its decision in a written statement on October 25, the Department for Transport (DFT) said building a third runway at the airport – the first full-length runway in the southeast since World War Two – would deliver "a major boost for the UK economy". The DFT added: "[It] will bring economic benefits to passengers and the wider economy worth up to £61bn. Up to 77,000 additional local jobs are expected to be created over the next 14 years and the airport has committed to create 5,000 new apprenticeships over the same period." It does come with some conditions though including a 6.5hrs ban on scheduled night flights, more stringent noise restrictions and legally binding noise targets.

Heathrow has been the UK's busiest airport for more than six decades and the recent trend towards consolidation and partnership between airlines has reinforced its position as the country's most important gateway. Indeed, the airport ranks inside the top six busiest in the world by passenger traffic, behind Tokyo/Haneda and narrowly ahead of Los Angeles. However, the issue of a lack of capacity in South East England is perhaps most critical at Heathrow: the airport is capped at 480,000 flights a year and is operating at more than 98% capacity.

Heathrow's proposal is based on the construction of a new 11,483ft (3,500m) runway to the northwest of the existing airport site. This would increase capacity up to 740,000, placing the airport on an equal footing with its European counterparts and, according to Heathrow, will be "sufficient... until at least 2040".

A July 2013 report commissioned by Heathrow revealed the lack of capacity at the facility is costing the UK economy an estimated £14bn per year in lost trade; this is expected to rise to £26bn per year by 2030.

The new runway is also expected to deliver benefits domestically, with Heathrow proposing six new routes – to Belfast, Liverpool, Newquay, Humberside, Prestwick and Durham Tees Valley – to be added after expansion.

The third runway is expected to cost £14-£18bn – to be paid for by the private sector rather than the UK exchequer – and is due for completion by 2025. It will, however, necessitate bridging or tunneling the nearby M25 motorway – a significant undertaking in itself.

Commenting on the decision, the Secretary of State for Transport Chris Grayling said: "A new runway at Heathrow will improve connectivity in the UK itself and crucially boost our connections with the rest of the world, supporting exports, trade and job opportunities. This isn't just a great deal for business, it's a great deal for passengers who will also benefit from access to more airlines, destinations and flights."

The move has been well received by a host of bodies, organisations and trade unions including IATA, the British Airline Pilots Association (BALPA), the Confederation of British Industry (CBI) and numerous chambers of commerce as well as the Scottish Government.

However, there has also been considerable political fallout as a result of the decision. Long-time Heathrow opponent and former London mayoral candidate Zac Goldsmith resigned as a Conservative MP in protest, describing the third runway as the "most polluting, most disruptive, most expensive option". Other campaigners, including London Mayor Sadiq Khan, warned of legal obstacles.

While Heathrow's proposal has now been given the green light, there are still several fundamental hurdles to overcome. The project must first be taken forward as a draft national policy statement (NPS), needed for planning purposes and requiring approval by parliament. This requires a full public consultation and examination by a Commons Select Committee before being put to a vote, a process that is expected to take at least another year. **Craig West**

Russian Carrier Transits the Channel

The Russian Navy aircraft carrier *Admiral Kuznetsov* (063) transited southwards through the English Channel on the morning of October 21.

Joined by a Task Group of seven other Russian naval vessels, including the nuclear-powered Kirov Class battlecruiser *Pyotr Velikiy* (099) and two Udaloy Class destroyers, *Vice Admiral Kulakov* (626) and *Severomorsk* (619), the ships were believed to be en route to the eastern Mediterranean Sea, where its aircraft are expected to participate in operations against Daesh and other militant groups in Syria. This will be the first time the ship has been used in combat operations.

A Ka-52K combat helicopter has been sighted on the ship which is the first time it has deployed with the carrier. Also on board are MiG-29K/KUB and Su-33 fighters plus KA-27PS and Ka-31 helicopters.

The *Admiral Kuznetsov* cruises down from the Norwegian Sea en route to the Mediterranean Sea via the English Channel. Norwegian MoD

Airbus Celebrates 10,000th Delivery

European aerospace giant Airbus is in a celebratory mood after delivering its 10,000th aircraft. The landmark jet, A350-900, 9V-SMF (c/n 054), was handed over to Singapore Airlines on October 14 during an elaborate ceremony at the manufacturer's Toulouse/Blagnac facility in France.

Addressing the assembled audience of employees, dignitaries and media representatives, Airbus Group CEO Tom Enders kicked off his speech with a nod to the manufacturer's Chief Operating Officer – Customers John Leahy who, Enders quipped, is "the man who sold 8,800 of the 10,000 aircraft".

He continued: "It's a real honour to deliver this aircraft – MSN54 – to Singapore Airlines, one of the world's greatest and most admired carriers, and one of our longest-standing customers."

Handing over the landmark aircraft to the carrier was particularly poignant for Airbus. Its relationship with the airline dates back to 1979 and its first order for the A300 – Singapore Airlines and its subsidiaries have operated every subsequent model produced by the European firm. **Craig West**

UPS Orders Up To 28 747-8 Freighters

An artist's impression of the 747-8F in the colours of cargo carrier UPS. Boeing

Well-known freight carrier UPS has ordered 14 747-8 Freighters from Boeing and has signed an option to purchase up to 14 additional airframes.

"These aircraft are a strategic investment for increased capacity for UPS customers around the globe," said Brendan Canavan, President, UPS Airlines. "The 747-8 will allow UPS to upsize our network in both new and existing markets."

Boeing describes the 747-8 Freighter as "the world's most efficient freighter, providing cargo operators the lowest operating costs and best economics of any large freighter on the market." The aircraft has 16% more revenue cargo volume than the earlier 747-400F and reduces the noise footprint around an airport by 30% compared with its predecessor.

Aeroméxico Dreamliner

Aeroméxico's first Boeing 787-9 Dreamliner (XA-ADL) is adorned in a colourful special livery. Named *Quetzalcoatl*, the design, created by graphic designer José Manuel Escudero, promotes Mexico's heritage. Brian Worthington

Major Boeing Order from Qatar

An $11.7bn deal will see Qatar Airways operating a mix of widebody and single-aisle Boeing aircraft.

The order, for 30 Boeing 787-9 Dreamliners and ten 777-300ERs, is in addition to the Doha-based carrier's existing firm commitments for between 65 and 105 Boeing airliners, including 60 next-generation 777Xs.

Significantly, the Qatari flag carrier has also signed a letter of intent (LOI) for up to 60 737 MAX 8s, valued at an additional $6.9bn if converted into firm orders. This would be Boeing's first single-aisle aircraft to serve with the fleet and is a notable departure for the current all-Airbus narrowbody operator.

Confirmation of the LOI will be a further blow to Airbus, which is dealing with ongoing, but unrelated, issues with Qatar Airways' A320neo and A350 deliveries, Group Chief Executive Akbar Al Baker commenting: "Qatar Airways is at risk of reporting a financial loss this year due to these ongoing issues."

He told reporters the airline had cancelled commitments for two A320neos – making three in total – because the company felt the jet and its engines are not meeting contractual obligations, adding that it would "keep on cancelling" orders as each jet passes its delivery date until the situation is resolved.

Al Baker has also threatened to walk away from the entire 46-aircraft order.

Extra Funds for Monarch

Just hours before a CAA deadline for Monarch Airlines to prove it had sufficient funding to stay afloat, the carrier won an eleventh-hour reprieve after securing a £165m funding package by majority shareholder Greybull Capital.

The injection of funds, confirmed on October 12, is the biggest of its kind in the British carrier's 48-year history. Monarch had been due to renew its Air Travel Organiser's Licence (ATOL), which allows it to fly package holidaymakers, on September 30 but was granted a 12-day extension after encountering difficulties, which it declined to discuss.

The CAA has since approved the renewed ATOL licence, which is valid until September 30, 2017, following confirmation Monarch had met all the necessary requirements.

The investment will help fund 30 new Boeing 737 MAX 8s, the first of which is due for delivery in 2018.

Porter Marking Canada's 150th

Porter Airlines' Q400 C-GLQB departs North Bay Jack Garland Airport, Ontario, on October 11 in its new markings. Andrew H Cline

Porter Airlines is celebrating the Canadian Sesquicentennial celebrations in 2017 with a commemorative colour scheme on its Bombardier Q400 NextGen airliners.

The company is the 'Official Canadian Airline' for the festivities and its first Q400 (C-GLQB) has been adorned with special markings, including its raccoon mascot on the tail. Titles include '2017 Ottawa' along with the sesquicentennial logo, 'Celebrating Canada's 150th' and 'Porter official Canadian airline' on the port side and French 'Célébrons 150e du Canada' titles on the starboard side.

A second aircraft will be painted in the full livery, while the entire fleet will carry anniversary decals throughout the year.

Andrew H Cline

Improving Chinese Links

The Chinese and UK Governments have agreed to more than double the flights permitted between the two countries, with passenger flights increasing from the current maximum of 40 a week for each nation to up to 100 – and no limit on all-cargo services.

Restrictions on the number of destinations airlines can serve have also been lifted to allow for operations between any point in either the UK or China. Until now, airlines could serve just six in each country.

UK Government figures show that visitors from China are on the increase. In 2015 almost 270,000 visited Britain, up 46% on the previous year; and they spent £587m (up 18%), moving China into the UK's top ten of most valuable inbound markets.

Spirit Debuts the A320neo

The first US-operated Airbus A320neo has been handed over to Spirit Airlines. Airbus

Spirit Airlines became the first US carrier to operate the Airbus A320neo when it took delivery of N901NK on October 7. The carrier has 55 A320neo family aircraft on order – five leased from AerCap and 50 ordered directly from the manufacturer.

All the airline's neos will be powered by Pratt & Whitney Pure Power PW1100-JM engines. Meanwhile Denver-based Frontier Airlines received its first A320neo, N301FR, on October 19.

First Falcon 8X Delivered

Greek charter company Amjet Executive took delivery of the first production Dassault Falcon 8X business jet on October 5. Registered SX-CGR, it left the manufacturer's plant at Bordeaux-Merignac in France en route to Amjet's base in Athens.

Amjet already operates a large fleet of Falcon models, including the 50, the 900EX and 7X. The three-engined Falcon 8X, which gained its EASA and FAA certification in June, is Dassault's largest business aircraft, with a range of 6,450nm (11,945km).

Developed from the Falcon 7X, with a stretched fuselage, it's been under development for two years. The prototype first flew on February 6, 2015.

Dassault has so far delivered 16 aircraft to its completion centre at Little Rock, Arkansas, and 11 more Falcon 8Xs are on the Bordeaux production line for delivery to customers from countries including Brazil, the UAE and India. **Rod Simpson**

Russian Post Tu-204

Russian Post has taken delivery of the first of two former Transaero Airlines Tupolev Tu-204-100Cs. The freighter, RA-64051, repainted into a striking blue and silver livery, will be used for domestic postal deliveries between Moscow and the Russian Far East and on long-haul routes to China. AirTeamImages.com/Alexander Mishin

New Q400s for Philippine Airlines

Philippine Airlines (PAL) has signed a letter of intent with Canadian manufacturer Bombardier for up to 12 of its Q400 turboprops.

The Filipino national carrier will be the launch customer of the latest variant of the Q400, which features a two-class, high-density 86-seat configuration including ten premium service seats.

It's thought the carrier is negotiating a deal for five firm orders plus seven options, but neither party has confirmed nor denied the details. Bombardier had earlier announced an 86-seat variant of the Q400, but with a single-class cabin.

SAS Receives A320neo

SAS Scandinavian Airlines has taken delivery of Airbus A320neo LN-RGL *Sol Viking*, the first of its 30-strong order and one of three due to be handed over this year. The others are expected to follow by 2019.

The airline is using the new type to pioneer its upgraded short-haul cabin, inspired by its new widebody product and featuring 174 Recaro seats (increased from 168 on its A320ceos) along with Viasat high-speed WiFi, USB power sockets and mood lighting.

The revised cabin will also be rolled out across the carrier's existing short-haul fleet under a €51.5m two-year upgrade programme.

Sky Gates Opens Service

Russian start-up Sky Gates Airlines has begun commercial services after receiving its Air Operator Certificate (AOC). It will initially fly from Moscow/Sheremetyevo to Baku and Maastricht but has outlined plans to develop its Moscow/Zhukovsky base into an intercontinental freight hub once its new cargo terminal comes online in autumn 2017.

Sky Gates is currently using former Cathay Pacific Boeing 747-467F, VP-BCI – leased from Azerbaijan operator Silk Way West Airlines. AirTeamImages.com/Jan Severijns

Widerøe Awarded PSO Routes

Norwegian-based carrier Widerøe has won a new five-year contract to operate 13 of the nation's Public Service Obligation (PSO) routes.

The services, which link remote northern communities, were put up to tender by the Norwegian Ministry of Transport and Communications in June and attracted bids from carriers including Tromsø-based FlyViking and Danish Air Transport.

Widerøe, already the current incumbent on most of the PSO routes, will begin the new contract on April 1.

Major Changes at airberlin

German low-cost carrier airberlin has unveiled a plan to streamline its operation, increase profitability and deliver long-term growth – but at a cost of more than 1,000 jobs.

The new strategy follows a comprehensive review of the German low-cost carrier, which is facing mounting pressure from rival operators such as easyJet, Ryanair, Wizz Air and Lufthansa's new-look Eurowings subsidiary.

Key elements of the reorganisation include consolidating its two hubs at Berlin and Düsseldorf, shifting tourist and leisure business into a separate division, refocusing its core network to "higher-yielding" markets and reducing its fleet by almost half.

Under the plan, outlined in late September, the carrier will reduce its fleet to 75 aircraft – consisting of 17 Airbus A330s, 40 A320 family aircraft and 18 Bombardier Dash 8-Q400s – by next summer.

The company says streamlining will be aided in part by an agreement to wet-lease up to 40 A320s to Lufthansa, 35 of which will join Eurowings with five destined for fellow subsidiary Austrian Airlines.

The changes will also see airberlin axe up to 1,200 jobs by February through a combination of voluntary redundancies and redeployments elsewhere in the Etihad Airways Partners group, which includes Air Serbia, Air Seychelles, Alitalia, Etihad Airways, Etihad Regional and Jet Airways.

Chevron Sets Up Prestwick MRO

Chevron has signed a ten-year lease with Glasgow Prestwick Airport and will move into the Scottish airfield in November to establish a new maintenance, repair and overhaul (MRO) facility. It will be ready to receive aircraft from January 2017.

The firm says existing facilities at the site will provide a large space for its line maintenance support operations, and the new MRO hangar, with a bespoke teardown/parts processing facility, aircraft parking area and management offices, all of which will total 150,000ft² (1,394m²).

Neil Morris, Chevron Aircraft Maintenance's MD, said the company has embarked upon a two-year project, visiting facilities with similar prospects all over the world. "Capable of accommodating widebody aircraft up to B747 size, Glasgow Prestwick Airport was finally approved as the preferred site for the future development of our new MRO facility.

"The airport offered many key attributes, such as [round the clock] operational access, underpinned by a tried and tested infrastructure."

Lufthansa Ends 737 Ops

German airline Lufthansa flew its last Boeing 737 commercial service on October 29. The carrier was the launch customer for the 737-100, receiving its first one in 1967.

The last flight, by 737-300 D-ABEF, touched down at Frankfurt Airport at 1953hrs, soon after three other 737s had arrived. In tribute, 'follow me' cars led the jets to park in front of Terminal 2 so that, the airline said, "a crowd of aircraft fans and plane spotters could take a final look at the planes from the Visitor's Terrace."

Cobrex Trans 737

Romanian helicopter operator Cobrex Trans has introduced its first fixed-wing airliner into service. The Brasov-based carrier will initially use the 148-seat Boeing 737-382 (YR-CBK), which wears the basic livery of former owner Kyrgyzstan Aircompany, for passenger charters from the northeastern town of Suceava. Marcus Steidele

HiFly Zero-G A340

Airbus A340 9H-TQM emerged from the Air Livery hangar at Manchester Airport on October 12 after being painted for HiFly. The jet will now be leased to Swiss Space Systems and be operated as a 'Zero-G' aircraft. It began life as 9V-SJF for Singapore Airlines in 1996, also flying with Khalifa Airways as 7T-VKL and Etihad Airways as A6-EYC. Nik French

Russian Approval for Embraer E-Jet

Embraer is celebrating after its E170 and E175 regional aircraft gained type certificates from the Rosaviatsia, the Federal Air Transport Agency – moving the firm a step closer to selling the 70 to 80 seat aircraft to Russia.

The larger E190 and E195, certified in 2012, are now in service with Saratov Airlines and other carriers across the CIS including Air Astana, Belavia and AZAL Azerbaijan Airlines.

Low-Cost Wingo Takes Off

Colombian-based Copa Holdings has launched a new low-cost carrier, Wingo Airlines. It will begin operations on December 1 using a fleet of four single-class 142-seat Boeing 737-700s.

Wingo will operate as a business unit of Copa Airlines Colombia "with completely autonomous structures for its commercialisation, distribution systems and customer service", according to the firm.

It will initially serve 16 cities in ten countries including direct flights from Bogota to Cancun, Havana, Aruba, Punta Cana, Mexico City, San Andres, Panama City, Quito and Cartagena.

Aeroflot Bound for Gatwick

Aeroflot is launching a new daily route from Moscow/Sheremetyevo to London Gatwick from November 15, expanding the Russian state airline's network to 131 destinations in 50 countries. It will also increase the frequency of its services to nearby Heathrow to 25 per week from November.

Saudia 777-200ERs Being Retired

Saudia will phase out its entire 23-strong Boeing 777-200ER fleet by the end of next year as part of a fleet modernisation programme that will see 113 new aircraft joining the carrier.

They include 15 777-300ERs, 13 Boeing 787-8 Dreamliners and 35 Airbus A320neo family aircraft. The airline also signed a deal earlier this year for 50 Airbus A330 Regional and A320 jets.

Five 777-200ERs will leave the fleet by the end of this year, the other 18 following in 2017. Saudia has already removed four Boeing 747-400s in 2016 and will have retired its 15-strong Embraer 170 fleet by the end of December. Its 28 A320s will be withdrawn over the next two years.

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Citation Longitude's First Flight

Cessna's Citation Longitude prototype takes off on October 8. Textron

Cessna's new Model 700 Citation Longitude took its maiden flight from the former Beechcraft airfield in Wichita, Kansas, on October 8 with test pilots Ed Wenninger and Stuart Rogerson at the controls.

The aircraft (N9722L) is the prototype of the new super-mid-size business jet and is currently the largest in the Citation range – the even larger Citation Hemisphere is under development.

The Longitude's two-hour flight tested flaps, landing gear and pressurisation systems and, according to the crew, the jet showed a "high level of maturity in handling". A second prototype, actually the first production Longitude, is to fly shortly and will be used for systems testing.

The Longitude will compete in the market with the Bombardier Challenger 350, Gulfstream G280, Falcon 2000S and Embraer's Legacy 500. Certification and first customer deliveries of the Longitude will be towards the end of 2017. **Rod Simpson**

CIVIL ORDERS

Airline	Aircraft	Number	Order Placed	Notes
Atlas Air	Boeing 767	9	October 11	Passenger to freighter conversions
China Southern Airlines	Boeing 787-9	12	October 12	
Industrial Bank Financial Leasing	Bombardier CRJ900	10	June 20	Previously announced as 'unidentified customer'
Philippine Airlines	Bombardier Q400	12	October 14	Launch customer of 86-seat two-class aircraft
Qatar Airways	Boeing 737 MAX 8	60	October 7	Letter of Intent
Qatar Airways	Boeing 777-300ER	10	October 7	
Qatar Airways	Boeing 787-9	30	October 7	
Swiss International Air Lines	Boeing 777-300ER	1	October 26	Takes number on back order to four
UPS	Boeing 747-8F	14	October 27	Also includes option on 14 further airframes

New Mexican Next-Gen 737

The Fuerza Aérea Mexicana (FAM - Mexican Air Force) has taken delivery of its first brand new Boeing 737NG. The 737-8ZY (3527) is seen here arriving back at Boeing Field, Seattle at the end of a pre-delivery air test on October 7. It joins 737-800 3526 in FAM service, although that aircraft was acquired second hand after serving with Transaero as EI-RUS. Joe G Walker

AirTanker Achieves Voyager Full Service Date

AirTanker reached the final milestone in the Future Strategic Tanker Aircraft (FSTA) programme with the achievement of Full Service Date (FSD) for the Voyager aircraft. In an announcement on October 3, the company said that FSD was reached on September 30.

The FSTA programme has been delivered under the largest Private Finance Initiative (PFI) of its kind in the UK defence sector and consists of a 27-year contract through to 2035 covering the delivery of aircraft as well as associated infrastructure, service and support.

The FSD landmark is the culmination of an eight-year delivery phase that has seen AirTanker deliver 14 A330-200MRTT Voyager aircraft to the RAF. The final aircraft (ZZ343) arrived at RAF Brize Norton, Oxfordshire on July 13 and the fleet of aircraft now operate in both the military and civil leasing sectors.

Second C-130T Delivered to Philippine Air Force

The Philippine Air Force's second ex-USMC C-130T Hercules runs up its engines prior to departure from Davis-Monthan AFB on October 5 just before beginning its delivery flight. USAF/309th AMARG

Philippine Air Force (PAF) C-130T Hercules 5040 (ex USMC 163022) completed its delivery flight to Mactan-Benito Ebuen Air Base, Cebu, in the Philippines on October 9. It had left Davis-Monthan AFB, Arizona, four days earlier.

This is the second of two former US Marine Corps C-130Ts being supplied to the PAF, after being de-converted from KC-130T tankers. Both were refurbished by the 309th Aerospace Maintenance and Regeneration Group at Davis-Monthan where they had been in storage following retirement from USMC service. The first example (5011/ex USMC 162786) arrived in the Philippines on April 5.

Seahawks Prowlers Return Home For the Final Time

Grumman EA-6B Prowlers from Marine Tactical Electronic Warfare Squadron 4 (VMAQ-4) *Seahawks* completed their final operational deployment on October 10. The aircraft flew back to their home base at Marine Corps Air Station Cherry Point in North Carolina on conclusion of a six-month long deployment to Incirlik Air Base in Turkey. The squadron is now scheduled for de-activation in the summer of next year.

During their stay in Turkey the EA-6B Prowlers flew electronic attack missions associated with the on-going counter-Daesh operations that are supporting Operation Inherent Resolve in both Iraq and Syria. The Prowlers were able to protect coalition aircraft and ground troops by intercepting Daesh communications.

First Su-30SMs for Russian Knights

The Russian Air Force aerobatic display team, the Russian Knights, received its first Sukhoi Su-30SM fighters when four examples of the latest *Flanker* variant were delivered from the factory at Irkutsk to the team's Kubinka base on October 14.

The new aircraft, comprising Bort numbers '30 Blue', '31 Blue', '32 Blue' and '33 Blue', will initially supplement and eventually replace the team's current Su-27 *Flankers*. A further four Su-30SMs are due for delivery by the end of this year.

Colombian Creeks

The Fuerza Aérea Colombiana (FAC – Colombian Air Force) formally inducted its first 30 TH-67A Creek helicopters into service during a special ceremony at Base Aérea Militar 4 Melgar-Tolima on September 22.

The former US Army helicopters retain their US Army titles, registrations, codes and colours, but have had FAC serials added on the cabin doors.

The first ten arrived at Melgar on March 23 and a total of 60 are due to be delivered through a co-operation programme with the US Government. They are being used in the basic rotary-wing training role and will replace the OH-58 Kiowas, which will be returned to the USA.

One of the TH-67A Creek helicopters that have been transferred to the Colombian Air Force.
Colombian Air Force

Ex-RAF Tutors Bound for Finland

Finnish Defence Minister Jussi Niinistö authorised the acquisition of 28 second-hand Grob G115E elementary and basic flying training aircraft on October 10. The aircraft had previously been in service with Babcock International flying for the UK military which called them Tutor T1s. They were used for pilot grading, basic and elementary flying training for the Army and Royal Navy, plus air experience flying for University Air Squadrons and Air Cadet organisations.

The Grobs will be modernised after delivery with new navigation systems, cockpit displays and radios. Total value of the contract will be approximately €6.06m, excluding the upgrade work. Deliveries are scheduled to take place in 2016 and 2017, and the aircraft will replace the current elementary and basic flight training provided by Patria Aviation using the Valmet L-70 Vinka at Tikkakoski.

Under the UK MOD's new Military Flying Training System contract Babcock is replacing the Tutors with 23 Grob G120TP Prefects, which will be based at RAF Barkston Heath and RAF Cranwell in Lincolnshire.

King Stallion Initial Operational Testing Complete

USMC pilots manoeuvre the second development CH-53K King Stallion as it delivers a 12,000lb external load after completing a 126-mile mission during OT-B1 at West Palm Beach, Florida.
Sikorsky

The US Marine Corps' new CH-53K King Stallion helicopter completed its two-week initial operational test period (called OT-B1) on October 19 at the Sikorsky Development Flight Center in West Palm Beach, Florida.

OT-B1 included multiple external lift scenarios up to 27,000lb (12,200kg), and ground testing included the embarkation/debarkation of combat-equipped troops, internal and external cargo rigging, tactical bulk fuel delivery system (TBFDS) operation and medevac litter configuration.

With four development aircraft in test, the CH-53K has logged over 200 cumulative flight hours to date. Initial operational capability continues on track for 2019 and is defined as having four aircraft, with combat-ready crews, logistically prepared to deploy. Entry into low-rate initial production is now anticipated in the second quarter of 2017.

Scorpion Gets its Sting

Textron Airland's Scorpion jet has successfully completed its first weapons exercise at White Sands Missile Range while operating from Holloman AFB in New Mexico.

All weapon types performed flawlessly and included Hydra-70 unguided 2.75in rockets, BAE Systems' Advanced Precision Kill Weapon System (APKWS) and AGM-114F Hellfire missiles. The weapons were guided to their targets first using a ground-based laser designator system and then an airborne laser on the Scorpion's L-3 Wescam MX-15Di.

The system design, integration and flight test co-ordination for all three weapon types were achieved in under three months, and weapons testing took place from October 10 to 14 co-ordinated by both US Naval Sea Systems Command and the USAF's 586th Flight Test Squadron at Holloman.

Special Scheme for Austrian Alouette

Austrian Air Force (AAF – Österreichische Luftstreitkräfte) Sud Alouette III SA-316B has been painted in a dramatic special scheme to commemorate the 50th anniversary of the Bundesheer (Austrian Armed Forces) in 2017.

The aircraft is one of 12 Alouette IIIs operated by the AAF's Luftunterstützungsgeschwader (Air Support Wing) and is assigned to the Hubschraubergeschwader (Helicopter Wing) based at Aigen-im-Ennstal in central Austria.

The special scheme depicts the Grossglocker (Austria's highest mountain) and an eagle, which is the symbol of the AAF. An elongated Austrian flag can also be seen running horizontally down the side of the fuselage.

The Alouette's new paint scheme was shown off to the public at the Search & Rescue Meet at Koksijde, Belgium on October 11. Darren Willmin/Aviation in Action

MILITARY AIRCRAFT ORDERS

Customer	Manufacturer and Type	Number	Contract Date	Notes
Angolan Air Force	Airbus Helicopters AW139	2	February 17	Previously noted as an order from an undisclosed West African government
Bangladesh Army Aviation	Airbus C295W	1	October 11	First fixed wing type for the service
Costa Rico Ministry of Public Security	Harbin Y-12E	2	September 26	Donated by the Government of the People's Republic of China
Finnish Air Force	Grob G115E	28	October 10	Ex-RAF aircraft operated by Babcock International
Indian Army & Navy	Kamov Ka-226T	200	October 15	160 to be produced locally by HAL
Indonesian Air Force	Boeing 737-400	1	October 10	Ex Lion Air PK-LIW
Iraqi Air Force	Cessna AC-208B Combat Caravan	2	October 7	Approval granted by US State Dept
Netherlands Ministry of Defence	AeroVironment UAVs	TBC	October 14	To include Raven B, Puma AE and Wasp AE micro air vehicles
Philippine Navy	Beech TC-90 King Air	5	October 26	Leased from Japan Maritime Self-Defense Force
Saudi Arabian Government	Sikorsky UH-60M	8	September 30	To be operated by Royal Saudi Land Forces or Saudi Arabian National Guard
Royal Thai Air Force	Airbus Helicopters EC725 Caracal	2	October 4	For delivery in 2019
Taiwan National Airborne Service Corps	Sikorsky UH-60M	6	September 28	Delivery by the end of 2021
Tunisian Ministry of Defence	Sikorsky UH-60M	4	September 28	For delivery by April 2020

Canada's 425 Sqn Anniversary Hornet

Royal Canadian Air Force CF-188 Hornet 188742 from 425 *Alouette* Sqn has gained special tail markings to celebrate the unit's 75th anniversary.

No.425 Sqn was the first French Canadian squadron and was formed at RAF Dishforth, Yorkshire on June 2, 1942 as a bomber unit flying Vickers Wellingtons. By December 1943 it had swapped to the Handley Page Halifax and flew them with distinction until the end of the war in Europe.

Fittingly, Hornet 188742's special red and blue tail art carries a depiction of both the Handley Page Halifax and the CF-101 Voodoo and the 425 Sqn's motto 'Je te plumerai' ('I shall pluck you'). Galen Burrows

The squadron was re-formed at RCAF Station St Hubert in October 1954, flying CF-100 Canucks as an all-weather fighter squadron and later converted onto the CF-101 Voodoo. It retained the Voodoo until the Hornet arrived in 1985.

Final Navy Wildcat Delivered

Leonardo-Finmeccanica Helicopters delivered the final AW159 Wildcat HMA2 to the Royal Navy's Fleet Air Arm on October 25.

The helicopter (ZZ530) was flown the short distance from the factory in Yeovil, Somerset, to RNAS Yeovilton to join 825 NAS.

Original plans had been to acquire 30 helicopters for the Royal Navy, but in 2008 this was reduced to 28. The first example was delivered to the Navy on April 23, 2013.

RAF Typhoons Arrive in Japan

Four RAF Typhoons from II(AC) Sqn at RAF Lossiemouth, Moray arrived at the Japan Air Self-Defense Force's (JASDF's) Misawa AB in northern Honshu, on October 22 in readiness for the Guardian North 16 bilateral exercise.

This marks the first time the JASDF has held a bilateral exercise in Japan with any foreign military other than the US, providing an opportunity for both air forces to learn from each other and develop their skills.

JASDF aircraft taking part in the exercise included F-15J/DJ fighters from the 2nd Kokudan (Air Wing) at Chitose AB (Hokkaido) and F-2A/B fighters from the 3rd Kokudan at Misawa AB, both from the JASDF Northern Air Defense Force.

An RAF Voyager tanker from RAF Brize Norton, Oxfordshire, crewed by personnel from 10 and 101 Sqns, provided air-to-air refuelling during the 3,500-mile (5,632km) non-stop flight from Malaysia. An RAF C-17A Globemaster III transport aircraft also supported the detachment carrying essential engineering equipment.

Hurricane's Down Under Debut

Hawker Hurricane XII 5481 (VH-JFW) performed its first post-restoration flight on October 2 from Scone in New South Wales, Australia. The flight is believed to be the first time a Hurricane has taken to the skies in Australia since 1944.

Built in Canada in 1942, the aircraft was struck off charge in 1944 and purchased by Jack Arnold. It remained on his farm in Ontario until 1984 when it was recovered and shipped to the UK by Charles Church. The rebuilt aircraft flew as G-ORGI in 1991 but was later sold to David Price in California. In 2004 it was sold to Ed Russell in Canada but in 2013 it was shipped to Australia where it has been meticulously restored by Pay's Air Service.

Ross Pay flying Hawker Hurricane XII 'V6748' on October 2 in Australia. Mark Jessop

Ross Pay was at the controls for the 20-minute debut flight and the aircraft's new owners were present at Scone to witness the maiden flight.

The aircraft has now been repainted to represent V6748, the Hurricane IIB flown by Australian P/O John Crossman during the Battle of Britain while serving with 47 Sqn at Stapleford Tawney, Essex. Crossman claimed a 'probable' Dornier Do 17 on September 15, 1940 but was killed in action just 15 days later.

