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JETS



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Andover

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Meteors***

***Stop Gap
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*Short's Sperrin
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From the Left Hand Seat



When I was younger one of the highlights of the year was the day that Key Publishing's annual 'Airshow' guide hit the shelves.

As a child I would devour this magazine for news about new acts, new colour schemes and new events and I would take my highlighter pen to the schedule of dates to indicate the shows that I would later be begging my father to drive me to!

It's probably fair to say that this one publication did more than anything else to influence my choice of a career in both aviation and aviation publishing.

You can perhaps now understand my delight when Key Publishing chose to resurrect this popular product for the 2015 airshow season... and asked me to edit it!

I've edited and written for countless titles over the years but I have to say the opportunity to revive the magazine that helped formed my career is a dream come true.

Special issue

By the time this issue of *Jets* hits your coffee table *Airshow 2015* will also be on sale in WHSmith, Sainsbury's and leading newsagents. This special 84-page magazine features stories from behind the scenes at events and focuses on some of the world's best loved and most exciting aircraft, pilots and crews.

What's more, if you are a *Jets* subscriber (or a subscriber to any of Key Publishing's magazines) you can call 01780 480404 to claim your special £1 discount from the normal £4.99 price.



I hope you enjoy reading and planning your own airshow visits this season.

Special themes

Following on from Key Publishing's recent purchase of *Jets* I'm pleased to report that the magazine is being subject to increased levels of investment – both in editorial and marketing terms.

This means we have the opportunity to produce some 'bumper' issues later this year focusing on special themes that are of interest to you. And, dear reader, this is where we need your feedback... What would you like to see in these bumper issues?

Would you like to see more coverage of the 40th anniversary of the end of the Vietnam War? How about a particular air arm, airline or manufacturer?

I can be contacted on steve.bridgewater@gmail.com or via the editorial address and I'd be really keen to hear what you'd like to see more of (or less of) as we move forward with the magazine.

Eclectic

I think this issue of *Jets* is probably one of the most eclectic editions we've ever produced. From RAF Meteor night fighters and Royal Navy Scimitars to USAF Starfires, US Navy Tigers, classic airliners such as the Caravelle and HS 748 to the unique Short Sperrin, the distinctly odd French Grognaard, a tour of HMS Ark Royal and even a proper 'hands-on' Airbus A320 report by Scott Germain I hope there's something for everybody within the next 84 pages!

Until next time
Blue Skies



Steve
Stephen Bridgewater
Editor



Paul Heasman

JETS PHOTO OF THE MONTH

Among the latest RAF squadrons to mark its centenary is XI Sqn, which has painted Eurofighter Typhoon FGR.4 ZJ925 with special black and gold commemorative tail art. The aircraft, which is coded DXI and affectionately known as 'Dixie', also carries the names of Netheravon (its base in 1915) and RAF Coningsby (its current base) on the upper surfaces of its canards. It is seen here over the XI Sqn hardened aircraft shelters at RAF Coningsby



www.jetsmag.co.uk

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CONTENTS

INSIDE THIS ISSUE OF JETS:



6 Jet Noise

News from the Jet World

12 Military History Starfires over North Korea

The Lockheed F-94 Starfire had been in service just two months before it was summoned to assist in the Korean War. Warren Thompson charts the career of one of the USAF's unsung jet fighters

18 Museum of the Month Sri Lanka Air Force Museum

The Sri Lanka Air Force Museum has rescued some interesting exhibits and houses an impressive aviation library, as Tom Singfield discovers

20 Preservation Dominie's last flight

Just over 50 years after the first HS.125 Dominie T.1 took to the skies, the last of these RAF navigation trainers made the type's final flight on February 20, 2015. Peter R March reports

22 Anniversary Alive & Kicking

Twenty five years ago Captain Tim Lancaster had a close brush with death when he was nearly sucked out of the cockpit of his BAC 1-11. Kimberley Hawkins investigates what went wrong (and right) that fateful day

24 Military History Meteors by Moonlight

Meteor night fighters were crucial to filling the UK's defence capability gap after World War Two. Paul Fiddian takes an in-depth look into the 'Meat Box's' spectral shadows

30 Dogfight Super Sabre Kill

Flying primarily air-to-ground missions during the Vietnam War, the USAF's F-100 Super Sabre was only briefly used in a fighter role. Jamie Ewan relates how the type made its mark against the enemy MiGs

33 Testing Times

The latest in Jet related books and products put to the test

34 Memory Lane

Jets is all about rekindling the memories of days gone by. As part of this we're keen to hear from you and see the images filed away in your photo albums. This month Mike Vines recalls a "grand day out" aboard HMS Ark Royal in 1978

36 From the Cockpit The Mind Set Jet

The Airbus A320 is one of the most modern airliners in

Airbus

36



44



48



USAF Museum

62



76



service. Scott Germain takes readers aloft for a check flight in the 'baby bus'

44 Pioneers The Grumbler

One of the most unusual looking aeroplanes of all time was the French Sud-Est Grognaud. Jamie Ewan takes a look at the 'Grumbler'

47 Incoming! Letters to the Editor

48 Record Breakers Streak Eagle

The one-of-a-kind McDonnell Douglas F-15A Streak Eagle broke eight time-to-height records. Steve Bridgewater looks back at the jet's achievements

50 Classic Turboprop Avro's Last Hurrah!

Avro's successful turboprop airliner and military transport was conceived nearly sixty

years ago. Richard Freail examines the development and service of the HS 748 and HS 780

58 Military History Turbo Connie

It's a Lockheed Constellation, but not as we know it! Richard Evans investigates the US Navy's turboprop powered R7V-2 Super Connie

62 Classic Airliner La Belle Caravelle

The beautiful and uniquely styled Caravelle was the world's first short-haul jet and set the bar for every small jet airliner to follow. Andy Martin explains why

68 Pioneers Britain's Stop-Gap Bomber

One of life's understudies, the Short Brothers' SA.4 was conceived as a stop-gap, emerging with seriously dated technology. Yet the Sperrin was docile and flew beautifully, as Pete London reveals

76 Classics Compared Tiger vs Scimitar

Both Grumman's Tiger and Supermarine's Scimitar were destined to have short service lives but both made ideal formation aerobatic mounts. Sebastian Morgan looks at a pair of swept-wing carrier borne fighters



50



Front Cover: Airbus

Jet Noise



VAAC Harrier to Cosford

The unique Vectored-thrust Aircraft Advanced Control (VAAC) Harrier T.4 test-bed (XW175) is set to make a rare public appearance in the static display at this year's RAF Cosford Air Show on June 14.

The aircraft has been involved in many trials in its career and was most recently employed in the 2007/8 testing of shipborne rolling vertical landing (SRVL) methods to be used by British F-35 Lightning II fighters. The aircraft has been in storage at QinetiQ's base at Boscombe Down but recently moved to RAF Cosford.

In order to ease traffic congestion, tickets for the show are available for advance sale only. This year adult tickets are priced £22.00 with accompanied under-16s admitted free of charge. Other star items include a rare outside appearance by the RAF Museum's TSR.2.



Steve Bridgewater

The VAAC Harrier flew SRVL tests aboard the French navy carrier *Charles de Gaulle* in 2007 and *HMS Illustrious* in 2008. It has now moved to RAF Cosford

Paul Heasman



Jamie Ewan



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RAF special tails aplenty

Among the RAF units celebrating their 2015 centenary by adorning jets with special tail art are XI, XV and 29(R) Sqns. RAF Coningsby-based XI and 29(R) Sqns have both painted examples of the Typhoon FGR.4 in unusual colours. XI Sqn's ZJ925 has gained a black and gold tail and the names of Netheravon (its base in 1915) and RAF Coningsby on the upper surfaces of its canards.

Meanwhile, 29(R) Sqn has painted ZK353 with both a red tail and red canards along with a stylised eagle and 'XXX' motif. The tail also features the silhouettes of a number of aircraft previously flown by the unit and it is believed the jet will be allocated to Typhoon display pilot – Flt Lt Jonathan 'Jonny' Downen for the 2015 season.

Elsewhere, RAF Lossiemouth-based XV Sqn unveiled a special centenary anniversary paint scheme on March 3. The tail of one of the unit's Tornado GR.4 jets (ZA461) has been painted in the squadron's famous blue and red colours and was 'unveiled' during a special training sortie, alongside the XV Sqn's famous 'MacRobert's Reply' aircraft (ZA602).

easyJet unveils new livery

easyJet, the UK's largest airline, has launched a new aircraft livery – the first change to the look of the airline's iconic white and orange fleet since easyJet.com replaced the call centre number on the fuselage in 1998.

There are two main design changes. Firstly, easyJet's trademark orange has been extended from the tail fin on to the fuselage to create a larger space for the easyJet logo (which is 15% bigger than before) and secondly, an orange stripe has been introduced onto the fuselage. This enables the easyJet logo to be reversed out of that colour – in accordance with brand guidelines – and gives the aeroplane a sleek, more modern look.

The airline currently has a fleet of 226 Airbus A319 and A320 aircraft and has a further 197 on order. The new livery will feature on all new aircraft delivered from April 2015 and the existing fleet will gain the scheme when they are next repainted, typically every six years.



According to easyJet, 50% of its fleet will sport the new livery by the end of 2017

The Latest News from the World of Jets

RAFALES FOR EGYPT

Egypt has ordered 24 examples of the Dassault Rafale fighter and a 'multi-mission frigate' worth a combined US\$5.9 billion, according to a statement made by French President François Hollande on February 12.

The jets sold to Egypt will reportedly be modified to remove their nuclear capability and NATO communication systems. Once adapted, the first fighters could be delivered as soon as August to enable Egyptian pilots to fly them in Egyptian colours over the official opening of a new waterway on the Suez Canal.



Lottery grant for Brooklands

One of the UK's most historically significant sites for motoring, aviation and engineering is to undergo a significant redevelopment to bring to life more of its remarkable history, thanks to funding from the Heritage Lottery Fund (HLF). Brooklands Museum in Weybridge, Surrey, has received a confirmed grant of £4.681 million from HLF for its 'Brooklands Aircraft Factory & Race Track Revival Project'.

This project will transform the Museum's Grade II listed World War Two Vickers Wellington Hangar into 'The Brooklands Aircraft Factory'; build a new annexe (the 'Flight Shed') to house more of the museum's outstanding collection of historic aircraft; and restore the finishing straight of the Brooklands Race Track, the world's first purpose-built motor-racing circuit.



Work at Brooklands is due to start in the next couple of months with completion of the Aircraft Factory and Flight Shed experiences anticipated by summer of 2016 Brooklands Museum



Morphing seats that can harvest a passenger's body heat to power aircraft systems such as holographic pop-up pods are among previous ideas submitted to the Airbus Fly Your Ideas competition

"Fly Your Ideas"

After an evaluation process by over 50 Airbus experts and innovators judging more than 500 ideas, Airbus has selected the 100 teams that have made it into Round Two of the fourth annual 'Fly Your Ideas' global student competition, which is organised in partnership with UNESCO.

The competition is dominated by teams registered in India (17 teams), UK (10), USA (8), France (7), as well as China and Hong Kong (6) and Australia (5). The 100 selected teams comprise of 413 students representing 48 different nationalities. Each of the teams has been assigned an Airbus mentor and an Airbus expert to help take their ideas further and share their insights of real-life aviation over a 100-day period. The top five teams will present their ideas at a live event at Airbus facilities in May.



RAF HS.125 RETIRES

The RAF has retired its last Hawker Siddeley HS.125s after more than 40 years of service. Operated by 32 (The Royal) Sqn at RAF Northolt, London, three of the remaining four airframes (ZD620, ZD703, ZE395) flew out to Dunsfold, Surrey for disposal in late March. The final aircraft (ZD621) took to the skies on March 30 for a commemorative last flight over Cranwell, Finningley and Chester (Hawarden). It will now serve as a 'gate guardian' at RAF Northolt.

FIRST ITALIAN-BUILT F-35A

The first Lockheed Martin F-35A Lightning II was rolled out of the Final Assembly and Check Out (FACO) facility in Cameri, Italy on March 12. This aircraft is the first F-35A for the Italian Aeronautica Militare and is expected to fly later this year. The FACO will build all Italian F-35A and F-35B aircraft and is programmed to build F-35As for the Royal Netherlands Air Force.



Jet Noise



Boeing's 'ecoDemonstrator' 757

After the flights are complete, Boeing will work with the Aircraft Fleet Recycling Association and the lessor, Stifel's aircraft finance division, to recycle the 757 using environmental best practices



Boeing

On March 18, Boeing began several months of flights with its ecoDemonstrator 757 to evaluate new technologies designed to improve commercial aviation's efficiency, reduce noise and carbon emissions. Boeing is collaborating with TUI Group and NASA on these tests and the aircraft's left wing includes a 'Krueger shield' that can protect the leading edge from a build up of dead insects. The vertical tail also included 'active fluid control' (AFC) to improve airflow over the rudder and maximise its aerodynamic efficiency. Based on wind-tunnel testing, AFC could improve the rudder's efficiency by up to 20% and may allow for a smaller vertical tail design in the future.

AFGHANI A-29s DELAYED

Delivery of the first of 20 Embraer A-29 Super Tucano close air support aircraft for the Afghan military has been delayed until December, meaning the nation will be without a suitable aircraft to counter the Taliban during the summer 'fighting season.' The USAF's \$427 million programme to provide A-29s to Afghanistan has reportedly been caught up in long-running contract disputes and delays in the training of air and ground crews.



Embraer



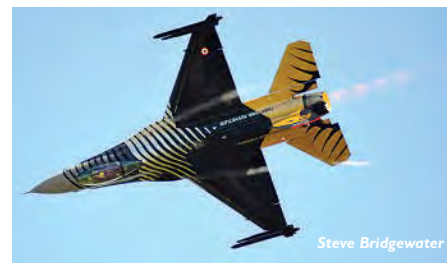
Airbus

50th A320 FOR SPRING AIRLINES

Spring Airlines, an all-Airbus A320 family operator and China's first low-cost airline, has taken delivery of its 50th A320 at the Airbus (Tianjin) Delivery Centre in China. The jet is on lease from ICBC Financial Leasing, a lessor owned by the Industrial and Commercial Bank of China. The aircraft is the 210th A320 aircraft assembled at the Tianjin Final Assembly Line

SEASIDE SOLOTURK

Having taken the European Airshow scene by storm for the past five years, the Turkish Air Force's SOLOTURK F-16 display is heading back to the UK in 2015 to appear at the Bournemouth Air Festival on August 20-23. Formed in 2010, SOLOTURK flies a General Dynamics F-16C Block-40 jet adorned with a striking black, gold and white colour scheme and performs a high energy award-winning display



Steve Bridgewater

JAM'S JAVELIN ARRIVES

The Jet Age Museum, based at Gloucestershire Airport (Staverton), took delivery of its newly acquired Gloster Javelin FAW.4 (XA634) on March 25. The aircraft had been acquired from the MoD and had been serving as a 'gate guardian' at RAF Leeming. It is thought to be the last remaining FAW.4 version of the Javelin and it will now join Javelin FAW.9 XH903 at the Jet Age Museum.

Darren Lewington/JAM



9,000th AIRBUS

On March 20, Airbus celebrated the delivery of its 9,000th aircraft at a ceremony in Hamburg, Germany. The aircraft was also the first A321 to be delivered to Vietnamese carrier VietJetAir and will join the carrier's all-Airbus A320 family fleet flying on its fast-growing Asia-Pacific network. Since delivering its first A300 in 1974, Airbus has constantly ramped up production and the 9,000th delivery comes less than two years after Airbus reached its last milestone of 8,000 aircraft – delivered in August 2013. It now produces more than 600 aircraft per year



Airbus

The Latest News from the World of Jets



Airbus A380 – Out Now!

This 100-page special magazine from the team behind *Airline World* celebrates the first ten years of the world's largest passenger airliner – the Airbus A380. Taking readers on an exclusive look behind the scenes of the A380 production line, inside the aircraft's most luxurious cabins and onto the hangar floor to reveal the work of maintenance specialists, this special publication also tells the story of the world's most distinctive commercial aircraft through the people who fly it and the passengers it carries.

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Jet Art Harrier

Jet Art Aviation has purchased Hawker Siddeley Harrier GR.3 XZ130 from the Ministry of Defence.

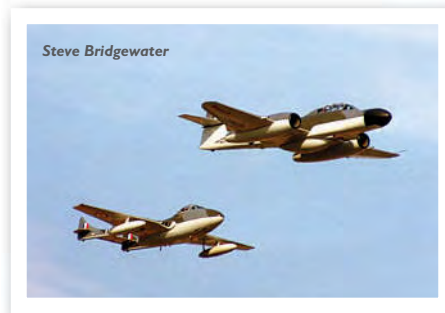
In 2004 the RAF delivered XZ130 to its former home with the Surbiton Air Training Corps, where it was on loan to the ATC cadets and spent the last ten years outside serving as a 'gate guardian.' The cadets had done an excellent job looking after the machine but she was starting to show signs of what Jet Art's Chris Wilson describes as "weather induced wear." The MoD therefore elected to put the aeroplane up for tender.

The aircraft was recovered on January 28 and is now reassembled and under cover for the first time in a decade. Jet Art intend to carry out a museum quality restoration and repaint into its original IV Sqn markings. "Subject to locating some missing components and spares we may be taking this project to the next level as a ground runner/fast taxi aircraft", says Chris. "Once restoration is complete the aircraft will be available for sale."

Jet Art also moved SEPECAT Jaguar XX121 from Gatwick to Selby in January and this also joins the fleet of restorations underway.



When the RAF delivered XZ130 to Surbiton in 2004 she was craned over the fence because it wouldn't fit through the gate. Ten years later buildings had been erected where the crane was previously sited and the only option for extraction was to take it out 'that' gate!



Topping the bill on May 2 will be a reunion of the 'Heritage Pair', as Gloster Meteor NF.11 WM167/G-LOSM and de Havilland Vampire T.55 G-HELV fly together for the first time in many years

CAF returns to CVT

The Classic Air Force has announced plans to close its Newquay site, moving all of its operations back to its traditional base at Coventry. This follows a two-year 'pilot test' of its outlying site at Newquay, Cornwall.

Mike Collett, a trustee of the Classic Aircraft Trust, the charity of which CAF is the operating arm, explained the rationale: "The operating costs at Newquay have risen to a level that's frankly unsupportable. Our focus is, and always will be, the continued care and protection of the collection. By putting all of our focus on Coventry we secure its future for generations to come."

"We're expanding and improving our Coventry AIRBASE to make it more visitor-friendly and turn it into a major Midlands attraction," said Mike. "There'll be a new reception, shop and café, more activities, flight simulators and interactive exhibits. It all starts with our grand re-opening on May 2."

That re-opening includes the largest airshow to be held at Coventry in more than a decade and is scheduled to include the collection's Gloster Meteor NF.11 and Vampire T.55, as well as Jet Provost T.5, Avro Anson and Percival Proctor.

NEWS IN BRIEF

IWM Duxford's American Air Museum closed for redevelopment on March 2. The glazed wall will be removed from the rear of the building, the suspended aircraft will be lowered from the ceiling and all aircraft will be removed from the building for conservation and cleaning. The exhibition will also be brought up to date with material covering the last two decades of conflict and the political context of that period. The museum will reopen in spring 2016.

News reports in India suggest five Antonov AN-32 military transport aircraft have gone missing in Ukraine. According to an Indian Air Force official, the last five out of 40 AN-32s undergoing upgrade at the Kiev-based Antonov State Company have become "untraceable" and "diplomatic efforts to find their whereabouts have failed."

British Airways has teamed up with Danish airline SUN-AIR – a BA franchise partner – to open a new route between Cambridge and Gothenburg. Flights will take just two hours and will be operated by a SUN-AIR 32-seater Dornier 328 regional jet. The route was introduced to allow AstraZeneca to fly employees between the two major hubs in the UK and Sweden but is open to all travellers.

The Vulcan to the Skies Trust has teamed up with Doncaster Sheffield Airport and the Aviation Skills Partnership to create the Vulcan Aviation Academy. Along with other industrial, commercial and educational leaders, the project will see Vulcan XH558 play a role in a brand new type of educational initiative that will give young people the skills they need for rewarding careers in aviation.