Bf 109F Arrives at Pima

Messerschmitt Bf 109F-4 WkNr 13045 has recently arrived at the Pima Air & Space Museum in Tucson, Arizona, for restoration to static display standard.

The aircraft is believed to have been built at the Wiener-Neustädter Flugzeugwerke factory in Austria in late 1941 or early 1942 before it was assigned to Jagdgeschwader (JG) 5 at Petsamo, Finland. The aircraft crashed due to engine failure on October 22, 1942, while being flown by Lt Theodor Weissenberger, already a 33-victories ace. Weissenberger ended the war flying Me 262 jets as the commander of JG 7, with a total of 208 victories.

The wreckage was recovered in the 1990s and had passed through several hands before Pima acquired the partially restored aircraft this summer. The museum plans to restore it to the way it looked on the day of its last flight.

German Special Scheme Transall Preserved

Specially marked C-160D Transall 50+95 shortly after shutting down at Eindhoven. Remco Stalenhoef

A number of Transporter Allianz C-160D Transall aircraft have been decommissioned with the introduction of the Airbus A400M into the German Air Force (GAF).

One of these airframes (50+95) was recently donated to the European Air Transport Command (EATC) and delivered to Eindhoven AB in the Netherlands. Once it has been stripped of useful parts, the aircraft will take up position outside the EATC headquarters building.

The aircraft is painted in a special colour scheme in honour of both the 60th anniversary of the GAF and the 55th anniversary of its last user, Lufttransportgeschwader 63 (LTG 63, Air Transport Wing 63) based at Hohn AB in Northern Germany. Col Hartmut Zitzewitz, commander of LTG 63, flew the aircraft on its last flight on September 12, during which 50+95 accumulated its 13,095 and final flying hour. **Remco Stalenhoef**

Rimowa Junkers Takes Flight

The Swiss luggage manufacturer Rimowa has successfully flown its replica of the pre-war Junkers F13 light airliner.

The new aircraft, registered HB-RIM and named *Annelise 2*, flew from Dübendorf, Switzerland on September 15 and is a replica of the world's first all-metal commercial aircraft.

The first flight was performed by test pilot Oliver Bachmann along with Rimowa's President and CEO, Dieter Morszeck and was the culmination of more than five years' research and planning and two years' manufacture.

Rimowa's replica Junkers F13 during its maiden flight. Test pilot Oliver Bachmann was at the controls and he was joined by Rimowa's President and CEO Dieter Morszeck. Rimowa

The replica is powered by a 450hp Pratt & Whitney Wasp Junior R985 nine-cylinder radial engine and has a luxurious leather-trimmed interior but departs somewhat from the original by using modern instrumentation.

Rimowa anticipates the aircraft will receive European Aviation Safety Agency (EASA) approval by the end of 2016 and the company plans to build new examples for private owners. **Rod Simpson**

Bizjet Swapped for Curries

In a highly unusual business deal a West Yorkshire chef has acquired the fuselage of a dismantled BAe 125-800, last registered G-JJSI, in exchange for 500 takeaway curries and 1,000 poppadoms.

Shajahan Chowdhury of Keighley now plans to furnish the 49ft shell, which arrived at Bruntingthorpe by lorry in mid-October, in the style of an executive jet to form the basis of a new restaurant. "It will seat ten people comfortably for a totally unique dining experience," he told the *Daily Mail*.

The deal between Chowdhury and Gary Spoors, Managing Director of aviation salvage company GJD Services, was brokered by mutual friend Mustafa Azim who helped locate the aircraft. Azim told the *Daily Mail* the aircraft had been involved in an incident at Biggin Hill. "The landing gear didn't work but no one was injured," he said.

The aircraft was dismantled by GJD at Kidlington in March and the fuselage transported to its premises at Bruntingthorpe airfield, Leicestershire. "It was really too nice to cut up, so I'm glad to have found a good home for it," Spoors told *Aviation News*." He added: "Yes, we do like curry here."

Some of the meals, which would have cost around £3,700 to buy, have already been delivered. The remainder, Spoors said, are expected to arrive "bit by bit". **Bruce Hales-Dutton**

YF-117A Restoration at Edwards AFB

The YF-117A was a full-scale development prototype and was added to the Air Force Flight Test Museum collection in 2008 after being withdrawn from service and stripped of usable parts. Tony Sacketos

Personnel at Edwards AFB in California are restoring and repainting Lockheed Martin YF-117A Nighthawk 79-10783.

The airframe, one of the few early 'stealth fighters' preserved for display, will eventually be displayed in the Air Force Flight Test Museum's new building outside the base's west gate.

Also now at Edwards after being displayed in Rantoul, Illinois, for many years is Boeing XB-47 Stratojet 46-066. It was disassembled, transported and is currently being put back together at its new home, thanks to a grant from Boeing and the support of sponsors.

Vulcan '603 Refurbished at Woodford

All 136 Avro Vulcans were built at Woodford, Cheshire, so it was fitting that XM603 returned to her place of 'birth' in March 1982 and has been a major attraction at the site ever since.

However, many years of exposure have taken an inevitable toll on the airframe and it is now being repainted and refurbished by the recently created Avro Heritage Museum. The organisation is undertaking the task after sponsor Leon Howard of Warmco Properties funded the scaffolding and tenting needed to enable the work to go ahead. The Vulcan B.2 was due to be ready for unveiling during November.

The museum opened at Woodford in November 2015, and received more than 8,000 visitors in its first eight months. Its aim is to preserve and protect the heritage of Avro aircraft and record its history from 1907 to 2011. The group recently took delivery of the forward sections of Vickers VC10 C1K XV106 and Hawker Siddeley Nimrod MR2 XV235; the former from Bruntingthorpe, Leicestershire, and the latter from Scampton, Lincolnshire.

Canadore College Receives Boeing 727

A former KF Aerospace Boeing 727-200F has been repainted by students at Canadore College in North Bay, Ontario. Andrew H Cline

Canadian KF Aerospace has donated several retired Boeing 727 freighters to four college-level aircraft maintenance training programmes over the past few years.

The latest aircraft was delivered to Canadore College at Jack Garland Airport in North Bay, Ontario. Students painted the 727 with a red tail, large Canadore titles on the fuselage, and the college's panther mascot on the tail prior to its official acceptance on October 7.

The Boeing 727-200 (C-GJKF) carried KF Aerospace fleet number 722 and was retired in 2015. It had carried freight across Canada for 17 years, accumulating more than 11,000 flight hours.

The aircraft will now be used as a hands-on training aid for students and serves alongside the college's other training aids, which include various general aviation aircraft and helicopters. Canadore has incorporated an aviation programme for 43 years, specialising in rotary-wing pilot training, avionics, and aircraft maintenance. **Andrew H Cline**

Turbo Mentors to Fly Again

A pair of former Gabon Presidential Guard Beech T-34C-1 Turbo Mentors are being restored to flying condition by Weaver Aircraft in Carson City, Nevada.

The first aircraft (ex-TR-KFT/GM-86) has been partially repainted in a US Navy (USN) scheme, while an overhauled Pratt & Whitney PT-6A-25 powerplant and propeller are waiting to be fitted. Unusually, while both sides of the aircraft are painted in dark blue, the port side will feature USMC decals, and the starboard side will feature USN livery. The aircraft will be finished with shark mouth markings on the nose, and will include an under-fuselage gun pod along with under-wing rocket packs. It is likely to fly next March and is now for sale.

The second aircraft (ex-TR-KFU/GM-87) is being completely rebuilt for its owner and will have new hydraulics, pitot-static system, electrical wiring, as well as all-new bearings, bushes and nuts and bolts. It too will feature the gun pod and rocket packs, as well as an overhauled PT-6-25A. **With thanks to Keith Wilson**

Swedish Texan Goes Dutch

Wings Over Holland at Lelystad in the Netherlands has acquired North American AT-6A Texan SE-CHP and registered it as PH-TXN for operations in the country.

Formerly based at Västerås, Sweden, the aircraft was built in 1941 and served with the Swedish Air Force between 1953 and 1957. A year later it entered civilian hands, flying with Svensk Flygtjänst AB, which used it to train radio operators for national airline SAS, among other tasks. In 1971, Björn O Löwgren acquired the aircraft and continued to operate it until his death in 2011.

'Fab Four' Caravelle Cockpit Restored

The nose section and cockpit of former Air France Sud Aviation Caravelle III F-BHRU *Poitou* has been refurbished by Nils Alegren in Munich, Germany.

Over the past four years Nils has completely restored the section and converted it into a fully functional Caravelle simulator with state-of-the-art visuals and technology. Remarkably, during the restoration, Nils found a boarding pass used by pop legend John Lennon. Following some research, he also discovered a photograph showing all four members of The Beatles climbing on board *Poitou*.

SR-71A Move

Lockheed SR-71A Blackbird 61-7968 is to be moved to the Science Museum of Virginia in the US, after the closure of its current home, Virginia Aviation Museum. The aircraft will be taken apart and moved by Worldwide Aircraft, the organisation responsible for transporting it from California to Virginia in 1999.

Recce Canberra Refurbished at former RAFG Base

Canberra PR.7 WH773 in its new paint scheme at the former RAF Laarbruch. via Rod Hawkins

English Electric Canberra PR.7 WH773 has moved from the Gatwick Aviation Museum, Sussex, to the RAF Laarbruch Museum at Weeze, Germany and has been repainted in the 31 Sqn colours it wore when originally stationed at the base during its RAF service.

The museum is looking for a set of inner undercarriage doors and the clear plastic covering for the port navigation light to complete the restoration.

BOEING C-17
MASTER OF THE GLOBE

Tom Kaminski examines the Boeing C-17A Globemaster III, which has proved to be a very capable airlifter.

The C-17 can perform strategic and tactical missions and is in service with eight countries as well as NATO. While the military airlifter has built up a good reputation in service, its development was not so straightforward. Work on the aircraft formally began in October 1980, when a request for proposals (RFP) for the C-X Airlift System (Cargo-Experimental) programme was released. Requirements included the ability to deliver large payloads and outsized equipment weighing up to 130,000lb (58,967kg) over intercontinental distances to main and small austere airfields as short as 3,000ft (914m).

Proposals were received from Boeing, Lockheed and McDonnell Douglas, which was named the winner of the C-X competition on August 28, 1981. The airlifter was designated the C-17A on September 8.

McDonnell Douglas did not immediately receive a contract because the Department of Defense (DoD) began looking at near-term solutions to augment its capabilities due to a perceived urgent airlift capacity shortfall. Development and production of the C-17A was originally deferred pending the purchase of interim airlifters. In January 1982, approval came to procure 50 Lockheed C-5B Galaxies and 44 McDonnell Douglas KC-10 Extenders (16 more KC-10s were added later), with a $31.6m C-17A research and development contract following on July 23, 1982.

A later review – which considered a service life extension for the Lockheed C-141 Starlifter as well as buying more C-5s and a modified commercial aircraft – determined the C-17A was the best choice to meet the need for the additional strategic airlift, and so the US Air Force moved forward with plans for 210 airframes.

Additional funding came in 1983 and 1984 but development progressed slowly. On December 31, 1985, McDonnell Douglas received a $3.4bn Full Scale Engineering Development (FSED) contract to fund a flying prototype and two structural test airframes.

With its first flight scheduled for February 1990, construction of C-17 prototype T-1 began at the company's Long Beach, California, plant in November 1987, an order for two Lot 1 production aircraft following two months later. The four-engined jet was formally named the Globemaster III on February 5, 1993.

But design changes, production delays and inefficiencies, labour issues and problems with the aircraft's electronic flight control system all caused its initial operational capability (IOC)

date to slip from January 1992 to May 1994.

Planned procurement dropped from 210 to 120 after the release of the DoD's Major Aircraft Review in early 1990. Driven by a reduction in airlift requirements following the end of the Cold War, the move increased costs and the IOC slipped to July 1994.

Budget cuts in 1991 brought more delays, postponing the C-17's first flight to June that year and IOC to January 1995.

FIRST FLIGHT

Aircraft T-1 finally rolled out at Long Beach on December 21, 1990 and flew for the first time on September 15, 1991.

The first production aircraft, P-1, took its maiden flight on May 18, 1992 and a Development Test and Evaluation/Initial Operational Test and Evaluation (DT&E/IOT&E) programme, involving six aircraft, began at Edwards AFB, California, on June 3.

Developmental testing finished in December 1994 – and IOT&E and Follow-on Test and Evaluation (FOT&E) in June 1995 and October 1998 respectively – but the programme continued to be dogged by delays, design issues, test failures and cost increases.

In December 1993, the Pentagon had capped production at 40 aircraft and placed the programme on probation. It was reorganised and, with restructured management and manufacturing process changes introduced, from June 1994 all aircraft were delivered on time. Meanwhile C-17As already in service were performing beyond expectations.

In August 1995, the 17th Airlift Squadron successfully completed a 30-day reliability and maintainability demonstration to assess the C-17A's mission capabilities, including aerial refuelling, equipment and personnel airdrops, formation flying, low-level operations and use of small, austere airfields.

The project was then permitted to move forward with Multi-Year Procurement (MYP), the USAF awarding a $14.2bn multi-year contract for 80 aircraft plus 350 Pratt & Whitney F117-PW-100 engines in May 1996.

The C-17's turnaround was recognised when the programme won the Collier Trophy for 1994. Awarded in May 1995, it honoured the aeronautical achievements during the type's development, and the aircraft itself as the most versatile airlifter in history.

In 1997 McDonnell Douglas was bought out by Boeing, and two years later the C-17 won the nation's top award for quality management with the presentation of the Malcolm Baldrige National Quality Award to Boeing Airlift and Tanker Programs.

Another Mobility Requirements Study, completed in December 2000, determined that the USAF should buy 180 C-17s to meet an increased airlift requirement, and Boeing subsequently received a second multi-year award for 60 in August 2002.

Ultimately the operational fleet size was increased to 222, and the last aircraft for the USAF were ordered in Fiscal Year 2010. One aircraft was lost in a crash but replaced, and a prototype (which never entered operational service) brought total USAF examples built to 224.

As early as August 2006, Boeing had threatened to shut down the C-17A line, but production continued following orders for the USAF and foreign customers.

In July 2013, with no additional orders, Boeing announced it would build up to 13 so-called 'white tails' – using company funds – while it continued to pursue foreign customers.

Two months later it announced it would end production and close the C-17A final assembly facility by the end of 2015. It later reduced production to just ten aircraft and advanced the timetable for completion to mid-2015.

Final assembly of the last of 279 C-17As began in Long Beach in February 2015. When it left Long Beach in November last year, Boeing had sold nine 'white tails'. One entered storage at the company's San Antonio, Texas, facility where it remained unsold at the time of going to press.

The C-17A can carry all military equipment designated for airlift. For example, a single M1 Abrams main battle tank; or three M2/M3 Bradley fighting vehicles; or four Stryker armoured vehicles; or two AH-64 Apaches; or four UH-60 Black Hawks; or one Chinook helicopter.

Alternatively, it can transport up to 102 paratroopers or 134 troops – or, for aeromedical missions, six stretchered and 54 ambulatory patients and medical attendants.

The C-17's aerial delivery system can air-drop a single item of up to 60,000lb (27,215kg) or sequential loads up to a total of 110,000lb (49,895kg). It can also deliver equipment via low-altitude parachute extraction system drops, although this ▶

The USAF's fleet of 222 C-17As is operated by active duty, Air Force Reserve Command and Air National Guard squadrons. This aircraft is assigned to the 437th Airlift Wing.
AirTeamImages.com/Danish Aviation Photo

capability is seldom used, and can uplift a total payload of 170,900lb (77,520kg).

Although it can be refuelled in flight, Extended Range Fuel Containment System (ERFCS)-equipped models can fly 2,420nm (4,481km) with a 160,000lb (72,575kg) payload and land in 3,000ft (914m) or less on small unpaved or paved airfields.

OPERATORS

Boeing delivered the 223rd C-17A to the USAF in September 2013, and the type is currently operated by nine operational USAF, six Air National Guard (ANG) and ten Air Force Reserve Command (AFRC) squadrons.

Two ANG and nine AFRC associate squadrons share the responsibility for operating and maintaining C-17As assigned to co-located active duty units. The aircraft are also assigned to a flight test squadron, a weapons squadron and an active duty training squadron plus an associated AFRC squadron.

Above left: **The C-17A was built at Long Beach in California.** Boeing

The 437th Airlift Wing's (AW's) 17th Airlift Squadron (17 AS) at Charleston AFB, South Carolina, received the first operational Globemaster III – serial 89-1192 – on June 14, 1993. It achieved IOC on January 17, 1995.

The 97th Air Mobility Wing's 58th AS, which serves as the Formal Training Unit (FTU) for the C-17A, took on its first aircraft at Altus AFB, Oklahoma in March 1996.

Conversion of a second operational wing began when the 62nd AW at McChord AFB, Washington state, received its first C-17A in July 1999. The inaugural C-17A flight to Antarctica's McMurdo Station, performed by the 62nd AW, in support of Operation Deep Freeze took place on October 15, 1999.

The reserve component accepted its first C-17A in December 2003, operating with the Mississippi ANG's 172nd AW in Jackson. While AFRC units shared the responsibility for C-17As with the two active duty wings, no aircraft were directly assigned until August 2005, when the 452nd AMW at March Air Reserve Base, California, took on its first aircraft.

Left: **Four C-17As on the ramp at Stewart Air National Guard Base, New York State. Eight Globemaster IIIs are assigned to the 105th Airlift Wing's 137th Airlift Squadron. The New York wing was the second of five Air National Guard units to receive the C-17A.** Tom Kaminski

Below: **The Kuwait Air Force flies two C-17As, which are operated by 41 Transport Squadron.** AirTeamImages.com/Jan Severijns

Above left: **Test aircraft T-1 performed the first flight by the type on September 15, 1991.** Boeing

Above: **An M1 Abrams tank, weighing 130,000lb, rolls down the ramp of a C-17A.** Boeing

Deliveries to the 305th AMW at McGuire AFB, New Jersey, the 60th AMW at Travis AFB, California, and the 436th AW at Dover AFB, Delaware, followed in September 2004, August 2006 and June 2007 respectively, sharing responsibility for the aircraft with AFRC squadrons at each location.

The Pacific Air Forces accepted its first C-17As in February 2006 with deliveries to the 15th AW at Hickam AFB, Hawaii. The 3rd Wing at Elmendorf AFB, Alaska, followed in June 2007, and ANG associate units share responsibilities with both wings.

Since 2011, the AFRC's 445th AW at Wright-Patterson AFB, and the ANG's 105th AW, 164th AW and 167th AW in New York, Tennessee and West Virginia respectively, have transitioned from the C-5A to the C-17A.

During Fiscal Years 2015 and 2016, 16 C-17As transferred to Backup-Aircraft Inventory (where aircraft are available, but without funds for maintenance personnel); and the 17th AS at Joint Base Charleston plus the 10th AS at Joint Base Lewis-McChord were inactivated in June 2015 and May 2016. The availability of these aircraft will enable C-130Hs operated by another ANG and AFRC unit to be replaced in the near future.

The Royal Air Force became the initial international operator of the C-17A when the first of four leased aircraft arrived on May 17, 2001 for 99 Squadron, which flew its operational debut from RAF Brize Norton, Oxfordshire, in early June. The aircraft achieved its fleet in-service date on September 30, 2001.

The Ministry of Defence bought the aircraft when their leases expired in mid-2008 – plus a fifth C-17, delivered in February 2008. Three more were delivered in June 2008, November 2010 and May 2012. ▶

Right: **A NATO C-17A rolls down the runway during departure from RAF Leeming. Three Globemaster IIIs are operated by the Heavy Airlift Wing's Heavy Airlift Squadron headquartered at Pápa Air Base, Hungary.** AirTeamImages.com/Chris Procter

Below: **A Royal Canadian Air Force CC-177 operated by 429 Transport Squadron landing on a gravel runway at Resolute Bay Airport in Canada's northern Nunavut territory, demonstrates the type's rough field capability.** Canadian Forces Combat Camera/ Sgt Norm McLean

The flight deck of an RAF C-17A. The Globemaster III's advanced glass cockpit features four multi-function colour displays, dual head-up displays and fighter-type control sticks. AirTeamImages.com/Simone Ciaralli

Australia's Department of Defence bought four C-17As for the Royal Australian Air Force in July 2006, the first arriving at RAAF Base Amberley, near Brisbane, in December that year. Three more were accepted in May and December 2007 and January 2008. The C-17As achieved IOC with 36 Sqn on September 11, 2007.

Increased demand for humanitarian and disaster relief missions led to the purchase of another pair of C-17As, delivered in September 2011 and November 2012. Australia then acquired two 'white tails' from Boeing, which arrived at Amberley in July and November 2015.

Canada announced its purchase of four C-17As via direct commercial sale in 2006, the first aircraft arriving for 8 Wing at CFB Trenton, Ontario in August 2007.

Known as the CC-177 in Canadian service, the airlifters are operated by 429 Transport Squadron. The unit flew its first operational mission on August 23, 2007, delivering humanitarian relief supplies to Jamaica after a hurricane hit the Caribbean.

The three other CC-177s arrived in Canada in October 2007 and March and April 2008. The RCAF later acquired a fifth, which was delivered to Trenton in March 2015.

Three C-17As, including one supplied by the United States, have been supplied to ten NATO countries and Partnership for Peace (PfP) nations under the multinational Strategic Airlift Capability (SAC) initiative.

Left: **No 86 Wing of the Royal Australian Air Force is responsible for a fleet of eight C-17As based at RAAF Base Amberley in Queensland.** Commonwealth of Australia/Cpl Peter Borys

Below: **One of eight C-17As owned by the United Arab Emirates that reside at Al Minhad Air Base.** AirTeamImages.com/ Philippe Noret

Boeing delivered the first C-17A to the NATO Heavy Airlift Wing at Pápa Air Base, Hungary, in July 2009. The wing flew its first mission with a cargo delivery cargo to Mazar-e Sharif, Afghanistan, in support of the International Security Assistance Force (ISAF) in September that year.

The second and third C-17As were delivered in September and October 2009 and the SAC achieved full operational capability (FOC) in November 2012.

The fleet clocked up its 20,000th flight hour on August 10, 2016 and, over seven years, the wing has flown 5,600-plus sorties in more than 1,600 missions and transported some 90,500 passengers and 59,400 tons of cargo.

Qatar became the first Middle East customer to buy the C-17A – in July 2008 – taking delivery of the first of four in August 2009 and the last in December 2012.

It later doubled its Globemaster III fleet with four 'white tails' from Boeing. Delivered between February and May 2016 they joined the original quartet at Al Udeid Air Base, home to the Qatar Emiri Air Force's Transport Squadron.

The United Arab Emirates purchased six C-17As in January 2010, receiving its first in May 2011 and the last, at Al Minhad Air Base, in June 2012. Plans to buy two 'white tails' from Boeing were announced in February 2015, the first of which arrived at the UAE Air Force's Heavy Transport Squadron five months later.

Meanwhile Kuwait's 41st Transport Squadron took on two C-17As in February and September 2014. Both operate from facilities at Kuwait International Airport.

India became the largest international C-17A operator when it purchased ten, the first being delivered in June 2013. They are flown by 28 Wing's 81 Sqn, the first having arrived at Hindan Air Force Station on December 11, 2014.

OPERATIONS

Globemaster IIIs were first involved in a major military operation when they supported NATO peacekeeping force deployments to Bosnia as part of Operation Joint Endeavour.

A C-17A's cabin can carry 102 paratroopers using 54 permanently installed sidewall seats and additional seating in the centre. Boeing

During the initial three months of operation (December 1995 and February 1996), C-17As were tasked with around 26% of the missions and were responsible for moving 44% of the cargo and 30% of the passengers that were delivered to Tuzla. This equates to 19,892 tons of cargo and 5,574 passengers transported.

The C-17A's first missions supporting combat operations were in support of Operation Allied Force when US Army AH-64 helicopters were delivered to Rinas Air Base, Tirana, Albania, in April 1999.

Globemaster IIIs carried out the first sorties in support of operations in Afghanistan in 2001, delivering equipment and personnel to the Camp Rhino Landing Zone (LZ) in Kandahar on November 28, 2001. The missions marked the C-17A's first use of NVGs during combat operations. ▶

The Indian Air Force acquired ten C-17As and is the biggest international operator of the type. AirTeamImages.com/Vedant Agarwal

Below: **A C-17A wearing the standard scheme worn by the type in Qatar Emiri Air Force service.** AirTeamImages.com/ Jan Severijns

The aircraft's first combat personnel, and low-altitude, airdrops were conducted over a five-night period when 2,015 paratroops and 3,000 tons of cargo and equipment from the US Army's 173rd Airborne Brigade were delivered to Bashur Airfield in northern Iraq in March 2003 during Gulf War 2.

Combat operations have not been without incident, and one C-17A was struck by a surface-to-air missile (SAM) shortly after it departed from Baghdad International Airport, Iraq – an incident partially responsible for the USAF's urgent requirement to install the AN/AAQ-24 Large Aircraft Infrared Countermeasures (LAIRCM) system on the airlifter.

The aircraft was repaired and returned to service. Meanwhile at least four Globemaster IIIs were damaged in mishaps while landing at austere sites in Afghanistan; and one C-17A was written off in a crash at Elmendorf AFB, Alaska, in July 2010.

The worldwide C-17 fleet reached 3 million flight hours on May 5, 2015.

BLOCK CHANGES AND UPDATES

The C-17A was continuously modified during production, with most changes incorporated via block upgrades. A digital 'glass' cockpit featuring four colour, active matrix, liquid crystal multi-functional displays replaced the earlier colour cathode ray tube displays, beginning with aircraft P-71 – it was also the first equipped with an ERFCS that enables the C-17A to carry an additional 9,600 gal (36,340 lit) of fuel and increases range by 1,400nm (2,593km) when carrying a 40,000lb (18,144 kg) load or 600nm (1,111km) when hauling 90,000lb (40,823kg).

Aircraft P-98 meanwhile was the first to receive the Mobility 2000 Aircraft Communications Addressing and Reporting System (ACARS) compatibility for data link communications.

The AN/APS-150 (Honeywell RDR-4000M) terrain mapping weather radar was first fitted to aircraft P-121, replacing the Honeywell AN/APS-133 system. It was also the first to be equipped with the Secure En Route Communications Package-Improved and communication open systems architecture (COSA).

Globemaster III MAB wears the colours of Qatar Airways but is assigned to the Qatar Emiri Air Force's Transport Squadron. AirTeamImages.com/Simon Wilson

The Honeywell Formation Flight System (FFS), which facilitates up to 53 aircraft to deliver their cargo over a drop zone within 30 minutes, was first installed in aircraft P-153, replacing the earlier AN/APN-243 station keeping equipment.

NVG-compatible internal and external lighting, a high-frequency data link (HFDL) and the Global Air Traffic Management/ Required Navigational Performance-Improved (GATM/RNP-I) – for operation on preferred routes in controlled airspace where extremely accurate navigation is required – were also introduced on P-153. An updated FFS was later installed, beginning with aircraft P-212. Defensive systems have been upgraded through the installation of the LAIRCM system, which was first installed on Special Operations Low Level II (SOLL II) C-17As.

The final 80 airframes were delivered in the Block 18 configuration, which featured a replacement core integrated processor to replace the earlier mission computer/core integrated processor; a redesigned video processor; and a GPS inertial reference unit.

Additionally, the Flying Areas Local Area Network has been incorporated, enabling embarked army personnel to conduct en route mission planning and information-sharing between aircraft during formation flight. The block also included flight control system and software improvements.

Many of the features introduced on the production line have been incorporated into the earlier aircraft through field and depot modifications. Much of this work has been carried out as part of the C-17 Globemaster III Sustainment Partnership.

Beginning in March 2005 the ERFCS was retrofitted into aircraft P-1 to P-70. Under the terms of a ten-year Globemaster III Integrated Sustainment Program contract issued in 2012, Boeing is responsible for life-cycle support and depot maintenance for the C-17 fleet.

Additional retrofit work is undertaken via the Global Reach Improvement Program, which upgrades early production aircraft, incorporates improvements and standardises the configuration of the entire fleet.

These projects are providing C-17s built prior to aircraft P153 with systems introduced on the production line in Blocks 14 to 18. The various retrofits are being carried out by the Warner Robins Air Logistics Complex at Robins AFB, Georgia, and Boeing Support Systems at its San Antonio, Texas facility.

The C-17A's versatility in strategic as well as intra-theatre missions has allowed the USAF to reduce the size of its Galaxy and Hercules fleets. Although the Globemaster III had a lengthy and sometimes contentious development period, it has proved to be one of the most capable airlift aircraft in history. AN

Royal Air Force C-17A serial ZZ175 on approach to Gibraltar International Airport. The RAF's fleet is operated by 99 Squadron. William Jardim

F-104 STARFIGHTER

The **Aeroplane ICONS** series celebrates the history of aviation. Exploring and illustrating the history of iconic aircraft from around the world. Highlighting some of the great aircraft, this series is the perfect read for aviation enthusiasts looking to explore the in-depth history behind these iconic aeroplanes.

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DESTINATION MUNICH

With its own brewery and surfing in a land-locked plaza, Munich Airport dares to be different – as **James Ronayne** discovered.

You don't have to spend long in the terminals at Munich Airport (IATA: MUC) to see why it is regularly ranked among the top airports in the world. It is the lone European facility to have been awarded a five-star airport rating by respected air travel review website *Skytrax*, and one of just five in the world to have collected the accolade. Only Singapore Changi Airport and Seoul's Incheon International Airport finished above Munich in *Skytrax*'s Top 10 Airports of 2016. What is particularly pleasing for the Bavarian gateway is these awards are based on passenger experiences, collated by *Skytrax* in its annual Customer Satisfaction Survey.

THE GREAT DEBATE

Far from resting on its laurels, focus is now on improving the facility and enabling it to handle more movements and passengers. MUC is currently battling to build a third runway. The project has gone through all the legal processes and been approved but requires the green light from local politicians.

"The challenge is to communicate well and convince the normal citizen to support the project," Dr Michael Kerkloh, Munich Airport CEO, told *Aviation News*.

"We went through all the public hearings; the approved process plus all the legal battles up to the highest court in Germany. So this has been done formally, we have the approval, we have the planning approval and we also have the money to build the runway. The only thing we lack is the political decision."

Dr Kerkloh said the issue is highly controversial, but if a decision is not made soon slot constraints will hinder the airport's growth.

"From 2018 we will have slot restrictions so we really have to go for it," he stressed. "Runways are like stations or refineries or atomic plants; they are controversial; [however] it is fundamental for economic and job growth, for structural growth. It is going to be the last runway built in Germany I'm pretty sure. There is no other space

Qatar Airways Airbus A350-941 A7-ALB taxies out for the return flight to Doha.
Key-James Ronayne

in Germany and there is no project where we see that it could be realised. The only airport that would have some spare capacity as far as the land is concerned is Berlin. If they were to build in Berlin, it would have an effect that is ten times higher on the neighbourhood than our airport has – the impact is very low here."

To promote the need for a third runway, the airport has set up a website – www.gutfuerbayern.de – where local business leaders, airport staff and passengers can leave testimonials giving their backing.

"The [project's] supporters, they are the majority, they don't speak," explained Dr Kerkloh. "We have 20% who are against the project but they feel like the majority.

"We've asked companies to support us and now we have around 200 that have made testimonials and are actively supporting the project. We needed [local] industry, and that is supporting us now, to convince politicians that it is a good thing for people," added Dr Kerkloh. "Runways are good things for people because they define the future. People who don't fly frequently don't see that runways are a part of their everyday life."

The Munich Airport CEO was clear that traffic will head to the Middle East if the project is shelved.

Munich Airport CEO Dr Michael Kerkloh.
Munich Airport

Lufthansa is the largest carrier at Munich, where it operates from Terminal 2 alongside its Star Alliance partners.
Key-James Ronayne

"What we could grow as a transport market will then go to the Gulf or to Turkey," he warned. "We are one of the very, very few hubs in Europe and we are the only hub in Germany which has this spare capacity as far as land is concerned and, in the end, a relatively low impact on the environment. We're doing everything we can to become a sustainable airport; we strive to be very green. If you accept that mobility will grow, then why not do it at an airport and in a country where they know how to make it as green as possible? That is the case here."