RwandAir, the national flag carrier of the Republic of Rwanda, has ordered two Airbus A330s, making it the first airline in East Africa to order the type. The aircraft will be delivered in the second half of 2016 and will be equipped with Rolls Royce Trent 772B engines.

Finmeccanica-Alenia Aermacchi has delivered the first C-27J Spartan aircraft to the Peruvian Air Force. A further three airframes are scheduled to follow by the end of 2017 and will be employed in passenger and cargo transport, humanitarian, fire-fighting, search and rescue and internal security missions.

Flybe, Europe's largest regional airline, has launched its summer schedule with the announcement of two brand new bases and 3,012 flights a week across 156 routes, 27 of which are brand new. In addition to new bases at Bournemouth and Cardiff, the airline will be re-opening its Aberdeen and London Stansted bases.

Jet Noise

A400M 'City of Bristol'

The first of the RAF's 22 Airbus A400M Atlas transports has been named 'City of Bristol' to highlight the important role industry in the city has played in the delivery of the aircraft.

The wings were designed and manufactured at the Airbus factory in Filton, Bristol, with a number of other businesses in the city, including Rolls-Royce, GKN Aerospace, and Atkins, demonstrating a range of high quality aerospace skills which support the A400M programme. The A400M programme has created or secured work for around 900 people in the local area.

'City of Bristol' performed its first operational mission on March 5 when it delivered a cargo of vital freight to Cyprus. In the Captain's seat on this historic flight was 24 Sqn pilot Flt Lt Jamie "JJ" Jackson.

Meanwhile, the A400M continues to make news around the world and on January 30 the first of four ordered by the Royal Malaysian Air Force performed its maiden flight. The aircraft was handed over to the Chief of Malaysian Defence Force on March 9.

The RAF's first A400M arrived back after the type's inaugural operational mission on March 5 Crown Copyright



RJ85 Tanker returns home

A BAE Systems-built Avro RJ85 Airtanker has arrived back in Canada after nearly three months of aerial fire-fighting missions in Australia. The aircraft is one of three RJ85s owned by Conair Group of Abbotsford, Canada and has been heavily modified and fitted with a large external tank enveloping the mid-underbelly fuselage. This tank contains nearly 2,500 Imp Gal of fire retardant or water, released through a sophisticated computer-controlled system.

Contracted by the State of Victoria to strengthen its armoury against wildfires during the Australian summer season, the RJ85 (painted as Tanker 162) was used to support ground-based firefighters by flying low over scrubland and forest wildfires and delivering the retardant in seconds to help suppress the flames.



In a two-day period in January, Tanker 162 dropped 45,000 Imp Gal of retardant on fires in Southern Australia. Turnaround times have been in the order of 20-30 minutes



BAVARIAN BRONCO

The Belgium-based Bronco Demo Team has repainted OV-10 Bronco 99+18 for the 2015 season. To help mark the 50th anniversary of the Bronco, the aircraft has gained special Royal Bavarian Air Force titles on the forward fuselage and a Bavarian chequered flag on the external fuel tank. A 'UK Bronco Fan Day' will take place at Cotswold Airport, Kemble on May 2



FIRST 787-9 FOR LATAM

LATAM Airlines Group became Latin America's first operator of both the 787-8 and 787-9 variants of the Dreamliner family when it took delivery of its first 787-9 in February. This latest aircraft, seen here departing Everett, Washington, took the airline's Dreamliner fleet to eleven with a further 22 yet to be delivered.

VC10 FOR GULF AIR

The forward fuselage of ex-RAF Vickers VC10 ZA149 is currently undergoing work at Bruntingthorpe, Leics to convert it into a teaching aid. The aircraft's grey scheme has been replaced with Gulf Air colours and the interior is being prepared to receive a full passenger fit. Once the work is complete, the aircraft is due to be shipped out to Sharjah, UAE where it will be placed in a museum. ZA149 arrived at the airfield in March 2013 after retirement from the RAF and the rest of the aircraft was scrapped on site.



TINTIN'S JET

A Brussels Airlines Airbus A320 has received a special livery inspired by the Tintin comic book 'Red Rackham's Treasure'. The unique scheme represents a great black shark, based on the shark-shaped submarine invented by popular character Professeur Tournesol in the comic. It took aircraft painter Andre Eisele 1,500 hours to complete the artwork, which will remain on the jet until 2019



CZECHS SELL L-159s TO IRAQ

The Czech Republic has announced plans to sell 15 Aero Vodochody L-159 jets to Iraq for 28 million Euros. In a statement the Czech Defence Minister confirmed: "These are three single-seated and one double-seated aircraft directly from the Czech army arsenal and eleven pieces that are stored at Aero Vodochody."



The Latest News from the World of Jets

XF8U-1 CRUSADER UNVEILED

On March 25 the Museum of Flight marked the 60th anniversary of the first flight of the Vought F8U Crusader by rolling out its recently restored XF8U-1 in Everett, Washington. After making the type's maiden flight, BuNo 138899 served for five years in the test role before it was gifted to the Smithsonian's National Air & Space Museum. However, a lack of space meant the jet was loaned to the Museum of Flight. Restoration began in 1996 and the volunteer team has slowly returned the jet to the condition she was in back in 1955, complete with the unique prototype livery.



MIG-NIFICENT YEOVILTON

Northern Europe's only flying MiG-15 will be making a rare UK appearance at RNAS Yeovilton International Air Day 2015 on Saturday July 11. The jet, which belongs to the Norwegian Air Force Historical Squadron, will be the first of its kind to display in this country since the Old Flying Machine Company-operated example was exported in the late-1990s. This MiG was built in Poland and wears the markings of the aircraft flown by famed Soviet cosmonaut Yuri Gagarin before he became the first man to visit outer space in 1961.



£2.5 Million for RAF Museum

During March's budget, Chancellor George Osborne announced that financial penalties levied on British banks involved in the LIBOR lending rate-fixing scandal would benefit a variety of museums, including the RAF Museum.

£2.5 million of the money recouped will go towards the RAF Museum's plans to commemorate 100 years of the RAF in 2018 and to re-landscape the site to create a sense of the original London Aerodrome that stood on the ground nearly 100 years ago. The museum will also build a new visitor centre with a café, shop and soft play area and create new permanent exhibitions. Chief Executive of the RAF Museum, Maggie Appleton said: "We are a happy museum!"

Other museums benefiting from the LIBOR fines are the Biggin Hill Memorial Chapel (£1 million), Stow Maries Great War Airfield (£1.5 million) and the Bristol Aerospace Centre at Filton (£2 million).

Voyager 'incident'

According to a recently released incident report, 33 British military personnel were injured when an Airbus A330 MRTT Voyager transport on its way to Afghanistan dived more than 4,000ft after the captain's camera became lodged alongside the aircraft's joystick!

The Voyager jet was around five hours into its journey from Brize Norton to Camp Bastion when the SLR camera, used by the captain to take photographs on board, got stuck between the armrest and the side-stick controller when his seat moved forward. The aircraft lost nearly 4,500ft in just 27 seconds and then diverted to Turkey after the incident, which took place on February 9, 2014. The fleet was grounded for 11 days while the incident was investigated.

The report stated that: "The aircraft was cruising at FL 330 when the captain's personal D-SLR camera was placed between his seat-arm rest and his side stick controller."

Shortly afterwards, when he adjusted the position of his seat, the side-stick was deflected fully forward [by the camera] which resulted in the aircraft rapidly entering a steep descent. The captain who was alone on the flight deck while the co-pilot took a break, was unaware that his camera had caused the pitch down."

After the co-pilot returned to the cockpit: "The captain shouted repeatedly that he could not disengage the autopilot. With his feet on the flight deck roof, the co-pilot reached down and attempted to disengage the autopilot by pulling back on his side-stick."



'GHOST RIDER' RETURNS FROM THE GRAVE

On February 13 (Friday 13th) Boeing B-52H Stratofortress 61-0007 'Ghost Rider' awoke after seven years of slumber in the Davis-Monthan AFB 'bone yard' in Arizona and took to the skies, flying to Barksdale AFB, Louisiana. Although it was well preserved the Arizona sun had taken its toll on the dormant aircraft bleaching sections of its exposed aluminium skin almost white and causing the tyres and fuel lines to dry rot. Nevertheless it took less than 70 days to return the aircraft to flyable condition. It will now re-join active service (more than 50 years after it was first built) and replace B-52H 61-0049, which was badly damaged by fire while on the ground at Barksdale AFB.

HAWK T.2 ROLE DEMO

This year sees the RAF displaying the BAe Hawk T.2 for the first time on the British airshow circuit. Two BAe Hawk T.2s operated by IV(R) Squadron based at RAF Valley, Anglesey will fly a 'role demonstration' showcasing the capabilities of the advanced jet at selected events. Flown by two of the unit's instructors, Lt Ben Polwin and Flt Lt Toby Keeley, the 'demo' is to include a variety of manoeuvres including close formation work, simulated attacks and basic air combat principles.





STARFIRES OVER NORT

The USAF gave top priority to getting an operational jet fighter to give the slower World War Two era F-82Gs some relief. This happened in 1949 when the first flight of the F-94 was recorded and one year later, the specialised fighter went operational (May 1950). Two months later, the Korean War started and within a few months, the MiG-15s began going after the B-29s. In March 1951, the F-94Bs went to the 339th AWS at Johnson AFB (Air Force Base) and in May, the 68th All-Weather Squadron began receiving their share at Itazuke AFB.

At this time, the protection of all the South Korean airbases was almost too much to handle and the F-82G Twin Mustangs and F7F Tigercats were supposed to deal with a night-flying MiG-15 if one ever came down below the 38th Parallel. Fortunately, the only problem in early 1951 was the Po-2 which was much slower than either of the defenders. The 68th had been furnishing the F-82Gs, but they were quickly shifted to Korea with their new F-94Bs. Both of the all-weather units had their hands full defending Japan and the Russians were constantly checking out their response time approaching the northern Japanese coast from their base at Vladivostok.

Choice B

The F-94B had a maximum speed of 527kts and could easily cruise at 393kts. Its ceiling was at least 48,000ft with a max range of 900+ miles. The 'B' model also kept the E-1 fire control system and J33-A-33 engine that had been available in the F-94A models. The 'B' also incorporated the Sperry Zero Reader for landing in adverse weather conditions and an upgraded hydraulic system. Lockheed had been in a tight race with Northrop to put a mass-produced jet night fighter programme together. Northrop's entry had been the F-89 Scorpion which did a lot of defensive work along the west coast, Alaska and Iceland. Yet



A pair of F-94Bs in the landing pattern at Suwon AFB after an early morning mission to protect the B-29s that were hitting a supply dump in the extreme northwest corner of North Korea
Craig Washburn via author

H KOREA

*The Lockheed F-94 Starfire had been in service just two months before it was summoned to assist in the Korean War. **Warren Thompson** charts the career of one of the USAF's unsung jet fighters*

the Pentagon chose the F-94B to outfit the Far Eastern airbases and also sent the 319th to Korea.

The alarms sounded in December 1951, when radar picked up MiG-15s flying at their maximum altitude over Seoul. FEAF HQ reacted immediately, making sure that an all-weather jet interceptor was on its way.

At that period, the only aircraft available to fill the gap was six F-82G Twin Mustang along with a handful of F7F Tigercats. The first move was to send some of the 68th Squadron's F-94Bs from Itazuke down to Suwon to give them immediate success in having a jet fighter on alert. This allowed the F-82Gs and F7F-3Ns

to continue their reconnaissance and weather mission against North Korean hot spots.

Mission-ready

On January 24, 1952, the Pentagon ordered the 319th Squadron to move their F-94Bs from McChord AFB, Washington over to Korea strictly for the air defensive missions. On February 10, the squadron boarded the USS Sitkoh Bay for the move to the Far East. The 319th got their aircraft ready and soon moved up to Suwon AB (K-13) and so, on March 23, the 68th AWS was pulled out of their deployments to South Korea to resume their main missions of protecting southern Japan (Kyushu).

It was a tough job for the F-94B; at first they were not allowed to go north of Pyongyang because of the risk of being shot down, which would give the Russians a chance to take one apart and study the secret airborne interception radar equipment on board. But by the time that the 68th Squadron was pulled back to Itazuke, they had flown 58 interceptions during February alone during night-time or bad weather days.

In March 1952, the 319th began flying missions at Suwon, providing CAP (combat air patrol) for the Superfortresses at night. Although the 68th was pulled back to Japan, they had several aircraft on one hour alert

to respond in an emergency in Korea. By the first of June 1952, the first F-94 contact against enemy jets (MiG-15s) was made. These deep penetrations were a sign that the communists were testing the radar-warning equipment. When the 319th aircraft were getting close enough to fire, the MiGs would start evasive action indicating that they were equipped with a form of warning radar:

Multiple bogeys

It was difficult to understand why there was so much security at all of the key bases in South Korea and the main bases in Japan. To the civilian population in the US, it was assumed that the North Korean AF had been kicked out of Korea and the also that the Chinese pilots were not flying missions in the MiG-15. Intelligence for the Far East provided the answer: it was determined that all of the Chinese MiGs that had been shot down (over 100) had been replaced. This put a total of well over 350 MiGs in Manchurian bases (supposedly being flown by Russian and Warsaw Pact pilots).

The 319th Squadron's primary concern was to intercept and destroy any of these aircraft that attempted to attack friendly airfields. Co-ordinating all of their operational activities with the 502nd Tactical Control Group, they drew up the following standard



One of the 319th F-94Bs is pictured north of Suwon AB on a practice flight in 1952. The rugged mountains of North Korea are seen to the upper right *Craig Washburn via author*

operating procedures governing types of approaches, responsibility for attacks, communications, operational limitation, emergency procedures, fighter recovery, weather minimums and CAP routes.

When vectored in on a 'bogey', there were three types of approaches:

Free to roam

The strict rules for the F-94 operation in Korea had severely affected its potential. The aircraft were limited to areas south of Pyongyang while most of the MiG traffic was far to the north (MiG Alley). Some time in the fall of 1952, General Hoyt S. Vandenberg,

"I began firing and could see hits sparkling off the MiG"

Surveillance, Identification and Attacking. The most critical of these was the first one, for it determined if the other two should be pursued. The Surveillance approach was defined as when the target is known, or suspected, to be friendly... The controller will vector the interceptor towards the target, stating "this will be a surveillance approach" and through the efforts of the controller and F-94 crew, their aircraft will synchronise its speed with the 'bogey' at 1000 yards with its airborne radar locked on. From this position, the controller could order a closer look or if hostile, could order the night fighter to get into position for a firing pass. This cautious approach, with positive identification, was responsible for saving more than one friendly aircraft!

after visiting with the squadron and hearing their views, ordered all restriction lifted on their operations. They were now free to go all the way up to the Yalu River.

On November 1, 1952, the Commanding Officer of the 319th received orders to fly four missions over North Korea. The Starfires would fly a 'racetrack' pattern, northeast to southwest. This would put at least one aircraft in position to quickly intercept any night intruder trying to dash south of the Yalu. But, the plan had its drawbacks and within six weeks, a more effective option was initiated in the form of the 'Barrier' patrol in which 4-6 Starfires would space out about 30 miles in advance of the B-29 bombers formations. The intercepting MiG-15s would once again scramble against the bombers, but



A 319th aircrew getting this F-94B ready to go on alert at Suwon AB (K-13). At the time this photo was taken, the threat of the MiG-15 was a factor, even though none of them had executed any raids on friendly airbases in the south *V.W. Martin via author*



The 68th All Weather squadron filled in on alert at several of the big bases in South Korea until the 319th could come in from the states to relieve them. This Starfire is sitting on the alert pad at Suwon while the aircrew is close by in case they had to scramble *Vern Wright via author*



Occasionally, the 319th had a detachment over at Taegu AB (K-2). This was taken in the spring of 1953 at that base. The squadron emblem was missing on this aircraft (probably a replacement). There were two F-94Bs in this detachment *Ben Sowaske via author*



A flight of four F-94Bs from 319th Squadron get into positions for their landing at Suwon AFB. The formation is tighter than it appears. Note the vertical stabiliser showing right above #408 fuselage Al Farnsworth via author

when their GCI discovered that there was a gaggle of night fighters in the area, they would retreat back across the Yalu, rather than risk penetrating the deadly barrier.

Sparks fly

F-94 pilot Lt. A.M. 'Sandy' Rankin relates what happened during a nightcap mission half way up into North Korea, protecting a large number of B-29 coming from Okinawa.

"We were vectored after a fast moving bogey, which quickly changed direction when its pilot got the word we were closing. He was much faster than we were, as the MiGs could easily outperform our F-94. We hung with him heading north on vectors from our radar station on Chodo Island. As the MiG got closer to the Yalu River, something happened. Apparently their ground radar went off because the intruder began to slow down, not realising we were on his tail about 40 miles behind. We were using afterburner, so the gap was rapidly closing. Finally, we were close enough to capture him on our airborne radar. By this time, we were just about over the river which was strictly against the rules, especially in this aircraft. It was apparent the MiG was letting down to his base at Antung.

"As we followed his decent, we could see the lights of the big MiG airbase. It was getting close because not only did my Radar/Observer Lt. Craig Washburn, have him on his scope, but I also had a lock on him from my pilot's radar display. I began firing and could see hits sparkling off the MiG (later confirmed on gun film). The enemy pilot reacted by doing a violent split-S with us right on his tail. Seconds later, we lost radar contact. We saw no fire or any sign of an explosion on the ground, so could only claim a 'damage'. It had been a long night so we returned to Suwon with our F-94 running on fumes. This had been the first encounter with the MiG-15 by our squadron and it would serve as a preview of things to come!"

This mission was logged on January 30, 1953.



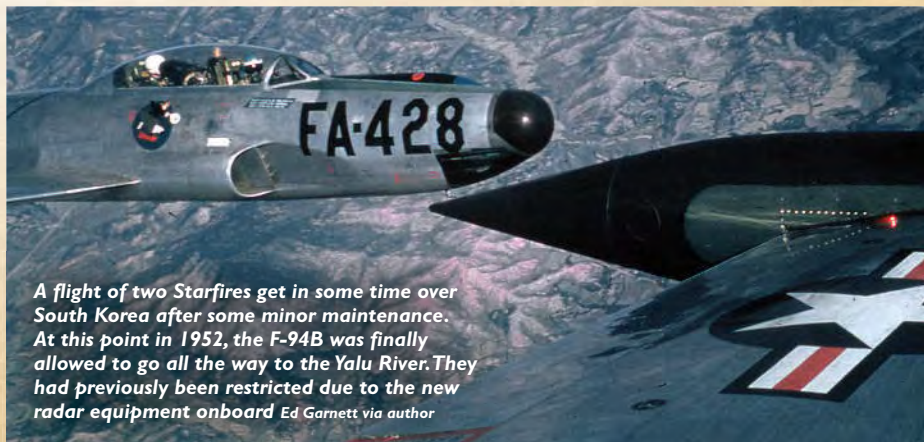
One of the 319th Squadron aircraft taxis out for an early night MiG CAP up on the Yalu River to protect the B-29s. They will be relieved by another 319th aircraft after a few hours of patrolling Steve Jeffers via author

Intruder

However, the enemy pilots were constantly probing to find weaknesses in coverage. The presence of the La-9s, La-11 and Yak-9s made up the fast prop driven intruders and in late December 1952 and early January 1953, they proved to be coming down toward the 38th Parallel several times a week. They would turn back as soon as their GCI told them that the F-94s had scrambled. On January 31, 1953, one of the aircrews made the first confirmed kill for the squadron. The Lavochkin La-9 could drop down very low and it was hard to get a fix on them and most of them got away with no shots being fired. However, not all were able to elude the F-94 that had got airborne. On

this night, things did not go well for the La-9. Captain Ben Fithian and his radar operator Lt. Sam Lyons recorded that first kill.