Should Munich construct a third runway, it will be the latest piece of infrastructure in an already impressive facility.

PASSENGER EXPERIENCE

Terminal 2 is the jewel in the crown, and is home to Lufthansa and the Star Alliance carriers. In April, a new satellite pier was opened increasing capacity as well as reducing the need to bus passengers to remote stands. Terminal 2 is where Munich Airport's innovative and customer-focussed attitude really stands out.

Passengers with a long layover between connections can get some shut-eye, thanks to the airport's Napcabs. These can be found in three separate places in T2, in close proximity to the gate area. The pods feature a bed, an iPhone or MP3 connection and a USB port, making them ideal for relaxation or work. ▶

An aerial view of the central passenger area at Munich. Terminal 2 is at the top with Terminal 1 at the bottom and the Munich Airport Center and control tower in between. Munich Airport

Between 0600hrs and 2200hrs the cost to use a Napcab is €15 per hour, reducing to €10 per hour overnight, with a minimum charge of €30.

For those looking to unwind during a short connection, the airport has several 'Recreation Zones' throughout the terminal. These are divided into relaxation and working zones, are free to use and open to all passengers. The relaxation area is furnished with comfortable seats and couches, special lighting and plants, and monitors displaying the latest flight information. The working zones have desks, chairs, free internet points and power outlets.

Lufthansa also has its own Senator and Business lounges in Terminal 2 for its premium passengers.

Terminal 1 handles the non-Star Alliance traffic, plus Turkish Airlines, and is slightly dated in comparison. However, it provides a quick and efficient transit enabling passengers to continue their journey with minimum fuss.

Movements at Munich Airport are handled via two parallel runways, each 13,100ft (4,000m) long and 197ft (60m) wide.

MUNICH AIRPORT CENTER

The airport also has a quirky side to it. How many airports have their own brewery? Munich does. Airbräu (airbrew) was opened in 1999 and has three regular types of beer and various seasonal ones which are all brewed on site. What's more a pint costs just €2.75. In the main restaurant, guests can sit among the brew kettles and watch the airport's master brewer Rene Jacobsen at work, while enjoying the traditional Bavarian cuisine on offer.

Airbräu is situated in the Munich Airport Center (MAC), a multi-function area, situated landside between the two terminals. It is also home to the airport's railway station, car hire centre and a wide range of shops and food outlets. Outside is a large covered plaza where special events are held throughout the year – these include the European Championship in Stationary Wave Riding. During international football tournaments, large screens are erected and locals are invited to watch the games together.

Germany still operates strict trading laws on a Sunday and supermarkets are shut. An exemption to this is where shops are co-located with a transport hub so the Munich Airport Center is an ideal shopping destination for residents.

The airport actively promotes this aspect of its business and is keen to engage with its neighbours – wanting people to use the facility even if they are not catching a flight.

The airport also has an array of spotting areas for aviation enthusiasts and families to watch the action. An enclosed terrace in Terminal 2 provides a view over the ramp and Satellite terminal, and is free to use. Alternatively, there is the Visitors' Hill which gives superb views over both runways and Terminal 1, and costs just €1 to use. At the foot of the hill is a Visitors' Centre with interactive displays, a children's playground and some preserved aircraft.

"We also have the Visitors' Hill on the other side so we have different possibilities to look at the airport operations," added Dr Kerkloh. "What I would like is that those aficionados support us when we build our third runway; that they speak out and not only take photos."

Lufthansa uses Airbus A340-600s and A330s on its long-haul routes from Munich. During the winter schedule 2016/2017, the carrier's initial A350 XWBs should be delivered to the Bavarian gateway. Key-James Ronayne

Above left: **Terminal 1 hosts the non-Star Alliance carriers, including Emirates, Qatar Airways and easyJet.** Munich Airport

Above right: **Passengers can work or relax in between flights at the airport's recreation zones.** Munich Airport

Left: **Visitors can talk to an information service representative at the InfoGate via a real-time video link on life-sized screens.** Munich Airport/Stephan Goerlich

Right: **Travellers with an extended layover in Terminal 2 can take advantage of the airport's Napcabs, which feature a bed and electrical charging points.** Munich Airport

The airport has its own brewery, Airbräu, complete with outdoor beer garden. Munich Airport

The Munich Airport Center hosts a number of unusual events throughout the year, including the European Stationary Wave Riding Championships. Munich Airport/Flo Hagena

AIRLINES

Lufthansa is the dominant carrier at Munich, with both short- and long-haul services to destinations around the globe. It operates from Terminal 2 and the newly built T2 Satellite alongside its Star Alliance partners. Lufthansa has a large fleet of Airbus A330 and A340-600s based at Munich for long-haul services, along with A320 Family jets, Bombardier CRJ900s and Embraer 190/195s for regional and domestic operations. During the winter schedule 2016/2017 the carrier's first Airbus A350 XWBs will arrive at Munich, where they will be put into service on flights to New Delhi, India, and Boston in the US.

Seeing an opportunity to boost Italy's connectivity, the airport has styled itself as 'Italy's Northernmost Hub'. Working with Air Dolomiti, which is part of the Lufthansa Group and serves more than ten destinations in Italy from Munich, the airport has opened up its global network to the Italian market. Part of Terminal 2 has been turned into 'little Italy', offering passengers Italian cuisine, newspapers and television while waiting to catch their flight.

Emirates, Etihad Airways and Qatar Airways have all expanded services to Munich in recent years. Emirates now connects the Bavarian airport to Dubai three times a day with all flights operated by the Airbus A380. Etihad Airways and Qatar Airways both offer twice-daily connections to Abu Dhabi and Doha respectively, the latter using its new Airbus A350 and Boeing 787-8 Dreamliners. Oman Air also serves Munich from Muscat. "There aren't that many airports in Europe that have this intense Arabic footprint," pointed out Dr Kerkloh.

Like many other airports across Europe, Munich has been affected by the downturn in Russian traffic because of strained political relations. However, this winter Ural Airlines will fly a weekly service from Ekaterinburg and Aeroflot, S7 Airlines and Ural (DME) will link Munich to Moscow.

Dr Kerkloh wants to promote Munich's hub credentials and expand other airline partnerships. The Munich CEO revealed that the proportion of connecting traffic had risen over the last 15 years and is currently between 35 and 36%.

"In Terminal 1 the connectivity is only 3 to 5%; the high connectivity is in Terminal 2 with Star Alliance. We also have for example, Delta [a SkyTeam member] flying to Munich and using the Lufthansa [of Star Alliance] network."

He also highlighted the opportunity for other airline alliances to use Munich. He pointed to the potential for oneworld carriers to use airberlin's domestic network from the Bavarian airport, much like the German carrier's airline partner, Etihad Airways, already does.

The airport's management hosts MunichExchange, a networking event that enables executives from tenant airlines to ►

explore opportunities to collaborate with one another. "We want to encourage these airlines to do more together here in Munich. We think that the overall potential of our airport has not been reached yet."

Part of the airport's appeal is its location; it acts as a gateway to the Alps and has a wonderful city on its doorstep. Dr Kerkloh said the facility also benefits from an affluent local population: "the propensity to fly is very high, the highest in Germany," he said. "It is also an attractive destination to fly into so we have a very good mix of incoming and outgoing passengers. It is about 50/50 and not many destinations can say that."

FREIGHT

Munich recorded double digit increases in cargo last year and the airport sees it as a potential area for further growth if it settles the runway debate. It is slightly hamstrung by an overnight curfew, closing to scheduled traffic between midnight and 5am, however, as its long-haul network expands there has been a rise in belly cargo transiting the facility. Dr Kerkloh said this provides Munich with "a critical mass that makes cargo-only flights more and more attractive."

Bavaria's strong automotive and aerospace industries can also benefit from strong connections at the airport. "For example, BMW and Audi, they both construct in a factory in Mexico, which has pushed the need for a passenger route to Mexico out of Munich," explained the CEO. "Investments in machinery, spare parts and other assembly line-related products may cause the need for a regular air link to Mexico."

The airport is becoming more popular with freight forwarders because of the close proximity between the aircraft and the cargo handling facilities.

Local businesses also use the airport to fly in and out in their corporate jets, although Dr Kerkloh said this can be problematic.

"Business aviation at a large commercial airport is a loss-making issue," he admitted. "When you look at the slot profitability of a business aircraft at a congested airport, which has a lack of slots, compared with a 777 or an A340 – no way! We do it because we have to do it, but it is not really a business opportunity when you look at the infrastructure that you have to build for them."

Emirates uses Airbus A380s on all three of its daily rotations from Dubai. Key-James Ronayne

BACKGROUND

The current Munich Airport is one of Europe's newest airports, built just 24 years ago. It is 18 miles (28.5km) from Munich city centre, in Erdinger Moos, and covers 1,575 hectares, two-thirds of which are green areas.

Munich Airport is owned by the Free State of Bavaria (51%), the Federal Republic of Germany (26%) and the Bavarian capital city of Munich (23%).

MAGNIFICENT MUNICH

So what does Dr Kerkloh believe makes Munich such a special airport?

"We have one major advantage, we were built as a greenfield airport," he said. "We still have growth opportunities but the concept of the airport and the design is still suitable. The airport looks very good; it's German engineering with functionality. It works very well. The interesting thing in Munich is it is not only German efficiency but also what people do not expect – German hospitality. No one expects us to smile but we can!

"We have an easy to use airport; it is, relative to other airports, fairly hassle free."

Should the third runway debate be settled in the airport's favour, that will provide a different set of challenges admitted the CEO.

"Can we become a mega airport and not feel like a mega airport?" he asked. "There is a certain hurdle...if you pass a certain number of passengers, in the end the passengers don't like it anymore because it is a big, big machine. We want to prove that even a very large airport can be a nice airport. I don't know whether we can make it, but we have that philosophy."

The Munich Airport boss says the facility's appeal as a destination in its own right also helps give it a special feel.

"We think airports can also be a destination. We really concentrate on this unique place we have. We have our central marketplace; we are the only airport that owns a brewery. We look for other elements that help make this become an attractive place to visit."

Munich Airport has the space, the desire and the money to expand. If it does prove successful in its quest to build a third runway, it can only be a good thing for travellers, who will be provided with more opportunities to use this first-class airport. AN

Munich currently has two parallel runways and is campaigning to get a third built. Key-James Ronayne

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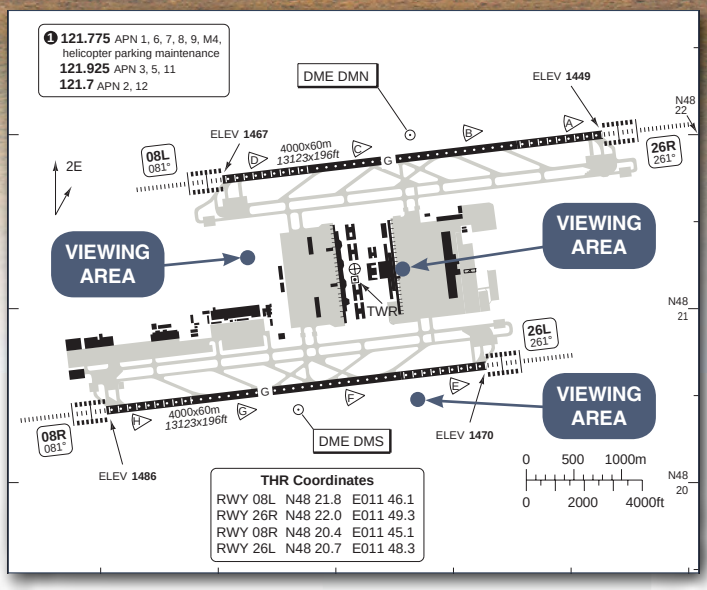
MUNICH AIRPORT

James Ronayne reports on the wonderful viewing options available at an airport that attracts a wide array of interesting traffic.

Main photo: **Lufthansa Airbus A330 D-AIKE passes the Munich Airport Center and control tower on departure from Runway 26L. This photo was taken at 135mm from the southside viewing hill.**

Munich is Germany's second busiest airport, a major Lufthansa hub and gateway to Bavaria.

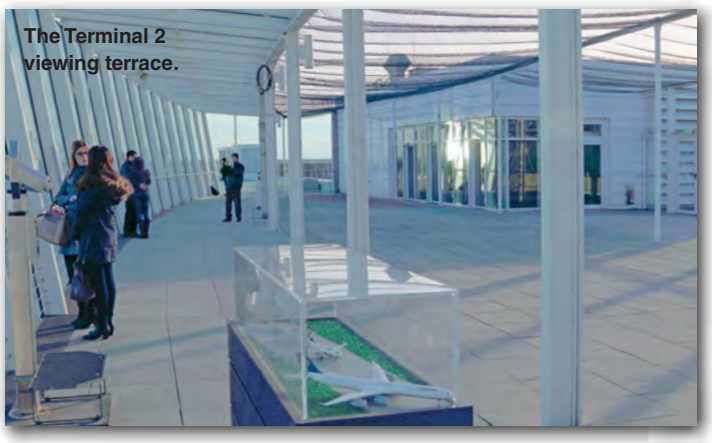
The airport is extremely welcoming to aviation enthusiasts and the local community, and has three viewing areas, the pinnacle of which is the visitors' park. Located between the two parallel runways, it features eating and drinking facilities, an information centre with a shop offering aviation souvenirs, a children's playground, a selection of preserved aircraft (Lockheed Super Constellation, Douglas DC-3, Junkers Ju 52 and a Bo105) and a viewing hill.



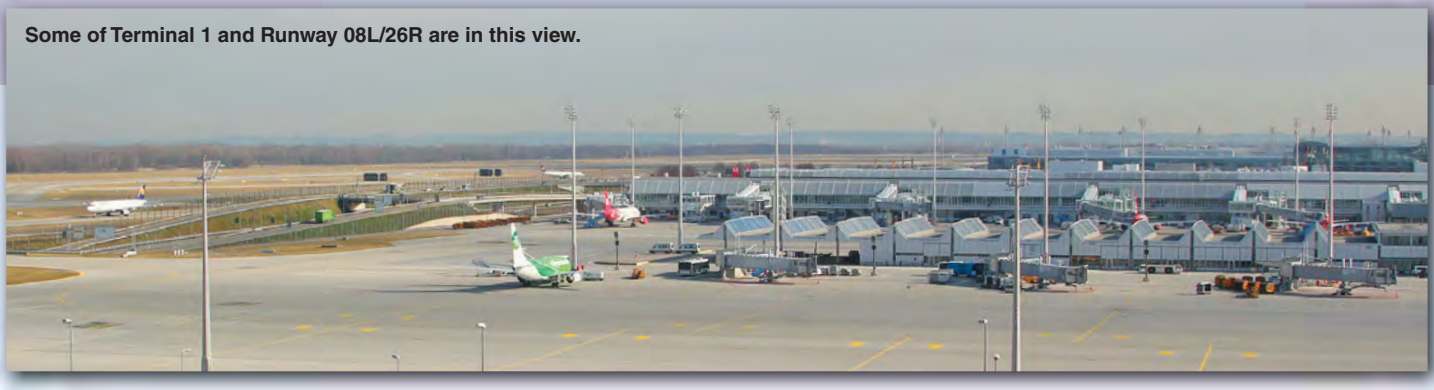
Left: **An airport chart with the viewing areas marked.** Not for airborne/operational use, Navtech Aerad

Entrance to the viewing hill is via a turnstile and costs €1. It has two levels, both offering excellent views of the aircraft parked on Terminal 1, the remote stands and both runways. A 172-step climb is required to get to the top or for those looking for a more relaxed ascent a ramp runs around the outside of the hill all the way to

The viewing hill in the visitors' park is split into two levels. All photos Key-James Ronayne unless stated



The Terminal 2 viewing terrace.



Some of Terminal 1 and Runway 08L/26R are in this view.

the lower level. Once on the hill there are no food and drink facilities and there is also no shelter from the elements, so be sure to dress appropriately. Facilities on the hill include telescopes (costing between 50 cents and €1), benches and an information board detailing the different landmarks visible on the horizon to the north of the airfield.

An Airbus A320 landing on Runway 08L requires a focal length around 400mm while the same type taxiing out from the main ramp could be photographed at 230mm. Access to the viewing hill is possible 24 hours a day, the information centre is open from 930am to 6pm between March and October and for the rest of the year 930am to 5pm.

A further viewing hill to the south of the airport is free of charge and offers close views of the touchdown point on Runway 26L. This is only accessible by car and there are a limited number of parking spaces available; again there is no shelter from the elements. It is open 24 hours a day. From here, you can also see the aircraft parked on Terminal 2 and the new satellite pier. Aircraft parked on the GA ramp are also visible although fairly distant, as are those parked on the freight ramp and at the maintenance hangars at the Western end of the airfield. To photograph an Airbus A320 rolling down Runway 26L requires a focal length around 230mm.

The third and final official viewing area is in Terminal 2. This open-air terrace is also free of charge and overlooks the aircraft parked on the terminal and the new satellite pier. Terminal 2 is home to Lufthansa and its Star Alliance partners. Photography is best in the afternoon but is difficult because of the terrace's thick glass surrounds. Both of the runways are visible from here although the views are not as good as those offered from the two observation hills. This terrace is open from 8am until 10pm daily.

During *Aviation News*' visit, the airport was welcoming two Qatar Airways Airbus A350s per day and Thai International Airways was still using the Boeing 747 on its flights from Bangkok, although there are plans afoot to change this to the Boeing 777-300ER.

Not only is Munich regularly voted Europe's leading airport it is also one of the very best in the world from an aviation enthusiast's point of view and is very much worth a visit. AN

TAROM's retrojet, 737-700 YR-BGG, prepares for departure back to Bucharest Henri Coandă International Airport.

This airberlin Airbus A320 – still in the basic livery of OLT Express – was photographed from the split level viewing hill with a focal length of 400mm as it landed on Runway 08L.

Below: **Part of the vista from the viewing hill at the visitors' park with aircraft parked at Terminal 1 and remote stands.**

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STAR AND BAR STARFIGHTERS

Warren E Thompson looks back at the iconic Lockheed F-104 Starfighter in US service.

This sleek, stubby-wing supersonic fighter was just one of the many advanced aircraft designs to be developed in Lockheed's famed Skunk Works by Clarence 'Kelly' Johnson and his engineers. The XF-104 Starfighter prototype made its first flight on March 4, 1954, and after nearly four years of extensive testing, during which numerous problems were overcome, the F-104A was finally delivered to its first operational unit, the 83rd Fighter Interceptor Squadron (FIS) of the USAF's Air Defense Command, at Hamilton AFB, California on January 29, 1958.

It entered operational service a few weeks later on February 20. Production ran to an eventual 2,578 Starfighters built, the majority under licence in other countries, and the type was used by 15 nations.

The 'A and 'C models were the two main variants that served the USAF, the former being a pure interceptor version for Air Defense Command. A total of 153 F-104As were constructed, together with 26 two-seater versions (known as the F-104B), and the variant was equipped with the M61 Vulcan 20mm cannon and two AIM-9B Sidewinder air-to-air missiles. It carried a basic AN/ASG-14T-1 fire-control radar.

The 'C model was the frontline tactical strike version to meet the requirements of Tactical Air Command. The first flight of the variant was on July 24, 1958, when it was unofficially referred to as the YF-104C, before being delivered as the F-104C to its first operational unit, the 476th Tactical Fighter Squadron (TFS) of the 479th Tactical Fighter Wing (TFW) at George AFB, California.

It had a distinct advantage over the earlier 'A and 'B models in being equipped with the General Electric J79-GE-7 engine, rated at 10,000lb (44kN) of thrust. This was 1,000lb (4.4kN) greater than the two earlier model Starfighters. It also had two additional wing pylons for AIM-9B missiles, an improved AN/ASG-14T-2 radar and, unlike the 'A and 'B models, could be aerially refuelled.

The F-104C was designed to be capable of delivering a nuclear bomb, such as the Mark 28 or Mark 43, which would be attached to a centreline pylon. In Europe however, the USAF's nuclear responsibility was to be shouldered by the North American F-100 Super Sabre fighter-bomber, which was already based there. Production of the F-104C ran to 77 aircraft. As with the 'A model, a two-seater version was produced, the F-104D. Both the 'B and 'D variants were combat-capable but only used for training purposes.

Above: **An F-104A of which 153 of this variant served with the USAF.** The Aviation Photo Company

Below: **The second of two XF-104s, s/n 53-7787, on a test flight.** Lockheed via Warren E Thompson

Major Howard 'Scrappy' Johnson just prior to flying Starfighter 55-2957 to a world record height of 91,243ft on May 7, 1958 from George AFB. Howard 'Scrappy' Johnson via Warren E Thompson

FLYING QUALITIES

Colonel E R 'Gris' Grischkowsky (Ret'd) flew the F-104 in both its 'A and 'C guises (as well as the 'B and 'D two-seat training variants), accumulating 1,000-plus hours on the type. He recalls its qualities: "When the F-104 first appeared in 1958, there was no other fighter that could compete – as long as its pilots fought in the Starfighter in the way it was intended, namely to capitalise on its speed, difficulty of detection and climb rate, and made correct use of the armaments provided." The F-104's short, small wings, however, presented some difficulties: "The Starfighter did everything it was designed to do so long as its pilots refrained from the old high-g turns learned in the F-86s. One glance at the F-104's wing area told us everything we needed to know about the advisability of engaging in a turning fight with other fighters."

Grischowsky also recalls teething troubles with the J79 engine: "The biggest problem, to begin with, was the use of its engine oil to operate the exhaust nozzles. Often vibrations caused leaks in the nozzle system resulting in a total loss of oil. A number of birds were lost until this deficiency was corrected. Unfortunately, we lost our squadron commander shortly after receiving our first aircraft at Hamilton in mid-1958. The F-104 did have a high accident rate in the late 1950s and early 1960s."

VIETNAM SERVICE

The Starfighter received plenty of coverage from the media, mainly as a result of its speed and altitude records and the fact it was referred to as a 'manned rocket', and the Vietnam War offered an opportunity to test it in a high-profile combat situation. But its limited range and endurance proved a weakness, and the USAF McDonnell Douglas F-4 Phantom II and US Navy Vought F-8 Crusader dominated in the air-to-air role.

In April 1965, the 476th TFS moved with its F-104Cs from George AFB to Kung Kuan AB, Taiwan. This meant it could counter any Chinese aggression and allowed regular rotations to Da Nang AB in South Vietnam, putting the unit in a perfect position to score aerial kills if pilots encountered any MiGs.

The first assignment for the 476th was to fly combat air patrol missions, armed with the M61A1 20mm cannon and four AIM-9 Sidewinders, in support of US fighter bombers. North Vietnamese intelligence was well aware of the Starfighter's presence and on their escort missions the MiGs were scarce. Squadron records state there were only two close encounters between the F-104s and MiGs and the former never got close enough for a missile shot.

As the MiG threat diminished, the F-104s were heavily tasked with visual weather reconnaissance and the air-to-ground mission, using 750lb (227kg) general-purpose bombs. Their pilots' bombing skills ▶

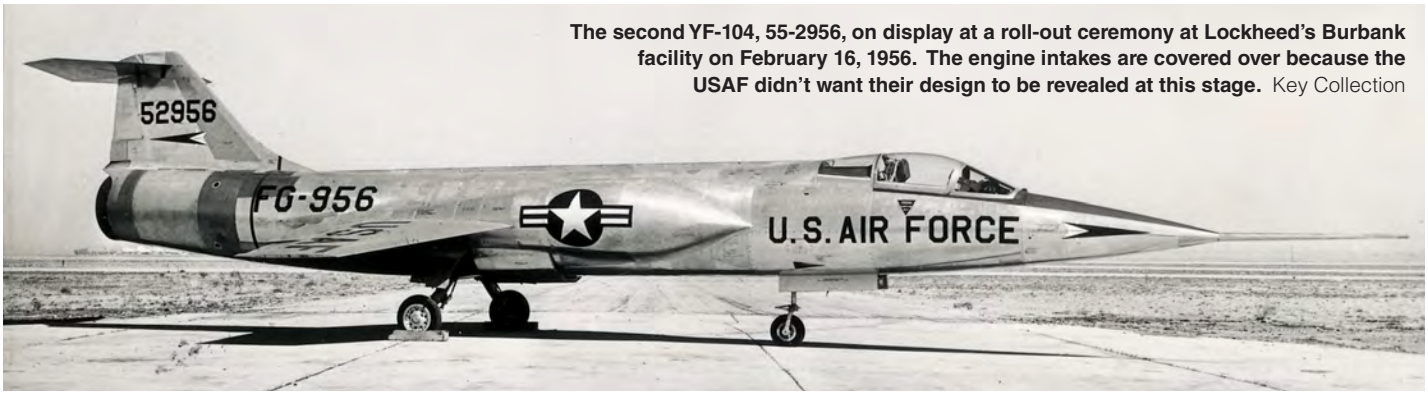
A DAY FOR THE RECORD BOOKS

One of the best known F-104 pilots was Major Howard 'Scrappy' Johnson (Ret'd), who flew some of the first Starfighters to come off the production line. In 1950 he became one of the first North American F-51 Mustang pilots to fly in combat during the Korean War. On May 7, 1958, he made an attempt on the world altitude record in an F-104A at Palmdale, California, with many spectators in attendance including Lockheed executives. He recalls the day: "I taxied out, positioning myself on the centreline at the end of the active runway. In order for me to have sufficient room for zoom, my track had been planned in detail and the apogee of the climb would take place directly over Edwards AFB. This was where the official radar and cameras had been set up to record my exact altitude as I went over the top.

"To ensure my success, several things had to happen in rapid sequence and each at the appropriate moment. First, I needed to obtain optimum speed, then burn off just the right amount of fuel so as to be in precisely the right location to start my climb. That amount had to get me into the record books with enough remaining to get me back to base. Things went according to plan and, just as I was over Edwards, I moved the throttle to full afterburner and as the needle hit Mach 2.23, I eased back on the stick and pointed the Starfighter's nose to the recommended 52° angle of attack. The F-104A climbed from 50,000 to 60,000ft (15,240 to 18,288m), then, just as predicted, at 63,000ft (19,202m) the afterburner cut out and at 67,000ft (20,422m) the engine quit. There wasn't enough oxygen. My partial pressure suit automatically inflated and now I was flying a glider! However, the Starfighter was a rocket which continued to climb!"

The jet eased through 70,000ft (21,336m); and then 80,000ft (24,384m), with no power from the engine now and in very thin air. The ailerons, which also acted to stabilise the aircraft, were quickly becoming ineffective and Johnson was having difficulties in keeping the wings level. "The moment I went over the top, I glanced down at my airspeed indicator and it read 30 knots! I was barely moving. The sky was a dark purplish-blue and I could readily make out the curvature of the earth. The Lockheed engineers later said I could have seen as far as Salt Lake City, 525 miles [845km] away, if I'd taken the time to look.

"On my way down, the radar operator at Edwards radioed that I had reached 91,249ft [27,813m], which meant I had broken the world's altitude record by over 14,000ft [4,267m]! Continuing my gliding descent, I turned toward Palmdale and at 47,000ft [14,326m] I restarted the GE J79 engine. My pressure suit deflated and I began my dash towards the Lockheed plant where the anxious crowd awaited the results. I entered the traffic pattern at Palmdale with less than 400lb [181kg] of fuel, landed with no problems and taxied to the ramp. It was a very memorable experience!"



The second YF-104, 55-2956, on display at a roll-out ceremony at Lockheed's Burbank facility on February 16, 1956. The engine intakes are covered over because the USAF didn't want their design to be revealed at this stage. Key Collection

Three F-104As were modified for astronaut training at Edwards AFB. This Starfighter is zoom-climbing under the additional power of its 6,000lb thrust Rocketdyne booster.
Lockheed-Martin via Warren E Thompson

ACTIVE DUTY AND ANG F-104 VARIANTS

F-104A

First operational variant for the air-to-air role with a GE J79 engine. Equipped with M61 cannon and two wing pylons for AIM-9B missiles. A total of 153 were produced and served in the USAF from 1958 to 1960. Many were then exported to Jordan, Taiwan and Pakistan. Not capable of aerial refuelling. Major Howard 'Scrappy' Johnson established a short-lived altitude record of 91,249ft (27,813m) in an F-104A on May 7, 1958.

F-104B

These were built as two-seater versions of the A model for use in the training squadrons. A total of 26 were constructed. All served with the USAF and seven were sold to the air forces of Pakistan, Taiwan and Jordan after retirement from US service. Not capable of aerial refuelling.

F-104C

Fighter-bomber version that served with Tactical Air Command and also flew in combat during the Vietnam War. It was capable of aerial refuelling.

On December 14, 1959, Captain Joe B Jordan set a world altitude record of 103,395ft (31,529m) in this model. A total of 77 were built and each was equipped with the improved fire-control radar (AN/ASG-14T-2). It had a centreline station and two pylons on each wing for a total of five ordnance stations. Capable of carrying AIM-9B missiles, Mark 28 or Mark 43 nuclear bombs or 500/750/1,000lb (227/340/454kg) general-purpose bombs.

F-104D

Two-seater trainer version of F-104C. Capable of aerial refuelling. Only 21 were built.

DEVELOPMENT VARIANTS

XF-104

Two prototypes were built, powered by the Wright J65 engine. Only one was equipped with the M61 cannon (as a test for the potential cannon armament). Both prototypes were eventually lost in test crashes.

YF-104A

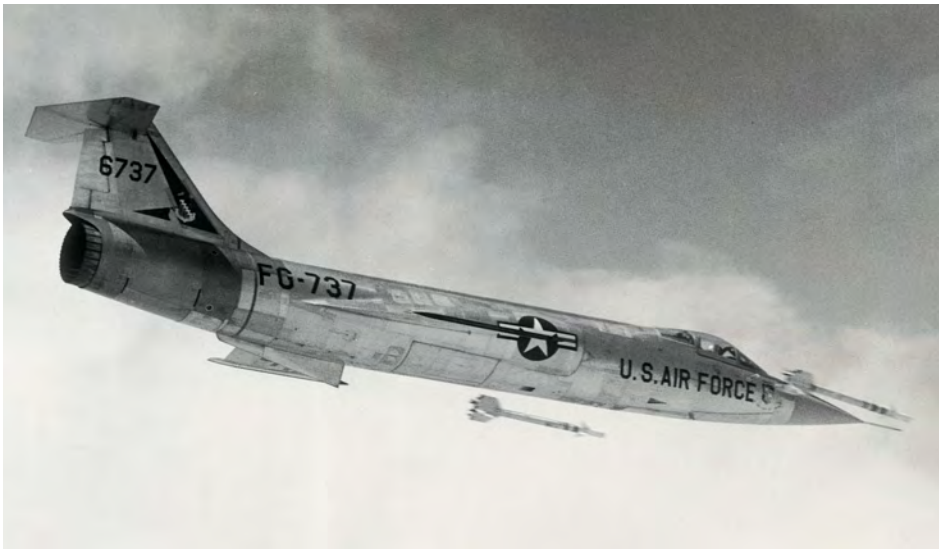
Seventeen were built and used for extensive engine, equipment and flight tests. Most were eventually converted to standard F-104As.

were excellent, especially when they were working with airborne forward air controllers. The maintenance personnel of the 476th achieved an exceptional 94.7% in-service rate during their time in Vietnam.

On July 11, 1965, the 436th TFS arrived to replace the 476th in Vietnam and was mostly tasked with rapid response close air support to assist ground troops in contact with the enemy.