Captain Fithian describes what happened: "It was a clear, cold night at Suwon AB and we were standing alert (we were third in the 'Scramble' order). We heard through Intelligence that there was a lot of enemy aircraft activity over North Korea. About that time, a call came in from K-13 tower asking us to scramble one of our aircraft to pace an F-80 Shooting Star (from the 8th FBG) in for a landing. The plane asking for help had lost its airspeed indicator. We had been selected to do the job. After getting airborne, it took us at least fifteen minutes to locate the aircraft, join up and help him back to a safe landing here



A flight of two Starfires get in some time over South Korea after some minor maintenance. At this point in 1952, the F-94B was finally allowed to go all the way to the Yalu River. They had previously been restricted due to the new radar equipment onboard Ed Garnett via author

at Suwon. At this time, we were too heavy on fuel to land, so we changed to a tactical channel and requested to be vectored into North Korea, since one of our unit on station near Chodo Island was having trouble with its radar; they accepted our request.

"On the way in, I heard the F-94 aircraft ahead of us calling 'no joy' which meant they could not establish radar contact. In fact, the pilot was complaining that he thought Chodo was vectoring them in on the rocks projecting from the sea. When we got within 50 miles of the activity, Chodo released the other Starfire for recovery at Suwon. At that time, the controller was taking control of us while we were at 25,000ft. This is when he started giving us range and direction to a 'bogey' and it was only about 30 miles at one o'clock. They gave us a descent order to 5000ft and a series of turns. We ended up at 5000ft going southeast, ten to fifteen miles west of Pyongyang, the capital of North Korea. At this time, we were six miles behind the hostile who was doing about 130kts. We swung in behind the 'bogey' and continued to descend, making the first radar contact at about five miles.

Killer instinct

"In order to get the optimum advantage with our airborne radar fire control system, we descended to tree top level. It was a moonlit night and I could see the ground under us, but not ahead. Once, I looked out and we were very close to some trees that looked like tall poplars or sycamores, so I climbed up a little. I figured the North Korean pilot probably knew the terrain well and if he could get through, we could too. Also, the prize of making the first kill using the F-94 was worth laying it all on the line.

"We made solid radar contact at a little less than five miles and slowed down to around 130kts with speed brakes extended, after

Squadron Radar specialists are working on a problem with the plane's radar. Until this is fixed, the aircraft had been pulled from the alert status. Without their radar working properly, they would be totally ineffective Ed Garnett via author



getting a lock on the intruder. We were closing fast and slowly climbing since the target was actually at about 1200ft altitude. That was extremely low because of all the mountainous terrain. We had an overtake speed of about 40kts and as we got close enough I started firing on the radar scope with a long burst and saw no results. We continued to close and I fired again... Still no hits!

escorting the F-80 at the beginning of the flight. Our altitude was still very low and we ran into some automatic weapon fire coming up from enemy troops on the ground, as we climbed out of it. About that time, my R/O said we had a fire in the rear cockpit. I thought at first we had been hit by ground fire, but it turned out to be an electrical short which went away when the rear cockpit light turned off.

"Making the first kill using the F-94 was worth laying it all on the line"

"We were at about 600ft behind the target and I moved the stick around in about a six-inch circle and saw some flashes. We were armed with API (Armor Piercing Incendiary). They make a flash upon impact and as soon as I saw a lot of flashes, I held the stick steady and continued to fire. The intruder (LA-9) burst into flames and started down. He crashed with the cockpit closed.

"We called 'Splash One' and Chodo gave us a vector towards another 'bogey' that was eight miles away. We were low on fuel due to our

"On recovery at Suwon, we did a victory roll and landed. We were met in the revetment area by almost everyone in the squadron. When we shut our engine off, everyone clapped their hands.

"After that night, it would be several months before the North Koreans flew at night, or at least [were] detected by our radar at Chodo Island. The next time they got active, a brave young crew from my flight, Lieutenants Wilcox and Goldberg, apparently shot one down over the water

In late 1952 a huge gaggle of 319th Starfires fly in formation over the new super base at Osan. When finished, it would be the main base for the F-86F Sabres of the 18th Fighter Wing Robert Haller via author



and then either crashed into the sea or hit the enemy aircraft. They called 'Splash' and that was the last ever heard from them."

No nasty surprises

To get a positive identification on an unknown 'bogey', 90% of the contacts made by the 319th, in Korea, had to be identified in the air. The Starfires had to operate much closer (maintain radar contact closer to the target) than the radar was designed to maintain a lock-on. The APC-13 was not made to keep an accurate lock inside 200 yards range. On a dark night, identification might not be made until the F-94B was within 100-200ft from the target. Tactical advantages to this method were numerous: the fighter's speed was synchronised with the enemy; they had to hold his position at ten or more degrees port or starboard to the target and about ten degrees below when the visual was made. It was assumed that any hostile gunners could do the same. The friendly would never be in a position to fire while in this position and finally... The element of surprise had been compromised and the resultant target's evasive action had all but neutralised the chance of making the 'kill'.

The effectiveness of the enemy's radar control (GCI) remained flawless and at any signs of the 319th being up and above Pyongyang, the MiGs would pull back north of the river. The squadron was turning in a lot of barrier patrol along the Yalu protecting the B-29 formations. By early 1953, the



Lt. Sandy Rankin sits on the alert pad at Suwon AFB, prior to being scrambled. The only threat to the airbases at this time was the slow moving Po-2s A.M. Rankin via author



A Starfire pilot gives his aircraft a going over before flying an early night mission to protect a formation of 307th Bomb Wing B-29s coming in from Okinawa V.W. Martin via author



A pair of 68th Squadron Starfires on their way from Itazuke AFB in Japan to Suwon to assume alert duties. The pilot in the one shown was Captain Al Farnsworth, who flew the P-61 Black Widow in World War Two Bob Wargo via author

Marines had also sent in their F3D Skyknight to protect the bombers and they proved to be very effective also. During this period, the number of daytime MiG kills by the F-86 Sabres had swelled. By May 10, 1953, the 319th squadron was long overdue for the first USAF night-fighter jet kill over the swept-wing MiG-15. The number of shot down/shot up B-29s had greatly diminished. However, on this date, America's dry spell would end.

MiG-15 kill

Captain John R. Phillips and his R/O Lt. Billy J. Atto would make a MiG-15 kill to become the first in that category. Captain Phillips recalls that mission. "Squadron operations figured that if we could start sending a flight up north around three or four o'clock in the mornings, we just might catch the MiGs flying south of the Yalu. On the 10th we were flying just such a mission. The weather was poor with visibility about 300ft in heavy rain. We launched with no problems, heading north we checked in with Chodo control. They told us there were heavy tracks south of the MiG base at Antung, so we climbed back up to 40,000ft until we got in that area and I eased it back down to 30,000ft. In a few seconds Lt. Atto picked up two unidentified aircraft on his scope and we dropped down to their level and contacted Chodo again and they would not give permission to fire. We kept calling them and finally we got the go-ahead to fire.

"The exhaust patterns were very distinct and they were MiGs. We starting firing and the two 'bogey's split up with us going after the one on the left. The second one [went] around behind us to set up for a firing pass.



Lt. Craig Washburn poses by his F-94B during the bitter cold winter of 1952/53. For most of the winter months, the Starfires were ready to fly. This was taken at Suwon in January 1953 Craig Washburn via author

"We held our position and before we shot down our target, the other MiG had a lock on us! After several bursts of .50 calibre rounds into the first MiG, there was a terrific flash of fire as it exploded. The concentration of the second MiG was sidetracked, as he immediately broke off and headed for home. Lt. Atto looked up from his scope and saw flaming debris passing by the right wing of our Starfire. We then set a course for Suwon and hoped. When we arrived in the area, the ceiling was now at 500ft, so we were able to land without diverting to Japan as we originally through we would. Our 'kill' was made over Puckchin, North Korea."

When the Korean War ended in late July 1953, the 319th Starfires continued to fly air defence over Japan and South Korea. The new North American F-86D began to replace the F-94 in the Far East. By the end of 1954, all of the F-94Bs in the Far East had been sent back to the USA to serve with the Air National Guard. However, the F-94C equipped with rockets continued to do some service with Air Defense Command and they lasted five years longer than the 'B' model. ●



The new crews coming in had a certain amount of time to learn the routes and approach to Suwon AB. Note that the 319th Squadron had their patch display on both side of the fuselage Steve Jeffers via author

SRI LANKA AIR FORCE MUSEUM

The Sri Lanka Air Force Museum has rescued some interesting exhibits and houses an impressive aviation library, as *Tom Singfield* discovers

Aviation in Sri Lanka (formally Ceylon) goes back a very long way... The Hindu classic book *Ramayana* tells how Ravana, a king of Sri Lanka around 300 BC, outwitted Rama, his Indian counterpart, by using a wooden aircraft called 'Dandu Monara Yanthranaya', designed in the shape of a peacock. He reportedly used this device to escape from India with Rama's wife Sita Devi and flew her to Weragantota (in Sinhala language: 'a place of aircraft landing') which was the capital city of

King Ravana. Move forward 2000 years and the next flight was better recorded when German Franz Oster flew an Etrich-Rumpler Taube monoplane from Colombo racecourse on Christmas Day 1911.

With this long history of aviation on the island, it is nice to see it celebrated with such an impressive aviation museum. In the southern outskirts of Colombo city, the Ratmalana Air Force Base houses

the Sri Lanka Air Force Museum which contains around 60 aircraft as well as other items from the Sri Lanka Air Force (SLAF) including vehicles, aircraft engines, uniforms and armaments. Many of the outdoor exhibits are set in lush gardens amongst trees and shrubs, which can be a problem for the photographer but most aircraft are fine for pictures although the hangar display is a bit dark.

Right: Nine of the original 12 Jet Provost T.51s delivered from 1959 survive in Sri Lanka. The slightly battered CJ704 (illustrated) is displayed in the lush gardens at the museum. Not far from the museum, Jet Provost CJ712 is also displayed in fine condition outside the Eagles' Lakeside Banquet & Convention Hall at Attidiya. The venue was constructed by and is staffed by the Sri Lanka Air Force. *All Tom Singfield*

Below: Two Shenyang FT-5s, FT-1301 and 1302, are displayed in fine condition outside the main hangar. Over 1000 of this Chinese-built two-seat trainer version of the MiG-17 were built prior to production finishing in 1986





Five Hawker Siddeley HS 748s were flown by the SLAF but two were shot down on the same day in April 1995. The example on display at Ratmalana (CR831 ex 4R-ACR) was taken over from Air Ceylon after the airline closed down in 1978. Two other 748s are preserved at Koggala and Weerawila

Distinguished past

Ratmalana was Ceylon's first proper airfield and opened on November 27, 1935 with the arrival of Madras Flying Club's chief instructor Harold Tyndale-Biscoe in a de Havilland Puss Moth. On February 28, 1938 a WACO YQC-6 biplane of Tata Sons Ltd launched the first Air Mail service from Ceylon/Ratmalana to Britain, via India. That flight also marked the start of scheduled passenger services to and from Ceylon, although by a foreign airline. During World War Two, a based squadron of RAF Hurricanes saw intense activity during the Japanese bombing of Colombo on Easter Sunday 1942 and downed several Japanese carrier-based aircraft but with the loss of 15 out of 36 launched that day. Other RAF types that served at Ratmalana included Liberators, Warwicks, Blenheims and Walrus. After the war the airfield became Ceylon's main international airport until Katunayake took over in the 1960s leaving Ratmalana for domestic services.

Special project

The museum was originally set up in 1993 as the 'Aircraft Preservation and Storage Unit' with the idea of preserving the history of aviation in Sri Lanka in general and the history of the SLAF in particular. Situated alongside the operational Air Force Base with its Bell and Mil helicopters, Y-12s, MA-60s, Beech

200s and Antonov An-32s, the museum site can give glimpses of current SLAF transport operations although photographing the active aircraft is forbidden. The present form of the museum was initiated by Air Chief Marshal WDMRJ Goonetilleke (the 13th Commander of the SLAF) who organised a special project in 2008 to modernise the museum with new exhibits and up to date facilities. Re-opened on November 5, 2009, the museum has been continuously updated and expanded since then and has recently opened an impressive aviation research reference library. 'The Knowledge Hub' was declared open by the Commander of the SLAF Air Marshal Harsha Abeywickrama on March 11, 2013. The museum mostly concentrates on the military aviation history of Sri Lanka since RAF operations commenced there during World War Two and covers the Royal Ceylon

Below left: A handful of the ten Antonov An-32s originally delivered to the SLAF are still in service. One complete example, CR868, is preserved at Ratmalana along with the nose of CR865 (seen here) which forms part of a display of aircraft wreckage

Below right: The Royal Ceylon Air Force bought five MiG-17s from the Soviet Union to boost its firepower after they were caught off-guard when the Marxist JVP launched a nationwide insurrection in 1971. CF904 is one of those on display at the museum



Air Force (founded March 2, 1951) and the many combat operations of the SLAF in the recent past.

Jets

The first jet aircraft to enter service with the Royal Ceylon Air Force was the Hunting Jet Provost T.51. Twelve examples were delivered from 1959 onwards and nine of them still survive in preservation around the island. CJ-701 (actually CJ-711) and CJ-704 are both preserved outside at the SLAF museum. Other jets on display include a MiG-15UTI, two MiG-17s and a MiG-27M complete with a large display of underwing ordnance and ECM equipment. There is also a pair of two-seat Shenyang FT-5s (Chinese licence-built MiG-17) that were operated from 1990 to 2001 before being placed in store prior to their display in 2009. The latest exhibit to arrive is an Israeli-built Kfir C.7, serial CF-721 (probably ex-SFM5208).

Turbo-Props

Other turbine-powered exhibits include an HS 748 (originally G-ATEJ), an Antonov An-32, a Pucara (the last of four operated on COIN ops from 1993 – the other three were shot down), two SF260TPs, a Jet Ranger, two VIP SA365 Dauphins, a Kamov Ka-26 and a Mil-24V. Especially interesting to British visitors is the only civil aircraft on display: Auster Autocrat VP-CAO. Other non-jet types of particular interest include three DH Doves (one used as a kiddies' plaything), three DH Herons (one used as a milk bar), three Chipmunks (two airworthy), an airworthy Tiger Moth, two C-47s, a Prestwick Pioneer and no less than two very rare Boulton Paul Balliols.

OPENING HOURS

The museum is open Tuesday to Sunday from 9am to 5pm except Public Holidays. Admission for non-Sri Lankans is \$US10.00. The gift shop has a nice selection of SLAF items including models, clothing, cutlery and stickers as well as the beautifully illustrated four-volume *History of the Sri Lanka Air Force*. Visit www.airforcemuseum.lk for more information.



Hawker Siddeley
Dominie XS739
performs its final
take-off at Kemble
on April 20
Glen Moreman via PRMAVIA



DOMINIE'S LAST FLIGHT

*Just over 50 years after the first HS.125 Dominie T.1 took to the skies, the last of these RAF navigation trainers made the type's final flight on February 20, 2015. **Peter R March** reports*

Registered N19UK, but retaining its former gloss black and white RAF training paint scheme, HS.125 Dominie T.1 XS739 was flown by Wally Epton from Cotswold Airport/Kemble to Humberside Airport on February 20, 2015. In doing so it made what is likely to be the last Dominie flight.

The aircraft (alongside its sister N19CQ / XS712) is heading for an active ground training role with the BAE Systems Aircraft Maintenance Academy just established at Humberside.

Civil roots

The first prototype of the de Havilland designed, low-wing, twin-engined executive jet, DH.125 G-ARYA0 was flown for the first time at Hatfield on August 13, 1962. In total, three prototypes and seven production variants of this initial Series 1 version were assembled at Broughton, Chester. Now named the Hawker Siddeley 125, the improved Series 1A (for USA) and Series 1B that followed into production had longer-range fuel tanks, modified flaps and main undercarriage doors as well as cabin and flight deck refinements.

An order for 20 HS.125 Series 2 Dominie



T.1 navigation trainers was placed under MoD contract T233D&P and the first aircraft (XS709) flew on December 30, 1964 and was handed over to the RAF in August 1965.

Service life

Normally flown by a single pilot, the Dominie T.1 had a unique navigator training cabin with provision for two students and three crew members – two instructors and a supernumerary. Externally it differed from the civil HS.125 in having a ventral fairing forward of the wing that housed Doppler and Decca aerials.

Built at Hawarden, most of the 20 Dominies (XS709-714 & XS726-739) were delivered to No 1 Air Navigation School (ANS) at RAF Stradishall between late 1965 and June 1966, where they replaced Meteor NF(T).14s for high-level, fast-jet navigator training.

Six Dominies went to the College of Air Warfare at Manby, Lincs and when Stradishall closed in 1970, the aircraft transferred to 6 FTS at RAF Finningley. The jets remained there until shortly before that station closed in 1996. The Dominies' final base was RAF College Cranwell where they equipped No 3 FTS – later redesignated 55(R) Sqn.

Retired

This type's service life was cut short in the autumn of 2010 when the Strategic Defence and Security Review (SDSR) announced that the Dominie would be retired from service as soon as the current course had been completed.

With graduation of these final students on January 19, 2011 there was a final flypast at Cranwell by six of 55(R) Sqn's nine Dominies the following day, bringing to an end nearly 45 years' RAF service.

Survivors

Of these last airworthy aircraft, XS709 (the 'prototype') was flown to Cosford for the RAF Museum, XS713 went to the Fire section at RAF Shawbury, XS727 stayed at Cranwell on display and the remaining six (XS712, 728, 730, 731, 737 and 739) were acquired by Executive Jet Support (EJS), the company owned by Simon Browse, who facilitated their purchase from the MoD.

These Dominies were put onto the FAA 'N' register and flown to Kemble in May 2011 by Wally Epton, former RAF Dominie Squadron Commander and Phil Woodley (also ex-Dominie Squadron), both very experienced HS.125 pilots.

EJS had anticipated sale of the Dominies to the USA, but this was not to be. However, late in 2014 XS712 (now N19CQ) and XS739 (N19UK) were purchased by Resource Group's Aviation Technical Training division at Kemble for the up-coming Aircraft Maintenance Academy at Humberside. The fuselage of a third Dominie (XS731/N19XY) was transported to a company at Marlborough, Wilts in December 2014.

The three un-sold Dominies (XS728/N19CU, XS737/N19EK and XS730/N19UG) remain at Kemble. Two are to be used to provide spares for the Humberside aircraft whilst one (N19CU) will be utilised to train Resource Group apprentices for their various airline clients.

Ferry flight

Carefully prepared by the team at C2 Aviation to meet the FAA's requirements for a single, VFR ferry flight, the two Dominies were ready to go on February 19. Unfortunately



N19UK flying past on Kemble's tower during its 'confidence circuit' in the hands of Wally Epton

Glen Moreman via PRMAVIA

the weather wasn't – with heavy rain and low cloud precluding the flight. Friday February 20 was much improved and Wally Epton with co-pilot Richard Lloyd flew N19CQ to Humberside and returned to Kemble to make the final Dominie flight in N19UK. This aircraft (XS739) had been the last of the 20 Dominies delivered to the RAF on June 1, 1966.

I was privileged to be invited to observe this last ever flight and it was by a strange coincidence that XS739 was the first Dominie that I had flown in, at Stradishall in October 1966. The cockpit and cabin were superficially very little different from when it made its last flight at Cranwell on January 20, 2011, although only the basic avionics were 'live'.

After an 'on-time' start at 14.30, Wally taxied out to Kemble's runway 26, completed the necessary pre-takeoff checks, powered up the lightly loaded Dominie and we were quickly airborne. He flew a 'confidence circuit' for a visual check from the ground before setting course north-east towards Humberside.

Flying at 4,000ft with good 12-mile visibility, Richard was able to pinpoint our position accurately as we routed to Leicester; Rutland Water; Newark and west of Scampton, until the coastline of the Humber Estuary came into view.

Ending this 40-minute, 150-mile last flight from Kemble, Wally touched down at Humberside to bring the HS Dominie T.I's flying career to an end.

David Talbot, Head of the BAE Systems Aircraft Maintenance Academy received N19UK after it had joined N19CQ and four Hawks in Hangar 9, the academy's temporary home. The aircraft will move into the new £5 million R J Mitchell Aircraft Maintenance Academy when it is completed in the autumn.

Around 60 apprentices a year will be trained at the academy with a one year full-time training course followed by one year work placement, leading to an NVQ in aviation maintenance. Individuals will go on to full time employment servicing the RAF's fast jets and international contracts.