During the early months of 1966, the MiG threat escalated when MiG-21s began flying missions against Republic F-105 Thunderchief bombers. Another unit, the 435th TFS, was deployed to Udorn AB in

A weapons display at George AFB, California, in May 1963. The USAF was keen to show the public the wide variety of weapons that the Starfighter could carry.
Ray Holt via Warren E Thompson



Above: **A USAF Starfighter launching Sidewinder air-to-air missiles.** Key Collection

Below: **This two-seat F-104 was used to train new pilots at Luke AFB in July 1971. By this time, most of the trainees at the base were from the West German Air Force.** Mike Korte via Warren E Thompson

Thailand with F-104Cs at the time and escorted the F-105s returning from strikes. The Starfighters weren't able to accompany the bombers on the outward leg due to their lack of endurance – which would have necessitated aerial refuelling over MiG territory, something the USAF was unwilling to do. So the Thunderchiefs relied on F-4s, backed up by Douglas EB-66E radar jamming aircraft, for escort until the F-104s were able to escort them out of Vietnam. These missions put the Starfighters in MiG territory, but the MiGs continued to stay away from the F-104s. This didn't entirely remove the Starfighter from danger, however: on August 1, 1966, two aircraft of the 435th were lost to surface-to-air missiles (SAMs).

Records show a total of 14 Starfighters were lost in the war (not all to enemy action) – five each in 1965 and 1966 and four in 1967 – with the F-104 achieving no aerial kills, although it did succeed in deterring the MiGs. Only one was shot down, which was by a Shenyang J-6 (Chinese-built variant of the MiG-19) after it strayed into Chinese airspace. ►

USAF AND ANG F-104 UNITS

USAF AIR DEFENSE COMMAND: F-104A/B

- 83rd FIS at Hamilton AFB, California (operated F-104 from 1958 to 1960)
- 56th FIS at Wright-Patterson AFB, Ohio (1958 to 1960)
- 319th FIS at Westover AFB, Massachusetts, and Homestead AFB, Florida (1963 to 1969)
- 331st FIS at Westover AFB and Homestead AFB (1963 to 1967)
- 337th FIS at Hamilton AFB, Westover AFB and Homestead AFB (1958 to 1960)
- 482nd FIS at Homestead AFB (1965 to 1969)
- 538th FIS at Larson AFB, Washington (1958 to 1960)

USAF TACTICAL AIR COMMAND: F-104C/D

- 434th, 435th, 436th and 476th TFS of the 479th TFW, George AFB, California (1958 to 1967)
- 4512th Combat Crew Training Squadron, 4518th CCTS/69th Tactical Fighter Training Squadron and 4443rd CCTS, all of the 4510th Combat Crew Training Wing/55th Tactical Fighter Training Wing at Luke AFB, Arizona (training of foreign air force F-104 pilots from 1969 to 1983)

AIR NATIONAL GUARD: F-104A/B

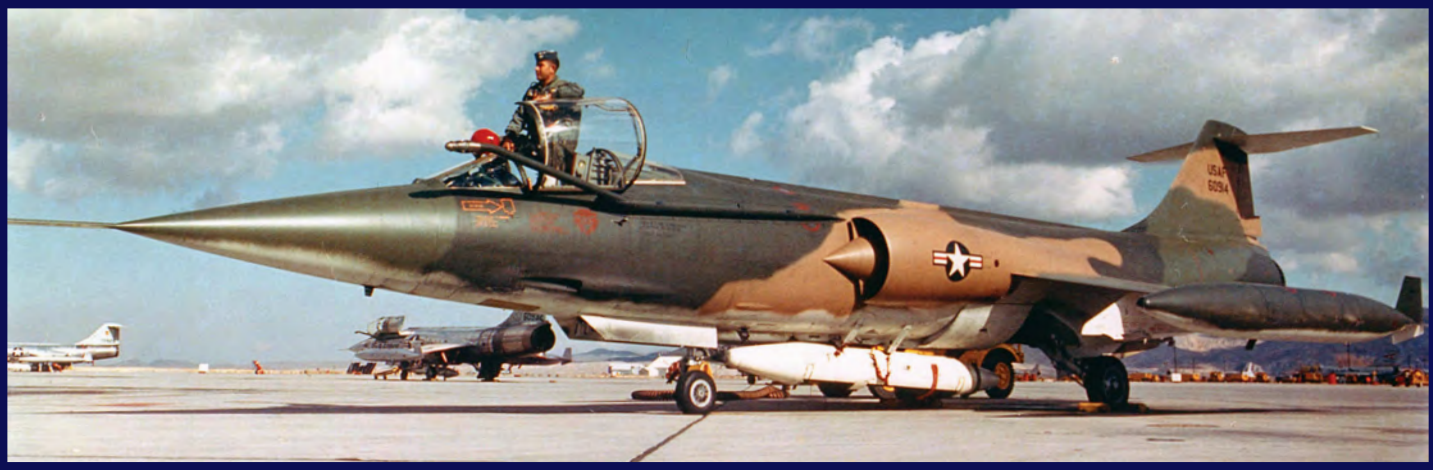
- 151st FIS Tennessee ANG at McGhee Tyson ANGB, Knoxville, Tennessee (1960 to 1963)
- 157th FIS South Carolina ANG at McEntire ANGB, South Carolina (1960 to 1963)
- 197th FIS Arizona ANG at Sky Harbor ANGB, Phoenix, Arizona (1960 to 1962)

AIR NATIONAL GUARD: F-104C/D

- 198th TFS (15th Tactical Fighter Group) of the Puerto Rico ANG at Muniz ANGB, San Juan, Puerto Rico (1967 to 1975)

Other F-104s were assigned to and flown by the Air Proving Ground Command at Edwards AFB and National Aeronautics and Space Administration (NASA).

A pair of 476th TFS/479th TFW F-104Cs on the ramp at George AFB in June 1962. Howard 'Scrappy' Johnson via Warren E Thompson



Above: **Captain Mike Korte standing up in his Starfighter before heading out on a sortie. All the USAF F-104s were given this camouflage ready for deployment to Vietnam.** Mike Korte via Warren E Thompson

Below: **The 435th TFS based at Udorn AB in Thailand was the last F-104 unit to fly the Starfighter in Vietnam. Pilot Major Herb Drisko stands next to his F-104 named Snoopy Sniper, which was one of many aircraft in the unit that had nose art applied.** Herb Drisko via Warren E Thompson

END OF USAF SERVICE

In July 1967, the 435th TFS, the third and final Starfighter squadron to see service in Vietnam, returned to George AFB. Once the type's withdrawal from the conflict was complete, the USAF began to phase it out, squadrons re-equipping with the F-4D Phantom II. The F-104A and 'B models left frontline service with the 319th FIS in December 1969 while the 'Cs and 'Ds were transferred from their final USAF squadron, the 435th TFS, to the 198th Puerto Rico Air National Guard (ANG). The 198th would continue to operate the Starfighter until July 1975, thereby becoming the final US operational unit, although USAF training units would continue to train pilots for foreign F-104 users until 1983. Meanwhile the F-4 Phantom had rapidly become the aircraft of choice for both the USAF and ANG.

"The F-104A eased through 70,000ft; and then 80,000ft, with no power from the engine now and in very thin air."

The F-104 was considered the USAF's foremost interceptor during its early years. Its career was relatively short as it was superseded by newer fighters during the 1960s: it served with the regular air force until 1969 and with the ANG until 1975. Nevertheless, it made a big impression on all who came into contact with it, and the 'manned missile' remains one of the icons of US military aviation. When summing up his memories of flying the Starfighter, Colonel Grischowsky simply said: "What a treat!" AN

A USAF F-104 streaks through the sky hitting Mach 1 with a sudden burst of speed. USAF via Warren E Thompson

Flight Bag

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THE QUEST FOR SPEED – AIR RACING AND THE INFLUENCE OF THE SCHNEIDER TROPHY CONTESTS 1913-31

Book

Written by: Mike Roussel

Price: £20

Roussel's highly detailed book, divided into four parts, begins with 'Early Development of Flying Machines' – describing engine development from 1900 and the advent of rich prizes for flying achievements and culminates with the origins of the Schneider Trophy. The section features the first two contests in 1913 and the following year. French industrialist Jacques Schneider was convinced that flying boats and seaplanes were the future because of the large number of places with stretches of water from which to operate. He intended the competition rules to be challenging for the designers of aircraft and the pilots who flew them. There would also be the potential to introduce further challenges in line with aircraft development.

Part 2 is entitled 'The Golden Years of Aviation' and features the resumed contests from 1919. Politics and international prestige began to play their part in 1926 and Part 3 – 'Government Support and Military Pilots' – shows how seriously the contest was being taken. The event ceased for various reasons in 1931, but not before a Supermarine S.6B achieved a record air speed of 407.5mph (656km/h). Part 4: 'The Supermarine Venture into the Quest for Speed' tells how Rolls-Royce believed that its involvement in the Schneider Trophy had compressed ten years of engine development into two years, producing the Merlin. A final section shows the direct links between the Supermarine racing seaplanes and evolution of the Spitfire.

There are 162 black and white photographs and 16 colour photos and art plates. Appendices list the nationalities of pilots and aircraft taking part.

Published by The History Press, ISBN 9780750967914 and is available from www.thehistorypress.co.uk

THE MODERN EAGLE – THE BOEING F-15 EAGLE/STRIKE EAGLE EXPOSED (2ND EDITION)

Book

Written by: Jake Melampy

Price: $34.95

The F-15 is a legend in the fighter community with a lifetime air-to-air kill record of 102-0. It reigns supreme as the most effective and lethal combat aircraft in the history of air warfare. Soon after its debut in 1972, the Israeli Air Force bloodied its claws in the skies over Syria in 1979. Even now, as the Eagle approaches its 45th birthday, it's still widely regarded as one of the finest jet fighters in the sky. Indeed, some air forces are still keen to buy more while the US Air Force plans to keep them in service for many years to come albeit with some upgrades.

With the above in mind it is little wonder there have been so many books published on the Eagle. This book goes into huge detail with the author having photographed every panel, cockpit instrument and missile rail – it's an exceptional undertaking and should prove an excellent reference work for aeronautical engineers and aircraft modellers. This is more than just a collection of images, the author's level of F-15 knowledge is evident as he explains the host of upgrades undertaken during the Multi-Stage Improvement Programmes (MSIPs).

Published by Reid Air Publications, ISBN 9780988852952, available from www.reidairpublishing.com/

TESTING TORNADO – COLD WAR NAVAL FIGHTER PILOT TO BAE CHIEF TEST PILOT

Book

Written by: J David Eagles AFC

Price: £16.99

The story begins with flight training by the US Navy under the Mutual Air Defense Assistance Program. After jet qualification on the Lockheed TV-2 and Grumman Panther, the author returned to Fleet Air Arm duty flying Vampires and Sea Hawks, followed by operational training at RNAS Lossiemouth. He then took up the offer of a temporary attachment to the Royal Australian Navy and flew Fireflies and Sea Furies. Returning to the UK in 1958, his next types were the Sea Venom and then the Sea Vixen.

A successful application for the Empire Test Pilots' School resulted in a course at Farnborough, then service at Boscombe Down where he experienced a great variety of aircraft types culminating in the Buccaneer Mk 2, for which he became project pilot for its service introduction. Returning to civilian life, he joined the Warton flight test team in 1971 on Lightnings, Jaguars, Strikemasters and Canberras.

Then came the project which would become the Tornado. The lengthy process of ironing out the faults in the Tornado, and the test pilots' wrangles with its design engineers is described in fascinating detail. As the author observes: "Never develop a new airframe with a new engine. Problems with one delays progress with the other." He also had major input in the project which eventually led to the Eurofighter Typhoon. As entertaining as it is instructive, this is a very good read.

Published by The History Press, ISBN 9780750968416 and is available from www.thehistorypress.co.uk

SR-71 FLIGHT MANUAL – THE OFFICIAL PILOT'S HANDBOOK DECLASSIFIED AND EXPANDED WITH COMMENTARY

Book

Commentary by: Colonel Richard H Graham, USAF (ret)

Price: £60

This massive slab of a book is entirely proportionate to its subject; a legendary aircraft, which stretched the boundaries of performance and made enormous demands on its crews. A facsimile reproduction of the SR-71A Flight Manual – all 1,000-plus pages of it – is accompanied by a 63-page commentary from Col Richard H Graham, USAF (Ret'd) who flew and instructed on the type, as well as commanded the 1st Strategic Reconnaissance Squadron. His depth of knowledge is such that he can easily and simply explain the complicated physics, procedures and peculiarities of an aircraft designed to fly at Mach 3+ over hostile territories on reconnaissance missions. He tells how afterburners in more conventional military aircraft are designed to be used when extra thrust is required. The SR-71, however, was certified for continuous afterburner operation and utilised a special fuel, JP-7, and a fleet of 35 supporting tankers of the KC-135Q variant. There are also 37 photographs, most in colour.

The SR-71 was stealthy too, especially at speed and altitude where its radar profile was said to be the same as a Piper Cub's. Computerised star-tracking immune to electronic jamming was used for high level navigation.

Emergency procedures for certain scenarios had to be memorised by both crew members because there would be no time to look them up in a checklist. The dramatic experience of an 'unstart', when an engine ceases functioning as a ramjet at a high Mach number, is well described.

The SR-71 is an aircraft that can legitimately be called a legend.

Published by Voyageur Press, ISBN 9780760351741 and is available from https://www.quartoknows.com/brand/15/Voyageur-Press/

ITALIAN STARFIGHTERS REMEMBERED

Tom Docherty reviews the career of one of the Italian Air Force's most iconic aircraft.

In 1963 the Lockheed F-104G Starfighter entered service with the Italian Air Force (Aeronautica Militare – AM). The Italian pilots nicknamed the sleek fighter the 'Spillone' (Hatpin). Unfortunately it also gained another nickname – 'Bara volante' (Flying Coffin).

Apart from its production in the USA by Lockheed, a number of groups were set up in Europe to licence-build the Starfighter. The Italian group comprised Fiat, as the main contractor, with Aerfer-Macchi, Piaggio, SACA, and SIAI-Marchetti as subcontractors. The Italian group produced 169 F-104G, TF-104G and RF-104G aircraft between 1962 and 1966 for the air forces of Italy, West Germany and the Netherlands.

INTRODUCTION

The AM received 125 Fiat-built F-104Gs plus a further 28 TF-104Gs. Construction of the latter aircraft was divided between Lockheed (12 aircraft) and Fiat (16 aircraft). The first AM unit to receive the F-104G was 9° Gruppo of 4° Stormo at Grosseto, Tuscany, in March 1963. Later that year 20° Gruppo of 4° Stormo, also based at Grosseto, received the type. The next unit to receive the F-104G was 102° Gruppo/5° Stormo at Rimini in May 1964. More units accepted the Starfighter in the years that followed (for a full unit list see table).

The F-104G was a multi-role fighter, designed for use by European air forces. It had full all-weather capability, carrying an Autonetics F15A-41B fire control system which was optimised for both air-to-air and air-to-ground target interception and attack. The fuselage, wings, and empennage were strengthened to enable the aircraft to carry an increased weapons load on seven centreline, under-wing and wingtip hard points. The F-104G could carry up to 4,000lb (1,814kg) of external stores. Total fuel load was increased from 1,624 to 1,784 US gal (6,148 to 6,753 lit).

The F-104G had the enlarged and broader vertical tail of the F-104B/D two-seater and the irreversible hydraulically-powered rudder. With higher maximum takeoff and landing weights than the F-104C, landing speeds were higher. Larger wheels with improved, fully powered wheel brakes with anti-skid capability were fitted. The tail-braking parachute was increased in diameter from 16 to 18ft (4.9 to 5.5m).

The fire control system provided radar search, acquisition and automatic tracking of aerial targets to make it possible to carry out head-on attacks with automatic missile release. The F-104G also had a director-type gun sight for its M61 Vulcan cannon. The director sight gave the pilot an optical line-of-sight indication after the F15A-41B had computed the required lead angle. This sight incorporated basic infrared night-sighting.

For air-to-ground modes, the F15A-41B provided range information for visual bombing, ground mapping for all-weather bombing and navigation, contour mapping for navigation, and terrain avoidance for ▶

A four-ship of 5° Stormo F-104Ss over the Italian countryside. Key Collection

low-level combat missions. The F-104G was also the first production fighter to be equipped with a Litton LN-3 Inertial Navigation System, which provided the pilot with a continuous indication of direction and distance to a pre-selected target.

The Starfighter was powered by the General Electric J79-GE-11A, rated at 10,000lb static dry thrust, increasing to 15,600lb with afterburner engaged. The engines were manufactured under licence by the Fabrique Nationale in Belgium, MAN-Turbo in Germany and Fiat in Italy.

CHALLENGING

Like their counterparts in other Starfighter-equipped NATO air forces, the AM pilots found the aircraft a handful. The accident rate for the single-seat Hatpins was high, with over a third of the force being lost. The first F-104G loss was on April 23, 1964, just over a year after the type's introduction, when MM6596 of 102° Gruppo/5° Stormo crashed. More than 22 years later, on August 4, 1986, the last loss of a 'G model occurred when MM6586 of 132° Gruppo/3° Stormo crashed near Bernbach in West Germany. The TF-104G also suffered many losses, the first of which was MM54236 of 20° Gruppo/4° Stormo, destroyed on February 19, 1969. The last occurring on August 22, 2000 when a TF-104G-M of 20° Gruppo/4° Stormo, MM54588 coded 4-46, was lost in a controlled ditching after suffering landing gear damage at Grosseto.

Captain Alessandro Albiani attended a training school in the USA where the instructors commonly expressed the opinion that the F-104 was their most difficult aircraft to fly. He recalled how the Starfighter handled: "It was not an easy aircraft to deal with, but if you respected the flying envelope she was a great one! She had a tendency to pitch up and then spin with a high angle of attack...That's why they built in a stick shaker and stick pusher."

Albiani also commented that, "the TF-104, the two-seat trainer version, was a good one, but it was developed from the G model, so didn't have the avionics of the S and later ASA and ASA-M models."

The worst day for AM F-104 losses was on September 25, 1975 when four F-104Gs of 154° Gruppo/6° Stormo (MM6508, MM6516, MM6523 and MM6575) crashed into a mountain in bad weather conditions, 15nm (28km) south of Bitburg in West Germany.

RECONNAISSANCE VERSION

Twenty RF-104Gs were constructed in Italy and allocated to 101° Gruppo from 1964. A further 15 were converted from F-104Gs. In 1969 the AM received the F-104S, and only 154° Gruppo kept the F-104G in the ground attack role. All the remaining F-104Gs and RF-104Gs went to 3° Stormo at Verona-Villafranca, to be used mostly as reconnaissance aircraft (usually with the Orpheus pod), and they were all designated RF-104Gs, despite the fact that this was not strictly accurate as most lacked an internal camera.

In 1990, the Iraqi invasion of Kuwait resulted in Italian forces being sent to protect the southern borders of Turkey (Operation Ace Guard). On December 21, 28° Gruppo sent six RF-104Gs equipped with the Orpheus reconnaissance camera. By January 7 they were operational and on January 26, the Gruppo carried out its first scramble. In

Lockheed F-104S MM6791, coded 5-06, of 102° Gruppo/5° Stormo at RAF Bentwaters on August 16, 1983. TGD

Lockheed F-104S MM6810/53-03 of 21° Gruppo/53° Stormo in 1986. Note the smaller style code. TGD

This F-104S carries the markings of 10° Gruppo/9° Stormo. The variant entered service with the Italian Air Force in June 1969 and equipped eight multi-role squadrons. TGD

A dramatic shot of the sharp end of an F-104S of 12° Gruppo/36° Stormo. Italian Air Force

An Orpheus reconnaissance pod is clearly visible on F-104G of 132° Gruppo/3° Stormo. TGD

An F-104S of 12° Gruppo/36° Stormo displaying the code style the type wore in later years. This unit first received the Starfighter in 1965, flying the G, S and ASA models consecutively. Key Collection

early March, after more than 300 sorties over the southern borders of Turkey, 28° Gruppo returned to Villafranca. On December 13, 1992, the 28° Gruppo RF-104Gs began to be flown to Grosseto for subsequent disposal.

The pilots of the reconnaissance RF-104 found the Starfighter a difficult aircraft to operate in the low level role and several were lost. The first, MM6659 coded 5-18, was lost on June 25, 1965. Operated by 102° Gruppo/5° Stormo, the Hatpin's engine failed due to a broken linkage. The final RF-104 loss occurred 23 years later on July 27, 1988 when MM6608 hit a VOR antenna on take-off from Villafranca and crashed.

The AM was the last NATO air force to operate the F-104G and the last fighter-bomber unit, 154° Gruppo/6° Stormo, re-equipped with Tornados in early 1983. The last AM RF-104G unit was 28° Gruppo/3° Stormo, which finally retired the type in June 1993. The TF-104Gs continued to be used in limited numbers alongside the other Starfighter model in AM service.

IMPROVED MODELS

The F-104S was an upgraded and improved version of the F-104G, built by Fiat. The 'S' indicating that it was equipped with the Sparrow air-to-air missile. It was the winner of a 1965 AM design competition, which also evaluated the Dassault Mirage III, McDonnell Douglas F-4 Phantom II, North American F-100 Super Sabre and Northrop F-5.

The F-104S was fitted with the more powerful J79-GE-19, rated at 11,870lb dry thrust and 17,900lb with afterburner, providing 13% more power over the F-104G. The F-104S had two extra fuselage pylons underneath the air intakes, increasing to nine the total number of hard points. The two inner hard points under each wing could house fuel tanks or bombs, and beyond-visual-range missiles could be attached to the outer hard points. The wingtip and centreline points typically carried ►

Aeritalia produced 143 of the F-104S ASA, which involved armament and avionics upgrades, between 1985 and 1993. Aeritalia

The final upgrade of Starfighters in Italian service was the F-104S ASA-M, such as this example CMX611/ RS-06 of 311° Gruppo, RSV. Ninety F-104S-ASA aircraft received the ASA-M upgrade. Key Collection

Lockheed TF-104G-M MM54253/4-20 of 4° Stormo in 2004, wearing a commemorative scheme of a stylised lion in celebration of 40 years of service by the Starfighter in the Italian Air Force. Key Collection

fuel tanks, while the under-fuselage pylons carried AIM-9 Sidewinder air-to-air missiles. The additional fuel and avionics required the removal of the internal 20mm M61A1 cannon.

Aerodynamic improvements consisted of two extra ventral fins placed on either side of the original (which itself was slightly enlarged) to give additional keel area. In the fighter-bomber role the F-104S could carry up to 7,500lb (3,402kg) of bombs, napalm tanks or rocket pods, and as an interceptor it could carry two under-wing AIM-7 Sparrow semi-active radar homing and/or two AIM-9 Sidewinder infrared homing missiles.

A total of 206 F-104S new build airframes were constructed for the AM by Fiat (later Aeritalia), Alfa Romeo and Macchi. The J79-GE-19 engines were produced by Fiat and General Electric International. Two RF-104Gs were also converted into the new variant.

The F-104S entered service in June 1969 with 22° Gruppo and went on to equip eight multi-role squadrons. The final F-104S was delivered in March 1979. The type later was used purely for the air-to-air role when the Tornado and AMX took over the air-to-ground role.

Flight tests of the F-104S ASA with an updated weapons system designed to extend the life of the F-104S interceptors into the 21st Century, began in December 1984. Although the F-104S initially had to dispense with its internal cannon, in later years, smaller electronics allowed the reinstatement of the cannon. The Aspide missile entered service with the F-104S ASA in 1988, and aircraft typically carried an AIM-9L Sidewinder under the port wing, an Aspide 1A under the starboard wing, and two wingtip tanks.

Despite the upgrades, the cockpit workload for the pilot was still high, and losses continued. within two years of its introduction, the first F-104S was lost when MM6743, coded 36-43, of 156° Gruppo/36° Stormo, suffered total hydraulic failure near Altamura, Bari and crashed. The final F-104-ASA loss was MM6818 of 18° Gruppo/37° Stormo on April 19, 1997, which crashed into the sea.

The ASA-M programme was introduced in 1994 and this further enhanced the Hatpin's air defence capability. In early 1996, 90 F-104S ASA aircraft were allocated for upgrade to ASA-M standard. Airframe components such as the main landing gear legs and the horizontal stabiliser were replaced. Electrical and avionic components were also renewed. New navigation and communication equipment, including TACAN, GPS, a LN-30A2 Inertial Navigation System and a new UHF radio were provided. Once again the Vulcan cannon was removed. At the same time 15 TF-104Gs were modified. They had their electrical systems replaced and new avioinics installed which included a new INS and also a GPS. As part of this process the aircraft became pure trainers and were no longer combat capable.

The AM F-104s were now more than 30 years old and despite the airframe, engine and cockpit upgrades they still suffered losses. The first ASA-M loss was MM6944, coded 37-24, which went down while serving

A flight line of 37° Stormo Starfighters at Gioia del Colle in 1999. The unit was home based at Trapani/Birgi on Sicily. Key-Alan Warnes

with 18° Gruppo/37° Stormo on November 4, 1998, crashing into the sea near the island of Marettimo, off the coast of Trapani, Sicily.

Captain Albiani flew the F-104S and F-104S ASA from 1982 to 1989 with 22° Gruppo/51° Stormo and described the weapon configuration and interception capabilities: "In the standard alert configuration, the F-104 was fitted with one AIM-9B infrared missile until 1985 and then the AIM-9L. It also carried the AIM-7E Sparrow radar-guided missile, later replaced by the Aspide. In the wartime full-load configuration, the Starfighter had two Sidewinders and two Sparrows, plus two droppable pylon tanks. The 'S' did not have the Vulcan six-barrelled gun, as the space was needed for the avionics for the radar guidance system of the AIM-7.

"The F-104 was a good missile launch platform, very stable due to the high wing loading, but the radar performance was poor. Theoretically it could establish target contacts up to 40 miles away and lock-on at up to 20 miles, but in the real world her capabilities were about 20 miles for contacts and 10 to 12 for lock-on. It had very poor look-down capabilities until the late 1980s. The AM F-104 was optimised as a high altitude, short range interceptor."

OPERATIONS

The F-104 undertook a Quick Reaction Alert (QRA) from several bases with units overlapping on the cover they provided, as Albiani explained: "Squadrons were on alert on a three-day rotation. On the first day, two aircraft would be on five minutes' readiness and two on 30 minutes', on the second day two on 30 minutes', with the third day off. Within five minutes we were able to take off by day or night, in all weather. Our QRA started at 0900 and lasted 24 hours until 0900 the following day. This system involved four squadrons in northern Italy (21° Gruppo at Cameri, 22° Gruppo at Istrana, 23° Gruppo at Rimini and 9° Gruppo at Grosseto). One of these squadrons would redeploy to Sicily for a two-week period at Trapani and Sigonella for alert service with the same reaction times. During NATO operations over Yugoslavia, the Italian air defence was on alert."

"...instructors expressed the opinion that the F-104 was their most difficult aircraft to fly"

By the time of the commencement of Operation Deny Flight in April 1993, which was designed to impose a UN no-fly zone over Bosnia and Herzegovina, the AM considered the Starfighters to be obsolete, despite forming the backbone of Italian air defence at the time. Consequently, the AM leased 24 Tornado ADVs from the RAF. Even so, 12 F-104s from 4°, 5°, 9° and 37° Stormi were deployed to Amendola and Cervia on Italy's east coast to provide QRA against any potential threat from the other side of the Adriatic. Due to their simpler avionics fit, the Hatpins could be scrambled faster than newer, more complex types, and were able to get airborne in just three minutes. At least twice in the first days of the operation, F-104s were ordered to scramble to intercept unknown aircraft approaching from the east. In both cases though, the Starfighters were stood down before take off.

Pilots of the AM had to fly the Starfighter with great care, taking advantage of its virtues with tactics developed to suit its capabilities. "Many accidents occurred in the fighter-bomber role, flying at high speed and low level – not really her role," Albiani recalled. "The F-104 was difficult to fly in dogfights, there was very little margin for error! When the pilot made a mistake, he had a very short amount of time to recognise it and get out of that situation. Otherwise, the Starfighter was out of control faster than you could predict. The cockpit was an old style, analogue one. It was not really ergonomic ▶

A specially painted F-104S ASA of 311° Gruppo, Reparto Sperimentale Volo (Flight Test Centre) to mark the 50th anniversary of the unit. Key Collection

A stylish 40th anniversary scheme was applied to F-104S ASA-M MM6873 of 9° Gruppo/4° Stormo in 2003 to mark the type's 40 years of service with the Italian Air Force. This unit, based at Grosseto, was the first to equip with the F-104 in March 1963.

and it had very little room for the pilot. The 104's best virtues were its acceleration and rate of climb. When used in the clean configuration (with only two Sidewinders on the wingtips), it was manoeuvrable and able to get good results in Dissimilar Air Combat Training (DACT) with allied aircraft in the ACMI range in Sardinia.

"We developed tactics based on the basic cell of two or four aircraft using a pincer or trail attack, arriving on top at very high speed using afterburners (to avoid the black contrails of exhaust smoke). Our small radar signature gave us a good advantage. The best tactic was to arrive at the target supersonic, shoot an AIM-9L at an aspect angle of 135° and depart to avoid being engaged in a short-range dogfight."

Eventually serving for 41 years, the Hatpin was progressively upgraded, but towards the end of its career its obsolescence was increasingly obvious, as the need to lease Tornados in the early 1990s had proved. By mid-2002, five AM squadrons were still operating the F-104S ASA-M, but the eventual retirement of the type was not far away. The last frontline Italian Air Force unit to fly the Starfighter was 10° Gruppo of 9° Stormo based at Grazzanise which undertook its last training QRA scramble on October 31, 2004 and withdrew the type in December. However, 311° Gruppo of the Reparto Sperimentale Volo (Flight Test Centre) continued to fly two TF-104G-Ms and a pair of F-104S ASA-Ms with the last flight on July 27, 2005 bringing to an end the Starfighters Italian service.

ITALIAN AIR FORCE STARFIGHTER UNITS

GRUPPO	STORMO	BASE	DATE FIRST EQUIPPED WITH STARFIGHTERS AND VARIANTS FLOWN
9°	4°	Grosseto	1963 (F-104G,S, ASA-M and TF-104G)
20°	4°	Grosseto	1963. (F-104G, S, TF-104G and TF-104G-M)
102°	5°	Rimini	1964. (F-104G and S)
28°	3°	Villafranca	1964. (F-104G and RF-104G)
154°	6°	Ghedi	1964. (F-104G)
12°	36°	Gioia del Colle	1965. (F-104G, S and ASA)
132°	3°	Villafranca	1965. (F-104G and RF-104G)
156°	36°	Gioia del Colle	1966. (F-104G, S and ASA)
10°	9°	Grazzanise	1967. (F-104G, S and ASA-M)
21°	53°	Cameri /Novara	1967. (F-104G, S and ASA)
101° (later 23°)	5° Aerobrigata (later Stormo)	Rimini/Miramare	1967. (F-104G, S, ASA and ASA-M)
22°	51°	Treviso/Istrana	1969. (F-104G, S and ASA)
155°	50°	Piacenza	1967. 155° Gruppo later moved to 51° Stormo (F-104G, S and ASA)
155°	51°	Istrana	1973. (F-104S and ASA)

Note: At Pratica de Mare 311° Gruppo of the Reparto Sperimentale Volo (Flight Test Centre) also flew each variant of the Starfighter starting in 1969.

PILOT'S VIEW

Was the F-104 a success in AM service? The answer to that question is perhaps best left to one who flew it, Captain Albiani: "I would say yes, over its period of 40 years in service! But when aircraft like the F-15 appeared, the Starfighter's capabilities were out of date. The Starfighter had good performance, but very poor electronic warfare, countermeasures and radar systems. She was created as a pure interceptor: climb fast and high, shoot the target, come back quickly...The AM also used the '104 as a low level fighter-bomber. Again it was fast and stable, with low radar signature, but had poor electronics and radar and, especially, a very poor inertial navigation platform. As an air defence interceptor, she had limited capabilities to operate autonomously, and depended on a ground-based radar station.

"So, in conclusion, the answer is yes until mid-career, second half no. Just to fly, she was absolutely fantastic! I loved her. But, you know, I'm an old, sentimental pilot!" AN

Two-seater Starfighter MM54553/4-44 of 4° Stormo at low level. Twenty-five of these were operated by Italian Air Force units. David Cenciotti

AIR MAIL

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or **e-mail** dino.carrara@keypublishing.com, giving your full name and address.
The Editor reserves the right to edit all letters.