Although XS739 will not add to its 19,465 flying hours, it will continue to have an important training role both inside the hangar and on the flight line. And if you want to get up close to a Dominie, there are two preserved in museums – XS709 at RAF Museum Cosford and XS726 at the Newark Air Museum. ●



Wally Epton (right) handing over the Dominie to David Talbot at Humberside PRMAVIA Collection

Dominies N19EK and N19UG remain with Resource Group at Kemble for spares use Resource Group via PRMAVIA Collection



ALIVE AND KICKING!

Twenty five years ago Captain Tim Lancaster had a close brush with death when he was nearly sucked out of the cockpit of his BAC 1-11. *Kimberley Hawkins* investigates what went wrong (and right) that fateful day

Sunday June 10, 1990 dawned bright and sunny at Birmingham International Airport.

With their pre-flight checks complete, the crew of British Airways BAC 1-11 G-BJRT 'County of South Glamorgan' lined the jet up on the runway at the beginning of flight BA 5390 to Malaga, Spain and everything appeared normal.

On board that day were 81 passengers, four cabin crew and a flight crew comprising 42-year-old Captain Tim Lancaster and co-pilot 39-year-old Alastair Atchison. With 11,050 and 7,500 hours in their logbooks, respectively, they were a very experienced crew – although this was the first time they had flown together.

Routine take-off

The jet took off normally at 07.20 with Atchison as the handling pilot, and in the climb he handed control to the captain. With everything going to plan, the crew turned off the 'fasten seat belts' sign and then released their shoulder harnesses. Lancaster also chose to loosen his lap belt

as he prepared to eat his breakfast and having engaged the autopilot, he was happy to leave his colleague at the helm.

Bang!

Some 13 minutes into the flight, G-BJRT was overhead Didcot, Oxfordshire and climbing through 17,300ft. The passengers were just about to tuck into their breakfast and all appeared normal until there was an enormous bang! The cabin filled with a white mist (condensation) and oxygen masks dropped from the ceiling. Loose items and debris were thrown through the aircraft and people began to panic.

Big trouble

However, on the flight deck matters were even worse. The cockpit door had been sucked from its hinges and the source of the explosive decompression the aircraft had just experienced was immediately apparent... The left windscreen had blown out!

Where once there had been toughened glass, now there was simply a pair of feet

and legs – Captain Tim Lancaster had been sucked through the hole! Only the fact that his feet had become entangled in the control column stopped him from being dragged completely out of the window. Outside, the 350kts airflow had ripped his shirt from his back and was now pinning his body against the roof of the stricken airliner.

Out of control

Although the control column was keeping Lancaster firmly in the cockpit, his feet had inadvertently released the autopilot and the 1-11 quickly went out of control and began to roll and dive.

Just behind the cockpit, flight attendant Nigel Ogden had been preparing the Captain's breakfast in the galley when the explosion occurred. He reacted quickly, stepping over the damaged door and grabbed Lancaster around the waist while trying to pull him back into the cockpit. It was to no avail but he was able to free the Captain's feet from the control column – thus allowing Atchison to regain control of the jet.



Mayday

Atcheson also tried to call make a Mayday call but the airflow around the cockpit meant it was impossible for Air Traffic Control to understand what he was saying. He decided his only option was to make an unapproved emergency dive to 11,000ft – hoping that ATC would move other traffic out of their way when they saw them descending on their radar screen.

At that height the passengers and crew could dispense with their oxygen masks and he slowed to 150kts to reduce the airflow into the cockpit and allow improved two-way communications with the tower.

Hang on!

Meanwhile, Chief Steward, John Heward strapped himself into the left observation seat and assisted Nigel Ogden – who was still clinging onto the Captain's feet.

Outside it was -17C without the added cooling effects of airflow, and when the aircraft slowed, Lancaster's frostbitten body slid into view. His colleagues could see that his eyes were open but there was no sign of life.

Nonetheless, the crew clung on tightly. Not only did they want to ensure they could hand the Captain's body to his family, they were also concerned that, if they let him go, he could damage the wing or an engine as he fell. His body was also acting as a partial

shield, plugging the gap in the windscreen and protecting the instruments and crew from the full onslaught of the airflow.

Landing back

With communication systems up and running, Atcheson requested to land at Gatwick (which he was familiar with) but due to the busy airspace around London, the damaged aircraft was directed to Southampton Airport. This was closer to their location but Atcheson had never landed there before (and all the maps and charts had been lost when the window popped out). To add to the co-pilot's stress levels, the aircraft was heavy and the runway short – but at this point there was no other option.

The jet landed safely at 07.55 and the emergency services released the Captain from the window and he briefly regained consciousness before being taken to hospital.

Amazingly the dramatic flight resulted in just one serious injury – that of Captain Tim Lancaster who suffered a broken arm, wrist and thumb as well as bruising, frostbite and shock. The only other recorded injuries were those of Nigel Ogden who suffered from frostbite, bruising, shock and a dislocated shoulder.

What went wrong?

The inquiry by the Air Accident Investigation Branch discovered that the windscreen had been replaced the day before the flight and incorrect bolts had been used to refit the

“His eyes were open but there was no sign of life”

By now Nigel Ogden was also suffering the effects of exposure so fellow cabin crewmember Simon Rodgers swapped places with him, although the Captain slipped a further 6in out of the cockpit during the 'handover'.

With the emergency services standing by BA 5390 began its descent and, amazingly, at 300ft, Captain Lancaster's legs began to kick. Could he really have survived such an ordeal?

window. Although these were only 1/200th of an inch too small it was enough to cause the window to 'pop' under pressure.

Astoundingly, Tim Lancaster returned to work with BA five months later and continued until retirement. Alistair Atcheson also returned to work but Nigel Ogden and a number of other cabin crew members never flew again. ●

Scramble! A pilot and navigator prepare to launch in a Gloster (AW) Meteor NF.11 in 1953



METEORS BY MOONLIGHT

Meteor night fighters were crucial to filling the UK's defence capability gap after World War Two. Paul Fiddian takes an in-depth look into the 'Meat Box's' spectral shadows

Jets readers of a certain age may well remember Matchbox's 1/72 scale model kit of the Meteor NF.11/12/14.

Never afraid to embrace aviation's more esoteric subjects, the UK toy manufacturer distilled into a single boxing all but one of the night-fighting Meteor's four variants. Here were presented the 1950s RAF's primary night-fighters as a collection of plastic mouldings: a neat reminder for some, perhaps, of how the real aircraft began as an assemblage of already-tooled full-size Meteor components. The night-fighting Meteors, though, became so much more than (quite literally) the sum of their parts via evolution, innovation and exportation.

For the Western world, the Soviet Union's ascending profile and perceived power level of the immediate post-war years was a rising concern. August 3, 1947's Aviation Day parade over Moscow's Tushino Airport, involving Tupolev Tu-4 *Bulls* (in essence, reverse-engined Boeing B-29 Superfortresses) en masse, further charged the already-tense air: how, exactly, could the Soviets' strategic reach be overcome?

UK defence capability gaps were swiftly identified and from the Air Ministry emerged a flood of developmental requests; one concerning jet-powered night fighters able to engage high-level Soviet bombers while operating under cover of darkness.

Faster & higher

Generally, said the Air Ministry officials, with the jet age streaking in and piston power's increased obsolescence, Britain really ought to have in service something faster, higher-flying and with considerably more punch than the final Mosquito variants. Accordingly, Specification F44/46 was released, calling on British aircraft manufacturers to design new types which might meet this need. The criteria therein called for a twin-seater with a top speed of 600mph (520kts) at 40,000ft. Also requested, performance-wise, was the capacity to reach an altitude of 45,000ft within ten minutes from start-up, a two-hour flight endurance, a maximum 1,400m



Top: Gloster Meteor T.7 VW413 was used as a trials ship for the NF programme and first flew in modified form in October 1949

Above: WA547, the second NF.11 prototype, taxis out to display at the 1950 SBAC airshow at Farnborough with Sqn Ldr Lancaster again at the helm as its demonstration pilot

take-off run, an airframe with sufficient strength to withstand 4G turns and a raft of integrated systems including radar.

Despite their apparent promise, none of the offerings – including Hawker's dashing, swept-wing P.1057 with its projected top speed of 625kts – were considered suitable. Thus in F44/46's wake, Specification F24/48 emerged on February 12, 1949, this tasking the Gloster Aircraft Company with adding a specialised night-fighter to its Meteor range. In the meantime, there had been released a further specification named F4/48 that would eventually result in the Gloster Javelin.

F24/48 thus covered a Meteor whose duration of service would be intentionally short: a stop-gap solution pending the Javelin's introduction and deployment.

Contracted out

With Meteor F.8 production in full swing, Gloster sent the F24/48 programme to Armstrong Whitworth Aircraft: the Coventry-based firm having by this point already pieced together a run of 46 Meteor F.4s.

Shades of things to come had already appeared in Gloster's October 1948 sales brochure, which depicted the nocturnal Meteor in its elemental form – the design showed a longer nose than had previously been seen on the type.

The concept thereafter leapt from paper to metal and, in October 1949, VW413 –

an adapted Meteor T.7 – entered its flight-testing phase. The sorties flown yielded valuable test data prior to the first new-build Meteor night fighter's maiden flight on May 31 1950. Following the numerical Meteor sequence so far maintained by Gloster, the aircraft was designated 'NF.11' and it wore the serial WA546.

New radar nose

Combining a veritable potpourri of earlier model Meteor parts (including elements of the T.7, F.8 and PR.10), the NF.11 more than met the interim night fighter brief, which would have been bypassed had the aircraft been designed and built from scratch.

Where, previously, the Meteor's four 20mm cannons – boasting a collective 640 rounds of ammunition – had been located in the nose section, the newly-integrated radar arrangement rendered such positioning impossible. The guns were therefore moved to outboard the engine nacelles, while the radar – an AI (Airborne

Interception) Mk 10 based on the US-origin SCR 720 design – occupied their former place. The extended nose took the NF.11's fuselage length to 48ft 6in – considerably longer than that of any standard preceding Meteor – while the 43ft wingspan remained unchanged throughout the NF series' lifespan. Rolls-Royce Derwent 8 engines generating 3,700lbs/thrust powered the NF.11 to a maximum speed of 475kts at 30,000ft and its time-to-climb performance from a standing start to this same altitude – 10,000ft below its maximum ceiling – was in the order of 11 minutes, 12 seconds.

Public debut

Barely a month into its test programme, WA546 participated in the RAF Display held at Farnborough on July 7-8 1950 flown by Sqn Ldr J Lancaster. *Flying Magazine*, in its post-show review, heralded the Meteor NF.11's emergence ("At last", it wrote, "Britain has jet night fighters") while *Flight* noted how, "with its new radar nose, the Meteor II [as then it was known] has a sinister and purposeful appearance."

"At last Britain has jet night fighters"

Around 200,000 people were present over this show's two days: some 50,000 more attended Farnborough's other big public event of 1950 – the third SBAC Show to be held at this venue, staged from September 5-10. This time, WA547, the second NF.11 prototype, was the display mount but Sqn Ldr Lancaster again was the nominated demonstration pilot. On November 13 1950, the first production airframe (WD585) had its maiden flight. The following May, WD599 led its breed into RAF service by joining the Tangmere-based 29 Sqn: the first of 14 frontline squadrons in whose service the NF.11 was placed.

The first Meteor NF.11 was WA546, seen here aloft during the summer of 1950, carried a large 'P' denoting its prototype status





Clockwise from left:
NF.11 WM239 proves the large Meteor was no slouch as it pulls into the vertical. This aircraft was delivered to the RAF in December 1952 but such was the pace of development it was declared obsolete in May 1956 and sold for scrap via 20MU at Aston Down

A pair of 2nd TAF, RAF Germany NF.11s from 256 Sqn at RAF Ahlhorn aloft during March 1956. WM238 (foreground) was delivered in November 1952 whereas WD585 arrived on 256 Sqn in early 1955

The original May 26, 1954 caption for this image reads: "Close Harmony Quartet: The slender aircraft pictured here among powder-puff clouds are Armstrong Whitworth NF.12s of the RAF's 25 Sqn. They were accompanied by another nightfighter carrying Armstrong Whitworth Aircraft photographer, Alec Scott"

The Meteor NF.12 had an AI Mk 21 radar system which required the fuselage to be stretched by a further 15in. To offset this extension's performance impact, a tail fairing was introduced. This example, WS719, was delivered to 25 Sqn on December 29, 1953 but was scrapped less than six years later

Coronation Review

The July 15, 1953 Royal Air Force Coronation Review saw 29, 85, 141, 151 and 264 Sqn provide no less than 36 Meteor NF.11s, which overflew a further 20 examples positioned on the ground.

Formation aerobatics were more commonly the Meteor day fighters' and trainers' pursuit but history has recorded a single such happening at RAF Wahn in July 1957. Here, 68 Sqn's assets put on a show at an event marking the unit's upcoming relocation to RAF Laarbruch. Besides those RAF squadrons already mentioned, the Meteor NF.11 also equipped 5, 11, 46, 87, 96, 125, 219 and 256 Sqn, plus 226 and 228 Operational Conversion Units. It remained operationally-deployable until June 1960, by which point the Javelin era was well underway.

Export market

RAF aside, the aircraft was utilised by several foreign countries and the Royal Danish Air Force's 20 NF.11s – serialised 501-to-520 – arrived between November 1952 and March 1953. Taken on by 723 Sqn, they replaced its Meteor F.4s.

Then, there was the Belgian Air Force, whose 24 examples equipped 10 and 11 Sqn of Beauvechain's night fighter wing.

With 32 ex-RAF airframes delivered to Escadre de Chasse 30 at Tours – these serving until 1957, the French Air Force was the most prolific international NF.11 operator. Elsewhere in France, the Centre d'Essais en Vol (CEV) was a highly enthusiastic Meteor user, beginning with five NF.11s. Their noses were sufficiently capacious to accommodate an array of associated electronics systems, meaning the CEV's Meteors were employed on a variety of radar and missile-based tasks and on the Concorde development programme, to name but three applications.





Above: Compared to earlier models the NF.14 had much improved visibility by virtue of its large bubble canopy. This example, WS788, was delivered to the RAF in March 1954 and was allocated to 152 Sqn at RAF Wattisham. It later served with 1 Air Navigation School (ANS) at RAF Thorney Island, 1 ANS at RAF Stradishall and the Partington Radar Station at Spurn Head before being retired as a gate guardian at RAF Leeming. In 1991 it was passed to the Yorkshire Air Museum at Elvington, where it remains today

Above right: After squadron service a number of Meteors were sold off for various duties. This example, the former NF.11/TT.20 WD592, was sold to the Confederate Air Force's Al Letcher as N94749 and is seen here transiting through Biggin Hill on January 2, 1975 en route to the USA. It was painted gloss white on arrival at Mojave, California before appearing in an episode of Wonder Woman, depicting the fictitious 'XPJ-1' prototype. In 1994 it was donated to the Edwards AFB Flight Test Center Museum

Demonstrating the night fighting Meteor's somewhat ungainly appearance NF.14 WS733 peels away from the camera during a photo shoot in 1955 while in service with 25 Sqn



Trials ships

NF.1s also strongly supported innovative weapons trials enacted in other nations' skies. Those bearing the serials WD743, 44 and 45 were involved in Fairey Aviation's 'Blue Sky' (as the MoD rainbow codenaming system termed it) project that evolved Fireflash – the RAF's first guided air-to-air-missile – while, similarly, WM372, 73 and 74 took part in 'Blue Jay' and thus helped deliver the Firestreak infrared

homing air-to-air missile into RAF and Fleet Air Arm service.

Of the radar trials-tasked NF.1s, WD790 was the most enduring and, in the Royal Radar Establishment's charge, participated in numerous developmental programmes including those of the TRS2 and the MRCA/Tornado. Scrapped in 1984, WD790 these days exists as a cockpit section preserved by the North East Land, Sea and Air Museums, Sunderland.

Target tugs

Modified NF.1s saw further use as Royal Navy target-towers. Almost 50 were converted to TT.20 standard with their radar removed and an ML Aviation G-type winch fitted on their starboard wing. Replacing the Fairey Firefly TT variants, these Meteor TT.20s remained in Royal Navy service throughout the 1960s prior to the Canberra TT.18s' arrival on the scene at the next decade's start.



A trio of 78 Sqn NF.14s at altitude in 1955. The aircraft nearest the camera, WS782, was lost on March 3, 1958 after it collided with Meteor NF.12 WS700 while in the circuit at RAF Church Fenton



The June 29, 1951 issue of *The Aeroplane* carried this dynamic illustration of the night-fighting Meteor on its front cover

Elsewhere in Europe, Swedish contract services group Svensk Flygtjänst had a pool of four TT.20-standard Meteors to support both its own nation's and the Royal Danish Air Force's military operations. The Swedish Air Force had, incidentally, itself been a prospective NF.11 operator but in the end drew on other types to meet its nocturnal requirements.

Ongoing development

Extending to 355 examples, the NF.11's manufactured total exceeded those of all other night-fighting Meteor variants combined.

Capped at 100, the Meteor NF.12's production run was more modest but its operational radar reach was extended by 100 per cent. An AI Mk 21 (ex-APS-57) system replaced the NF.11's AI Mk 10 and, consequently, the fuselage gained a further 15in in length, taking it to 49ft, 11in. To offset this extension's performance impact,

a tail fairing was introduced, as were Rolls-Royce Derwent 9s each rated at 3,800lbs/thrust. Maximum speed, rate of climb and service ceiling were unchanged and WS590, the initial NF.12, first took flight on April 21 1953. Subsequently, the NF.12 entered 25, 29, 46, 64, 72, 85, 152 and 153 Sqn's service, plus that of 228 and 238 OCU's, but was not exported.

Tropical conversion

In contrast, the NF.13, of which 40 were built, saw considerable foreign use, as befitted a Meteor which, with enlarged engine nacelles, a cold air unit and other appropriate adaptations, was optimised for warmer climes.

First flown on December 23 1952 (WM308 the prototype airframe), the NF.13 actually preceded the NF.12. Dimensionally and in terms of its powerplant, it precisely matched the NF.11.

The RAF's 39 Sqn (at RAF Fayid, Egypt and later RAF Luqa, Malta) and 219 Sqn (RAF Karbit, Egypt) were the sole British NF.13 operators and once these aircraft had become surplus to requirements, 20 were passed to France (which got two), Syria (six), Egypt (six) and Israel (six).

The NF.13s used by the Israeli Air

Force's 119 Sqn were purchased in 1956 and delivered either side of the Suez Crisis on account of its associated arms embargo. Sales to the Royal Egyptian Air Force were pre-Suez and it's known that these Meteors were deployed during the crisis period, targeting Israeli ground forces and allegedly engaging and wounding an RAF Vickers Valiant on one occasion.

Ultimate nocturnal 'Meat-box'

By late 1953, the night-fighting Meteor range had another new member, but it would be the last of the line. Sparring skywards on October 23 of that year was WS722 – the first example of the final nocturnal Meteor development. Replacing earlier models' heavily-framed canopy, the NF.14 had instead a bubble canopy – this feature warmly received by those pilots unimpressed with a previously significantly more limited view of the panorama beyond the glass.

Not only was this canopy framework-free but it was electrically-operated, sliding backwards pre/post-flight – another most pleasing NF.14 aspect so far as those who flew it were concerned.



The Royal Danish Air Force ordered twenty NF.11s and the first, coded 501 and seen here during testing, was originally allocated the RAF serial WM384 and was delivered to Denmark on November 28 1952



A colour air-to-air photograph of Meteor NF.11 WD597, taken on May 17, 1951 during an air test from Armstrong Whitworth, Baginton. The jet was used by Rolls-Royce to test the Derwent 8 engines before it entered RAF service with 29(F) Sqn Adrian M Balch Collection

The NF.14 was the same length as the NF.12 and was equipped with Derwent 9 engines. Its maximum speed was 808kts and its service ceiling was 43,000ft. Equipping, 25, 33, 46, 60, 64, 72, 85, 96, 152, 153, 213 and 265 Sqns, plus 228 and 238 OCU, the NF.14 was thus the closest match yet to the original Specification F44/46 but – great though it was – this model's entry-into-service coincided with a major shift forward in Soviet bomber technology. Tupolev Tu-16 *Badgers* with a top speed of 560kts-plus and a 4,474-mile range had started displacing the Tu-4s to become the prime Soviet threat.