Concorde Tribute

I was in absolute awe at your September 2016 issue. I am a huge fan of Concorde and getting to hear from the Concorde Chief Pilot was fascinating. I've read quite a few Concorde books and articles, but I still learnt so much about Concorde from the article. I don't think we'll ever see the passion or creativity that led to Concorde again.

Technology will, of course, progress, but I'd be very surprised if a mainstream supersonic passenger jet ever elicited the same emotion as Concorde, assuming they ever create one again.

Thank you for the article and for doing a British Airways special issue. I do enjoy every issue, but Concorde, and news pertaining to British Airways, is of particular interest to me.

I look forward to many more issues. I've only been reading your magazine a short time, but each issue is great value for money and I still believe magazines have a place in this digital world.

Stephen Parry
by e-mail

LETTER OF THE MONTH

Welcome to the *Aviation News* incorporating *Jets* letters page.

The writer of the Letter of the Month, Des Brennan, will receive three DVDs: *Pilot Diaries – F-105 Thunderchief, Magic of Flight – Boeing 757-200* and *Military Helicopters – Military Aircraft of the 20th Century*.

Andover Endeavours

With reference to the HS 748 article (July issue) – in April 1972 I had the pleasure of carrying out three parachute jumps within 24 hours from an Andover C.1 of 46 Squadron, my first since qualifying at No.1 Parachute Training School then at RAF Abingdon. I was a member of Grangemouth-based 300 Troop, 131 Parachute Squadron of the Royal Engineers (Volunteers).

Departing from Edinburgh's then Turnhouse Airport via the Ferranti Flight Testing ramp (now the site of the main terminal area) and following a tactical low-flying route, we made our way north and west across Scotland and then back eastwards along the Great Glen. The drop zone (DZ) used and shared with other 46 Squadron aircraft carrying elements from our unit's other troops based in Hull, Birmingham and London was near Forres. Following a day of rapidly moving goalposts and very notional military achievements we enplaned that evening at RAF Kinloss for a night drop on the same DZ, followed late the next morning by a direct transit from Kinloss to a drop into a rather boggy field near Forth in Lanarkshire to complete the exercise.

These sadly were my only flights in an Andover instead of our more usual C-130 Hercules.

Des Brennan
Montrose, Angus

Bee Gees Boeing 720

The Boeing 720 used for a Bee Gees tour. Gerry Manning

I liked the piece on the Boeing 720 in the October issue of the magazine. In the article there is reference to one being used by various rock stars, including the Bee Gees.

I attach a picture of N7224U c/n 18077 at Marana, Arizona in October 1979. It wears the titles 'Spirits Having Flown' which was the name of an album and tour by the group – on the fin is artwork of the three Bee Gees and the wording 'The Tour, 79'. Sadly, this colourful aircraft ended its days at Davis-Monthan AFB providing spare parts for drab grey KC-135s.

Gerry Manning
by e-mail

MULTI-ROLE STARFIGHTERS
THE LUFTWAFFE F-104 STORY

In October 1958, the German Government chose to buy the Lockheed F-104G Starfighter. **Doug Gordon** tells the story of the Luftwaffe's Starfighters.

With the rebirth of the Luftwaffe in post-World War Two West Germany, a new force of aircraft was required and in September 1956 the first jet aircraft began to equip its tactical wings.

Through the North American Mutual Defense Assistance Programme (MDAP) aircraft such as the Republic F-84F Thunderstreak and RF-84F Thunderflash as well as the North American F-86K Sabre Dog and the Canadair Sabre 5 and Sabre 6 joined the fledgling force. However, even as these airframes were entering service these first-generation jet combat aircraft were rapidly becoming obsolete.

The Luftwaffe therefore sought to acquire a single aircraft type that could perform the three missions of fighter, fighter-bomber and reconnaissance. By 1958 commanders had shortlisted the Lockheed F-104G Starfighter, Grumman F-11F-1F Super Tiger and the Dassault Mirage IIIA and settled on the Starfighter as the aircraft of choice. The Starfighter also saw extensive service with the West German Navy, see the August 2016 issue for an article on that air arm's use of the type.

Above: **A JaboG 34 Starfighter in the wraparound camouflage worn by the F-104 in its later years of Luftwaffe service.** AirTeamImages.com/ATI

FLYING TRAINING

The initial cadre of five West German pilots to convert on to the F-104 were sent to the US in February 1960 in readiness for the arrival of the first of 916 Starfighters (30 F-104Fs, 137 TF-104Gs and 749 F/RF-104Gs) later that year . They reported to Lockheed's Burbank, California, plant where they experienced their first taste of flying the type – in a two-seat version.

These pilots were destined to be the Luftwaffe's first instructor pilots. After training they returned to West Germany to form the nucleus of Waffenschule (Weapons Training School) 10 (WaSLw 10) at Nörvenich AB. WaSLw 10 received its first two-seat F-104F in mid-1961. The last example of this variant was retired in December 1971.

From July 1963 training for the majority of West German F-104 pilots took place at Williams AFB, Mesa, Arizona. From October 1964 this moved to Luke AFB, also in Arizona.

Luftwaffe Starfighters were based at Luke AFB (albeit carrying USAF markings) and following successful training on USAF T-37s and T-38s pilots learned how to handle the F-104 prior to returning to West Germany to complete their training before joining a combat wing.

Oberst (Colonel) Wilhelm Göbel (Ret'd) was one of the first Luftwaffe Starfighter pilots and told *Aviation News*: "I was in the first F-104 flying class at Luke AFB from October 1964 to June 1965, where we received transition [training] on type and tactical and gunnery training.

Left: **Starfighter DA+105 of JaboG 31 sitting on the ramp under the Sardinian sun at Decimomannu in August 1963.** Klaus Kropf

"This took about 130 flying hours. After coming back to Germany, we received instrument training at Jever AB with WaSLw 10, which was close to another 30 hours flying."

WaSLw 10, which had moved to Jever from Nörvenich in the beginning of 1964, was responsible for acclimatising aircrew to the European flying environment after the fair-weather operations in Arizona. This entailed extensive training in IFR (Instrument Flight Rules) conditions.

INTO SERVICE

Between 1962 and 1964 nine front line Luftwaffe wings began to convert on to the Starfighter. Five of these were Jagdbombergeschwader (Fighter-bomber Wings), two were Jagdgeschwader (Fighter Wings) and two were Aufklärungsgeschwader (Reconnaissance Wings).

The Jagdbombergeschwader (JaboG) and the Jagdgeschwader (JG) flew the F-104G and the Aufklärungsgeschwader (AG) operated the RF-104G.

All units also had access to two-seat TF-104Gs, which were fully combat-capable although they were not fitted with the 20mm M61 Vulcan six-barrelled rotary cannon carried by the F-104Fs flown by WaSLw 10 for instrument training.

The first Luftwaffe unit to convert to the Starfighter was JaboG 31 *Boelcke*, which was based at Nörvenich and received its first F-104G on February 21, 1962. JaboG 33, based at Büchel followed in August 1962 and the three remaining fighter-bomber wings (JaboG 32 at Lechfeld, JaboG 34 *Allgäu* at Memmingen and JaboG 36 at Rheine-Hopsten) had all converted from the F-84F Thunderstreak to the new F-104Gs by 1967.

The two air defence units destined to convert on to the Starfighter were JG 71 *Richthofen* and JG 74 *Mölders*. Wittmund-based JG 71 replaced its Canadair Sabre 6s during 1963 and JG 74, based at Neuburg-Donau, converted from the F-86K in 1964.

In 1963 and 1964, the reconnaissance units (AG 51 *Immelmann* at Manching and AG 52 at Leck) relinquished their RF-84F Thunderflashes in favour of the RF-104G.

The West German F-104s also saw service with Erprobungsstelle für militärisches Luftgerät (ErpSt/Test Unit) 61, which was the centre responsible for testing and evaluating aerial military equipment and based at Ingolstadt-Manching. In 1987 the unit was renamed Wehrtechnische Dienststelle 61 ►

Below: **Lockheed F-104G 22+58 of JaboG 34 was one of the exhibits at an airshow in Oldenburg on November 10, 1984.** Stefan Goosens

Bottom: **An F-104G JA+233 of JG 71 next to a Mirage 5 of the French Air Force's Escadron de chasse 2/13 *Alpes* based at Colmar, on a squadron exchange at Wittmund in 1967.** Klaus Kropf

Two F-104Gs of JaboG 31 in company with RAF Harrier GR.1s while on an exchange visit to RAF Wittering in May 1965. Klaus Kropf

(WTD 61/Military Equipment Test Unit).

In the first years of service with the Luftwaffe, the Starfighter suffered from a very high accident rate, many of which proved fatal. Oberstleutnant (Obstlt/Lieutenant Colonel) Dieter Tschirschwitz (Ret'd) who flew the RF-104G gave his thoughts on this: "There were a number of reasons for the abnormally high accident rate. Let me give to you my very subjective point of view. The primary cause was that by selecting the F-104 Starfighter the Luftwaffe had leaped over at least two generations of aircraft technology in an air force evolution, and all of this in a very short time. The rather young men of the new Luftwaffe, aircrews as well as ground crews during those first years, were not experienced enough for such a highly sophisticated aircraft, which in fact represented a complete weapons system.

"As time went by, all leadership, pilots and ground crews, were gaining in professionalism and in routine. The Luftwaffe learned how to 'manage' a modern weapons system and, accordingly, the accident rate lowered to a normal standard of a combat-ready air force flying hundreds of missions per day with high performance aircraft in the European environment."

An alert scramble of two air defence F-104Gs of JG 71 *Richthofen* at Wittmund. The aircraft are configured with two underwing tanks, AIM-9 Sidewinder air-to-air missiles on wingtips rails and armour piercing and high explosive rounds for the internal M61 cannon. Wilhelm Göbel

NUCLEAR

One of the key reasons for choosing the F-104G over its competitors was the jet's ability to deliver a tactical nuclear weapon. Pilots who had gone through the training at Luke AFB had practised 'special weapon' delivery and it was to be the primary mission of the Luftwaffe's fighter-bomber units. This was in line with the 1960s' NATO doctrine of 'massive retaliation' in the event of aggression by the USSR.

The Starfighter was ideally suited to the low-level strike role, according to Obstlt Heinrich Thüringer (Ret'd): "The F-104 was a stable delivery platform when flying close to the ground due to high delivery speeds and small wings, which also provided only a small radar reflection area, thus minimising the effect of radar guided ground threats. It performed very well in low-level profiles, capable of all weather and night penetration and weapons delivery. With a single special weapon on board and four external fuel tanks, it matched the capabilities of other tactical aircraft."

The American Mk B.43 'special weapons' were under the control of the SACEUR (Supreme Allied Commander Europe) and their use in times of war could be authorised only by the US President. Obstlt Klaus Kropf (Ret'd) flew with JaboG 31 from the spring of 1972 to the end of 1980. He said: "We initially had four [later two] aircraft loaded with an American special weapon on alert 24 hours a day. The two aircraft were parked, guarded by German and American soldiers, in a fenced-off QRA [Quick Reaction Alert] area and pilots and engineers were on QRA duty within this fenced-off area.

"The F-104 fighter-bomber wings all had different schemes how to manage this QRA duty, but at our wing we ran a 24 hours 'on duty' followed by 24 hours 'off duty' regime. Scattered throughout the month this resulted

Two RF-104Gs of AG 51 *Immelmann* 'zapped' at Canadian Forces Station Marville, France in July 1966 while on a squadron exchange with 439 Strike Attack Squadron. Klaus Kropf

F-104G, 22+39 of JaboG 34 carries a MK 25 A/1 practice bomb dispenser on the centreline station and one 'flat nose' DM-18 bomblet. Frank Klaasen

in five to six QRA duties per month per pilot. The jets were on 15-minute alert, which meant that you had to be airborne within 15 minutes following the release by SACEUR."

BATTLEFIELD INTERDICTION

The secondary mission of each JaboG was conventional battlefield interdiction and this mission became more pronounced when NATO adopted its 'flexible response' doctrine.

NATO's Defence Planning Committee decided to adopt this revised strategic concept in December 1967 based on a range of potential responses to aggression involving the use of conventional as well as nuclear weapons.

One of the immediate consequences of this decision was to assign a purely conventional mission to JaboG 32 and the wing was also given a secondary air defence role.

The F-104 was at home with the conventional low-level attack mission as it was fitted with the 20mm M61 Vulcan cannon and able to carry considerable ordnance on its various fuselage and wing hardpoints.

Weapons included the LAU-51 FFAR (Folding Fin Aerial Rocket) in 19 tube rocket launchers and an assortment of both low- and high-drag bombs.

Ranges in West Germany, France, the Netherlands, Belgium and Denmark were used when available as well as Decimomannu in Sardinia. 'Deci' was the home base for the Taktische Ausbildungskommando der Luftwaffe Italien (Tactical Training Command of the German Air Force in Italy) and was a regular detachment for all Luftwaffe Starfighter units for air-to-air and air-to-ground weapons training.

Obstlt Thüringer recalled: "We used a centreline MK 25 A/1 [practice] bomb dispenser carrying two BDU-33B bomblets and two 'flat nose' DM-18 bomblets [MK-76 or MK-106 respectively]. Distance from the range and range time permitting, there would also be 100 rounds of 20mm practice ammo on board for some gunnery passes. When practising conventional weapons delivery, we usually didn't carry under-wing tanks; instead we had one LAU 32B/A rocket pod on one of the wing pylons containing four 2.75in air-to-ground practice rockets."

Obstlt Kropf attested to the efficiency of the F-104G in air-to-ground weapons delivery missions: "The F-104 was a very stable gunnery platform. The aircraft was easily flown into the required firing position to achieve good air-to-ground weapon delivery results. Lacking today's modern weapon delivery computers and/or modern radar, it was mainly the pilots' flying ability to manoeuvre into the correct weapon release position. However, the Starfighter was very responsive and thus a helpful tool."

Frequent attendance at Tactical Weapons Meets (TWMs) also served to develop the skills of the F-104 pilots. Initially these events were held once a year and the West German F-104Gs participated for the first time in June 1965 at Chaumont, France. From 1970 the TWMs were held every two years and the Luftwaffe Starfighters were represented at every one until 1982.

AIR DEFENCE

The two air defence units (JG 71 and JG 74) received their F-104Gs in 1963 and 1964 respectively.

The Starfighter was an ideal air defence fighter as it could reach altitude quickly thanks to its vertical 'zooming' ability. However, these missions were often compromised by the restrictions placed on flying supersonic over land in Europe. It was forbidden to fly supersonic under 36,000ft so most successful high-altitude practice intercepts were flown over the sea where there was no such restriction.

Taking full advantage of the positive flight characteristics of their aircraft, the West German pilots also became highly proficient at low-level intercepts, although the height restrictions of 500ft imposed over much of Europe again proved a disadvantage.

For air defence purposes, Central Europe was divided into four sectors: Sectors 1 and 2 were controlled by the 2nd Allied Tactical Air Force (ATAF), and Sectors 3 and 4 by the 4th ATAF. JG 74 at Neuburg-Donau was attached to the 4th ATAF and JG 71 at Wittmund to the 2nd ATAF.

Each of the F-104 air defence squadrons were required to have two aircraft on readiness alert at all times and the standard armament configuration called for two under-wing tanks, two AIM-9 Sidewinder air-to-air missiles on the wing tips stations and 700+ rounds of AP (Armour Piercing) and HE (High Explosive) ammunition for the internal M61 cannon.

Hauptmann (Captain) Manfred Bös (Ret'd) flew with JG 74 out of Neuburg-Donau and described the QRA scrambles: "We had training scrambles every weekday except on holidays. After an alarm, we had to be airborne within 15 minutes. Normally we only used only five to six minutes of the given time. After becoming airborne we contacted a ▶

A two-seat TF-104G of JaboG 33. Dr Stefan Petersen

A plan view of a German F-104G. This example belonged to WTD 61, which at the time was part of the Bundesamt für Wehrtechnik und Beschaffung (Federal Agency for Defence Technology and Procurement) and reported directly to the country's Ministry of Defence. Dr Stefan Petersen

radar station, which gave us radar vectors to the target(s) after which the two-ship formation split up to practise intercepts.

"A special scramble was held during the closing ceremony of the Olympic Games in Munich in 1972. The purpose of the scramble was to prevent a terrorist attack with a small aircraft, but, after all, there was no such aircraft flying towards the stadium."

Both JG 71 and JG 74 participated in the Air Force Central Command (AFCENT) Air Defence competitions that took place annually from 1965.

In the 1967 contest JG 71 and the 32nd Fighter Interceptor Squadron (FIS) of USAFE (United States Air Forces in Europe), based at Soesterberg in the Netherlands flew as the Sector 1 team. Obstlt Göbel flew with JG 71 in this competition and described a daylight intercept mission: "Due to the critical scramble times, we were on five-minute alert status. Each flight consisted of one 32nd FIS Convair F-102 Delta Dagger and one Luftwaffe F-104 and two flights were always scheduled, with one flight acting as the spare. Every pilot had his own aircraft, mine was JA+117; so every pilot was able to monitor his onboard sensors and could ask the maintenance for re-adjustments of the sensors after the flight, when necessary.

"Normally, after getting the scramble order, pilots jumped into their cockpits, the engines were started while you strapped in and the F-102 took off after three-and-a-half minutes and the F-104 after four-and-a-half minutes.

"Each flight had to participate in three scrambles; one to a medium altitude of about 15,000ft, one was a supersonic, high-altitude climb to about 40,000ft and the third one was at night.

"After the target passed the start line [the simulated border between the hostile and friendly forces] the F-102s did a head-on attack with missiles, normally within two minutes. This needed to be recorded on the onboard video and on the radar screens in the GCI [General Control Intercept] site at Den Helder in the Netherlands. The F-104s used the gun camera (missile mode was shown) and a radar scope camera."

The three principles upon which the scramble was judged were the 'contact' which was the point at which the target was picked up on the radar screen; 'Judy' which was the indication to GCI that the the pilot had taken over the intercept; and 'splash' which followed the missile launch and was the call that the target was destroyed.

In 1967 his Sector 1 won the Guynemer Trophy for the Best Air Defence Sector and the Huddleston Trophy for the Best Interceptor Team.

RECONNAISSANCE

The first RF-104Gs arrived at AG 51 in November 1963 and AG 52 received its aircraft exactly a year later.

However, initial reactions from pilots flying the RF-104G in the reconnaissance role were far from enthusiastic. The camera suite consisted of just three Delft TA-7M cameras installed in a trimetrogen arrangement. One camera was mounted vertically and the other two were mounted in the left and right oblique positions, each depressed 30˚ from the lateral axis of the aircraft. In this way, the terrain was covered from horizon to horizon but, compared with the extensive camera suite of the RF-84F, this was very disappointing.

Obstlt Dieter Tschirschwitz (Ret'd) flew with AG 52 and in the book *German Starfighters* by Klaus Kropf said: "Our task was Visual Tactical Air reconnaissance supported by photographs. As a result, the pilots were required to spot and identify possible targets very quickly. You had to identify a target, remember the important aspects while flying along at high speed and keep the cameras running for later interpretation and confirmation on the ground.

"Targets were differentiated based on requesting headquarters. Despite the fact that we were generally flying tactical reconnaissance, some targets like nuclear weapons stores, airfields with nuclear assignations, or 'second wave' further east had, without doubt, strategic importance. A certain number of aircraft and combat-ready pilots were always assigned to NATO. Initially

A line up of JaboG 31 F-104s at Decimomannu in the spring of 1973. Klaus Kropf

The badge on this F-104G identifies it as belonging to JaboG 32 at Lechfeld. AirTeamImages.com/Kieron Collection

we had, in addition to this assignment, two aircraft per reconnaissance wing at a constant 15-minute readiness alert. This readiness was abolished in 1966.

"Participating in the annual NATO Royal Flush reconnaissance competitions, German F-104 Recce wings were able to prove their high operational ability and readiness despite the limitations of the F-104 as a reconnaissance weapon system."

In 1971 both AG 51 and 52 began to relinquish their RF-104Gs and started to convert on to the McDonnell Douglas RF-4E Phantom, which was a far more capable reconnaissance platform. However, Obstlt Tschirschwitz was sad to see the F-104 go: "She was not a recce bird – but what an aircraft."

PHASE OUT

The AG's surplus recce RF-104Gs had their cameras removed and replaced by the Vulcan cannon before being redistributed to other Starfighter units.

The next units to lose their F-104s were the two Jagdgeschwaders (JG 71 and JG 74), which received F-4F Phantoms throughout 1974.

JaboG 36 also began the conversion to the F-4F in 1974, completing this in 1976 when the last Starfighters left Rheine-Hopsten.

Meanwhile, the remaining F-104G units soldiered on with the aircraft into the 1980s when the Panavia Tornado began to come into service. JaboG 31 converted to the Tornado in 1983 and JaboG 32 followed suit at Lechfeld in 1984. JaboG 33 was the next to swap to the Tornado in 1985 and the last Luftwaffe unit to convert from the Starfighter to the Tornado was JaboG 34 in 1987.

The bulk of the surplus airframes were sent to a temporary home with Luftwaffenversorgungsregiment 1 (LVR 1/ Luftwaffe Support Regiment 1) at Erding. During the conversion period this unit became responsible for the 'Operational Reserve Unit' based at Manching, which maintained the surplus Starfighters in an airworthy condition prior to their sale to Turkey and Greece and other NATO allies.

LVR1 also had responsibility for operating the F-104 'Kommando' unit, which was created in 1984 to keep F-104 pilots of JaboG 34 and Marinefliegergeschwader 2 (MFG 2) current on the F-104 while they awaited conversion to the Tornado.

JaboG 34 and MFG 2 were the last units to convert from the Starfighter and the Kommando unit finally closed down in September 1988. The honour of performing the final operational Luftwaffe F-104 flight fell to Maj Gottfried Schwarz (Ret'd)who landed 22+91 at Erding on September 19.

However, a few German F-104s continued to serve with the test and evaluation unit WTD 61 at Ingolstadt-Manching and the unit retired its last remaining Starfighter (26+60 but marked as 98+04) being on May 22, 1991. This brought the flying career of German Starfighters to an end. AN

Three F-104Gs wearing special schemes in the summer of 1987. From top to bottom is 20+49 of LVR1, 26+63 of the Marineflieger 'Vikings' display team, and 22+55 of JaboG 34. Major Gottfried Schwarz

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TRISTAR
A WIDEBODY PIONEER

The L-1011 TriStar was the only jet airliner ever built by Lockheed. **Philip Birtles** details the development and career of this tri-jet.

The Lockheed L-1011 TriStar introduced improved safety standards and technology to a new generation of widebody airliners. Unfortunately, it was launched into a period of rampant global inflation and the oil crisis of 1973, which sent the world into recession. Lockheed had a long line of successful propeller-driven airliners, particularly the graceful Constellation and the less successful Electra, which later evolved into the well-proven Orion maritime patrol aircraft.

Lockheed began preliminary studies of new jet airliners in early 1967 to meet the developing needs of major American operators. Initially it was to carry 250 passengers up to 1,600 miles (2,575km) at a gross weight of 300,000lb (136,000kg) to satisfy American Airlines. It was also necessary to look at the needs of the other major US airlines. TWA was just introducing the Boeing 747 and had an interest in a smaller widebody airliner for the domestic market. Eastern Airlines preferred a tri-jet, as its longest non-stop service was 1,800 miles (2,900km), much of it over water. This was before the introduction of the Extended Range Twin Operations (ETOPS) safety standard, which later permitted more economic twin-jet airliners to prove reliability over long-distance routes. TWA also preferred a tri-jet, which would make diversions safer in the event of engine failure on flights from Chicago to the US west coast over the natural barrier of the Rockies. Discussions with potential users during 1967 showed US transcontinental range was essential. Lockheed was offering the L-1011-365 with a capacity of up to 227 passengers, with a gross weight of 320,000lb (145,000kg). The power of the engines was estimated to be around 35,000lb (156kN) from a pair mounted on underwing pylons, and a third above the rear fuselage.

Main photo: **Air Transat's C-FTSW, at Shannon Airport in 2003, was sold by the airline in 2007. The carrier began operating TriStars on transatlantic charters from Canada to Europe in 1989.** AirTeamImages.com/Derek Pedley

This image: **The prototype Lockheed TriStar N1011 flies over the 'Star Factory in the Desert' at Palmdale.** Lockheed

American Airlines' choice of the McDonnell Douglas DC-10 enabled Lockheed to concentrate on the transcontinental range for Eastern and TWA. The all-up weight grew to 409,000lb (186,000kg) with an equivalent payload capacity equal to 345 passengers, and an engine thrust requirement of 40,000lb (178kN). Cruising speed was Mach 0.8 at 35,000ft over a typical range of 3,300 miles (5,300km). The DC-10 was a competitor to the TriStar, intensifying the sales battle between the two manufacturers. In an effort to influence the decision of both Eastern and TWA, Lockheed offered very favourable terms, which proved uneconomical for the manufacturer. The two airlines worked together and were aware of the costings involved. Board meetings on March 26, 1968, reached decisions in principle but the conclusions were kept secret for further discussions the next day with Lockheed and Rolls-Royce which was supplying the engines.

AGREEMENT WITH TWA AND EASTERN

On March 28, TWA came to an agreement with Lockheed and advised both McDonnell Douglas and Eastern Airlines of the decision. Eastern confirmed its interest later the same evening and letters of intent were signed over breakfast the next morning ready for the public announcement, launching the TriStar into development. The orders worth $2,160m (£1,080m) were a record for an airliner still on the drawing board. Specification included 270 passengers in a mixed-class layout, or up to 300 in all-economy seating. The engines selected by Lockheed on March 29, 1968 were three all-new Rolls-Royce RB211 fan-jets, giving high power, low fuel consumption and quiet operation. The aircraft would have a transatlantic range with provision for additional fuel capacity in the wing centre-section and fin.

Manufacture of the first TriStar began on March 1, 1969 at Palmdale, California, with assembly starting on June 24. It was built in a new factory constructed around the aircraft.

The first RB211 fan jets were delivered and fitted in June 1970 in preparation for the official roll-out on September 1 and a move to the flight test hangar for systems and functional testing ready for the maiden flight on November 16, 1970. This started a demanding 12-month flight development programme involving five aircraft flying 1,700 hours on around 1,500 flights, with certification scheduled for November 15, 1971.

The flight development programme for the RB211 engines was under way, with the first flight-cleared engine becoming airborne in a modified VC10 from Hucknall, Nottinghamshire, on March 6, 1970. The Lockheed engine order was the largest single export deal achieved by British industry, with Rolls-Royce responsible for the complete power module. Some other parts relating to the engine such as the cowling and pylons were sub-contracted to Short Brothers in Belfast. The first flight-test engine required a flight development programme of 1,100 flying hours, enabling investigation of the full TriStar performance envelope. Target thrust for the production engines was 42,000lb (187kN).

ENGINE ISSUES

Roll-Royce was forced to introduce more costly titanium blades after experiencing structural problems with lightweight composite blades. A refinancing package was needed but the soaring costs of engine development led to Rolls-Royce becoming insolvent and it was placed into receivership in February 1971. At this point the prototype TriStar had flown only around 40 hours and the first two production aircraft were ready to join the flight test programme.

The second TriStar built (the first production example), in TWA markings, made its maiden flight on February 15, 1971. Testing continued at a reduced rate while negotiations went on to rescue the entire TriStar programme. An Eastern TriStar made the first overseas journey, travelling to the Paris Air Show in June 1971, with a stop at East Midlands Airport to be viewed by Rolls-Royce employees. ►

Series 100 N31030 taxiing for departure from Heathrow on June 14, 1988. TWA was a launch customer for the TriStar. Philip Birtles

TriStars for Air Portugal during assembly in the vast specially built Palmdale factory. Lockheed

Nationalisation of Rolls-Royce by the UK Government solved the political and economic problems leading to flight testing proceeding at an accelerated pace. A provisional airworthiness certificate was issued by the FAA on December 27, 1971, two months ahead of the revised schedule, facilitating route proving and non-revenue demonstrations. Provisional Air Registration Board (a predecessor to today's Civil Aviation Authority) certification was issued for the engine on February 24, 1972, with full American and British engine certification achieved on March 22. The TriStar was awarded its FAA type certificate on April 15, 1972, five months later than originally planned, enabling Eastern Airways and TWA to start passenger operations. British certification followed in July 1972.

NEW FACTORY NEEDED

Lockheed needed to build a new factory to produce the TriStar, adding to the overall financial burden. Plant 10, was constructed at Palmdale over an area of 677 acres, and cost more than $50m (£21m). It was named 'Star Factory in the Desert' and was a seven-building complex featuring the most advanced concepts in aircraft production and logistics, employing 6,000 people during peak production. It took two years of intensive civil engineering to complete. Major parts for the TriStar were produced at Burbank with materials, sub-assemblies and systems delivered by road, rail and air. The climate was ideal. Much of the work could be done outside and flight testing was almost uninterrupted.

Launch orders and options for TriStar 1s consisted of 50 for Eastern worth $860m (£358m) and 44 from TWA worth $750m (£313m). It gave sufficient confidence to launch the TriStar into development. Further sales would be needed to make the programme economically viable. Eastern Airlines eventually put a total of 31 TriStars into service.

Air Holdings, a British company, ordered 30 TriStars, plus options on 20 more. Air Holdings aim was to sell TriStars outside the USA.

Delta Air Lines was an early customer with an order for 24 aircraft, worth $360m (£150m). The airline later became the biggest operator of the TriStar. Northeast Airlines bought four with four options, later taking two more aircraft. Sales within a month of the launch decision totalled 152 aircraft worth $2,500m (£1,035m) with Rolls-Royce earning $385m (£160m).

ADVANCED TECHNOLOGY

Airlines were keen to introduce the TriStar's advanced technology and its comfortable and roomy widebody cabin, despite the downturn in the global economy. Seat mile costs were significantly better than for earlier generation jet airliners, giving it the ability to fly economically from coast-to-coast in the US, or on the high-density commuter routes. In addition to full automatic landing capability, the TriStar pioneered the automatic autopilot where the aircraft was flown automatically from take-off to touch down with the process being monitored by the aircrew. Great care was taken to ensure efficient aerodynamics to avoid unnecessary drag, and systems were designed for high efficiency and low maintenance.

Air Holdings' first sale was ten TriStars to Air Canada with options on nine more. Additional orders placed with Lockheed came from two leasing companies for three and two aircraft respectively. In early 1970, Northeast Airlines began a merger process with Northwest, the latter having already placed an order for DC-10s. The Northeast TriStars were cancelled, although Northeast eventually merged with Delta on April 1, 1972.

An order from Pacific Southwest Airlines (PSA) for two TriStars, and reservations

The flight line at Palmdale with early TriStars for Eastern Airlines. Lockheed

British Airways TriStar 1 G-BBAH on approach to Heathrow on February 12, 1988. Philip Birtles

Left: **TriStar 1 VR-HOD of Cathay Pacific at the airline's home base of Hong Kong Kai Tak in 1994. Cathay Pacific bought 14 new models and added three ex-Eastern examples. The airline flew its last TriStar service on October 15, 1996.** AirTeamImages.com/Daryl Chapman

for three further delivery positions, was announced on September 1, 1970 – the day the first aircraft rolled out. The first two airliners were to service the busy Los Angeles-San Francisco route.

In September 1971 Air Holdings was taken over by British & Commonwealth Shipping (B&CS). All Nippon Airways (ANA) took options on six TriStars in March 1971 but no money changed hands due to the uncertainty with the programme. Lockheed assumed responsibility for global sales, with B&CS becoming a marketing partner. Soon after this agreement was signed, Court Line of Luton ordered two aircraft, plus three options, and became the first European operator. It was also the first charter airline to operate widebody airliners on holiday charters. In September 1972 PSA confirmed its order for five aircraft.

FIRST AIRLINE DELIVERY

TriStar N306EA was the first airline delivery – to Eastern on April 6, 1972. Revenue service began on April 26 flying 123 passengers from Miami to New York. TWA followed in early May with the first passenger service from St Louis to Los Angeles.