The by-now outmoded NF.14s nonetheless remained in use for a number of years – WS848, in May 1955, the last-built of 100, soldiering on until August 1961 at which point the Javelin FAW.9 was in service.

Civil operators

Away from the operational frontline, three NF.14s were placed onto the UK civil register. One was Ferranti's radar trials-tasked G-ARCX (ex-WM261); its super-nasal extension taking fuselage length to an unsurpassed (in Meteor terms) 57ft 9ins. In

years a sole airworthy example has been in civilian ownership and operation. Built in 1952 as an NF.11, WM167 equipped firstly 228 OCU, then was consistently rotated between this unit and 33 MU (Maintenance Unit) at RAF Colerne before being modified to TT.20 standard and used by Boscombe Down's A&AE for target-towing trials.

Flight Refuelling Ltd was its next operator as, for a decade, WM167 plied its

operated one or more Meteor night fighters. France, for example, is home to no less than eight preserved NF.11s, while the Israeli Air Force Museum at Hatzerim houses three NF.13s. The UK's exhibited Meteor night fighter population comprises a solitary NF.11 (the Muckleburgh Collection's WD686), NF.12 (Newark Air Museum's WS692) and NF.13 (the much-moved ex-Israeli Air Force 4X-FNA, previously WM366, which in 2011 was gifted to the Jet Age Museum) and a plethora of NF.14s.

Thus in the air, at many museum sites and very likely in numerous aircraft modellers' stashes, the legend of the night-fighting Meteors is happily upheld. It's an abiding tribute to these creatures of the night which, all things considered, significantly enhanced the Meteor's already substantial legacy. ●

"The NF.14's bubble canopy was warmly received"

its very smart white and red trim scheme, this aircraft now resides at the National Museum of Flight, Scotland. The other two were destined to serve the short-lived Biafran Air Force and were registered G-ASLW and G-AXNE for their delivery flights. However, neither was to reach their destination after G-ASLW crashed off the Cape Verde coast on October 10 1969.

Other NF Meteors were sold into private hands after retirement, with some heading to the USA as 'warbirds', although their careers were shortlived.

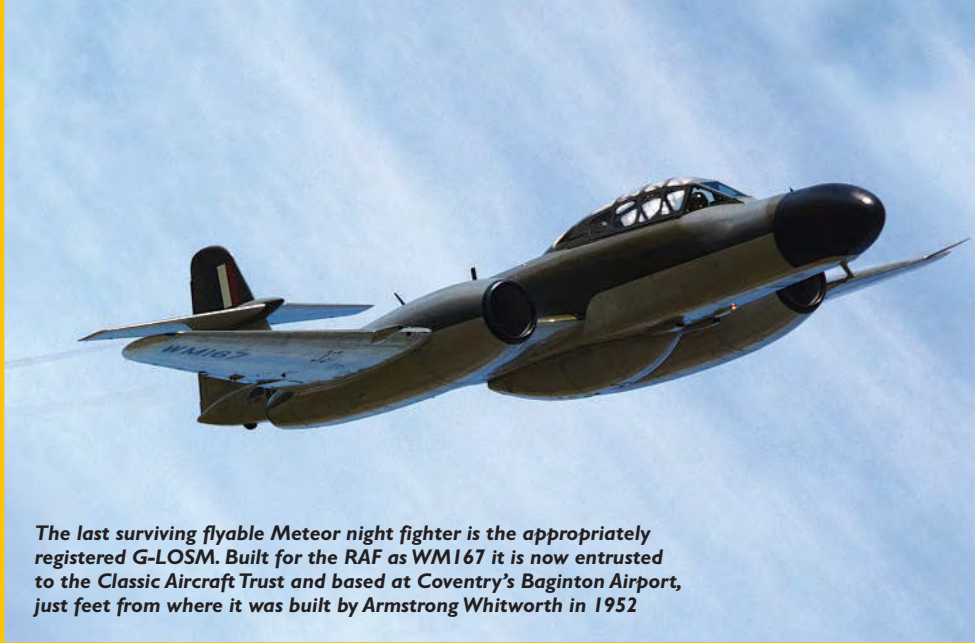
Unique survivor

However, the night-fighting Meteor story doesn't quite end there and for the past 30

trade above Dorset and North Wales. It then passed into civilian hands and, from Doug Arnold's Warbirds of Great Britain operation, joined Mike Carlton's expanding 'Hunter One' fleet at Hurn on July 6 1984 as G-LOSM. A classic jet pioneer, it has ever since been a unique presence on the European airshow circuit and is, fittingly, now based at Coventry Airport (close to the Armstrong Whitworth factory where it was built) with the Classic Aircraft Trust.

Preservation

Preservation-wise, WM167/G-LOSM aside, the range is well represented in museums the world-over. Included are those located in most of the nations whose air arms



The last surviving flyable Meteor night fighter is the appropriately registered G-LOSM. Built for the RAF as WM167 it is now entrusted to the Classic Aircraft Trust and based at Coventry's Baginton Airport, just feet from where it was built by Armstrong Whitworth in 1952

SPECIFICATION GLOSTER (ARMSTRONG WHITWORTH) METEOR NF.14



Crew	2
Length	51ft 4in (15.50m)
Height	13ft 11in (4.20m)
Wingspan	43ft 0in (13.10m)
Wing area	374sq ft (34.74m ²)
Empty Weight	12,620lb (5,725kg)
Max Take-Off Weight	21,200lb (9,625kg)
Max Speed	808kts (930mph/587km/h)
Ferry Range	950 miles (1,530km)
Service Ceiling	43,000ft (13,100m)

Powerplant Two Rolls-Royce Derwent 9 turbojets (3,800lb/thrust each)

Armament
Four wing-mounted 20mm Hispano cannon

First Flight May 31 1950 (NF.11)
October 23, 1953 (NF.14)



Meteor NF.14 G-ASLW began life as WS829 with the RAF but was registered to Rolls-Royce for flight test duties in 1963. It was later sold to an undisclosed owner and was to be delivered to Biafra/Nigeria to participate in the civil war. However the aircraft was lost in the sea off the Cape Verde Islands on October 28, 1969 on its delivery flight. The Dutch pilot was rescued by a passing ship. It is seen here at Woodford airfield in November 1968 wearing Rolls-Royce 'house' colours Iain MacPherson via Adrian M Balch collection

SUPER SABRE KILL

THE USAF'S FIRST VICTORY IN VIETNAM

*Flying primarily air-to-ground missions during the Vietnam War, the USAF's F-100 Super Sabre was only briefly used in a fighter role. **Jamie Ewan** relates how the type made its mark against the enemy MiGs*

Emarked for destruction in the early days of Operation *Rolling Thunder*, the bombing campaign against North Vietnamese strategic targets, the Thanh Hóa Bridge was to become one of the most infamous targets of the Vietnam War. Following the unsuccessful first attack by a strike package comprising 79 aircraft on April 3, 1965, a re-strike on the bridge was ordered for the following day. Despite the huge amount of ordnance directed towards it during the

initial attack, the bridge – nicknamed *Hàm Rồng* (Dragon's Jaw) by the Vietnamese – was still standing.

The good guys

Escorted by North American F-100D Super Sabres of the 416th TFS (Tactical Fighter Squadron) flying both MIGCAP (MiG Combat Air Patrol) and RESCAP (Rescue Combat Air Patrol) orbits, 48 Republic F-105D Thunderchiefs from the 355th TFW (Tactical Fighter Wing) took on the bombing effort.

Capt Kilgus and his 416th TFS colleagues come to the rescue on April 4, 1965. The USAF was about to score its first victory of the Vietnam War, but it would be 2009 before it would be officially recognised *Andy Hay | www.flyingart.co.uk*



Flying in flights of four the American F-105s, each carrying eight 750lb bombs, were unable to manoeuvre effectively or evade enemy fire with such heavy loads.

Orbiting offshore to the east of the target, the eight RESCAP Super Sabres, using the callsign *Green*, found themselves tasked with protecting both fixed wing and rotary aircraft in the event of a friendly pilot being shot down.

The aircraft were also on hand to engage any Soviet-built North Vietnamese Air Force (NVAF) Mikoyan Gurevitch MiG-17 *Frescos* attempting to disrupt the strike package. In the number two position was Capt DW Kilgus, flying F-100D 55-2894 *Kay Lynne*. His jet carried two pods of 19 2.75in rockets as well as 800 rounds for the aircraft's four 20mm cannons.

MiG foes

Despite sightings on previous missions, the USAF's first air-to-air engagement with a MiG-17 had taken place only the day before, when a number of the NVAF jets attacked two US Navy Vought F-8E Crusaders. The Vietnamese claimed kills for the two Crusaders; however, no aircraft were reported lost by the US Navy during the engagement.

Tasked with the defence of the Dragon's Jaw the 921st Fighter Regiment (also known as 'Sao Do' or 'Red Star Squadron') scrambled eight MiG-17s from Noi Bai Air Base. Although the MiGs were considered outdated, the NVAF pilots' exploits against the modern American jets were to come as a shock.

Devious decoys

On April 4, 1965 NVAF tactics saw the flight of eight MiGs split into two flights of four – one quartet heading west as decoys and the other, led by NVAF pilot Tran Hanh, flying in a southeasterly direction tasked with intercepting the US jets.

Knowing that the MIGCAP and US strike force were expecting any hostile aircraft to come from the west, the Vietnamese hoped that their decoy fighters would attract the

★★★★★ Dogfight ★★★★★

Right: The Super Sabre was only briefly used in the air-to-air combat role and was soon reassigned to ground attack missions. Here an F-100D of the 352nd TFS drops a napalm bomb near Bien Hoa, South Vietnam. Super Sabres could carry an impressive array of weapons, including high explosive bombs, napalm, rockets, cluster bombs and even the guided Bullpup missile USAF Museum

Below: 'Mud Moving' Thunderchiefs begin their take-off roll prior to another mission over North Vietnam USAF Museum



US F-100s' attention. If this plan worked, the four NVAF attacking jets would have free rein and be able to turn in behind the strike package from the south.

Fatal separation

Holding in an orbit ten miles south of the target – complications led to a delay in each attacking flight's Time on Target – the last flight of F-105s, callsign *Zinc*, found themselves separated from the MIGCAP. Under the guidance of the ground controller, the MiGs were vectored towards the unprotected Thunderchiefs, which were lumbering around the sky at 325kts.

Entering the fray, the pilots from Sao Do struck fast and downed two of the bombers in quick succession after diving through the cloud onto the unsuspecting jets.

As the MIGCAP raced to the scene in full afterburner, Tran Hanh was able to drop his MiG in just 1,200ft behind the lead F-105 and fire his cannons.

He downed Major F E Bennet (flying

Arriving on scene to find the MiGs had gained their first kills of the war; MIGCAP leader Lt Col Emmot Hays (the 416th TFS Commanding Officer) closed within missile range of the retreating MiGs.

Hays and Capt Keith Connolly each fired a single Sidewinder missile at the NVAF jets, but neither performed as expected and despite following up with 20mm cannon fire, the nimble Russian jets managed to escape after some evasive manoeuvring.

Tables turned

Meanwhile, Vietnamese ground controllers had vectored two MiGs towards the strike package and these soon came across Don Kilgus and the rest of Green flight, which was still on RESCAP duties.

Pulling his Super Sabre round to meet the danger, Kilgus jettisoned his drop tanks as Tran Hanh's MiG overshot and a second – flown by Dham Giay – dropped in behind the American jet.

Using evasive flying techniques the 416th pilot managed to get on Giay's tail just as he pushed his MiG into a steep dive in an attempt to escape.

Engaging the afterburner, Kilgus pushed the jet over from 20,000ft in hot pursuit and selected his guns. Initially firing short bursts as the altimeter quickly wound down, the US aviator started to increase the rate of

two North Vietnamese jets may never be known, but it possible that they may have been hit by Vietnamese anti aircraft fire or collided with one another in the ensuing chaos over Hàm Rồng.

Denied

Confident that he had indeed brought down the MiG he was chasing, the USAF pilot was only awarded a 'probable' despite his story and the events of the battle being confirmed by other members of *Green* flight.

Even after a number of requests to reconsider the decision, his claim was denied repeatedly. Part of the problem was thought to be that President Lyndon B Johnson had said that he did not want MiG shoot-downs, in case the engagement provoked China and Russia.

Although denied, Kilgus went ahead and painted his F-100D up with a MiG kill marking – the first to adorn a USAF jet in Vietnam.

Confirmed

In 2009, some 45 years after the dogfight, after checking various records and accounts – and with the help of the Vietnamese – the USAF finally approved Kilgus' claim. It would be the first and only air to air victory gained by the F-100 Super Sabre and the USAF's first MiG kill of the war.

Kilgus went on to fly three tours in three different aircraft (O-1 Bird Dog, F-100D and F-105) but sadly he was killed in a car crash in the 1990s and did not live to see his victory ratified. ●

"Had he just downed a MiG?"

F-105D 59-1754 as *Zinc 1*) and Capt JA Magnasun (flying F-105D 59-1764 as *Zinc 2*) was shot down by fellow VPAF pilot Le Min Huan; both American pilots were killed.

Close-range combat

With the flight in disarray, *Zinc 3* snapped his jet into a roll as one of the Vietnamese jets engaged him and found another light grey MiG in his gunsight. However, he missed the opportunity to fire at the Vietnamese jet and *Zinc 4* also missed the chance as he tried to complete the F-105's complex weapons set-up sequence.

The MiGs soon disengaged and split into two elements. Le Min Huan and Tran Nguyen Nam vectored north of the Bridge and Tran Hanh and his Wingman Dham Giay headed south. The MIGCAP were now onto the bandits.

fire as he passed through 7,000ft. This would be his last chance to hit the retreating jet.

With the MiG-17 being a much smaller and lighter jet, it could pull out of a dive faster than the larger Super Sabre. In the back of his mind Kilgus knew the MiG.

Unclear result

Confirming that the Super Sabre's guns were hitting the fleeing jet, the US pilot watched as sparks flashed off the MiG's fuselage and tail.

Larger parts were also seen to be ripping off the MiG as it vanished into the haze covering the Gulf of Tonkin. Kilgus pulled his jet out of the dive and flew for home – had he just downed a MiG?

On return to Noi Bai, Tran Hanh found he was the only member of the attack flight to have survived. What happened to the other



After Capt Kilgus' inaugural victory the USAF went on to claim a number of MiG-17 kills during the war. This example fell to the guns of F-105 pilot Major Ralph Kuster Jr on June 5, 1967 USAF Museum

Testing Times

Steve Bridgewater & Richard Freail put the latest jet-related books and products to the test



BOOK

Out of the Blue Too

Halldale Media Group
Ian Cowie, Dim Jones and Chris Long
368 pages, paperback, B&W
ISBN 978-0-9570928-2-2
£9.99 + postage

The successful first version of this book raised over £25,000 for charity so it is very welcome news to see "more scary and often funny tales from the Royal Air Force and friends" resurface in *Out of the Blue Too*, which again raises money for RAF, RN and Army charities.

At about 120 pages longer than the previous version, we revisit the world of the Cold War with 100 amazing and sometimes scary anecdotes, as told by some of those who were there, about the trials and tribulations of military flying and service life. Again a wide variety of aircraft feature, ranging from props to jets and supersonic fighters to helicopters; if they flew during the Cold War then they are probably included here. Each story varies from one to several pages in length and the anecdotes include flying in war, training exercises, display flying, ejections, station and squadron life, lessons learned about flying and the accidental shooting down of a Jaguar in 1982!

OOTB2 is a great read, amusing and brilliantly entertaining – what's more, if you buy it from the shop at www.rafbf.org every penny goes to three very worthwhile military charities. **RF**

BOOK

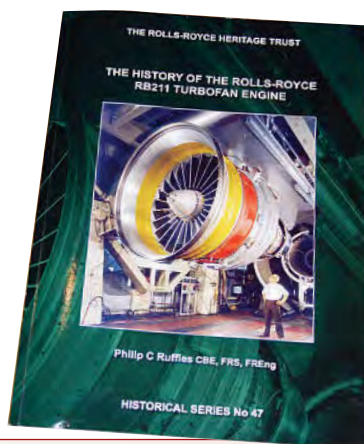
The History of the Rolls-Royce RB211 Turbofan Engine

Rolls-Royce Heritage Trust
Philip C Ruffles
326 pages, paperback, B&W & Colour
ISBN 978-1-872922-48-5
From £20.00

The RB211-22 three-shaft turbofan engine was ordered by Lockheed in April 1968 to power the Lockheed L1011 Tristar aircraft. Securing the order was a great achievement by Rolls-Royce but the programme ran into technical difficulties, causing the company to go into receivership in February 1971. However, the programme was saved and the engine entered service in April 1972, just four months later than originally planned. Subsequent developments of the engine powered the Boeing 747, 757 and 767 aircraft and it formed the basis for the very successful Trent family that powers today's wide body aircraft.

This large format book tells the story in great detail; in fact it could be argued it contains too much detail... It is clearly written by somebody with an in-depth engineering background and as such it is a complex read. Unless you are of a similar mind-set it can take several reads before some passages make sense, however you'll be hard pressed to find a greater book detailing the history of this world-beating powerplant.

The book is available from Rolls-Royce Heritage Trust (01332 240340) and costs £20 for Trust members or £30 for non-members. Current Rolls-Royce employees can obtain a copy for just £25. **SB**



BOOK

Libyan Air Wars – Part 1 (1973-1985)

Casemate UK
Tom Cooper, Albert Grandolini
& Arnaud Delelance
80 pages, paperback, B&W & Colour
ISBN 978-1-909982-39-0
From £16.95

Between 1973 and 1989, various Western powers and Libya were entangled in a seemingly never-ending exchange of blows. Supposedly launched in retaliation for one action or the other, this confrontation resulted in a number of high-profile clashes between the Libyan Arab Air Force (LAAF), the US Navy and even the French.

Meanwhile, almost as a sideshow, the LAAF – quantitatively one of the most potent air forces in North Africa and the Middle East – also saw intensive deployment in Chad. Initially, with sporadic fighting between different parties for the control of N'Djamena, the Chadian capital, this conflict eventually turned into a major war when Libya invaded the country outright. The LAAF deployed not only French-made Mirage but also Soviet-made fighter-bombers of MiG and Sukhoi design, Mil-designed helicopters and even bombers of Tupolev design, to establish dominance over the extensive battlefield of the Sahara Desert.

Detailing not only the aerial operations but the ground war and the geo-political background of these conflicts this book is illustrated with over 100 contemporary photographs, maps and colour profiles. **SB**

BOOK

Dragon Lady Today: The Continuing Story of the U-2 Spyplane

Chris Pocock
Available from Amazon
102 pages, paperback, colour
ISBN 978-1500965464
£15.25

The author's 50 Years of the U-2 published in 2005 (Schiffer) is widely acclaimed, particularly by those involved in the U-2 programme, as both an outstanding book and the standard reference on the aircraft's history. This year the U-2 celebrates its 60th birthday but has been under threat in recent times as the US seeks to retire some

older airframes and re-align defence budgets towards new projects.

Here, Chris Pocock updates the U-2 story in this self-published volume with nine chapters about developments, pilots, missions and equipment, all of which feature interesting photographs and diagrams – many previously unpublished. The final two chapters focus on a comparison of the U-2 and its supposed replacement, the Global Pavehawk UAV, and the ensuing political and military battle to retain the long-serving and still highly useful aircraft in service. A list of current airframes, former pilots and unit badges is also included.

This is an informative and interesting book which provides the very latest publicly available information on the U-2 programme and is highly recommended. **RF**



MEMORY LANE

Jets is all about rekindling the memories of days gone by. As part of this we're keen to hear from you and see the images filed away in your photo albums. This month Mike Vines recalls a "grand day out" aboard HMS *Ark Royal* in 1978

When I contacted the Royal Navy press department to ask if I could be included on their next press facility to HMS *Ark Royal*, I didn't realise it would be the last one.

"Be at RAF Turnhouse for 09.00 on February 28 [1978]," I was told. "The ship is operating 60 miles out in the North Sea off the coast of Scotland."

That didn't sound like the greatest time of the year to shoot slow colour transparency film. I hesitated; it didn't sound like the greatest of ideas. "It'll probably be the last press call aboard the ship before she's decommissioned", I was told.

It was now or never and I needed a bit of luck, especially with the weather. I thought of the notorious freezing-cold North Sea and bought a new thick fur lined jacket!

Ferry flight

At RAF Turnhouse (Edinburgh Airport) came introductions to my fellow photographers as we donned our day-glo passenger survival suits, had a safety briefing and struggled aboard one of *Ark Royal*'s

Wessex helicopters for our 40-minute flight to the carrier.

It was starting to get light and there was hint of broken cloud as we trundled towards the spec that was the 'Ark'. It looked a very small deck; was there even room for a Wessex to land, never mind Navy Phantoms and Buccaneers?

Upon landing came the call: "Which one of you lot is Mr Vines?" I owned up. "Follow me for your immersion suit fitting."

My fellow photographers looked disappointed but I'd requested in advance to fly aboard the SAR Wessex to shoot aircraft, carrier and sea. They muttered, but now totally waterproof in my squeaky rubber suit I left them behind and joined the winchman and a frogman aboard the helicopter. Complete with jump strap, talking hat, throat mike and bone dome I was escorted to my seat – an orange box (honestly) that faced the now glassless emergency window on the starboard side.

The weather had improved to blue sky and the outside temperature must have been approaching 20 degrees C. It was surreal – I was looking at a sea that was more like the

blue Mediterranean, yet it was February and we were near Scotland!

In the hover

Airborne and hovering just off the Ark's port beam and its 8.5 degree angled flight deck, I watched as Phantom FG.1s of 892 NAS, Buccaneer S.2s from 809 NAS and Gannet AEW.3s from 849 Sqn's 'B' Flight were attached to the steam catapult and launched. My pilot realised I couldn't pan my camera to follow the launches so he gently swung the chopper left a bit to pan while I kept perfectly still. He certainly improved the pictures!

My airborne sortie went far too quickly and I was soon back on board, four decks down in the Officers Mess having drinks and a bite to eat with my envious fellow photographers. But the regular thumps of aircraft landings unseen above our heads had us quickly back on deck. The unbelievable weather lasted and my new unworn jacket spent its day in a locker. What a thoroughly grand day out! ●

Three 892 NAS McDonnell Douglas F-4K Phantom FG.1s prepare to launch from HMS *Royal*'s deck on February 28, 1978 All Mike Vines

Looking forward on HMS *Ark Royal*'s deck, a trio of Phantoms shares space with a pair of Gannet AEW.2s and four Buccaneers

Below: Fairey Gannet AEW.2 XL449 begins its take-off. The aircraft would later be retired to the Wales Aircraft Museum at Rhoose (Cardiff) but was broken up on site in 1996. The nose is now privately owned in Surrey

Below: F-4K Phantom FG.1 XT859 prepares to launch from the Ark. British Phantoms differed in shape from US examples, mainly because of their Rolls-Royce Spey engines. The FG.1 variant also had a considerably longer extendable nose wheel oleo that gave the aircraft an appropriate angle of attack during the catapult launch aboard British aircraft carriers



Above: Fairey Gannet AEW.2 XL450 performs a catapult launch from the Ark. The aircraft joined the Royal Navy in March 1959 and after retirement was allocated maintenance number 8601M and was used by engineering apprentices at RAF Abingdon. The Gannet was later disposed of and found a home at the Flugausstellung Hermeskeil museum in Germany



Above: Phantom XV586 first flew on April 11, 1969 and was delivered to the Royal Navy two months later. In 1977 it joined 43 (F) Sqn at RAF Leuchars, although it briefly returned to the Ark Royal between November 1978 and October 1978. The aircraft was retired in October 1989, with 3,770hrs 'on the clock' and preserved as a gate guardian by 43 Sqn at Leuchars. Following 43 Sqn's disbandment, the aircraft was moved to RNAS Yeovilton in 2012 and has recently been repainted into its Royal Navy markings



This Fairey Gannet COD.4 began life as an AS.4 variant and first flew in March 1957. She is seen here in the dark blue COD scheme she wore when attached to 849 NAS at RNAS Lossiemouth. Today she belongs to the Fleet Air Arm Museum but since 1999 has been stored out of public sight in the Cobham Hall storage facility



HMS Ark Royal
at full steam in
the beautiful
winter sunshine



Right: Another photograph of Phantom XT859 aboard HMS Ark Royal in February 1978. The jet first flew on January 19, 1968 and was delivered to the Fleet Air Arm three months later. After the Royal Navy dispensed with its Phantoms, the airframe passed to the RAF and spent a while on strength with 111 Sqn at RAF Leuchars. It was finally scrapped in April 1992



The Mind Set Jet

Flying the Baby Bus

The Airbus A320 is one of the most modern airliners in service.
Scott Germain takes readers aloft for a check flight in the 'Baby Bus'

When the highly automated Airbus A320 first flew, the type was one of the most technologically advanced transport category jets ever. Its fly-by-wire (FBW) flight control system was advanced and complicated, and most of the aircraft systems talked to each other.

But more importantly, the series of twin-jet narrow body aircraft was very efficient; an important item for the bean counters at various airlines.

From the smallest A318 business jet to the massive A380 super, the consortium manufacturer has produced a range of aircraft that compete head-to-head with Boeing. Sales figures show that the single-aisle, twin-engine A320 series is one of the most popular commercial airliners ever produced. Compared with the more cramped flight deck and cabin seats of the

737, I feel the A320 is a quantum leap more comfortable for all occupants.

Family values

Launched in March of 1984, and first flown on February 22, 1987, Airbus quotes over 6,000 A320 deliveries to 311 civilian and military operators worldwide. And keep in mind, when I say A320, I also include the shorty A318, the still short 124-passenger A319, and the stretched 185-passenger A321.

Legacy 'Busses are known as 'CEOs' (Current Engine Option) but since December 2010 Airbus has been busy upgrading the design with more efficient engine options, new 'sharklet' wingtips, and some aerodynamic enhancements. These are 'NEO,' or New Engine Option aircraft and are set to come on line in 2016. They can be ordered with Pratt and Whitney PW1000G or CFM LEAP-X engines.

One type rating covers the line, which is

an attractive cost item for operators. Original engines choices were the CFM56-5 or the IAE V-2500 with thrust ratings between 22,000-33,000lbs. That's almost as much as a pilot needs to know about them, too.

The biggest difference we see is during start-up; the CFMs spool and start rather quickly, while the V-2500s take a little longer. The CFMs use percentage N1 on the engine display while the IAEs use Engine Pressure Ratio (EPR). Engine master switches and FADECs control everything else, with input via the thrust levers from the pilot and various sensors and probes.

Interface: Automation

When the A320 was introduced it featured the most advanced flight automation available at the time. New Airbus pilots spend the better part of a week learning this portion of the aeroplane.



Simply put, the code that runs the numerous and redundant computers won't allow the Airbus to stall, exceed certain bank and pitch angles, or exceed certain airspeed limits. The system works extremely well, and is transparent during normal operations. If certain computers fail, or if two or more components fail, the aircraft degrades through Normal to Alternate Law. Certain protections may be lost, but the aeroplane is still fully flyable. Further degradation results in Direct Law, and now you have to be a bit careful with control input. It would have to be a really, really bad day to land an Airbus only with the trimmable horizontal stabiliser, rudder, and engine power – but it can be done.

From normal operation through to any failure that can occur, the ECAM (Electronic Centralised Aircraft Monitoring) is the heart of the 'Bus when it comes to interfacing human and aeroplane. Two ECAM screens occupy the

centre instrument panel, and display all engine parameters, aircraft configurations and systems with the touch of a button.

Colourful jet

Colour plays a large role in operating the A320. The ECAM uses graphic system displays to tell the pilots what is working (green) and what isn't (amber Xs or components). If you're looking at the engine display, limits have a red arc. If, say, an EGT exceeds a limit – it turns red and triggers an ECAM warning.

The overhead panel works somewhat the same way. Based on a lights-out concept, if a fault develops, the affected push-button will illuminate with an amber FAULT light, drawing your attention. The ECAM will also join in the fun and bring up the related action and checklist.

Serious failures requiring immediate action activate a Master Warning Light, the CRC

Above left: "Captains simply arrive ten minutes before push, place their coffee cup in the holder, and congratulate the first officer on a job well done!"

All Scott Germain unless stated

Above: Taxiing the Airbus is simple and you use just a small amount of 'breakaway thrust' to get moving. Each pilot has a steer-by-wire tiller on their side consoles to control the aeroplane

(Continuous Repetitive Chime), and illuminate any other affected system push-buttons. The pilot will silence the CRC by pushing the Master Warning button, then begin the procedure for dealing with the problem.

Managed & selected

When it comes to the proper mindset to fly the A320, you will become very intimate with the terms 'Manage' and 'Select'. It doesn't matter if you are hand-flying or using the autopilot; one uses the FCU (Flight Control Unit) to select or manage

The A321 is longer and heavier than its siblings, but it has the same wing and only marginally more thrust



"The technique of landing with 'flaps three' and leaving the power in until the last second seems to get the aircraft in a self-cushioning ground effect"



the aeroplane's speed/Mach, heading/track, altitude, or rate of climb/descent.

Managing any or all of the items above means pushing the desired button on the FCU. This hands control of the button you just pushed – speed, heading, altitude, climb or descent, and at what rate – to the Flight Management System. Since you programmed the route, altitude, weight and fuel before you took off, the aircraft will control the portion which you just 'Managed'.

Airbus designed the aircraft with the logic that it should be flown in, or returned to, 'managed' flight whenever possible, but no flight is ever flown completely managed. You will always have to change something by using various 'selected' choices. Selecting means pulling the desired knob on the FCU and turning it to the value you desire. Want 280kts? Twist the airspeed knob to 280, and 'select' it by pulling it. Need an open descent to 25,000ft? Twist the altitude knob to 25,000 and pull, and the aeroplane will descend at the maximum rate it can for the airspeed. You can also select a Mach, heading, track, or a rate of climb or descent.

Preflight

Your duties as an A320 operative will be different based on which seat you occupy. For first officers at my outfit, you're tasked with initial cockpit safety checks, the walk-around, and then a lion's share of Flight Management System (FMS) programming. Both captains and first officers have flows to ensure each item is properly set and checked. The first person to the flight deck performs the initial

safety checks; ensures the landing gear handle is down, performs fire tests, and then turns on ground power or starts the Auxiliary Power Unit (APU). Once the APU is up and running you'll have electrical power and air conditioning if you need it. This is a good time to initialise the triple Inertial Reference Units (IRUs) so the aeroplane knows where it is and where it's going.

Captains simply arrive ten minutes before push, place their coffee cup in the holder, and congratulate the first officer on a job well done!

There is nothing special about an A320 walk-around. The aircraft sits rather tall and everything you need to see is in easy view. Make sure the nose gear pin and main gear

their FMS boxes are much more intuitive when it comes to entering the flight plan and managing it in flight. I think the best way to explain the logic in the Airbus system is that it's a 'going to' sort of logic, where the Boeing logic seems to be 'going from.'

Inserting the flight plan into the box begins with selecting the departure runway, which is linked to the SIDs [Standard Instrument Departures] that serve that runway. This only takes about three or four button pushes. Once the runway and departure are in the flight plan, you can insert your waypoints if the ACARS [Aircraft Communications Addressing and Reporting System] download didn't already do it. When you're ready to insert the Standard Terminal Arrival Routes (STARs) for the airport

"A quantum leap more comfortable"

sleeves are removed, engine cowlings are properly fastened, and that the crew oxygen and APU blow-out disks are intact. These are the only real 'gotcha' items.

Back on the flight deck, the next order of business is getting ATIS and clearance, then programming the FMS via the Multipurpose Control Display Unit or MCDU ('McDoo'). Since both MCDUs cross-talk, loading one loads them both. I'm sure different airlines have different methods of what they do and when they do it, but after a short time, you'll be used to the method your carrier uses.

INIT, F-PLAN, PERF, and the ACARS/ATSU pages are primarily where you'll input information for the FMS. I haven't had the pleasure of flying a Boeing jet, but I hear

you're landing at, you insert the runway in use first, then link it to the arrival and transition you're cleared to fly. Once done, scroll through the flight plan and make sure there aren't any discontinuities that aren't supposed to be there. Downlink and insert the winds aloft, copy the flight plan to the secondary flight plan, and you're good to go in terms of the route.

After you brief your flying partner, it's time to slam the doors and fly...

Starting up

Once pushback is complete, our airline has the first officer start the engines. I was used to the IAE engines that take a little over a minute to start and stabilise so once we started flying the CFM engines we found they crank right

Left to right: The A320 family now includes the smaller A319, the even smaller A318 and the stretched A321 All Airbus





Airbus

Fly-by-wire and glass screen displays differentiate the Airbus from earlier generation jetliners



"The overhead panel works on a lights-out concept, if a fault develops, the affected push-button will illuminate with an amber FAULT light, drawing your attention"



The A320's flight deck is equipped with side-stick controllers in place of a conventional 'yoke'

up and are ready to go rather quickly. We taxi out on the left engine, since it supplies Green (primary) hydraulic pressure to the aeroplane, and Yellow (secondary) hydraulics through a mechanical Power Transfer Unit. The Yellow system is normally powered by its own pump on the right engine, but can also be supplied by an electrical pump.

Nearing the departure runway, the second engine is started, and After-Start flows and the checklist is completed.

Taxiing the Airbus is simple and you use just a small amount of 'breakaway thrust' to get moving. Again, you'll find there is a difference in the engines: the IAEs spool up in a linear fashion whereas the CFM engines go from idle to a-little-too-much thrust in the blink of an eye, but it's nothing a little practice won't cure. Once moving, each pilot has a steer-by-wire tiller on their side consoles to control the aeroplane, but captains do the taxiing here at American Airlines.

Brakes, at least in older aircraft, work just fine, but they do require deft touches to be smooth. Newer machines have been reworked with brake pedal return springs that offer better control and feel, and the ability to feather in brake pressure more smoothly.

VI, Rotate...

When I first started flying the Airbus, I was surprised how simple and precise it was. Take-offs are ridiculously easy; crack the thrust levers to get the engines breathing, then move the levers to the FLEX/MCT [Max Continuous Thrust] detent if you're making a reduced-thrust take-off. Push them all the way up to TOGA [Take-Off / Go-Around] for a full-power take-off.

Nosewheel steering, via the rudder pedals, keeps the nose on the centreline with total ease, even in gusting crosswinds. As the airspeed builds, the steering automatically blends out as the rudder becomes more effective. The 'Pilot Monitoring' (PM) keeps tabs on the engines and systems and calls out any problems before VI.

At 'rotate,' some backpressure on the side stick raises the nose for lift-off. The target is to command three degrees per second to the climb attitude of 12 or so degrees. I would argue early production versions feel lighter in terms of control inputs, whereas later ones might have heavier artificial-feel springs within the stick's movement mechanism. It's easier to pop the early aircraft off because of this.

After a positive rate of climb is achieved, the 'Pilot Flying' (PF) commands the landing gear up. You can continue hand flying via the flight director's command bars, or what we call The Bird (the Flight Path Vector display).

Autopilot can also be engaged above 100ft AGL. At 1,000ft, the PF brings the thrust levers back to the CL (Climb) detent, which activates the auto-thrust. Until you bring them back in the flare to land, the levers don't move during thrust changes.

"What's it doing now..?"

We have a saying in the Airbus community. If you ask, "What's it doing now?" you're a newbie. If you say, "It's doing it again," you are a veteran Airbus driver.

In all honesty, the Airbus does exactly what you tell it to. It's you, more than likely, that didn't programme it or manage it correctly if it's doing something weird. In any case, whatever airliner you fly, automation requires you to become adept at a concept we call CAMI: Confirm, Activate Monitor; and Intervene.

You 'confirm' the input to the FMS, 'activate' the change, 'monitor' the aircraft,



and 'intervene' if necessary. This is a continual process during the flight, especially during managed descents where you need to adhere to altitude and speed constraints. When circumstances require you to intervene, it could be as simple as using speed brakes, selecting a higher airspeed, or turning off the automation altogether and hand-flying.

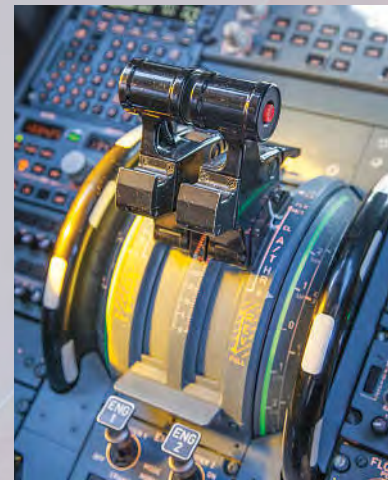
A319 and A320 aircraft will climb pretty well right up to FL390, the max certificated altitude. However, we jokingly call the A321 the Scud Runner. It's longer and heavier than its siblings, but it has the same wing and only marginally more thrust. That poor wing and engine combo struggles to climb to anything over 30,000ft – especially with the loads we carry out of Phoenix on a summer day. The A321 is a 757-sized aeroplane without its wing area or Rolls Royce engines... It does seem to earn its keep, though.

Usually, the only way you'll know you're in one or the other is looking at the aircraft ID on the instrument panel. They all fly the same, and save for some small differences in software or installed equipment, they all look the same. You will notice some differences when you fly the A321, however: In no uncertain terms, there is a real threat of striking the tail during landing. The limit on pitch in the flare is 7.5°, lest you scrape the tail.



"There is nothing special about an A320 walk-around. Make sure the nose gear pin and main gear sleeves are removed. The aircraft sits rather tall and everything you need to see is in easy view"

In pitch and bank, the PF doesn't dial any trim. He/she simply banks and/or pitches the aircraft and it will hold that angle or pitch – within generous limits. This makes it easy to fly the aeroplane very smoothly with small control inputs. I have noticed that really



At 1,000ft, the pilot brings the thrust levers back to the 'climb' detent, which activates the auto-thrust. Until you bring them back in the flare to land, the levers don't move during thrust changes

to the stick. And that is all the 'feel' you get out of the aircraft. The rest of the feedback you'll get is visual and by the seat of your pants. There is no stick shaker, no artificial feel, and no change in stick force as speed changes. I liken hand flying the Airbus to playing video games as a youngster: all of your feedback is visual, be it out the window or from the Primary Flying Display (PFD).

"I liken hand flying the Airbus to playing video games"

The technique to landing the A321 with 'flaps three' and leaving the power in until the last second seems to get the aircraft in a self-cushioning ground effect. Only a half-degree is needed to flare under calm conditions.

Hand-flying

Hand-flying the Airbus is greatly simplified by the auto-trim function of the FBW system.

good Airbus pilots feather in the appropriate rudder to keep the Beta target in the middle. Yes; the aircraft is auto-coordinated, but it's insufficient in my opinion.

There isn't much sense in hand-flying the A320 at altitude, and at any rate, the autoflight system does a pretty smooth job. When you do choose to hand fly the aeroplane, the first thing you notice is the linear mechanical feel

Descending

Descent planning on the Airbus takes some thought. In talking with Boeing pilots, it's clear the 'Bus descends and slows down a lot better than their aircraft do, so new jet pilots have a little easier time with it. The Nav display will have a descent point where it thinks you need to begin your Managed descent in order to hit constraints on the arrival.

If you've inserted the winds aloft and the descent winds, the automation does a fairly decent job of it. You do have to actively monitor the aeroplane in relation to the

American Airlines placed the largest aircraft order in history in July 2011, when it purchased 460 next generation Boeing 737 and Airbus A320 aircraft for delivery between 2013 and 2022. These aircraft were designated to replace American's short and medium-haul fleet of 757-200, 767-200, and MD-80 aircraft and will eventually consolidate the fleet around four aircraft families (Boeing 737, Airbus A320, Boeing 787, and Boeing 777). In July 2013 this A319 was the first of the new batch of Airbus' to be delivered Airbus



profile and correct any trend away from it. I've found the Airbus doesn't handle tailwinds in the descent very well; it tends to get high and fast. Cracking the speed brakes seems to handle all but the most egregious of problems.