Delta confirmed its choice of the TriStar in mid-1972. The DC-10s, which had been ordered as back-up, were transferred to United and leased back to Delta while the TriStars were being delivered. An aggressive battle for sales between Lockheed and McDonnell Douglas continued. Both visited Japan in July 1972. On completion of the tour, the TriStar returned to Palmdale and was readied for a European expedition, finishing at the Farnborough Airshow. It brought an initial order from BEA for six standard TriStars with options for six of a longer-range version. BEA and BOAC merged in April 1974 to become British Airways (BA), the TriStars being allocated to the new group.

Lockheed's Japanese tour led to ANA ordering six TriStars, later adding options on a further 15 aircraft to be used on the dense domestic services. This was followed by a letter of intent from the Düsseldorf-based charter airline, LTU, and Delta increased its total to 18 firm orders plus 12 options.

The oil crisis in late 1973 brought further financial problems to Lockheed and the airlines. Eastern was forced to defer nine TriStars because of overcapacity, creating an expensive slowdown in production. The cash position improved slightly when Delta, TWA and ANA requested early deliveries of seven aircraft, but development of longer range versions was delayed, due to lack of funding. In March 1974 Cathay Pacific signed a letter of intent for two extended range TriStars with two options and Saudia ordered two with options on two more. The first economic casualty was Court Line. Trading was suspended in its shares – mainly because holiday bookings had dropped by a third – in June 1974, with the airline going into liquidation on August 15, 1974.

The initial delivery to British Airways at London Heathrow was on October 21, 1974, and an additional order from the airline brought the total commitment to 15 aircraft. The first commercial BA TriStar service was on January 12, 1975 from London to Paris. ANA signed an agreement for a further seven TriStars in September 1974, conditional upon the Japanese Government permitting widebody airliners to operate from Osaka, and Saudia ordered two of the longer-range L-1011-200s in September 1974. In December, Gulf Air ordered four TriStars with four options.

The continuing fuel crisis in 1975, meant Eastern and TWA had an excess capacity of four TriStars each. PSA grounded its two and replaced them with Boeing 727s until the situation improved. As a result, Eastern and TWA were either selling their surplus aircraft, or delivery slots, to other operators. By the middle of 1976 there were signs of an improvement in the global economy, and the Gulf region continued to flourish. Both Delta and ANA increased fleets, followed by BA and Gulf Air.

A holiday charter operator of the TriStar was Düsseldorf-based airline LTU. Philip Birtles

VARIANTS

There were 165 TriStar 1s built. With a mximum load they could fly 2,950 miles (4,747km). The L-1011-100 gave more range with a new fuel tank between the wing centre section spars, increasing range by 930 miles (1,496km). This variant first flew in 1975 with the initial order from Saudia. A total of 23 were built with orders from Cathay Pacific, China Airlines, TWA, Air Canada and BEA. ►

TriStar 1 TF-ABM was leased from Air Atlanta Iceland by Iberia from November 1997 until May 1998. AirTeamImages.com/Bob O'Brien Collection

The next variant was the TriStar 200 which had more thrust and improved hot and high performance. It was powered by 50,000lb st RB211-524Bs. The range was extended to 4,000 miles (6,433km).

Lockheed announced the TriStar 250 at the end of 1974 with a gross weight increase to a total of 484,000lb (220,000kg), the additional load taken up by increased fuel capacity. This was a conversion option and six of Delta's TriStars ones were upgraded which extended their range to 3,500 miles (5,633km)

In November 1975, the ultimate long range TriStar 500 was announced combining the 52,000lb (222kN) thrust RB211-524B with the strengthened structure of the L-1011-250. The fuselage was shortened by 13ft 6in (4.1m), and by increasing fuel capacity by 22,000lb (10,000kg) using new wing centre-section tanks, the range was increased to 4,606 miles (8,530km) carrying up to 246 passengers. Other versions studied did not get beyond the drawing board.

The variant was launched by an order from BA in August 1976 by converting six earlier options, and placing a further six options. PanAm became a TriStar customer with an order for 12 TriStar 500s in April 1978 and took options on a further 14. Another new TriStar customer was British West Indian Airways (BWIA) which ordered a fleet of four aircraft for the Caribbean to London route.

The maiden flight of the first TriStar 500 was on October 16, 1978, followed by orders from Air Canada for six -500s, LTU for two and TAP Portugal for three -500s. PanAm began commercial services with TriStar 500s in July 1980 as part of its round-the-world service. At the end of 1979, Alia Royal Jordanian ordered four TriStar 500s and the final customer for the airliner was Air Lanka which ordered two -500s with options on two more. The sales prospects for further TriStar sales diminished with competition from the Airbus family of widebody airliners and the Boeing 767. Lockheed finally decided to cease production in 1984 with a total of 250 aircraft, including the prototype which never entered service. Total losses from the TriStar programme came to nearly $2,500m (£1,000m), including $400m written off to close the line.

The world's TriStar fleet attained a high level of reliability, maintainability and profitability for airlines, but the late 1980s signalled the beginning of the end. In the spring of 1989, following 17 years of TriStar operation, Gulf Air was the first big player to begin the process of replacing TriStars with Boeing 767-300ERs.

Overall the TriStar had been safe, but there were some accidents causing fatalities. The first loss was Eastern TriStar N310EA, which crashed in the Everglades on approach to Miami on August 18, 1972, with the loss of 100 of the 176 people on board. The second major incident, fortunately without any fatalities, involved TWA TriStar N31007 when fire broke out in the rear fuselage while on the ground at Boston on April, 19, 1974. Saudia TriStar HZ-AHK was involved in a disturbing accident after an emergency landing at Riyadh on August 19, 1980 when a fire was detected. For unknown reasons, evacuation was not initiated. By the time the airport fire service was able to gain entry to the aircraft flames had engulfed the cabin. All 301 Muslim pilgrims and the crew perished. Delta TriStar N726DA was on approach to Dallas Fort Worth on August 2, 1985 with 163 people on board. The aircraft flew through a violent thunderstorm near the runway threshold and was taken down by a downward microburst. There were 28 survivors, including three cabin crew who were seated in the rear of the airliner. Air Lanka TriStar 4R-ULD was destroyed by sabotage on the ground at Colombo on May 3, 1986 with 16 passengers killed. TWA TriStar N11002 was written off after abandoning a take-off from New York's John F Kennedy International Airport on

An RAF TriStar of 216 Sqn conducts air-to-air refuelling with Typhoons of 3(F) Sqn. This was the last ever aerial refuelling sortie (on March 24, 2014) before the type left RAF service. Key-Dino Carrara

Gulf Air TriStar 200 A40-TB; the carrier ordered its first example in 1974. Philip Birtles

July 30, 1992 with a fire on board. The 274 passengers and 12 crew were successfully evacuated.

SECOND-HAND TRISTARS

The gradual withdrawal from service with the initial airlines led to a buoyant market for used TriStars. BA retired its final TriStar from service in early 1992, but Caledonian Airways, the BA charter subsidiary with a fleet of five TriStars operated from Gatwick to Mediterranean destinations.

Eastern Airlines ceased flying in January 1991, a casualty of the economic recession; the fleet and spares being bought by Delta. The latter airline flew its last TriStar into retirement on March 31, 2010.

Among many other users of the TriStar, some examples being on lease from main operators, was American Trans Air (ATA) with a fleet of 14, and Air Atlanta of Iceland which had six.

TriStars were also converted for cargo operation, with American International placing the launch order for three conversions with options on five more in July 1994. Work was undertaken by Marshall Aerospace at Cambridge, UK, the main external feature being a large cargo door on the port side between the flight deck and wing leading edge. Arrow Air and Millon Air also operated cargo TriStars. Lockheed Martin Aircraft Services converted a TriStar into a fully equipped flying hospital to provide medical relief in under-developed countries, and probably the only TriStar now in regular operation is with Orbital Sciences Pegasus as a satellite launcher – it first flew from Cambridge on July 12, 1993, and made its first successful launch on April 3, 1995.

BWIA TriStar 500 9Y-TGJ was one of four of the type it ordered with the first delivered in November 1981. They were replaced by Airbus A340s. AirTeam Images.com/Derek Pedley

RAF OPERATIONS

Britain's Ministry of Defence (MOD) placed a contract on February 2, 1983 with Marshall Aerospace for the conversion of six ex-BA TriStar 500s into long-range tankers to replace the RAF's rapidly ageing Victor tankers. The first conversion made its maiden flight from Cambridge on July 9, 1985 in an interim standard as a tanker/passenger aircraft, but without a forward cargo door; later retrofitted. Additional fuel tanks were installed in the underfloor cargo compartments, and the aircraft were fitted with two air refuelling drogue units under the rear of the aircraft. The K1 and KC1 variants received in-fight refuelling probes but they were later removed to reduce drag and save fuel and were felt not necessary due to the long range of the type. However, the probes were retained in storage at RAF Brize Norton in case they were needed.

In 1984 three more TriStars were purchased by the MOD from PanAm and converted to purely passenger configuration without the ability to act as tankers. Two were designated as C2s and the third became a C2A due to minor avionics changes.

The initial TriStar for the RAF, ZD953, was handed over on March 24, 1986. The type was operated by 216 Sqn at RAF Brize Norton. The RAF TriStars were finally withdrawn on March 24, 2014 after 30 years' service. They were sold to GJD Services – which specialises in aircraft asset management and end-of-life services – about a week before they were delivered to Bruntingthorpe, Leicestershire. By the end of May 2014, the aircraft had been sold to a US buyer and are now owned by LJ Properties, a US property management company. There is a possibility of a new air-to-air refuelling company starting in the US, which is bidding for a US Navy training contract. The aircraft are looked after by GJD on care and maintenance at Bruntingthorpe.

Lockheed was never to make another jet airliner due to the losses with the TriStar though the type served many operators well. AN

Thai Sky Cargo TriStar 1, HS-AXF, at Dubai International Airport in November 2005. Key-Tony Dixon

MOSQUITO FIGHTER VARIANTS

DAY AND NIGHT DESTROYERS

Much has been written about the de Havilland Mosquito in its bombing role during World War Two. Less well known is the parallel function it undertook as a fighter. **Edward Ward** takes a close look at this varied part of the Mosquito's military career.

Artwork by David Ails depicting Wg Cdr John 'Bob' Braham's victory over a Heinkel He 111 during a mission to Denmark on April 13, 1944. David Ails/www.ailsaviationart.com

It is astonishing that the de Havilland Mosquito, an aircraft initially designed as a bomber, built of wood and not intended to carry guns, should have emerged as the pre-eminent British night-fighter, anti-shipping and light bomber aircraft of World War Two.

Virtually every fighter aircraft type involved in the conflict would find itself carrying bombs at some point in its career, yet by contrast the list of bombers that successfully operated as fighters was an extremely short one. It was curious, therefore, that both the Mosquito and its principal aerial opponent, the Junkers Ju 88, were examples of this unusual process.

EARLY DEVELOPMENT

The Mosquito fighter programme was inextricably linked with the bomber variant at the start of its development and began as a result of the Air Ministry's Specification P.13/36 for a new heavy bomber, which would produce the Avro Manchester and Handley Page Halifax. The specification called for the installation of nose and tail turrets, and, alarmingly, "provision for catapulting" due to the high weights likely to be required. The idea was to catapult heavy aircraft into the air from airfields, however the concept

No.487 Sqn RNZAF operated the FB Mk.VI from August 1943 until its disbandment in September 1945. During this period the squadron participated in several highly publicised missions including Operation Jericho and the destruction of Gestapo headquarters in Aarhus, Denmark. Key Collection

proved flawed. In light of the requirements to meet the specification it was expected that a large, heavy, all-metal aircraft would win the contract. At de Havilland, it was realised that a strong case could be made for a small, high-performance, wooden aircraft in which defensive armament was sacrificed for low drag and weight, allowing such high altitude and performance as to make interception difficult.

Such an aircraft could be produced in fewer man-hours, at lower cost, and using non-strategic materials; in addition, the two-man crew required made less of a demand on RAF personnel strength and training.

In hindsight, all these points seem little more than common sense, but at the time they were radical and it was only with difficulty that the aircraft was constructed at all. Development and production of the prototype was ordered to be stopped by Lord Beaverbrook, the head of the Ministry of Aircraft Production, on no less than three occasions. However, not once did he put this in writing and as a result, Air Vice-Marshal Wilfrid Freeman, Vice-Chief of the Air Staff and champion of the Mosquito project, chose to ignore him.

By the time Specification B.1/40 was written, specifically to cover the DH.98 – not yet named the Mosquito – the multi-role nature of the aircraft was already emerging.

Nominally it was considered a bomber, but already reconnaissance was at least as important a requirement. Yet even at this stage, before construction of the prototype had even begun, the de Havilland designers took care to ensure there was sufficient space under the cockpit floor for four 20mm cannon, a decision that would pay incredible dividends in the years to come.

A close-up of the 57mm Molins gun on an FB Mk.XVIII. Key Collection

The initial order was for 50 DH.98s, including the first prototype, to be built as a bomber-reconnaissance aircraft. By the time the prototype flew on November 25, 1940 official opinion had radically changed regarding the potential of the new aircraft and, in addition to three prototypes (one for each major role), there were to be nine photographic-reconnaissance (PR) aircraft, ten bombers and 28 fighters.

The prototype Mosquito fighter flew for the first time on May 15, 1941 fitted with four 20mm Hispano cannon in the belly plus four .303 Browning machine guns in the nose, an armament that was to remain standard for the majority of fighter variants produced. It sported a flat windscreen for better forward visibility, though this added drag, and modified cockpit arrangements for the crew, notably a stick replacing the bomber-style yoke, despite reports from pilots that the yoke actually made the aircraft more manoeuvrable.

Much has been written about the performance of the Mosquito, but it is difficult to overstate just how impressive it was. The Mosquito was the fastest operational aircraft in the world when it entered service and remained so for a full two-and-a-half years.

For example, the PR Mk.VIII, which first flew in 1942, was capable of an incredible 436mph (702km/h). Surprisingly, the fighter versions were always slightly slower, this was due to the drag imposed by the gun armament and the flat windscreen, rather than the more streamlined V-shaped screen of the bomber and reconnaissance variants. The fastest fighter variant was the NF Mk.XXX which could fly at 424mph (682km/h) at 26,000ft.

However, it is worth noting that this speed came at a price, as the Mosquito was difficult to fly. In his book, *Mosquito* Bill Sweetman described it as "a slightly nervous thoroughbred, which could perform impressive feats in the hands of the courageous and competent, but which would occasionally deal out a kick or a bite."

The stall was difficult to manage, the rudder inadequate at low speeds, and, despite demonstrably outstanding handling on one engine at high speed, the minimum ►

A side profile of Mosquito NF Mk.II, W4087, of 157 Sqn showing the aerials of the AI Mk.IV radar and the Special Night finish. This aircraft had earlier been fitted with an experimental 2,700 million candlepower Turbinlite in the nose. Pete West

Converted from an FB Mk.VI, HJ732/G was the prototype FB Mk.XVIII fitted with the 57mm Molins gun, the muzzle of which can be seen here beneath the nose. The 'G' suffix of the serial number denoted that the aircraft was to be kept under armed guard at all times. Key Collection

speed at which rudder control could be maintained with one engine feathered was 172mph (277km/h). By comparison, the Martin B-26 Marauder, an aircraft that due to its difficulty to fly was nicknamed the 'Widowmaker', had a stall speed of 160mph (257km/h). RAF Mosquito pilots tended to be selected for their proven airmanship.

INTO SERVICE

The F Mk.II, the initial production fighter Mosquito, entered service with 157 Sqn in December 1941 (though it would be a few months before it took part on operations), a month after the first bombers had been delivered.

The progress of the war at this date made it clear that the Mosquito fighter's initial use would be at night as by that time the Luftwaffe had switched to mainly night bombing the UK. As such, the first examples were finished in RDM 2a Special Night paint, which was commonly referred to as lamp-black. It was a matt paint that resulted in a rough texture sufficient to reduce the maximum speed by 26mph (42km/h). Comparative trials resulted in all Special Night Mosquitos being repainted in standard RAF black dope (a tightening varnish), named Smooth Night. Later standardisation resulted in all Mosquitos being finished in day-fighter finish, regardless of role.

More important than the black airframe were the 'black boxes' within it. Aircraft were fitted with airborne interception (AI) radars, either the AI Mk IV or the improved AI Mk V. These were long wavelength sets already in use by Bristol Beaufighters, sporting distinctive arrowhead transmitter aerials on the nose and wing-tip-mounted azimuth aerials.

Delays in getting the AI radars installed in the Mosquitos meant operations didn't begin until April 1942 with 157 Sqn initially, followed by 141 and 264 Sqns within a month. There were teething problems with the AI Mk V and with the Mosquito itself. Notably the flame-damping exhaust shrouds, which burned through, compounded with diminishing Luftwaffe activity, meant that the first confirmed Mosquito victory would only occur on the night of June 24 that year when Wg Cdr Irving Smith destroyed a torpedo-carrying Heinkel He 111.

"The Mosquito was the fastest operational aircraft in the world when it entered service and remained so for a full two-and-a-half years."

Further victories would rapidly follow as more operations were flown, and more squadrons converted to the type throughout the remainder of 1942. In the early hours of July 31, 1942 Wg Cdr Bertie Hoare became the first pilot to become an ace while flying the Mosquito when he took an NF Mk.II on an intruder mission to Orléans airfield in France, orbiting for half an hour until a Focke-Wulf Fw 200 Condor "came in to land, putting on his navigation lights and headlight at about 200ft. I immediately climbed up to 1,500ft, turned and attacked from the stern quarter as he was touching down. I opened fire with cannon only, at about 1,000ft, with a long followed by a short burst. Many strikes were seen, and the enemy aircraft caught fire and burned furiously."

During 1943 the Mosquito's value as a defensive night-fighter became even more apparent when the Luftwaffe started sending Messerschmitt Me 410 and Fw 190 raiders over the UK for the first time. The Mosquito was the only fighter able to intercept these new threats at night.

Despite the vaunted speed of the Mosquito, the difference in performance between it and these high-performance aircraft was relatively small, a matter of 40mph (64km/h) or so, thus skilful flying, combined with effective use of the AI equipment, was essential.

Wg Cdr Smith's encounter with an Fw 190 also serves to demonstrate one of the potential risks of these interceptions: "My navigator identified it as an Fw 190 with the aid of night glasses and I confirmed identification a few seconds later. Fired a one-second burst from dead astern… observed strikes and a brilliant explosion. The enemy aircraft went down and was seen to hit the ground where it exploded. We were obliged to turn sharply to port after firing, in order to avoid the flying debris." Several night-fighters would be lost to debris from the aircraft they were attacking.

As the Luftwaffe threat over the British Isles diminished, so the employment of the Mosquito as an intruder became ever more crucial to the squadrons so equipped.

Three hundred FB.26s were built in Canada and were essentially FB Mk.VIs but with Packard Merlin engines. Key Collection

Its importance for tackling the Luftwaffe night-fighters over mainland Europe also rose, none of which had the necessary performance to evade the ever-increasing numbers of Mosquitos. The greatest intruder pilot of all was Wg Cdr John 'Bob' Braham who already had achieved considerable success with Beaufighters. By February 1944 Braham was on a ground tour with the position of 'Wing Commander, Night Operations' attached to the 2nd Light Bomber Group of the 2nd Tactical Air Force (2TAF). However, he found that he was able, with persistence, to persuade his commanding officer to allow him to 'borrow' a Mosquito for solo daylight intruder operations – provided he always asked permission first.

A typical Braham sortie occurred on April 13, 1944 when he flew a Mosquito FB Mk.VI of the Polish-manned 305 Sqn from RAF Lasham to Denmark, encountered an He 111 circling a lighthouse and destroyed it, then came across an Fw 58 and shot that down, too. Chased by two Messerschmitt Bf 109s, Wg Cdr Braham made his escape into low cloud and flew back to RAF Benson, Oxfordshire. He returned the Mosquito the following day. Wg Cdr Braham would claim nine victories in borrowed aircraft during the course of these operations. If these flights were exceptional, the nightly missions flown by Mosquito crews seeking out Luftwaffe night-fighters were both effective and commonplace. They served to induce so-called 'moskitopanik' in German aircrew as the Mosquito could appear anywhere, at any time, throughout the night with deadly effect.

Typical was Capt Svein Heglund's destruction of a Messerschmitt Bf 110 on January 5, 1945. "At 500ft range I pulled up behind it and gave it a short burst, which caused an explosion in the fuselage. Lots of smoke and debris was flying off, and the enemy aircraft continued straight and level."

AGAINST THE FLYING BOMBS

Slightly earlier, on June 14, 1944 Flt Lt John Musgrave started a new phase of the air war when, in a Mosquito of 605 Sqn, he became the first person to destroy a V-1 flying bomb.

The Mosquito NF Mk.XXX had two-stage superchargers for improved altitude performance and can be distinguished by the lip intakes immediately behind the spinners. Aircraft RK953 was fitted with the US-built AI Mk X radar as well as the Serrate device that tracked the Lichtenstein radar used by German night-fighters. Key Collection

Mosquitos ultimately accounted for 623 V-1s, mostly at night, becoming the second most successful destroyer of flying bombs after the Hawker Tempest, and once again underlining the remarkable speed performance of the Mosquito.

Meanwhile, the most produced fighter variant, the FB Mk.VI, was proving itself the definitive all-rounder, especially with 2TAF and Bomber Command. Able to carry a 1,000lb weapons load in a bomb bay behind the cannon it was also fitted with racks for further bombs or eight rockets on each wing. It was this variant that performed Operation Jericho, the famous Amiens Prison precision raid, in which 18 aircraft breached the wall of the jail with delayed-action bombs, enabling 258 prisoners to escape.

The FB Mk.VI was also the premier version employed by Coastal Command and here, too, it proved its ability to act as a fighter-bomber in the truest sense. On January 15, 1945 the FB Mk.VIs of 143 Sqn were attacked by 30 Fw 190s from JG 5. Despite this the Mosquitos sunk an armed trawler and two merchant ships, and shot down five Fw 190s.

It was a derivative of the FB Mk.VI, the FB Mk.XVIII, that was the most radical version of the aircraft to see service. Designed for attacking U-boats and dubbed 'Tsetse Fly' (due to it being an insect with a more potent bite than a mosquito) retained the wing armament of the FB Mk.VI, but replaced the nose cannon armament with a single 57mm Molins gun (equivalent to a six-pounder field gun) with 25 rounds, and retained two of the .303 machine guns to assist in aiming this enormous weapon.

The effect on its intended targets was impressive; against aircraft it could be devastating. Sqn Ldr Tony Phillips destroyed a Ju 88 on March 10, 1944 with just four shells fired from his Tsetse Fly. One of the rounds tore an engine clean off the unfortunate Junkers. Just over a year later a mixed force of 37 FB.Mk VIs and FB Mk.XVIIIs from 143, 235 and 248 Sqns found three U-boats on the surface off Norway, and succeeded in sinking them all.

VE Day saw the end of Mosquito operations in the West, but production of the FB Mk.VI (as the FB Mk.40) had begun in Australia and 212 were to be built there. Although too late to see much action in the Far East, Mosquitos supported operations to recapture the Dutch East Indies from the Japanese.

When Gen Yamamura flew in to surrender his forces to the Allies, the fighter-bomber Mosquitos of 1 Sqn were called on to supply an escort, bringing to a close the incredible wartime fighter career of the Mosquito. AN

A 29 Sqn NF Mk.XIII from October 1943. The unit replaced them for NF Mk.XXXs and continued to operate them until 1951! This aircraft, HK428, survived the conflict to be struck off charge in September 1946. Key Collection

AIR BASE MOVEMENTS

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

One of the five Lockheed Martin F-16AM Fighting Falcons from 201 Squadron that the Portuguese Air Force deployed to RAF Lossiemouth for Exercise Joint Warrior 16-2. They arrived on October 6 with three leaving on the 20th, followed on the next day by the last two. Niall Patterson

RAF BRIZE NORTON.

1/9 54+04 A400M LTG62, German AF; HZ-124 A340-213 Royal Embassy of Saudi Arabia. 4/9 0454 C-295M 242.tsl. Czech AF. 6/9 ZZ419 Shadow R1 14 Sqn, RAF also 7th. 16/9 11-5733, 12-5757 & 13-5778 MC-130Js 67th SOS, 352nd SOW, USAF. **19/9 Z21122 C-130J-30 21 Sqn, Tunisian AF also 24th n/s**; ZJ994/AC Merlin HC3A 845 NAS, RN. **27/9** KAF327 KC-130J 41 Sqn, Kuwait AF dep 29th; ZJ134/S Merlin HC3 846 NAS, RN; 168980 C-40A VR-61, USN. 28/9 XZ689/314 & XZ691/366 Lynx HMA8SRUs 815 NAS, RN. 29/9 252 CN235-100MP 101 Sqn, Irish Air Corps. 30/9 **SU-BEX/1291 C-130H 4/16 Sqns, Arab Republic of Egypt AF**.

RAF CONINGSBY

6/9 QQ103 Diamond DA-42MMP ETPS. 20/9 108/YW Xingu EAT00.319, French AF. 21/9 087 Xingu EPV/28F French Navy. 30/9 ZZ419 Shadow R1 14 Sqn, RAF; ZK373 Typhoon FGR4 delivered from BAE Systems Warton.

RNAS CULDROSE

29/9 N-318 NH90-NFH 860 Sqn, Royal Netherlands AF.

RAF FAIRFORD

3/9 85-0089/DY & 85-0127/DY B-1Bs 345th BS, 489th BG, USAF both dep 13th. 13/9 99-0165 C-17A 445th AW, AFRC n/s. 19/9 **85-0089/DY B-1B 345th BS, 489th BG, USAF dep 26th**; **60-0038/BD B-52H 93rd BS, 307th BW, USAF n/s.**

RAF LAKENHEATH

6/9 08-8603/RS C-130J-30 37th AS, 86th AW, USAF. 14/9 **78-0573, 78-0563, 78-0572, 81-0065, 80-0055, 80-0057, 78-0561 & 79-0008 F-15Ds on delivery to Israel, all n/s**; 00-0171 C-17A 517th AS, 3rd Wing, USAF n/s. 16/9 07-8608/RS C-130J-30 37th AS, 86th AW, USAF. 28/9 **84-0014, 80-0018 & 82-0028 F-15Cs 194th FS, 194th FS Ca ANG; 85-0125/MA, 85-0113/MA, 84-0028/MA, 85-0122/MA, 83-0018/MA, 84-0016/MA, 85-0101/MA & 85-0118/MA F-15Cs 131st FS, Ma ANG; 85-0129 F-15D 194th FS, Ca ANG.**

RAF LOSSIEMOUTH

1/9 168853/853 P-8A VP-30, USN dep 5th. 2/9 84-0083 C-21A 76th AS, 86th AW, USAF. 5/9 130613 CC-130J-30 436 Sqn, RCAF. 7/9 CE-03 ERJ 145LR 15 Wing, Belgian Defence – Air Component; 08-0050 CV-22B 7th SOS, 352nd SOW, USAF dep 15th; 12-0063 CV-22B 7th SOS, 352nd SOW, USAF dep 19th. **13/9** 164996/BD C-130T VR-64, USN. 15/9 06-6157 C-17A 60th/349th AMW, USAF n/s. 16/9 08-8194 C-17A 446th AW, AFRC n/s. 19/9 168980 C-40A VR-61, USN. 22/9 16806 C-130H 501 Esq, Portuguese AF. 23/9 164997/AX C-130T VR-53, USN. 26/9 167956/JA P-8A VX-1, USN still present 30th. 27/9 168434/LN, 168855 & 168852 P-8As VP-45, USN all still present 30th; 140118 CP-140 14 Wing, RCAF. 29/9 18 Atlantique 2 21F, French Navy still present 30th; 0453 C-295M 242.tsl, Czech AF; **9235, 9236, 9237, 9238 & 9245 JAS-39Cs 211.tl, Czech AF**.

RAF MILDENHALL

5/9 MM62183 KC-130J 46ª BA, Italian AF; T-235 KDC-10 334 Sqn, Royal Netherlands AF o/s. 9/9 09-0016 C-32A 89th AW, USAF n/s. 10/9 MM62189 KC-130J 46ª BA, Italian AF. 14/9 900530 C-26D USN n/s. 16/9 94-6706 C-130H 158th AS, Ga ANG n/s also 17th n/s & 24th-1/10. 17/9 14-0028 A400M 221 Filo, Turkish AF n/s. 24/9 05-0932 C-40C 73rd AS, AFRC; **88-0422, 88-0428, 88-0463 & 88-0537 F-16Cs 175th FS, SD ANG all n/s**. 27/9 89-1052 AC-130U 4th SOS, 1st SOW, USAF n/s. 29/9 166694 C-40A USN n/s; 89-1181 C-130H 158th AS, Ga ANG n/s also 30th n/s.

RAF NORTHOLT.

1/8 258 Learjet 45 102 Sqn, Irish Air Corps also 28th & 30th. 3/8 CE-02 ERJ 135LR 15 Wing, Belgian Defence – Air Component. 10/8 144614 CC-144B 412 TS, RCAF n/s; 252 CN235-100MP 101 Sqn, Irish Air Corps also 22nd. 19/8 253 CN235-100MP 101 Sqn, Irish Air Corps also 28th. 24/8 81 Xingu 28F, French Navy. 25/8 024 C-295M 13 ELTr, Polish AF.

1/9 025 C-295M 13 ELTr, Polish AF also 4th n/s. 6/9 CE-04 ERJ 145LR 15 Wing, Belgian Defence – Air Component; 13-08135, 13-08434 & 13-08436 CH-47Fs H/1-214 Avn, US Army all n/s. 7/9 14+04 Global 5000 FBS, German AF n/s; V-11 Gulfstream IV 334 Sqn, Royal Netherlands AF n/s; 5105 Challenger 601 241.dlt, Czech AF; T.18-3/45-42 Falcon 900 451 Esc, Spanish AF n/s; 2/F-RAFP Falcon 900 ET00.060, French AF; MM62210 Falcon 900EX 31° St, Italian AF; 13-08135, & 13-08434 CH-47Fs H/1-214 Avn, US Army both n/s; TC-GAP Gulfstream G450 Government of Turkey. 8/9 237/F-RAFD Falcon 2000LX ET00.060, French AF; MM62029 Falcon 50 31° St, Italian AF. **14/9** 253 CN235-100MP 101 Sqn, Irish Air Corps. **15/9** 252 CN235-100MP 101 Sqn, Irish Air Corps also 19th & 23rd. 21/9 71 Xingu 28F, French Navy also 23rd. 27/9 166378 C-37B VR-1, USN dep 29th. 29/9 258 Learjet 45 102 Sqn, Irish Air Corps; 004/F-RAFQ Falcon 900 ET00.060, French AF.

RNAS YEOVILTON

6/9 MM62180 C-130J 46ª BA, Italian AF. 13/9 ZJ178 & ZJ203 Apache AH1s 3 Regt, AAC.

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

Lockheed EP-3E Aries II, 156529, of VQ-1 arriving at RAF Mildenhall on October 29 – it left the next day. Justin Ward

AIRPORT MOVEMENTS

A round-up of notable aircraft visiting UK airports.

Aviastar-TU Tupolev Tu-204C, RA-64032, visited Doncaster Sheffield Airport on October 16. Glenn Beasley

ABERDEEN

22/7 YL-BBL 737-33V Air Baltic. 24/7 N788ZJ Global 6000. 27/7 **S5-AAY CRJ700 Adria Airways**; HA-LYR A320-232(SL) Wizz Air, Keflavik Diversion. **30/7** D-CNMB Learjet 45. 31/7 D-CAAL Do.228-202 Arcus Air.