The terminal area is where the automation of the 'Bus shines. The navigation radios auto-tune based on the runway and approach details that you have punched into the MCDU.

Once you're cleared for an ILS approach you select the APP pushbutton, which arms the approach. If on autopilot, the aircraft will then navigate to and capture the localiser and glideslope. The aeroplane also has excellent capabilities when it comes to VOR, NDB, and especially RNAV/RNP approaches. In many ways, these are just as precise as the precision approaches are.

Configuring the Airbus for the approach is equally simple. The gear can be lowered at 250kts (indicated air speed), so this is a great tool for adding drag if you're high and fast. Each of the four flap settings limit speeds are displayed on the airspeed tape and if things are still a little hot and fast, speedbrakes can be used even with 'flaps 3'.

If you choose to hand-fly the approach, the automation makes it easy, but there are some caveats. In general, small corrections to the sidestick are all that are needed in normal conditions. I've landed the Airbus in all sorts of horrible wind conditions, and this is where I feel the logic – or roll authority – could be a lot better. In gusty conditions, I've had to input and hold full control deflection in several cases. Waiting for the aeroplane to respond,

mainly in roll, seemed to take an eternity. Once I had stopped the aircraft's movement, the input had to be quickly removed and often reversed to stop over-correcting.

There is probably a reason for this, shared between the wing tip fences, the size of the ailerons, and how quick your stick movement moves through the voting process within the FBW system. It's not precise in the least, and is one item I would definitely lobby for improvement.

Landing

All three versions of the Airbus land conventionally, but there are a few things to look out for. The A319 seems to be more difficult to land gently in a consistent manner. It's often has a very light wing loading at landing, so it can float rather well, run out of steam six inches off the runway, and 'plunk' right on.

If you judge it just right, and keep one eyeball on the radar altimeter, you could catch the trend, add some backpressure, and feather the aircraft down. If you keep the nose up some, aerodynamic braking is very effective.

Upon touchdown, the immediate application of thrust reverse disturbs some air over the elevators and can lead to the nose slamming down. The key is to gently fly the nose down, then apply thrust reverse and brakes to start slowing. At touchdown speeds, it's simple to brake smoothly and bring the speed under control. The rudder is effective, and as the speed bleeds down, nosewheel steering bleeds in seamlessly.

The after landing flow has you retracting the flaps and stowing the ground spoilers, putting the Predictive Wind Shear and TCAS modes into OFF or STBY, starting the APU, and re-configuring any switches on the overhead panel. After receiving clearance from ground control, taxiing to the gate is a simple affair.

Once at the gate, captains run through their shut-down flows: park brake on, Engine Masters off, Engine Mode normal, speed brake retracted, radar off, windshear off, fuel pumps off, slides disarmed, ground power and air can be selected on, and the APU turned off.

Bus Drivers

Some aircraft you can hop in, understand right away, and operate with a high degree of confidence and efficiency. The Airbus is not one of them if you are new to automation or transport category jets. The correct mind-set is a key component of getting through your training successfully and carrying proper procedures and techniques to the line. This



Above: After a positive rate of climb is achieved, the Pilot Flying commands the landing gear up

takes some time and experience.

Overall, I feel the flight deck is an order of magnitude more comfortable, better laid out, and offers better environmental control over commensurate Boeing products. The seats are large, comfortable, and adjust in a myriad of ways. It's almost as if you're customising the aeroplane to yourself. More importantly, the design of the flight deck and automation – once understood – rarely gets in the way of doing your job.

I can't tell you which is more difficult; coming from a small turboprop or transitioning from the Boeing you've been flying for 15 years... Both will require some rethinking on your part to adapt to a high level of automation, and Airbus' way of operating it. You'll feel like a student pilot, and place yourself in a situation a few times before you suss the darn thing out. And that's okay; we've all been there. You'll get that new mind-set, and you'll be one of the "It's doing it again," crowd. ●



Colour plays a large role in operating the A320



"The CFM engines spool and start rather quickly, while the V-2500s take a little longer. The CFMs use percentage N1 on the engine display while the IAEs use Engine Pressure Ratio"

SPECIFICATION AIRBUS A320



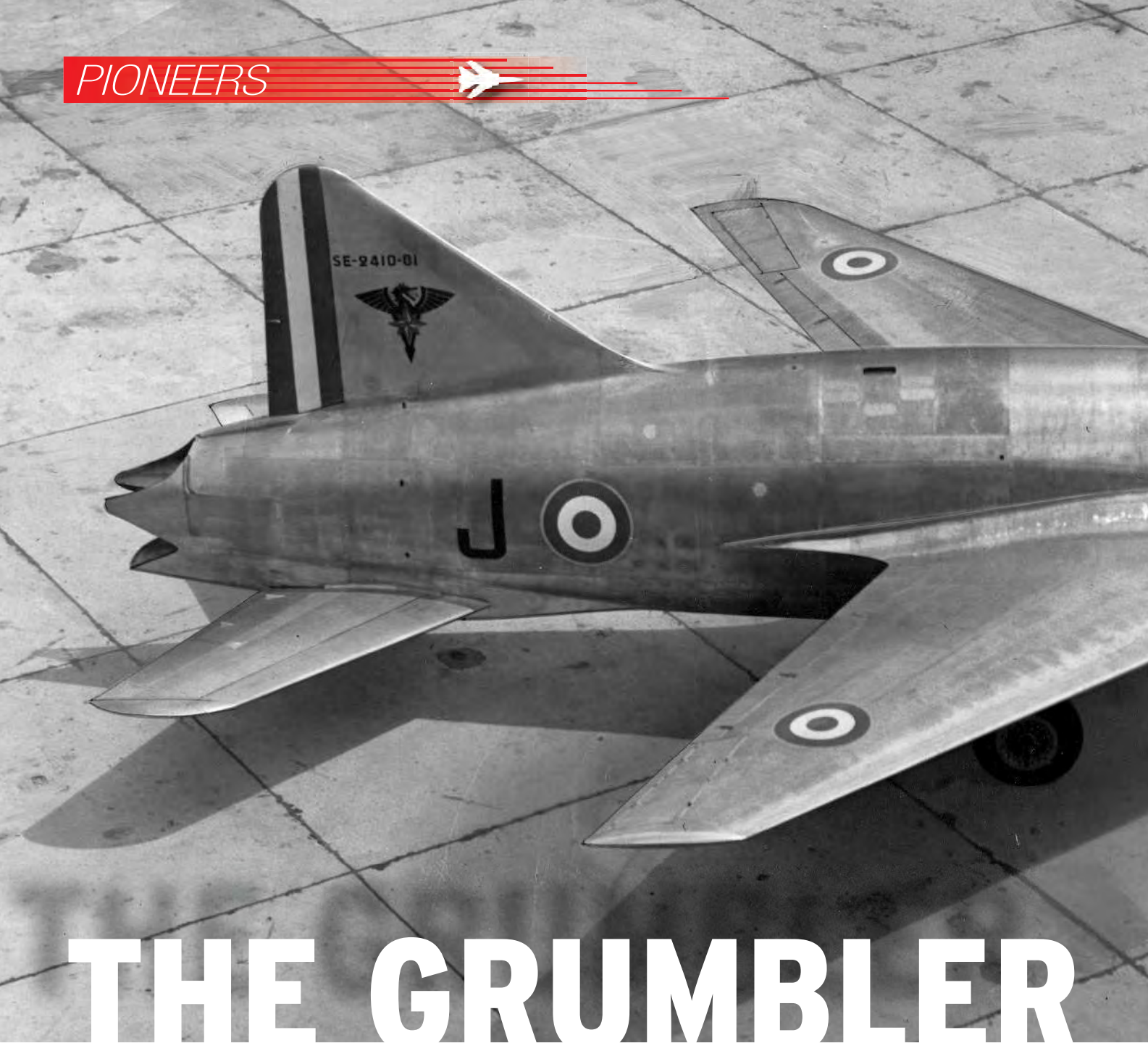
Crew	2
Capacity	Up to 180 passengers
Length	123ft 3in (37.57m)
Height	38ft 7in (11.76m)
Wingspan	111ft 11in (34.10m)
Wing area	1,320sq ft (122.6m ²)
Empty Weight	93,900lb (42,600kg)
Max Take-Off Weight	137,800lb (62,500kg)
Max Speed	467kts (537mph /871km/h/Mach 0.82)
Ferry Range	3,542 miles (5,700km)
Service Ceiling	39,000ft (12,000m)
Powerplant	Two CFM International CFM56-5 or IAE V2500 turbofan engine (22,000-33,000lb/thrust each)
First Flight	February 22, 1987



The latest versions of the A320 family have gained sharklet wingtip devices to improve aerodynamic efficiency, reduce fuel burn and increase range
Airbus







THE GRUMBLER

One of the most unusual looking aeroplanes of all time was the French Sud-Est Grognard. Jamie Ewan takes a look at the 'Grumbler'

Designed as a single-seat, low-level ground-attack aircraft, the 'distinctive' SNCASE Grognard (which roughly translates as 'Grumbler') was derived from an Armée de l'Air specification issued in 1948. Despite never making it past the prototype stages, the aircraft ultimately became one of the most innovative French aircraft ever flown.

The aircraft combined tried and tested methods of achieving the optimum in aerodynamic efficiency with new concepts that sparked change in the world of aviation.

Hunchback

Developed from the SE.2400 attack aircraft, the Grognard boasted a bulky fuselage that housed all of the operational

systems, tricycle landing gear, fuel tanks and drag chute (the very first fitted to a French aircraft) to help deliver the purest aerodynamic shape.

Sitting on top of the fuselage behind the heavily framed cockpit, which sat somewhat awkwardly at the very end of the nose, was the aircraft's most prominent feature – a streamlined air intake. Designed with a single inlet to feed air into a pair of 'stacked' Hispano-Suiza licence-built Rolls Royce Nene 102 engines (each producing 5,005lbs/thrust), the configuration gave the jet a unique look and resulted in the derisive nickname 'Hunchback.'

The shoulder-mounted high-aspect-ratio wing had a radical 47-degree leading edge sweep and was fitted with a drooping leading edge to increase lift – this meant the

Grognard was the first French type to utilise both swept wings and drooping slats. The trailing edges incorporated small ailerons and generous flaps.

The aircraft's horizontal tail sat low on the fuselage, placing it below the disturbed airflow that bounded off the wing in flight. This was considered much safer and more aerodynamically 'pure' than positioning it on top of the tail – the only other area that offered relatively low disruption to the airflow.

Elbow power

One of the most innovative concepts used in the Grognard saw the conventional (and traditional!) control column removed and replaced with an ingenious system whereby the pilots used their elbows to control



The Sud-Est SE.2410 Grogard I (F-ZWRJ) completed its maiden flight on April 30, 1950 from Bretigny airfield in the hands of test-pilot Pierre Nadot. The unique lines ably demonstrate why the type was nicknamed 'Hunchback'

unarmed and intended to be used primarily for flight-testing and configuration work.

Further evaluation soon revealed that the type was prone to vibration at speeds in excess of 280kts; this being partially rectified with the introduction of exhaust orifice plates. As the test programme continued, further changes were made to both the ailerons and tail unit.

Two of two

Less than a year after the first flight of F-ZWRJ, the second variant of the type was flown for the first time on February 14, 1951, again with Nadot at the helm. Designated the SE.2415 Grogard II and carrying the registration F-ZWRK, the aircraft was similar to its predecessor but had two-seats, a longer nose and a leading edge sweep of just 35 deg; the longer nose bringing forward the jet's centre of gravity which necessitated a shallower sweep.

Like the first airframe, F-ZWRK suffered the same vibration issues at higher speeds – a problem that took some seven months to identify and conquer.

Issues were found with the aircraft's tyres during high speed ground runs, causing the French-made ones to be replaced by British-manufactured Dunlop units instead.

Tail flutter was a constant headache for the French engineers during the type's initial

the jet via movable armrests in the seat! Although somewhat unorthodox, it was this concept that eventually evolved into the 'side-stick' that is now common throughout the world of aviation.

Fears that the intake may effectively stall when encountering high angles of attack were quashed in 1949 by wind tunnel tests undertaken at the ONERA facility using a scale model – just over half the size of the real jet. The same model gave the public their first glimpse of the type at that year's Paris Air Salon.

Prototype

The first and only Sud-Est SE.2410 Grogard I (F-ZWRJ) was soon completed and ready for its maiden flight, which took place on April 30, 1950 from Bretigny airfield in the hands of test-pilot Pierre Nadot.

Unlike the planned production model, of which the French government were considering some 360, the aircraft was



The Grogard's cockpit was fitted with the Satre-Lecarme patented armrest control system. Vertical handles, with firing and radio switches, were attached to the armrests, which moved both forward and backwards as well as up and down. The system worked on a radius action, one up, one down, both forward for ailerons and both back for elevators - which in essence allowed the pilot to control the jet with his elbows



trial flights; a problem easily overcome with the help of British engineers – the issue being identified to over balance in the tail.

Delayed

Sadly the issues met along the way had led to a delay in the programme which caused the company and type to miss the operational deadline by 12 weeks.

Many of the origin design specifications were surpassed by this hugely innovative aircraft, especially at a time when departing from the 'tried and tested' was considered radical. But, despite overcoming the problems, the French government cancelled its order for 360 machines earmarked for their Tactical Fighter Groups.

With the contract subsequently lost (and eventually won by rival Sud-Ouest's SO.4050 Vautour), the Grogard programme was cancelled in 1952.

Unveiled

Until the cancellation of the project, details and images of the type had been sparse to say the least. However, after four years of secret testing and development work,

The SE.2415 Grogard II shows the type in its final form as it taxis out for another test flight. Compared to its predecessor, the Grogard I featured two-seats, a longer nose and a leading edge sweep of just 35 degrees. During its entire existence the Grogard II never carried a second person

Below: The sheer size of the aircraft becomes apparent as the public crowd around the Grogard I after its arrival at Le Bourget on June 26, 1953. After four years of secret testing and development work, this was the only public showing of the Grogard Note the Second World War era 'birdcage' canopy



SE2410 F-ZWRJ was presented to the public at Le Bourget.

Both Grogards found roles after the project cancellation – F-ZWRJ being employed for weapons trial work and F-ZWRK being allocated to the Centre d'Essais en Vol (French Experimental Flight Centre) for flight-training.

During its entire existence the Grogard II never carried a second person even though it was a twin seater! F-ZWRJ, however, had some success in the 'afterlife' and unbelievably went on to notch up another 'first', becoming the very first French aircraft to fire an air-to-air missile!

Rather unceremoniously, the two prototypes ended their days on the gunnery range at Cazaux after both crashing within a year of one another – the SE.2410 being damaged beyond repair after a false fire indication led to a belly landing at Toulouse and the SE.2415 also belly landed after a flight control system ruptured, causing a loss of flying controls and hydraulics.

Although the full potential of the 'Grumbler' will never be known, it is fair to say that the both the SE.2410 and SE.2415 played their part in aviation as we know it today. ●



A rare shot of the Grogard II in flight shows the airframe's clean lines – despite its bulky fuselage. By this stage in its career the airframe had been reregistered F-WFRX

Incoming! Letters to the Editor



HAVE YOUR SAY

Write to: Incoming! **Jets**, Key Publishing Ltd, PO Box 100, Stamford, Lincs, PE9 1XQ, United Kingdom or e-mail steve.bridgewater@keypublishing.com

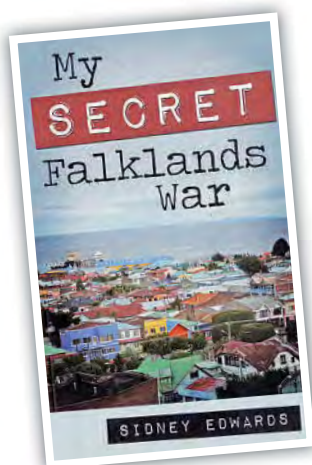
While we try to reply to all correspondence it is not always possible to reply individually to every letter. Please note, letters may be edited for style or length.

You can also send comments via our Facebook page or on Twitter at @JetsMonthly

Even More on Chilean Canberras

Having bought a copy of *My Secret Falklands War* by Sidney Edwards I totally agree with your review "A fascinating look at behind the scenes activity during the Falklands War at a bargain price" [*Jets* Mar/Apr 2015 p50]

I found the chapter on the plans to operate English Electric Canberra PR.9s from bases in Chile most interesting but also frustrating...



Obviously the author had little room in such a small book to find space to elaborate on many of the rumours which have been spread since the conflict, but going through this chapter I immediately thought of three questions that he has not provided answers for:

In my first letter (written in the spirit of stirring things up a bit and published in the Jul/Aug 2014 issue of *Jets*) I pointed out that when the *New Statesman* broke the story of 'RAF spy planes in Chilean markings' they named Grp Capt David L Edwards – then the Chief Intelligence Officer at RAF Strike Command HQ at High Wycombe – as being sent "to Chile to take charge of the secret operation." Was this simply a case of confusion between officers with similar names and of equal rank, or were both involved in Chile in 1982?

In the book, two Canberras were flown out to Belize and held there in reserve before the plan was cancelled. There is no

explanation of Jon Snow's repeated claim that he saw two Canberras (PR.9s or T.17s?) that were "adorned in Chilean colours, but they appeared to be British manned" in Chile during the war; five months before they were officially delivered...

Nor is there any reference to Jon Snow's claim to have seen a photograph of an Argentine air base showing six aircraft parked by a runway, five of them burnt out wrecks. He had first made this claim in a television report during the war, while the *New Statesman* named Mario Burgos as the Chilean Naval Intelligence specialist in its exposé in 1985. Had the new book's author seen such a photo and did he know anything about the origins of the story?

I am sure these are just the sort of questions that your readers would like to see answers to, Official Secrets Act permitting of course...

David Cole, Oakham, Rutland

Damp 707s!

In the September/October 2014 issue of *Jets* Bob Grimstead gave an excellent, first class account of flying Boeing's classic 707 jetliner. Along the way he also clarified an issue that had puzzled me for decades.

Flying to Crete in one of these ageing airliners in the late 1980s, I was mystified by a strange ritual after landing. As the aeroplane taxied to the terminal the hostesses scurried around the cabin, stuffing pieces of Kleenex against the windows. This helped prevent passengers being drenched by the now melting condensation of their breath. This is precisely the issue suffered by the pilots, as referred to by Mr Grimstead.

My other memory of the elegant-looking 707 was how extraordinarily noisy its engines were compared to other jets I flew in, particularly when reverse thrust was engaged on landing.

Roger Bowen, Blaenavon, Gwent (by e-mail)

Bob Grimstead replies: "That would likely have been a British Airtours 707 – on which, incidentally, I was a steward for a season. They carried more passengers (194 from memory) than the BA/BOAC examples so it was even more of a problem. We used to joke to the passengers that the life rafts must have been put back wet into their overhead stowage after the last flight!"

Tomcat memories

Thanks to Dave Sloggett for the review of the F-14 Tomcat in the Jan/Feb 2015 issue of *Jets*. He was dead right when he says that it was a great fighter but there were some interesting aspects to it, particularly once it got into close-in fighting and its BVR missiles became useable. In Oman we had regular exercises with the US Navy including dogfights with the F-14. It was a BIG aircraft and very easy to see, However, whilst it was extremely manoeuvrable it signalled exactly what the pilot was going to do next because the wing sweep was automatically controlled. If he was going to turn with you the wings went forward to give max turn; if running, they went back to give best acceleration - a very clear signal of intent!