2/8 EC-LLH Beech F.33A. 3/8 **S5-AAP CRJ700 Adria Airways also 5th**. 4/8 D-EAWA Gardan GY-80-180. 5/8 OE-WFL PC-12. 6/8 A7-CEI Global 5000 Qatar Executive. 8/8 D-EHVT Cesna F.172N. **9/8** D-CHR CitationJet 525C CJ4. 11/8 SE-MHH BAe ATP/F West Air Sweden. 12/8 OY-KVP Learjet 40; D-ISKY Beech 200. 14/8 D-CFOR Learjet 35A. **17/8** F-HGOD Avanti; OO-NAD Falcon 7X also 24th. **19/8** SE-MHI BAe ATP/F West Air Sweden; OO-NHY AS365N3 Noordzee Helikopters Vlaanderen. 21/8 VT-BRS Gulfstream G550; EC-MLA Falcon 2000S. **25/8** HB-JUF Gulfstream G650; **ZS-EOS AW149**.

BIRMINGHAM

1/9 9H-ZAZ 737-436 Horizont f/v; D-INKY & OY-RIB Avantis; LX-EAA Learjet 45. 3/9 SX-BHN A319-112 Olympus Airways op for Vueling. 4/9 **VT-GHD 737-86N Air India Express on delivery**; PP-FLS Falcon 2000; EC-KKD Beech 400XP. 6/9 PH-FHB PA-46-500TP. 11/9 2-SEXY Challenger 601-3A; D-BEEP Citation 750 X. 12/9 YL-RAC An-26B RAF-Avia Airlines also 22nd; F-GUST Cessna 421B. **13/9 EZ-A018 737-82K Turkmenistan Airlines on delivery**; HB-ALM ATR 72-202/F Zimex Aviation f/v; HB-JSG Challenger 605. 14/9 TF-GAY A330-343 WOW Air f/v, to MAEL; D-BMVV Falcon 2000EX; D-FKAE TBM 850. 15/9 HB-ALL ATR 72-202/F Zimex Aviation f/v. 16/9 OE-GKW Gulfstream G100. **18/9** OM-GTB 737-49R Go2Sky op for CSA. 19/9 9H-WII Citation 650 VII also 26th; OY-CKN Falcon 2000. 20/9 50+48 Transall LTG61, German AF; LX-VMF & OO-MLG Citation 560XLs. 21/9 LZ-ABR An-12B Air Bright; SP-SPC ATR 72-202/F Sprintair; D-IEKU CitationJet 525A CJ2. 22/6 YL-RAB An-26B RAF-Avia Airlines; OY-CKN Falcon 2000. 23/9 50+66 Transall LTG61, German AF. 25/9 D-AEWM A320-214(SL) Eurowings f/v. 26/9 M-HNDA Hondajet. 27/9 D-CEFE CitationJet 525C CJ4 also 29th; D-FUEL PC-12; EC-JFT Citation 560 Ultra; **HS-KPI Gulfstream G550**; OE-GDF Phenom 300. 28/9 D-IBJJ CitationJet 525A CJ2.

BLACKPOOL

7/8 A9C-HA Bell 430 Bahrain Amiri Flight. 5/9 VP-FAZ DHC-6-300 British Antarctic Survey dep 8th. 6/8 D-EGHW Bolkow Bo.209-180FV. 12/9 HB-OQU PA-28-181 n/s. 16/8 PH-OOM Cirrus SR-20; PH-PLG PA-28-181. 17/8 PH-1263 Diamond HK-36TC dep 18th.

DURHAM TEES VALLEY

2/8 OY-RJC CRJ100LR n/s also 4th. 3/8 9H-SSG Falcon 100 n/s. 6/8 D-AOLG Fokker 100 Avanti Air. 11/8 PH-CTR Citation 680 Sovereign+ n/s also 23rd; D-CESA Citation 550 Bravo dep 13th; F-HLRA Diamond DA-62 dep 13th & 28th n/s. 13/8 2-ROCK Cirrus SR-22 n/s. 14/8 OK-EMA Citation 680 Sovereign n/s & 21st-24th. 19/8 F-GEXV Beech A.100. 20/8 SP-KCK CitationJet 525A CJ2. 25/8 HA-JEO Citation 650 III. 26/8 OY-NLA Citation 650 III also 28th. 28/8 I-MOFI Falcon 2000LX. 30/8 D-IRUP Citation 551 II/SP dep 1/9; F-HFRA Citation 501 I/SP; PH-RLG Citation 680 Sovereign+ n/s; **HA-KAP Citation 650 III n/s**; OO-FPE CitationJet 525B CJ3 n/s; OO-DFG Falcon 2000LX dep 1/9. 31/8 EC-LYL Citation 560XLS+ dep 2/9.

EAST MIDLANDS

1/9 9H-VGV Phenom 100; N627CR Falcon 900EX also 4th. 3/9 9H-PAM 737-33A(QC) Maleth Aero. 5/9 A6-DDE 777-FFX Etihad Cargo also 20th; D-CARO Citation 680 Sovereign+; F-HATG CitationJet 525C CJ4. 7/9 LX-GJM CitationJet 525C CJ4. 9/9 RA-82043 An-124-100M Volga-Dnepr Airlines also 30th; G-CLAB 747-83QF CargoLogicAir also 26th & VP-BIK 747-46NFER Air Bridge Cargo F1 charters. 10/9 VQ-BRJ 747-8HVF Air Bridge Cargo & 9V-SFM 747-412F Singapore Airlines Cargo F1 charters. 12/9 9H-FWW Premier 1. 13/9 OK-FTR Citation 510 Mustang. 16/9 OY-YBP ATR 42-600 Nordic Capital Aviation, for painting from Satena c/s. 19/9 D-CVHB Citation 560XLS+; D-AIAF A321-211 Condor for painting. 22/9 D-CNUE Learjet 60; LX-LFB Falcon 900. 23/9 2-XAJQ ATR 72-212A Asian Wings for painting for Blue Island. 25/9 OH-RBX Citation 560XL. 26/9 166378 C-37B VR-1, USN; D-IVIN Avanti; CS-TGU A310-304 SATA International; OO-JJI 737-752 Equatorial Congo Airlines dep after painting. 27/9 A6-DDB 777-FFX Etihad Cargo; 9M-CJG Global Express. 29/9 VQ-BLQ 747-8HVF Air Bridge Cargo; I-GOCO Learjet 45.

GUERNSEY

2/7 D-AMGL BAe 146-200 WDL op for Air Berlin; EI-RJD RJ85 CityJet; OY-JJD Beech 400A; HB-

This KC-130T, 162309/406, is operated by US Navy weapons test squadron VX-30 Bloodhounds and carries the unit's markings on the tail as well as the two-letter code of its former unit, VMGR-234 of the US Marine Corps. Bloodhounds' aircraft are a rare sight in Europe and this Hercules arrived at Glasgow Airport on September 30 for a night-stop before departing to Benbecula. It returned the same day staying for two more nights at Glasgow before heading back to the US on October 3. Iain Mackenzie

FOW PC-12; F-GNAS CEA DR.253B. 4/7 2-TRAV Gulfstream G550. 6/7 F-HMBG CitationJet 525A CJ2 also 23rd; D-ECNP Cessna 210K; F-PDHV Verhees Delta; F-BMZY CEA DR.250. 7/7 2-SEXY Challenger 601-3A; F-ZBGG EC135T2+ French Customs. 8/7 HB-CHX & CYH Cessna 172Ps; HB-CYC Cessna 172RG; HB-PIV & HB-PMT PA-28-181s. 9/7 EI-RJR RJ85 CityJet; CS-DTR Falcon 2000; D-EAYO Beech A.36AT. 12/7 D-FNAH PC-12; I-B614 Jihlavan Skyleader. 14/7 D-IFGU Cessna 425. 15/7 D-EITG Cessna F172N; F-HSDG Mooney 20K; PH-VOP Cessna 172R. 16/7 EI-WXA RJ85 CityJet; PH-RMR Ruschmeyer R90-230RG; D-EXAV Cessna 172S; F-GUVD Diamond DA-40D. **18/7** 2-LIFE Eclipse EA.500; 2-MAPP Cessna 421C; F-HADP Robin DR400/140B; OO-WAN AA5 Traveler. 19/7 131/AQ TBM 700A ET00.060, French AF o/s; F-HNDI Robin DR.400/140B. 22/7 D-EOEA Mooney M.20K. 23/7 F-HIJD CitationJet 525A CJ2+; F-HBBR Cirrus SR-20; F-HVEB Cirrus SR-22. 25/7 N61SG CitationJet 525 CJ1 on delivery, ex I-EDEM; G-ISLG ATR 42-300 Blue Islands made its final revenue service and departed to Kemble on 28th for parting out. 27/7 R212/64-GL Transall ET00.064, French AF o/s. 29/7 F-GLOS Citation 510 Mustang. **30/7** SE-RIL Citation 560XLS; F-GNJP Diamond DA-40; F-GIDA & F-GIKK Robin DR.400/140Bs. 31/7 D-EHLZ Cessna T.182T.

LIVERPOOL

2/8 ES-SAK A320-214; **ZS-NEX 767-35D Aeronexus**. 6/8 SX-ATF 737-406 GainJet also 7th; 9H-FAM Phenom 100 also 9th. 7/8 PH-DND ERJ 145MP Denim Air; YU-MTU CitationJet 525 CJ1. 12/8 SX-BHN A319-112 Olympus Air op for Vueling. 17/8 OE-GKM Citation 560XLS also 20th n/s. 22/8 DU-142 AW139 Dubai Air Wing also 25th. **26/8** D-ISUN CitationJet 525A CJ2. 27/8 D-CDAS Phenom 300. 28/8 D-CLUE Citation 650 III. 29/8 LN-RTN Falcon 2000LX dep 31st; 125/XO TBM 700A ET00.060, French AF. 30/8 PH-WDL PA-34-220T also 31st; C-FEMT LearJet 36A n/s; 9H-FWW Premier 1 n/s. 31/8 SP-AST CitationJet 525 CJ1; OE-GKW Gulfstream G100.

LONDON GATWICK

2/9 B-LRB A350-941 Cathay Pacific f/v. 3/9 A6-EOX A380-861 Emirates f/v; N25CP Gulfstream V. 4/9 B-LRA A350-941 Cathay Pacific f/v; EW-455PA 737-8ZM Belavia f/v. 5/9 B-LRC A350-941 Cathay Pacific f/v. 6/9 SP-HAI A320-233 Small Planet Airlines f/v. 7/9 TC-JZE 737-8F2 Turkish Airlines f/v; 91-003 Gulfstream IV 212 Filo, Turkish Air Force. 11/9 CS-TPV E190LR TAP Express f/v; OY-LHD A320-231 Danish Air Transport op for Norwegian f/v. **12/9** CS-TQU 737-8K2 EuroAtlantic op for Monarch f/v. 13/9 A6-EUC A380-861 Emirates f/v. 15/9 4R-ALR A330-343E Air Lanka, Heathrow diversion f/v. 16/9 OY-RUB ATR 72-202 Danish Air Transport op for FlyBe f/v. 18/9 EI-FJV 737-8JP Norwegian Air International. 19/9 B-LRE A350-941 Cathay Pacific f/v. 20/9 UR-PST 737-8AS Ukraine International Airlines f/v; OK-PBT CitationJet 525A CJ2. 21/9 HB-JRG Challenger 604. 24/9 EI-CMD 767-324ER Blue Panorama ops for Norwegian. 25/9 N207AX 767-224ER Omni Air International; OO-PCK PC-12.

LONDON HEATHROW

1/8 A7-BDD 787-8 Qatar Airways f/v; VT-JES 777-35RER Jet Airways f/v. 2/8 TC-JTM A321-231(SL) Turkish Airlines f/v. 6/8 VP-BJX A321-211(SL) Aeroflot f/v. 10/8 CS-TOP A330-202 TAP Portugal f/v. 11/8 CS-TOK A330-223 TAP Portugal f/v; EC-MLB A330-202 Iberia f/v. 14/8 N65LJ Learjet 60 f/v. **15/8** 7T-VKO 737-8D6 Air Algerie f/v. 21/8 B-5947 A330-343E Air China f/v. 22/8 CS-TOM A330-202 TAP Portugal f/v. 24/8 B-5912 A330-343E Air China f/v. 28/8 D-AEWL A320-214(SL) Eurowings f/v. 30/8 CS-TOI A330-223 TAP Portugal f/v. 31/8 G-ZBKG 787-9 British Airways on delivery.

Trade Air Fokker 100, 9A-BTD, at Manchester Airport on October 20 after flying in the RC Toulon rugby team to play Sale Sharks. Nik French

3/9 HZ-AK32 777-368ER Saudia f/v; TC-JTN A321-231(SL) Turkish Airlines f/v. 5/9 OO-SSS A319-111 Brussels Airlines f/v. 7/9 HZ-AK31 777-368ER Saudia f/v. 9/9 EC-MKX A319-111 Vueling f/v; G-ZBKN 787-9 British Airways on delivery. 10/9 EC-MLP A330-202 Iberia f/v. 11/9 G-DHKX 757-23APF DHL Air f/v. 12/9 A6-EUC A380-861 Emirates f/v. **13/9** 9H-SUN A340-313X HiFly Malta op for Arik Air f/v. 15/9 A7-ALJ A350-941 Qatar Airways f/v; A7-HHE 747-8 Qatar Amiri Flight f/v. 18/9 N783AV 787-8 Avianca f/v. 19/9 N785AV 787-8 Avianca f/v; VT-JET 777-35RER Jet Airways f/v. 20/9 N786AV 787-8 Avianca f/v. 21/9 N784AV 787-8 Avianca f/v. 22/9 N782AV 787-8 Avianca f/v; VT-JEU 777-35RER Jet Airways f/v. 23/9 N780AV 787-8 Avianca f/v. 24/9 D-AIUW A320-214(SL) Lufthansa f/v. 25/9 A6-EUE A380-861 Emirates f/v; N791AV 787-8 Avianca f/v. **26/9** N781AV 787-8 Avianca f/v; OE-LWA E195LR Austrian Airlines f/v. 27/9 D-AIUX A320-214(SL) Lufthansa f/v. 28/9 F-HBNL A320-214 Air France f/v; G-ZBKO 787-9 British Airways on delivery. 29/9 HZ-AK34 777-368ER Saudia f/v; VP-BKI A321-211(SL) Aeroflot f/v.

LONDON LUTON

2/8 VP-BZF Gulfstream G650. 6/8 EC-LPQ 737-85P Air Europa; S5-ACK ATR 42-212 Chalair Aviation; D-IADV Citation 501 11/SP. 7/8 D-ANMB Global 6000; SX-SHC Challenger 605. 8/8 VP-CKL Gulfstream G650ER. 9/8 D-ALIK Challenger 850; A6-YMA Gulfstream G550. 10/8 D-CUTE Beech 350. 11/8 LX-IBR Lineage 1000. 12/8 CS-DTT Falcon 7X. 13/8 OY-RUD ATR 72-201 Danish Air Charter. 14/8 SX-FDK Citation 650 III. 15/8 CN-TKX Citation 650 VI; T7-MAB A319-133X(CJ). 17/8 B-8271 Gulfstream G450; PH-AJX Falcon 7X; 125/XO TBM 700A ET00.060, French AF; TC-AGG A321-231 AtlasGlobal. 19/8 P4-SMS Legacy 650. 20/8 TC-KIP Citation 560XLS+. 21/8 ES-ELI Citation 750 X. 22/8 D-ADZV Boeing 737-804 TUIfly for maintenance; B-8205 Falcon 7X. 23/8 **ZS-NEX 767-35DER Aeronexus**; OE-HPA Gulfstream G280. 24/8 B-LHK Gulfstream G650ER; T7-AZH Gulfstream G450. 25/8 YU-PNK Citation 560XLS+. 27/8 D-IXXX CitationJet 525 CJ1; T7-AZG Gulfstream G650. 28/8 VP-BBI Gulfstream G280; D-IJET Avanti. **29/8** F-HBDX Phenom 300. 31/8 HB-JOG A319-112 Holiday Jet.

2/9 T7-GQM Global XRS. 4/9 EI-FWA Sukhoi Superjet CityJet type f/v; YU-FSS Falcon 2000LX; A6-RDJ Challenger 604; **HA-KAP Citation 650 VII**; A6-MMF Falcon 7X. 5/9 OY-RUP A320-231 Danish Air Charter. 6/9 T7-HAS Legacy 650. 7/9 F-GOFX Falcon 900B; A7-MBK A320-232CJ Qatar Amiri Flt. **8/9** TC-MAN Hawker 850XP. 9/9 F-HJMD Falcon 900LX. 12/9 SP-KPG SAAB 340A/F Sprintair; OK-PBT CitationJet 525A CJ2. 13/9 9H-PAM 737-33A(QC) Maleth Aero. 15/9 **5Y-PAA Citation 680 Sovereign**; T7-BSA Gulfstream G450 ex VP-BSA; LX-SUN Avanti. 16/9 VP-COH 737-8DR BBJ2; OE-IPW Falcon 7X. 17/9 A7-CGC Gulfstream G650ER. **20/9** P4-BFY Gulfstream G550; EC-MLR Gulfstream G650. 22/9 LX-AGA Challenger 605; A7-CGB Gulfstream 650ER. 23/9 SE-RMA Challenger 300. **25/9** 9H-TOO Falcon 7X. 28/9 F-HBTV Citation 525 M2. 29/9 LX-LXL Falcon 900LX. 30/9 OE-IPE Gulfstream G550.

LONDON SOUTHEND

1/8 HB-DEV Mooney M.20F dep 3rd. 2/8 OK-SLX Citation 560XL f/v. 5/8 D-ECKR Cessna FR.172H. **6/8** HB-PGB PA-28-181. 11/8 VP-COM Citation 500

Falcon 2000EX, N899BC, wears an unusual livery and is shown just prior to departing London Luton Airport on October 2. Paul K Ferry courtesy of Apron Media

1. 18/8 F-GBPL Mooney M.20K n/s. 19/8 2-GNSY Commander 112B f/v. 23/8 HS-KPA Falcon 2000EX f/v dep 1/9. 24/9 D-EPJB Cirrus SR-20 f/v; D-EDDN Mooney M.20C. 25/8 **5N-BQS 737-524 Air Peace to Air Livery, dep 1/9**. 26/8 T7-ASH PA-46-350P. 28/8 OO-TRJ Cessna F.172P; F-GOPG EC135T2. 29/8 LN-MIX Beech 200 dep 31st. 31/8 N9512U United Consultants UC-1 Twinbee f/v.

3/9 PH-DRT PA-28-181 n/s. 4/9 D-IPVD CitationJet 525A CJ2 also 5th. 6/9 D-CRAS & D-CCAS Short SD3-60s Nightexpress; HS-VSK Gulfstream G650 n/s; LX-LQB Dash 8-Q402 Luxair f/v, London City diversion. 7/9 LX-TAC Phenom 300 also 23rd. 8/9 LX-LAR Learjet 35A. 13/9 M-YBBJ 737-7HE BBJ1. **14/9** D-MXIB Ikarus C.42C; HB-FOZ PC-12 n/s; D-IASC PA-31T Cheyenne 2 f/v. 15/9 OY-EVO Citation 550 Bravo; D-CFLY Citation 560XLS+. 16/9 OO-NRG Robinson R-44. 19/9 D-FALK Cessna 208 Businesswings. 21/9 **1411/DDU SA330Ba 1 RHC, French Army; 3664/GAF, 3850/GAI, 4019/GAY & 4233/GFB SA342M1s 3 RHC, French Army**; EI-FWB Sukhoi Superjet CityJet f/v. 23/9 D-IPCG Cessna 425 n/s. 24/9 D-EBIE Mooney M.20K; HS-KPA Falcon 2000EX dep 26th, also 27th-2/10. 27/9 D-FAST Cessna 208 Businesswings dep 29th. 28/9 D-EEAY Ruschmeyer R90-230RG dep 30th. 29/9 D-IVER DHC-6-300 Businesswings.

MANCHESTER

1/9 D-AIAF A321-211(SL) Condor f/v, for maintenance. 2/9 EC-KBZ Citation 550 II f/v. 3/9 EC-LUK A330-302 Iberia f/v for painting at Air Livery. **4/9** TC-JOJ A330-303 Turkish Airlines f/v; TC-JVS 737-8F2 Turkish Airlines f/v; CS-TPT E190LR TAP Express f/v. 5/9 C-GHLA 767-35HER Air Canada rouge f/v; 9H-KAS Challenger 605 f/v. 6/9 TC-JZE 737-8F2 Turkish Airlines f/v; F-GZTI 737-408F ASL France f/v; LZ-ABJ An-26B Rose Air f/v. 7/9 OY-TCH A321-211(SL) Thomas Cook Scandinavia f/v, for maintenance; OE-GEM Citation 680 Sovereign f/v. 8/9 TC-JTN A321-231(SL) Turkish Airlines f/v; A6-EUA A380-861 Emirates f/v. 9/9 D-IXAA Beech C.90GTi f/v. 10/9 F-HICM Citation 510 Mustang f/v. 12/9 OE-LWJ E195LR Austrian Airlines f/v; HB-JMG A340-313X Swiss International f/v, for painting at Air Livery into Edelweiss Air livery dep 23rd; N745CK 747-446BCF Kalitta Air, Lakenheath diversion; F-HRGD ERJ 145LU Regourd Aviation f/v. 13/9 D-AIUW A320-214(SL) Lufthansa f/v; VP-CHW Falcon 7X f/v. 14/9 B-8117 A330-343E Hainan Airlines f/v; SX-ORG A320-232 Orange2Fly f/v op for Small Planet; HB-JUF Gulfstream G650 f/v. 15/9 M-SIXT CitationJet 525C CJ4 f/v. 16/9 D-AIUX A320-214(SL) Lufthansa f/v; OK-PBT CitationJet 525A CJ2 f/v. 18/9 CS-TPV E190LR TAP Express f/v. 19/9 OY-TCI A321-211(SL) Thomas Cook Scandinavia f/v, for maintenance. 20/9 A6-EUC A380-861 Emirates f/v; EI-FJV 737-8JP Norwegian Air International f/v. TC-JVZ 737-8F2 Turkish Airlines f/v. 21/9 TC-JVY 737-8F2 Turkish Airlines f/v; OY-JTR 737-73A Jettime f/v, op for SAS; D-FGWZ TBM 850 f/v. 23/9 A6-EPL 777-31HER Emirates f/v; D-CEEE Citation 560XLS f/v; LX-SUN Avanti f/v. 24/9 EI-FJK 737-8JP Norwegian Air International f/v. 25/9 D-BEAR Citation 750 X f/v. **26/9** B-6527 A330-343X Hainan Airlines f/v. 27/9 EC-MKO A320-232(SL) Vueling f/v. 28/9 **UR-DPB ERJ 145LR Dniproavia f/v, Zorya Luhansk team to play Manchester United**. 29/9 OK-TVU 737-86N Smart Wings f/v; 9H-TQM A340-313X HiFly Malta f/v, for painting at Air Livery. 30/9 SE-DSX RJ100 Braathens Regional.

Bombardier Dash 8-200, TF-JMK, of Flugfélag Íslands was at Exeter Airport on October 3 having arrived for maintenance with Flybe Aviation Services. Rod Sayer

NORWICH

1/8 TF-FIH 757-208PCF Icelandair to Air Livery. 3/8 300/F-RACE DHC-6-300 GAM56, French AF. 6/8 HB-EWR Beech F.33A; OY-LHA ATR 72-202 Danish Air Transport. 9/8 G-JMCM 737-3Y(SF) Atlantic Airlines to KLM Maintenance, dep 17th. 10/8 **VT-SZN 737-8SH SpiceJet dep ex Air Livery**; D-CHIO CitationJet 525B CJ3. 16/8 D-CBCT CitationJet 525C CJ4. 17/8 F-GFKY A320-211 Air France to Air Livery. 19/8 OO-NHY AS355N3 Noordzee Helikopters Vlaanderen. 22/8 D-ABMU 737-86J Air Berlin to Air Livery, dep 27th. 24/8 CS-DGW CitationJet 525B CJ3. 25/8 D-IAAT Phenom 100 also 26th. 26/8 HB-IXO RJ100 Swiss European Airlines, dep ex KLM Maintenance; OK-RAH Hawker 400XP. 27/8 9H-CET A319-111 dep ex KLM Maintenance. 30/8 9H-BOM Challenger 605; SX-ATF 737-406 GainJet to KLM Maintenance.

PRESTWICK

1/8 KAF343 C-17A 41 Sqn, Kuwait AF n/s, also 5th-7th; 130602 CC-130J 436 TS, RCAF n/s; 91-1234 C-130H 165th AS, Ky ANG. 2/8 HB-FSK & HB-FSM PC-12s c/ns 1644 & 1666. 3/8 F-HANN & VP-CPX PC-12s. 4/8 130616 CC-130J 436 TS, RCAF also 7th. 5/8 N513DM Mu-2B-60; 02-0042 C-40B 76th AS, 86th AW, USAF. 7/8 UR-CNN An-12BK Cavok Air; 94-00316 & 94-00318 C-12Vs 39th MI Co, US Army. 8/8 HB-FSN (c/n 1647) & HB-FSO (c/n 1668) PC-12s. 9/8 98-0001 VC-32A 1st AS, 89th AW, USAF dep 11th. 10/8 15001 CC-150 437 TS, RCAF. 12/8 165738/BH KC-130J VMGR-252, USMC n/s; CH-01 C-130H 15 Wing, Belgian Defence – Air Component. 13/8 EW-382TG An-26B Genex; 87-0036 C-5M 436th/512nd AW, USAF n/s. 14/8 99-0058 C-17A 62nd/446th AW, USAF; 164993/BD C-130T VR-64, USN, also 16th; 168980 C-40A VR-61, USN, also 16th. 16/8 HB-FSP PC-12 c/n 1649. **17/8** UR-KDM An-12BK Cavok Air. 18/8 **A6-PFC 787-8 Abu Dhabi Amiri Flight**. 20/8 02-4452 C-32B 150th SOS; NJ Ang. 21/8 HB-VXB PC-24. 22/8 165161/BD C-130T VR-64, USN; HB-FSQ PC-12 c/n 1650. 23/8 15003 CC-150 437 TS, RCAF; 90-0030 C-20H 76th AS, 86th AW, USAF; 85-0034 KC-10A 305th/514th AMW, USAF. 24/8 83-0079 KC-10A 305th/514th AMW, USAF. 27/8 99-1431 C-130J-30 143rd AS, RI ANG; 15001 CC-150 437 TS, RCAF n/s. **28/8** 99-0100 UC-35A Co. B/2-22 Avn, US Army. **29/8** 130609 CC-130J 436 TS, RCAF; 166694 & 168980 C-40As VR-61, USN both n/s.

SOUTHAMPTON

4/8 EC-MFS 737-4Y0 AlbaStar. 7/8 D-AOLG Fokker 100 Avanti Air. 14/8 OK-UNI Citation 680 Sovereign. **17/8** N517DW Gulfstream G550. 19/8 N585RW Gulfstream G550. 20/8 D-IAAT Phenom 100; EC-LAV 737-408 AlbaStar.

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

Winair Citation CJ2, 9A-DWA, at Cardiff Airport on September 27. Phil Woods

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, Guernsey and Jersey registers.

Learjet 75, G-ZNTH, is a new addition to the UK register, its owner being listed as Zenith Aircraft. Rod Simpson

RESTORATIONS

REG'N	MODE(S)	TYPE	C/N	OWNER
G-ARRI	402817	Cessna 175B Skylark	175-57001	RJ Bentley, (Toomevara, Co. Tipperary, Republic of Ireland)
G-OYES	4070BC	Mainair Blade 912	1186-1198-7-W989	CR Chapman, East Fortune, East Lothian

NEW REGISTRATIONS

REG'N	MODE(S)	TYPE	C/N	OWNER
G-CJEF	4070CE	Sikorsky S-76C (built by Keystone Helicopter Corporation)	760790	The Milestone Aviation Asset Holding Group No.8 Ltd, Aberdeen
G-CJEG	4070CF	Sikorsky S-76C (built by Keystone Helicopter Corporation)	760792	The Milestone Aviation Asset Holding Group No.8 Ltd, Aberdeen
G-CJFO	407100	Airbus Helicopters AS350B3 Ecureuil	3077	Waypoint Asset Co. 3 Ltd, Denham, Buckinghamshire
G-CJFW	407121	Ace Aviation Easy/As-tec 15	AA15110	MJ Pollard, Ince Blundell, Merseyside
G-CJGV	40713A	Flylight FoxCub	DA138	RA Chapman, East Fortune, East Lothian
G-CJHT	40713C	Aeropro EuroFOX 3K (assembled by Ascent Industries Ltd)	49316	GS Aviation (Europe) Ltd, Clench Common, Wiltshire
G-CJIK	407172	Cameron Z-77	12023	P Greaves, (Maidstone, Kent)
G-CJIT	407175	Comco Ikarus C42 FB100 (assembled by Red Aviation)	1608-7466	M Skinner, Trustee of G-CJIT Group, (Swanage, Dorset)
G-CJJI	4071B5	Avro RJ100	E3336	Triangle Regional Aircraft Leasing Ltd, (stored at Cranfield, Bedfordshire)
G-CJJM	4071AE	Robinson R44 Raven I	2447	Heli Air Ltd, Wellesbourne Mountford, Warwickshire
G-CJJO	4071B6	Britten-Norman BN-2B-20 Islander	2313	Britten-Norman Aircraft Ltd, Solent Airport, Hampshire
G-CJJS	404F2A	Piper PA-28-151 Cherokee Warrior	28-7615377	SJ Harrison and VA Donnelly, Carlisle Lake District, Cumbria
G-CJJV	4071CF	Van's RV-12 (built by JW Stevens)	120050	PJ Reilly, (Billingshurst, West Sussex)
G-CJJW	4071C2	Lambert Mission M108	LAA 370-15429	DS James, (Umberleigh, Devon)
G-CJLD	4071B7	Lambert Mission M108	LAA 370-15408	PR Mailer, (Hail Weston, Cambridgeshire)
G-CJMF	4071C1	BRM Aero Bristell NG5 Speed Wing	LAA 385-15413	GE Collard, (Frensham, Surrey)
G-CJOI	4071C4	Cameron O-31	11638	Cameron Balloons Ltd, (Bristol)
G-CJRS	407108	BRM Aero Bristell NG5 Speed Wing	LAA 385-15406	A Watt, (Westhill, Aberdeenshire)
G-CJTA	4071BD	AutoGyro MTOSport (assembled by Rotorsport UK Ltd)	RSUK/MTOS/062	Rotorsport Sales and Service Ltd, (Prolley Moor, Wentnor, Shropshire)
G-CLRT	407012	Schleicher ASK-21	21939	Cotswold Gliding Club, Aston Down, Gloucestershire
G-CLSZ	40716C	DG Flugzeugbau DG-800B	8-85B22	M Roberts, (London W7)
G-CLTD	4071A5	Schleicher K.8B	8975	GD Western, Rattlesden, Suffolk
G-COGS	407193	Bell 407GXP	54636	HC Services Ltd, Manston Park, Kent
G-DVCI	407164	UltraMagic H-31	31/15	Davinci Associates Ltd, (North Boarhunt, Hampshire)
G-DVTA	4071A4	Cessna T206H Turbo Stationair TC	T20608753	D Parker, Blackbushe, Hampshire
G-ELSB	4071B0	Robin DR400/180R Remorquer	1145	Cambridge Gliding Club Ltd, Gransden Lodge, Cambridgeshire
G-EZPP	4070C9	Airbus A320-214	7340	easyJet Airline Company Ltd, London Luton, Bedfordshire (NB)
G-FEST	4071BE	Airbus Helicopters AS350B Ecureuil	2079	Wavendon Social Housing Ltd, (Pavenham, Bedfordshire)
G-GBHB	4070B5	SOCATA TB-10 Tobago	6	BA Mills, Bourn, Cambridgeshire
G-HNPN	407185	Embraer EMB-505 Phenom 300	50500276	Flairjet Ltd, Leeds-Bradford, West Yorkshire
G-HRLE	406ED6	Tecnam P2008-JC	1052	PJ Harle, Morgansfield, Fishburn, County Durham
G-IRTY	4071BB	Vickers Supermarine Spitfire Mk.T.IX	CBAF.IX.970	Boultbee Flight Academy Ltd, Goodwood, West Sussex
G-ISOB	407149	Cameron O-31	12026	CG Dobson, (Goring, Oxfordshire)
G-JZHJ	4070EE	Boeing 737-8MG	63144	Dart Group PLC, Leeds-Bradford, West Yorkshire
G-KLNH	407133	Leonardo-Finmeccanica AW109SP Grand New	22364	Saxonair Charter Ltd, Norwich International, Norfolk
G-LNAC	40709D	Leonardo-Finmeccanica AW169	69023	Specialist Aviation Services Ltd, RAF Waddington, Lincolnshire (for Lincs & Notts Air Ambulance)
G-OLPE	407106	Airbus Helicopters AS350BA Ecureuil	1272	Ariane SRL Unipersonale, (Sondrio, Italy)
G-OREZ	40714E	Cessna 525 Citation M2	525-0928	Helitrip Charter LLP, Hawarden, Flintshire
G-PERH	407197	Guimbal Cabri G2	1164	M Munson, Wycombe Air Park, Buckinghamshire

G-PRPI	40710E	Bombardier Dash 8-Q402	4204	Flybe Ltd, Exeter, Devon
G-RECW	407130	Piper PA-28-181 Archer II	28-8090257	REC Washington, Blackbushe, Hampshire
G-RNGD	4032F8	Murphy Renegade Spirit UK (built by AR Broughton-Tomkins)	PFA 188-11931	AG Chalk, Trustee of Spirit Flying Group, (Portsmouth, Hampshire)
G-SPCI	404711	Cessna 182P Skylane	182-61643	K Brady, Glenrothes-Fife, Perth & Kinross
G-SRBM	40712B	Beech 350i King Air (built by Textron Aviation Inc)	FL-1072	Skyhopper LLP, Gloucestershire Airport
G-TXTV	40711F	Leonard-Finmeccanica A109E	11769	Arena Aviation Ltd, Redhill, Surrey
G-ULZE	403565	Robinson R22 Beta II	2048	HQ Aviation Ltd, Denham, Buckinghamshire
G-USHA	407151	Learjet 75	45-535	Essexjets Ltd, Biggin Hill, Greater London
G-WNSV	4071A2	Sikorsky S-92A	920057	CHC Scotia Ltd, Aberdeen
G-ZBKN	406F7A	Boeing 787-9	38630	British Airways PLC, London Heathrow, Middlesex
G-ZBKO	406F7B	Boeing 787-9	38631	British Airways PLC, London Heathrow, Middlesex
G-ZNTH	407171	Learjet 75	45-540	Zenith Aircraft Ltd, Biggin Hill, Greater London
EI-FJV	4CA71A	Boeing 737-8JP	42080	Norwegian Air International Ltd, Oslo-Gardermoen, Norway (NB)
EI-FJV	4CACE4	Boeing 737-8JP	42286	Norwegian Air International Ltd, Oslo-Gardermoen, Norway (NB)
EI-FNE	Not Allocated	Javron PA-18	JA1009065	PJ McKenna, Oranmore, Co. Galway
EI-FNH	4CA615	Airbus A330-302	1744	Aer Lingus Ltd, Dublin
EI-FRV	4CA6D1	Boeing 737-8AS	44747	Ryanair Ltd, Dublin (NB)
EI-FRW	4CA6D2	Boeing 737-8AS	44748	Ryanair Ltd, Dublin (NB)
EI-FRX	4CA6D3	Boeing 737-8AS	44746	Ryanair Ltd, Dublin (NB)
EI-FRY	4CA726	Boeing 737-8AS	44750	Ryanair Ltd, Dublin (NB)
EI-FRZ	4CA727	Boeing 737-8AS	44749	Ryanair Ltd, Dublin (NB)
EI-FSG	TBA	Airbus A330-243	326	DAE Leasing (Ireland) 7 Ltd, (stored at Ras-al-Khaimah, UAE)
EI-FSU	TBA	Airbus A321-231	1843	ACG Acquisition 2004-1 Ireland Ltd (for Cobalt Air as 5B-DCS)
EI-FVC	TBA	Airbus A319-133	4403	Jessica Leasing Ltd (stored Tucson International)
EI-ITN	4CA723	Bombardier Global Express XRS	9159	Airlink Airways Ltd, Moscow-Vnukovo, Russia
EI-PGH	Not Allocated	Dudek Synthesis LT	P-07518	R Leslie, (Cork, Co. Cork)
EI-SLS	4CA752	ATR 72-201(F)	198	ASL Airlines (Ireland) Ltd, Dublin (NB)
M-ABJL	43EA5F	Gulfstream G650	6198	York Aviation Ltd, TBA
M-ABJW	43EAB9	Eurocopter EC225LP	2745	Parilease SAS (stored at Fleetlands, Hampshire)
M-ABKM	43EAC4	ATR 72-212A	699	Elix Assets 7 Ltd, (Dublin)
M-ABKN	43E807	ATR 72-212A	762	Elix Assets 7 Ltd, (Dublin)
M-AKER	43EAC1	Bombardier Challenger 605	5939	Temauri SL, Madrid-Barajas, Spain
M-CKSB	43EA9E	Dassault Falcon 2000	6	John Mason Aircraft Management Services Ltd, Biggin Hill, Greater London
M-DUBS	43E9F6	Dassault Falcon 2000EX	30	Six Daughters Ltd, London Oxford, Oxfordshire
M-MAVP	43EABA	Bombardier Global 6000	9742	Sentonian Investments Ltd, TBA
M-TFFS	43EAB8	Dassault Falcon 900LX	276	Astira Holdings Ltd, TBA
2-GIAR	TBA	Bombardier CRJ-200ER (Project Phoenix CRJ conversion)	7211	Sky Swallows Capital Ltd, Macao International, Macao Special Administrative Region of the People's Republic of China
2-RVEL	43EB82	Boeing 777-21H	27250	Triple Seven MSN 27250 Ltd (stored at Tereul, Spain)
2-TGHG	TBA	Embraer ERJ 145LR	14500932	Airbus SAS, TBA
2-XAJQ	43EB7F	ATR 72-212A	634	Avion Jet Leasing SARL, Guernsey (for Blue Islands as G-ISLK)
2-ZOOM	TBA	Commander Aircraft Commander 114B	14635	Bagair (Guernsey) Ltd, Guernsey

New Boeing 737-8MG, G-JZHJ, of Jet2 taxiing at Leeds Bradford Airport on September 15 after its ferry flight from Seattle via Gander. Pete Gibson

CANCELLATIONS

REG'N	TYPE	C/N	REASON
G-BITM	Reims Cessna F172P	2046	Cancelled as Destroyed (substantially damaged when force-landed in a field in Normans Lane, Higher Whitley, near Warrington 27.10.14)
G-BNWW	Boeing 767-336	25831	Cancelled as Permanently WFU (flown Cardiff to MOD St Athan for parting out 05.08.16)
G-BOBZ	Piper PA-28-181 Archer II	28-8090257	Re-registered as G-RECW
G-BUBW	Robinson R22 Beta	2048	Re-registered as G-ULZE
G-BUUR	BAe ATP	2024	To Sweden as SE-MHJ
G-BWDB	ATR 72-202	449	To Switzerland as HB-ALQ
G-BYBO	Medway EclipseR	155/134	To Bulgaria
G-BZOG	Dornier 328-100	3088	To Germany as D-CMHD
G-CBTG	Comco Ikarus C42 FB UK	PFA 322-13849	Cancelled as Destroyed
G-CFJF	Schempp-Hirth SHK-1	58	Cancelled by CAA (CofA expired 18.03.11)
G-CGDJ	Piper PA-28-161 Warrior II	28-8116256	Cancelled as Destroyed (crashed on take-off from Perranporth, Cornwall 11.08.16)
G-CHCJ	Eurocopter EC225LP	2745	To Isle of Man as M-ABJW
G-CHHG	Dudek Synthesis	P-05835	Cancelled by CAA
G-CHPU	Powerplay Sting 250/Albatros	23803	Cancelled by CAA
G-CILE	Schempp-Hirth Ventus 2a	99	To Australia
G-CIYS	Airbus Helicopters AS350B3 Ecureuil	4466	To Peru
G-CJFG	Aeriane Swift Light PAS	069	Cancelled by CAA
G-CJFM	Bombardier Dash 8-Q402	4204	Re-registered as G-PRPI

PREVIOUS IDENTITIES

REG'N	P.I.	REG'N	P.I.
G-CJEF	ex PR-OMD	G-ULZE	ex G-BUBW
G-CJEG	ex PR-OME	G-USHA	ex N40085
G-CJFD	ex EC-IYQ	G-WNSV	ex LN-OQN
G-CJJI	ex OO-DWG	G-ZNTH	ex N10872
G-CJJS	ex G-VIVS	EI-FNH	ex F-WWKH
G-CJJV	ex N888HS	EI-FRY	ex N1786B
G-CLSZ	ex D-KLPR	EI-FSG	ex A6-EKX
G-CLTD	ex PH-513	EI-FSU	ex N843AG
G-COGS	ex N591KS	EI-FVC	ex XA-VOP
G-DVTA	ex EI-SPB	EI-ITN	ex OE-ITN
G-ELSB	ex D-ELSB	EI-SLS	ex HB-AFS
G-EZPP	ex F-WWBK	M-ABJL	ex N698GD
G-FEST	ex HB-ZHC	M-ABJW	ex G-CHCJ
G-GBHB	ex F-GBHB	M-ABKM	ex VT-APA
G-HNPN	ex M-HPIN	M-ANKN	ex VT-APB
G-HRLE	ex G-OTUK	M-AKER	ex N605GS
G-IRTY	ex 3W-8 Royal Netherlands Air Force	M-CKSB	ex N954SC
G-OLPE	ex I-CRMC	M-DUBS	ex M-PDCS
G-OREZ	ex N4078L	M-MAVP	ex C-FLKC
G-PRPI	ex G-CJFN	M-TFFS	ex B-8212
G-RECW	ex G-BOBZ	2-GIAR	ex N888AU
G-RNGD	ex G-MWPS	2-RVEL	ex A6-EMI
G-SPCI	ex G-GUMS	2-TGHG	ex B-3057
G-SRBM	ex N1072B	2-XAJQ	ex XY-AJQ
G-TXTV	ex N53BK	2-ZOOM	ex 2-ADEL

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This Boeing 767-3Q8ER, EI-DBG, used to fly with Transaero but was repainted by Air Livery at Manchester Airport into VIM Airlines colours and has been re-registered VP-BVI. Nik French

G-COLH	Piper PA-28-140 Cherokee	28-23143	Cancelled as Permanently WFU (crashed on landing at Full Sutton, East Riding of Yorkshire 30.10.14)
G-CORL	Airbus Helicopters AS350B3 Ecureuil	4454	To Norway as LN-OYF
G-DUKY	Robinson R44 Raven I	1455	To USA
G-EXTN	Extra EA.300/LT	LT018	To Germany as D-EXGO
G-FIJV	Lockheed L.188C Electra	1129	Cancelled as Permanently WFU (CofA expired 27.09.07. Broken up at Coventry, Warwickshire 05.13)
G-FLLY	Dassault Falcon 2000EX	301	To USA as N927TD
G-GUMS	Cessna 182P Skylane	182-61643	Re-registered as G-SPCI
G-GYRS	Zlin Z.526F Trener Master	1238	To Germany
G-IGZZ	Robinson R44 Raven II	12192	To Botswana
G-IKUS	Comco Ikarus C42 FB UK	PFA 322-14130	Cancelled as Destroyed (crashed on take-off from Strubby, Lincolnshire 08.09.16)
G-LGMG	Embraer Phenom 100	50000187	To Malta as 9H-LGM
G-LOFB	Lockheed L.188C Electra	1131	Cancelled as Permanently WFU (broken up at Coventry, Warwickshire 28.01.10)
G-LWDC	Bombardier Challenger 601	3031	To Malta as 9H-IJK
G-MATE	Zlin Z.50LX	0068	To Czech Republic as OK-VIC
G-MEPU	AutoGyro MT-03	RSUK/MT-03/007	Cancelled as Destroyed (crashed at Turweston, Buckinghamshire 28.07.16)
G-MYUU	Pegasus Quantum 15	6917	To Estonia
G-MYXP	Rans S.6-ESD Coyote II	PFA 204-12886	Cancelled as Permanently WFU (Permit to Fly expired 28.07.16)
G-MZBV	Rans S.6-ESD XL (Modified)	PFA 204-13009	Cancelled as Destroyed (badly damaged when force-landed in a field at Andreas, Isle of Man 21.04.15)
G-MZLC	Mainair Blade	1146-0298-7-W949	Cancelled as Permanently WFU (crashed on landing at Croft Feach, Culbokie, Ross & Cromarty 22.08.15)
G-MZNX	Thruster T600N	9098-T600N-026	Cancelled by CAA (Permit to Fly current to 20.06.17)
G-OTUK	Tecnam P2008-JC	1052	Re-registered G-HRLE
G-OTVI	Robinson R44 Raven II	10833	To USA
G-OYES	Mainair Blade 912	1186-1198-7-W989	Cancelled by CAA (but restored again later in the month)
G-SMAS	BAC 167 Strikemaster Mk.80A	EEP/JP/149	To USA as N702MF
G-TAFI	Bucker Bu.133C Jungmeister	24	To Germany
G-TIGJ	Airbus Helicopters AS332L Super Puma	2042	To South Africa
G-TODG	Flight Design CTSW	8288	To France
G-VIVS	Piper PA-28-151 Cherokee Warrior	28-7615377	Re-registered as G-CJJS
G-VYGN	Airbus A330-243	160	To Ministry of Defence as Voyager KC.2 ZZ343
G-WRWR	Robinson R22 Beta II	2964	To Switzerland as HB-ZTS
EI-DBG	Boeing 767-3Q8ER	24746	To Bermuda as VP-BVI

UPDATES & CORRECTIONS

REG'N	DETAILS
G-ARRT	Stored at Old Warden, Bedfordshire. The 'G-ARRT' on display at Museo Piaggio, Pondetera, Italy is not the real one but rather is a modified Piaggio scooter used in a film (corrects Cancellations on page 73 last month)
G-BSZC	Became OK-BSC 09.09.16
G-BUND	Became F-HGPL 19.09.16 (officially cancelled by CAA 08.08.16)
G-CEAX	Reserved as N440SB
G-CGVM	Became OE-RCB
G-CIRJ	Became OO-MSL 30.08.16
G-CIWB	Builder officially changed to M Skalon and CG Price 18.09.16
G-CIWV	Builder officially changed to J Harris & JW Baker 18.09.16
G-HPEN	Became F-HPEN 19.09.16
G-MAYO	Became TU-GAD 03.10
G-MVLL	Type officially changed to a Gemini Flash IIA (Modified) 23.09.16
G-MVSF	Became PH-1Z5 06.07.16
G-NEAU	Type officially changed to an EC135T2+ 05.09.16
G-ODAD	Became N171LL 22.08.16
G-ODCR	Became YR-JTG 08.16
G-PINC	Became I-PINC 08.16
G-WHPG	Type officially changed to a Comco Ikarus C42 FB80 06.09.16
G-WYNE	Became XA-KVD 08.16
M-MNAA	Became HB-JFQ
M-OEPL	Falcon 900DX Became N89FC 23.09.16
M-OLLE	Became VQ-BBQ 08.16

EI-LED	Airbus A321-211	6726	To Bermuda as VP-BEE
EI-OVB	Airbus A321-211	6756	To Bermuda as VP-BEG
EI-SPB	Cessna T206H	T206-08753	To United Kingdom as G-DVTA
EI-SVX	Airbus A321-211	6817	To Bermuda as VP-BES
EI-VKO	Airbus A321-211	6678	To Bermuda as VP-BEA
M-AJWA	Bombardier Global 5000	9182	To Argentina as LV-GQE
M-AVOS	Gulfstream 450	4273	To San Marino as T7-ZZZ
M-AZIZ	Boeing 737-505	24649	Cancelled as Dismantled (stored and then broken up at Fujairah)
M-CCCV	Pilatus PC-12/47	813	To USA as N477SS
M-HPIN	Embraer Phenom 300	50500276	To United Kingdom as G-HNPN
M-IKAT	Dassault Falcon 2000EX	220	To San Marino as T7-ONE
M-VANG	Bombardier Global Express	9349	To Luxembourg as LZ-ZED
M-VVIP	Airbus A340-212	374	To Malta as 9H-BIG
M-YXLS	Cessna 560XL Citation XLS+	560-6193	To Belgium as OO-VMF
2-RLAI	Airbus A330-243	409	To Jordan as JY-JVA

Key: NB – Nominal Base

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

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MAIN HEADING						

AVRO TUDOR

TALES OF THE UNEXPECTED

In December 1942, in the middle of the war, the Brabazon Committee (named after its Chairman Lord Brabazon) first met to evaluate and advise on the types of airliner the British Empire would need after the conflict.

The committee had been formed because during the war the USA and Britain had agreed that the former would concentrate on transport aircraft while the latter built heavy bombers. It was felt that British manufacturers would be at a major disadvantage post-war if there was no planning to design and produce transport aircraft to compete with the American aircraft.

In the short-term after the war, wartime bomber designs were converted in a rudimentary fashion for civilian operations. Thus, the Avro Lancaster became the civilianised Lancastrian and the Handley Page Halton was developed from the Halifax bomber.

Meanwhile, the Brabazon Committee continued to meet up until November 1945 and recommended various types, some of which (including the Vickers Viscount and de Havilland Dove) proved to be very successful and achieved substantial sales, remaining in production until the 1960s. Another Brabazon type, the de Havilland Comet, definitely deserved to succeed but failed owing to the later discovery of metal fatigue which caused a lengthy hiatus in production.

SPECTACULAR FAILURES

However, quite regrettably, the Committee became better known for some rather spectacular failures than a moderate number of successes. Few can forget the huge white elephant that was the Bristol Brabazon, but the piston-powered Avro Tudor also ranks among the less successful recommendations of the Brabazon Committee. Although it entered series production, the Tudor was beset by performance problems and is mostly forgotten about today.

By late 1943 it was evident to the 'boffins' on the Brabazon Committee that a 'stop-gap' airliner was needed to serve the transatlantic routes until the projected Bristol Brabazon and Comet became available.

The Tudor 1 prototype G-AGPF first flew without markings from Manchester Ringway airfield on June 14, 1945. Avro Heritage

Stephen Skinner looks at the development and career of a post-war propeller-driven airliner that was also adapted to be powered by jets.

This BSAA Tudor 4 was named *Star Leopard*. Key Collection

A specification was accordingly issued to Avro in March 1944 calling for a pressurised airliner capable of carrying 12 passengers in liner-style luxury over 4,000 miles (6,437km). Initial designs were based on the Avro Lincoln bomber incorporating a new pressurised fuselage, but as the aircraft developed it became virtually a new type and schedules slipped. British Overseas Airways Corporation (BOAC) was heavily involved in the process of design and refinement, and the many and continual alterations requested by the airline severely hindered production.

Two prototypes of the new Tudor 1 were ordered and the first flew from Manchester Ringway (Avro's Experimental Department base between 1939 and 1946) on June 14, 1945 piloted by the company's Chief Test Pilot Bill Thorn.

Flight trials revealed serious aerodynamic problems; poor directional and longitudinal stability for which a larger fin, rudder and tailplane were fitted; pre-stall wing buffeting was cured by aerodynamic refinement and landing bounce solved by a shortened undercarriage. To make matters worse, range was 10% below specification.

After examining the prototype aircraft in February 1946, BOAC required 343 modifications to be carried out, but the Ministry of Civil Aviation (MCA) judged that only 81 of these were essential. The incorporation of these changes together with the other alterations necessary to reduce the aerodynamic problems played havoc with the production process.

REJECTED

Despite the ceremonial naming of the fourth production aircraft (G-AGRF) as *Elizabeth of England* at Heathrow on January 21, 1947, four months later, on April 11, BOAC rejected the troubled Tudor on grounds that it was incapable of operating a transatlantic service.

As a result of BOAC's decision, production of the Tudor 1 ceased. It was decided three would be completed as freighters and planned that two would be VIP ministerial transports. The latter pair were converted and re-named Tudor 3s but were not used for this purpose and conveted back to passenger configuration and were then called Tudor 1s again. Five were converted into Tudor 4s with fuselages lengthened by 6ft (1.83m) to accommodate 32 passengers for the nationalised British South American Airways (BSAA).

BSAA's Chief Executive was Australian-born Air Vice-Marshal (AVM) Donald Bennett whose illustrious wartime career included setting up the RAF's Pathfinder Force – a ▶

A Tudor 1 at Heathrow in July 1946 next to a KLM Constellation and a Lancastrian. Key Collection

Above: **An Air Charter Tudor 4B at Blackbushe in September 1958.** AirTeamImages.com/ATI Collection

Below: **Tudor 5, G-AKCD, in the colours of William Dempster Lines for which it flew from October 1950 until April 1954, prior to then it served with BSAA.** Key Collection

key component in the successful prosecution of Britain's strategic air offensive. He was very enthusiastic about the Tudor, and his plaudits must have been music to the ears of Avro.

However, relations between BOAC and Avro reached a nadir, and in September 1947 Sir Roy Dobson, Avro's Managing Director, issued a statement blaming the airline for delaying the aircraft's production by constantly requesting modifications. BOAC responded and requested a government enquiry.

When the enquiry published its findings a year later Avro was criticised for not having called in the Royal Aircraft Establishment at Farnborough much earlier to deal with the aircraft's aerodynamic and performance problems. The enquiry concluded that BOAC's rejection of the airliner had nothing to do with whether its performance deficiencies could be rectified and owed more to the fact that the airline was seeking to fly proven American types. BOAC was already operating Lockheed Constellations and in July 1948 received government permission to purchase Canadair C4 Argonauts, the performance of which it felt was superior to the Tudor. Not surprisingly, Sir Frank Spriggs, Chairman of Avro protested strongly against this decision.

TUDOR 2

While the Tudor 1 was intended as a long-distance transport, the Tudor 2 was designed to carry a larger load of up to 60 passengers over shorter distances, suitable for Empire routes with frequent refuelling stages. The Tudor 2 fuselage was 1ft (0.30m) wider and 26ft (7.92m) longer than the Tudor 1 though other features were common to the earlier mark. Two prototypes were ordered by the Ministry of Supply in August 1944 followed by a contract for 30 production machines, soon increased to 85, then decreased to 50 and reduced in 1948 to just 18.

The Avro Tudor 2 prototype (G-AGSU) had first flown at Woodford, Cheshire on March 10, 1946, piloted by Bill Thorn. After four months of company trials it then went to Boscombe Down, Hampshire on July 23 for more testing by the ministry. In September 1946, it returned to Avro to receive an extension of the inner nacelles and a larger fin and rudder. In an attempt to rectify performance shortfalls, the first production Tudor 2 (G-AGRX) had its Rolls-Royce Merlin engines replaced with Bristol Hercules powerplants providing 1,750hp and was designated as a Tudor 7. However following tests, it was determined that the performance was no better than the Tudor 2's.

On August 23, 1947 G-AGSU was involved in a tragic accident at Woodford. The right wingtip struck the ground shortly after take-off and the aircraft crashed into trees before coming to rest in a pond, killing four of the six on board including Roy Chadwick, Avro's Chief Designer who was responsible for the Lancaster and Lincoln and the company's Chief Test Pilot, Bill Thorn. The cause of the crash was determined to be the incorrect assembly of the aileron control circuit.

As the acrimony between BOAC and Avro increased, the first BSAA Tudor proving flight left Heathrow for Buenos Aires, Argentina on September 20, 1947. The BSAA fleet of Tudors was soon operating routes to Bermuda, but on January 30, 1948 G-AHNP disappeared on the latter stage of its route between the Azores and Bermuda, and no trace was ever found of the aircraft or its occupants.

The second Tudor 1 prototype flew as a conventional piston-engined aircraft on June 19, 1946. However, it was substantially reconfigured and flew on September 6, 1948 as VX195 with a fuselage of Tudor 4 dimensions and new wings with four 5,000lb/thrust Rolls-Royce Nene jets in paired nacelles. Key Collection

On February 3, the Tudors were grounded by the Ministry of Civil Aviation. AVM Bennett reacted angrily claiming that the minister, Lord Nathan, was interfering in a matter that was his responsibility. Bennett had sought advice from the Aircraft Registration Board and the Aircraft Accidents Investigation Branch and had found no grounds for any fault with the Tudor. Bennett said that if he had believed the Tudor was at fault he would have grounded it. His comments were reported by the *Daily Express*. The BSAA Board was angered by Bennett's outburst and asked him to resign. He refused to do so and so his contract was terminated. On March 23, the grounding order was lifted and BSAA's Tudor operations resumed. To show confidence in their product Avro organised a special flight to Buenos Aires for its top men; Sir Frank Spriggs and Sir Roy Dobson and their families.

BERLIN AIRLIFT

In June 1948, the Soviet Union blocked all road and rail access to West Berlin. At the time the city as a whole was governed and divided between it, the USA, UK and France. The Western allies were determined the Soviet Union would not starve West Berlin into submission so it would fall to the USSR and decided to supply it by air, which was a mighty undertaking. The armed forces and many airlines took part in what became known as the Berlin Airlift from June 1948 until May 1949. The Tudor's champion AVM Bennett established his own airline, Airflight and made a deal with Avro and the MCA to acquire the second prototype Tudor 2, G-AGRY and the first Tudor 5, G-AKBY – a development of the Tudor 2. The Tudor 5 was a more luxurious version for 44 passengers, although of the five completed none saw such service and all of them were converted at Woodford to become tankers

Above: **The Tudor 7, G-AGRX, was an attempt to rectify the type's performance shortfalls by replacing the Rolls-Royce Merlins with Bristol Hercules engines. Unfortunately, the re-engining delivered little improvement.** Avro Heritage

Below: **The sole Tudor 7 at the 1947 Farnborough Airshow.** BAE Systems

and could carry 25,000 imp gallons (113,652 lit) of diesel fuel.

Airflight's two Tudors flew 977 sorties (many captained by Bennett) during the airlift, carrying 7,984 tons of diesel oil and 749 tons of supplies. In September 1948 BSAA also joined in the airlift and employed three Tudor 1s and the five Tudor 5s on this important task. Like 'KBY, the Tudor 5s were used as tankers and gave sterling service. The carrier's aircraft ferrying 19,813 tons of fuel. It was during the Berlin Airlift that the Tudor finally had the opportunity to confound some of its critics, and the ten aircraft employed achieved a remarkable record for load-carrying reliability.

However, despite the type's successful use in the airlift, less than a year after its previous Caribbean accident, BSAA lost another Tudor 4 (G-AGRE) between Bermuda and Kingston on January 18, 1949. Once again, nothing was ever found. The Ministry of Civil Aviation relegated the BSAA Tudors to freight duties and the entire fleet was stripped of furnishing and pressurisation. Meanwhile BSAA was merged with BOAC.

Following the airlift, AVM Bennett was determined to use his two Tudors for passenger as well as freight transport. Renaming his airline Fairflight, the aircraft were substantially modified and approved ▶

Avro Ashton WB493 was one of the six redundant Tudor 2 airframes rebuilt for research purposes with nosewheel undercarriages and Rolls-Royce Nenes. This machine was later fitted with Bristol Olympus engines in outboard nacelles. BAE Systems

by the MCA for passenger carrying before beginning to fly charters in Europe and the Middle East.

On March 11, 1950 G-AKBY was operating a rugby charter from Dublin when it crashed on landing at RAF Llandow, near Cardiff, killing 83 of the 86 on board. This did not stop Fairflight and its remaining Tudor (G-AGRY) continued to serve until 1954. There were only two other examples of the aircraft in service – two Tudor 5s (G-AKCC and G-AKCD) bought from BSAA in April 1950 by William Dempster Lines – which also continued to fly. However, the former was damaged beyond repair while landing at RAF Bovingdon, Hertfordshire on October 26, 1951, while 'CD flew on until being bought for spares by Air Charter in 1954.

Many complete and partly complete Tudors were scrapped at Woodford, but in September 1953 the MCA agreed to the purchase of 12 of the redundant Tudor 1s, 3s and 4s by Aviation Traders owned by British aviation entrepreneur Freddie Laker. Six of these were extensively modified (G-AGRG, 'GRH, 'HNI, 'HML, 'HNM and 'HNO), receiving upgraded Merlins and a large freight door and were renamed by the company as Super Traders though also referred to as Tudor 4Bs. They were operated by Air Charter, also owned by Freddie Laker, as both airliners and freighters, while the unconverted aircraft were scavenged for spares by the latter. The Super Traders remained in service in gradually dwindling numbers until G-AHNL performed the type's final commercial flight (from RAF Changi, Singapore to RAF Lyneham, Wiltshire) on October 31, 1959. The following day it was flown to Southend, Essex for scrapping – it would be last time a Tudor would fly.

The Tudor is a sorry tale, and especially so as Avro had been so successful with the Lancaster and Lincoln. Despite grand expectations of sales to Commonwealth countries none ever materialised and only 33 Tudors were ever built. After its experience with the type, Avro stayed out of the civil airliner market until the end of the 1950s when the firm set to work on the Avro 748 – an aircraft that proved to be relatively problem free and sold far and wide. AN

THE WORLD'S FIRST FOUR JET AIRLINER

Almost immediately after its maiden flight on June 19, 1946 the second Tudor prototype G-AGST was returned to the factory to be modified as the sole Tudor 8. It was fitted with a lengthened Tudor 4 fuselage and new wings with four 5,000lb thrust Rolls-Royce Nene jets in paired nacelles, but still maintaining its tailwheel configuration.

Registered VX195 it made its first flight as a Tudor 8 on September 6, 1948 and was the world's first four jet airliner.

Tests indicated that rather than a tailwheel configuration a nosewheel undercarriage layout was required because jet blast damaged both the tail and the airfield itself as well as raising a dust storm.

The Tudor 8 was intended as a research vehicle and on August 29, 1949, while based at Woodford, it exceeded 40,000ft (12,192m). It only had a short life and was broken up at Farnborough in 1951.

Building on this experience, six redundant Tudor 2 fuselages were utilised in a similar configuration to the Tudor 8 but, sensibly, fitted with a tricycle landing gear to produce the Avro Ashton. These were employed as engine, navigational and bombing test-beds in the 1950s.

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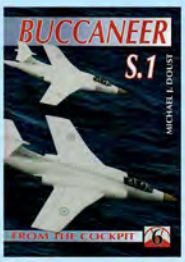

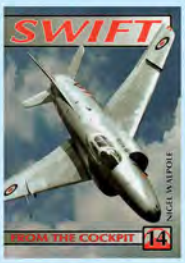

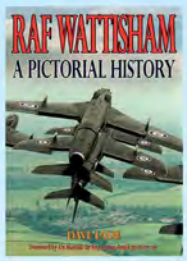

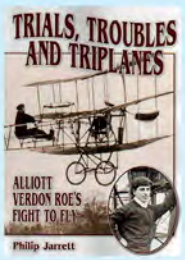

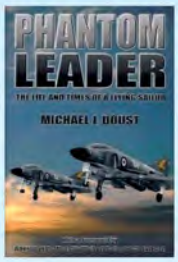

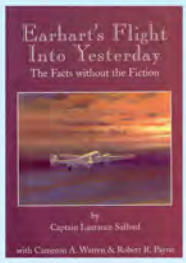

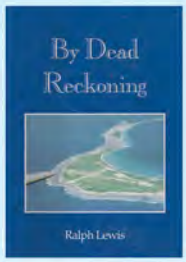

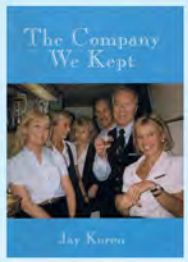

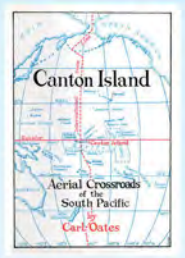

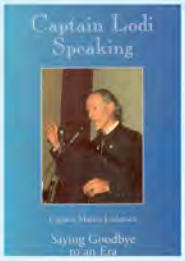

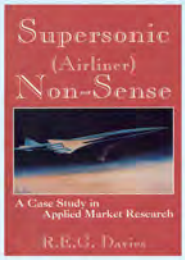

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