Rod Dean (by e-mail)

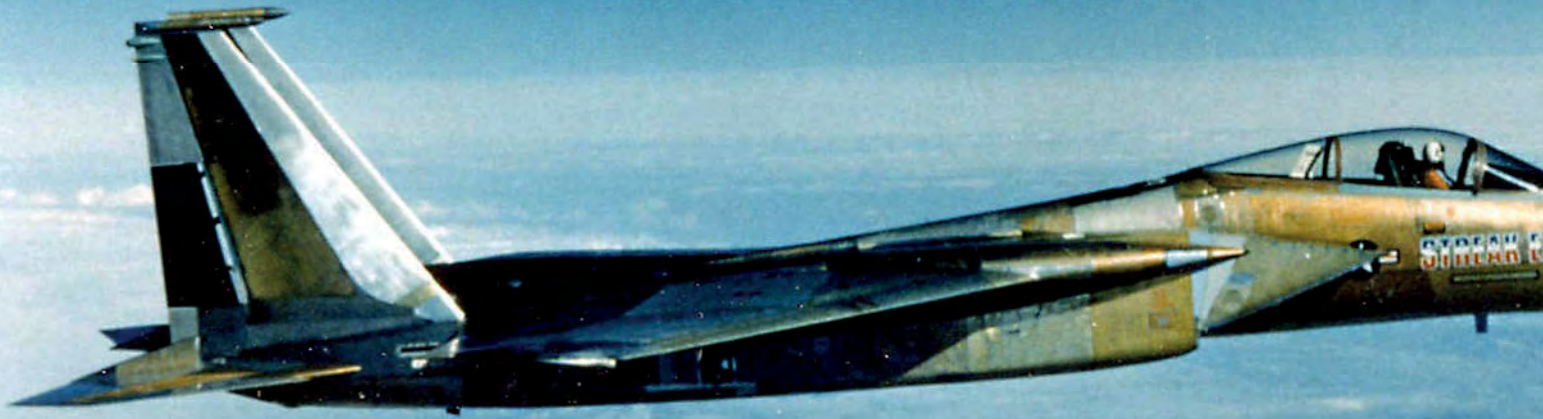
US Navy





STREAK EAGLE

The one-of-a-kind McDonnell Douglas F-15A Streak Eagle broke eight time-to-height records between January 16 and February 1, 1975! Steve Bridgewater looks back at the jet's achievements



Stripped and polished

The unique Streak Eagle was an early production F-15A (72-0119) and was specially modified for the record attempts. The flap and speed brake actuators were removed, as was the M61A1 Vulcan 20mm cannon and its ammunition handling equipment and the radar and fire control systems. Even unneeded cockpit displays and radios were removed along with a back-up generator.

A long boom was mounted onto the nose to verify speed and altitude and equipment was added to allow the pilot to wear a full pressure suit.

The aircraft was also left unpainted in order to save weight, with its bare metal polished to improve performance. In total, the modifications shed 1,800lbs from the Eagle's all-up-weight and gave it a thrust-to-weight ratio of 1.4:1.

Above: The Streak Eagle shows off its unpainted metal finish in flight during its record-breaking spree in 1975 All USAF Museum

Left: Streak Eagle pilots (L-R) Major William R 'Mack' MacFarlane, Major Roger Smith and Major Dave W Peterson



On February 1, 1975 Major Roger Smith lit the McDonnell Douglas F-15A Streak Eagle's afterburners and the aircraft began to roll down the runway at Grand Forks AFB in North Dakota.

Some 3 minutes, 27.8 seconds later, the aircraft reached 98,425ft and 'coasted' to 102,300ft before beginning its descent. The jet had just set its eighth time-to-height record in less than a month.

Propaganda

As the F-15 Eagle was being developed for the USAF, it soon became obvious that the performance was nothing short of astounding.

With its two Pratt & Whitney F-100-PW-100 engines combining to produce almost 48,000lbs/thrust and the Eagle weighing in at just 44,500lbs, the fighter was the first in history to have a thrust-to-weight ratio of greater than one.

It soon became apparent that the USA had the ideal machine to make an attempt on various time-to-height climb records – and in doing so could make an important propaganda point. After all, climb performance is arguably the most critical performance parameter for interceptors.

At this time the various standing time-to-climb records were held by either the McDonnell-Douglas F-4 Phantom (which the Eagle was due to replace in the USAF inventory) or the Mikoyan-Gurevich MiG-25 Foxbat (which the Eagle was designed to combat in the air superiority arena).

The Streak Eagle is prepared for launch at Grand Forks in January 1975





The airframe was stripped of any unnecessary weight, giving it a power-to-weight ratio of 1.4:1



The F-15 was sent to Grand Forks AFB – where the cold North Dakota air would be favourable for record-breaking performance. Three pilots (Major Roger Smith, Major Dave W Peterson, and Major William R 'Mack' MacFarlane) were sent to push the Streak Eagle to its limits.

Launch system

To further optimise the aircraft's performance, the Streak Eagle was only loaded with as much fuel as it needed to make each record attempt. Prior to take-off the jet was towed to the end of the runway at Grand Forks and hooked up to a 'hold-back bar'.

The pilot then engaged full afterburner and the bar was released allowing the aircraft to 'launch.' The aircraft rotated in just 400ft and began its climb at around 420kts.

The aircraft would pull a steady 2.65G into an Immelmann turn, this meaning the aircraft would arrive back over Grand Forks at 32,000ft – but upside down. It would then be rolled back the right way up as it accelerated and climbed through 36,000ft. As the Streak Eagle passed Mach 2.25 the pilot would pitch up to 60 degrees and climb until the engines began to overheat. He would shut down the engines and allow the inertia to carry him ever higher until the aircraft slowed to just 55kts. It would then be pitched forward and glide back



Above: Today the Streak Eagle is in the collection of the National Museum of the United States Air Force. To protect it from corrosion it has been painted in the grey scheme typical of most operational F-15s. It is currently in storage

Above right: The lack of paint gave the Streak Eagle a very distinctive look, especially when flying in the low winter sun



down to 55,000ft when the engines were restarted and the aircraft landed.

Record breaking

The record attempts began on January 26, 1975 and the Streak Eagle achieved five records in three flights in the span of six hours that day!

The first flight was merely a test of the systems but the second sortie broke three records (6,000m, 9,000m and 12,000m) and the third flight reached 15,000m (just shy of

50,000 feet) in one minute, 17.2 seconds. This gave the Streak Eagle a faster climb rate to 15,000m than that of the Saturn V rocket used by the Apollo programme.

It would be eleven years before the Russian Sukhoi P-42 (a prototype Su-27 Flanker) would finally snatch the records back from the USA. The big Sukhoi had an astounding power-to-weight ratio of almost 2:1.

As the Streak Eagle was a very early production F-15, its internal structure was weaker than the final production standard machines. It was therefore considered too expensive to modify for service life and the aircraft was transferred to the National Museum of the United States Air Force at Wright-Patterson AFB, Ohio, in December 1980. To protect it from corrosion it has since been painted in the grey scheme typical of most operational F-15s. It is currently in storage. ●

Flight	Date	Record	Time	Pilot	Old Record	Margin
1	Jan 16, 1975	3,000m	:27.57	Smith	:34.5	:06.9
2	Jan 16, 1975	6,000m	:39.33	MacFarlane	:48.8	:09.5
2	Jan 16, 1975	9,000m	:48.86	MacFarlane	1:01.7	:12.8
2	Jan 16, 1975	12,000m	:59.38	MacFarlane	1:17.1	:17.7
3	Jan 16, 1975	15,000m	1:17.02	Peterson	1:54.5	:37.5
4	Jan 19, 1975	20,000m	2:02.94	Smith	2:49.8	:46.8
5	Jan 26, 1975	25,000m	2:41.02	Peterson	3:12.6	:31.6
6	Feb 1, 1975	30,000m	3:27.80	Smith	4:03.9	:36.1

Avro's Last Hurrah!

Avro's successful turboprop airliner and military transport was conceived nearly sixty years ago. Richard Freail examines the development and service of the HS 748 and HS 780

When Duncan Sandys consigned the future of manned military aircraft to the dustbin in his 1957 White Paper, Avro – as a predominantly military manufacturer – faced a predicament. Its future military projects were now seriously in doubt and its recent record as a provider of civilian aeroplanes was not good; the Lancastrian, York and Tudor enjoyed limited success.

However, necessity would force a re-entry into the civil market so Avro researched potential openings. Having focussed on a 20-seat, high-wing, twin-engine design of around 18,000lbs gross weight which

garnered little interest, Avro eventually settled on offering a potential replacement for the ubiquitous Douglas DC-3/C47 aircraft which served throughout the world in significant numbers.

Avro wanted to produce an aircraft which could operate like a DC-3, but with a higher payload and less cost. Key requirements included the ability to fly from semi-prepared strips of less than 4,000ft in hot/high conditions, to operate from remote airfields without support, to be easy to repair, maintain and fly, to have ease of loading and be convertible from passenger to freight carrying without difficulty and to have low levels of noise and pressurisation for passenger comfort.



The Andover C.1 entered service with the RAF in July 1966 with the Andover Conversion Unit at RAF Abingdon and then with the reformed 46 Sqn in September. The unit's XS608 is seen here over the Isle of Wight in 1971 Adrian M Balch Collection

CLASSIC TURBOPROP

The main twin-wheel undercarriage retracted forwards and was housed in a bulbous compartment below the engine nacelle and wing which extended forward of the leading edge.

Ideas into practice

In January 1959 the Hawker Siddeley Board (as the owner of Avro) gave the go-ahead for the project to proceed; unusually this was a private venture, with no government money or advance orders to soften the financial impact.

Work began on four prototype airframes the following month with the first and third for flight testing and second and fourth for static ground tests. Although fires at Avro's Chadderton factory in 1959 and 1960 caused delays, the maiden flight of the first prototype Avro 748 Series 1, G-APZV, took place from the company's airfield at Woodford on June 24, 1960 flown by chief test pilot JG Harrison. Flight testing proceeded quickly until the prototype was grounded for modification that summer. An appearance at the SBAC Show, Farnborough followed on September 5, 1960 where it joined its competitor, a Handley Page Herald, on display.

The delayed second prototype, G-ARAY, with its forward freight door moved from starboard to port, completed its maiden flight on April 10, 1961; by this time its sister



Avro 748 production was undertaken at its Chadderton factory and final assembly took place at Woodford airfield

Low-wing design

The design team, led by JR Ewans, settled on an all-metal, low-wing pressurised monoplane with a large fin and tailplane. Its circular-section fuselage would allow 44 passengers to be carried four-abreast with a central aisle. Enlarging the original design allowed the proven Rolls-Royce Dart turboprop powerplant to be utilised. To provide good ground clearance, the R.Da.6 Dart engine was mounted high on each wing with the jet pipes passing over the wing. The Dowty-Rotol gearbox came from the Vickers Viscount 800, the four-blade 12ft propellers from the Armstrong Whitworth Argosy and pressurisation equipment from the Vickers Vanguard.



The first production 748s were destined for Skyways Coach Air, which ordered three examples in May 1961. The third of these, G-ARMX, is seen here at Luton in September 1970. The aircraft later passed to Dan Air and was finally scrapped at Manchester Adrian M Balch Collection

CLASSIC TURBOPROP

aeroplane had flown 360hrs towards full certification, which was awarded in January 1962. Changes to production aircraft included increasing the 95ft wingspan by 3ft 6ins, something already done to the prototypes, and fitting uprated RR Dart R.Da.6 engines of 1,740shp.

A total of 20 Series One 748s were manufactured in the UK before production of this model ceased in 1964.

First orders

Interest was strong before the first aeroplane had even been built. So much so, that in late 1959 the Board authorised the production of the first ten aircraft with ten more to follow. Full-scale production was to take place at Chadderton and final assembly at Woodford.

The first production aircraft were destined for Skyways Coach Air, which ordered three examples in May 1961. The first of these, G-ARMV, flew in August 1961 and was used on route-proving trials, helping towards full certification, as well as appearing at the 1961 SBAC Show in September.

However, the first order had been made in January 1961 by Aerolineas Argentinas which ordered nine aircraft, increasing it to 12 two years later. The second production aircraft and the airline's first, LV-PIZ, flew on December 10, 1961. It was then flown 11,300

miles to Buenos Aires in January 1962, taking eight days to complete the journey. In April that year the Argentinean airline became the first to use the 748 on a revenue service when LV-HGW (formerly LV-PIZ) flew from Buenos Aires to Bahia Blanca.

Other early customers included BKS Air Transport and Aden Airlines, a mock-up of the latter appearing at Farnborough in 1960, although the order fell through because of political instability in Aden. BKS initially leased an aircraft from Skyways in 1962 and became the first airline to use the 748 on UK domestic routes, cutting 25 minutes from the Leeds to Heathrow time, while operating with an 80% load factor. The future for the 748 was bright, and a steady stream of orders started to roll in.

Series two

As soon as the flight-test programme was completed the second prototype, G-ARAY, was converted to Series 2 standard which involved fitting higher powered R.Da.7 engines of 1,910shp and strengthening the wings and undercarriage. It first flew in November 1961 and received certification in October 1962. The Series 2 was manufactured in the UK from 1962 until 1975.

There were further changes for the UK's aviation manufacturers in 1963 with the

Avro name about to disappear in favour of the parent group Hawker Siddeley; the aircraft was now most commonly referred to as the HS 748.

The Series 2A, again with improved Dart engines of 2,230shp, was launched in 1967 with the new company demonstrator, G-AVRR, undertaking its maiden flight in September. The first production model was delivered to Columbian airline Avianca a year later.

Further improvements were made in the early '70s when a large freight door, incorporating the passenger entrance, was added to the airframe which would be known as the Series 2A/LFD. Fitted on the rear port side it was 8ft 9in wide and 5ft

Below left: The first airline to order the type was Aerolineas Argentinas. This Dan Air example (G-BEJD) began life with the Argentinian airline as LV-PUF. After Dan Air had finished with it the airframe passed to Emerald Airways *Martyn Cartledge*

Below right: Series 1 HS 748 EI-BSE was operated by the fledgling Ryanair between 1986 and 1990 and is seen here at Liverpool in April 1987. The aircraft began life as G-ARRW for BKS Air Transport and also flew with Skyways International. It eventually found its way to Nepal where it flew as 9N-ACM with Necon Air from 1992 to June 1997 when it was destroyed after overrunning the runway at Pokhara *Caz Caswell Collection*



Below: Two Series 2A 748s were delivered to the Civil Aviation Authority. G-AVXI and G-AVXJ served their whole active lives with the Civil Aviation Flying Unit from early 1969 until they were sold to Emerald Airways late in 1998. G-AVXJ is seen here in 1996 *PRMAVIA Collection*





CLASSIC TURBOPROP

Left: Air Senegal's HS 748 Series 2 6V-AEO at Cap Skirring Airport, Senegal on March 10, 1986. On February 1, 1997 the aircraft crashed at Senegal's Tambacounda Airport killing 23 of the 52 on board. The flight had been delayed for two hours due to overloading and fuel problems. Both engines stopped 30 seconds into the flight *Caz Caswell Collection*

Below: The 748 soldiered on long enough in British Airways service to gain the airline's Landor scheme. G-BMFT is seen here at Glasgow in April 1988. The aircraft began life as 5W-FAO with Polynesian Airlines and BA later disposed of it to Emerald Airways, with whom it flew as G-OPFW *Robbie Shaw*

8in high, facilitating not only ease of access but also the dropping of supplies and paratroops and thus increasing its appeal to military, as well as civil operators.

BAe era

In 1977 the UK aviation industry was nationalised and Hawker Siddeley became part of British Aerospace. The BAe 748 Series 2B was the next step forward and G-BGJV first flew in June 1979. It had an improved wing design and longer span, more powerful engines and an improved and modernised cockpit. The passenger cabin was also brought up to date. As with previous marks, the improvements could be retro-fitted to earlier aircraft.

In 1983 further improvements were made including a state-of-the-art flight deck, more powerful engines with 'hush kits', improved passenger cabin and facilities as well as a larger baggage hold. The aircraft was now designated the Super 748. The first example completed its maiden flight in July 1984.

Around the world

The 748 found its way into service around the globe, stretching across all continents, with both civil and military operators. At home British Airways and Dan Air were users. Overseas airlines included Air Illinois (USA), Austin Airways (Canada), Aeromexico, Varig (Brazil), SATA (Portugal), Air Malawi, Zambia Airways, Air Cape (South Africa), Indian Airlines, Air Ceylon (Sri Lanka), Bangkok Airways (Thailand), Neco Air (Nepal), Fiji Airways and Mount Cook Airlines (New Zealand). As designed, it operated from many places with remote airstrips – in Africa alone there were over 20 operators.

Military users of the 748 included Australia, Belgium, Brazil, Ecuador, India, South Korea, United Kingdom and Venezuela. Uses included VIP transport, communication duties, maritime/border patrol, freighter and trainer. For some nations, such as Brunei, Thailand and Zambia, the 748 made an ideal Presidential aircraft and was fitted with a luxurious interior.

India's story

The Indian Government quickly reached a licence-manufacturing agreement with Hawker Siddeley Aviation in July 1959 with components to be airlifted from the UK to



Kanpur, India where Avro opened a facility to assemble the aeroplanes. Initially, this would be undertaken by Avro employees with the aim of Hindustan Aeronautics Ltd (HAL) taking over full responsibility for manufacturing and constructing the 748, including the engines, from 1964. Aircraft were destined for the Indian Air Force (IAF) and the Indian Airlines Corporation (IAC).

The first Indian 748, serial BH572, made its maiden flight on November 1, 1961, with Sqn Ldr Kapil Bhargava at the controls, an astonishing achievement under the circumstances and not far behind the UK aircraft. It became the first 748 to enter service with the IAF in April 1964.

Unfortunately, the aircraft fell short of specifications and so the more powerful 748 Series 2 was demonstrated in India



The Indian Government reached a licence-manufacturing agreement with Hawker Siddeley Aviation in July 1959 and aircraft were subsequently delivered to both the Indian Air Force and Indian Airlines *Key Collection*

in May 1963. After only four Series 1 aeroplanes had been produced at Kanpur, production was switched immediately to the new model. HAL took over and the first indigenous HAL 748 Series 2 made its first flight in January 1964.

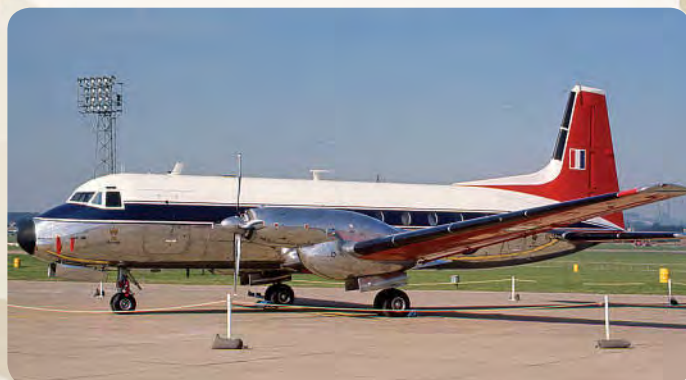
Military users of the 748 included Australia, Brazil, Ecuador, India, South Korea, UK, Venezuela and Belgium – an example of the latter air arm's aircraft is seen here *Peter Foster*



CLASSIC TURBOPROP



Although better known as a DC-3 Dakota operator Coventry-based Air Atlantique leased HS 748 G-BEKG in the late 1980s PRMAVIA Collection



IAC placed an order for the HAL 748 Series 2 in 1965 to replace its DC-3s. The first flight took place in February 1966 and revenue service started in August 1967. Orders for the IAF and IAC were plagued by slow manufacture, resulting in the IAC ordering the F-27 as well. The IAF continued to order the HAL 748 in the 1970s and 80s including examples with the large freight door. Production ceased in 1984 after the 85th Series 2 had been manufactured. The type remains in service with the IAF although there is funding allocated for a replacement.

Military 780 Andover

In the early 1960s the RAF issued a requirement for a medium tactical transport aircraft with STOL and rough airstrip capability. The Avro team applied itself to the task and set about turning the 748 into the 780. Trials took place at RAF Martlesham Heath in early 1962 involving

the prototype Avro 748 Series 2 aircraft, G-ARAY, and a HP Herald. Handley Page's failure to amalgamate with either BAC or Hawker Siddeley and the 748's rough field performance enhanced its position; RAF commitment was secured and a contract for 31 aircraft was awarded in April 1963.

The 780 was some 11ft longer and six feet taller than the 748. The basic design of the 748 was retained, but the rear fuselage was upswept to allow for a loading ramp which could be opened in flight while the tailplane was moved to the base of the fin. More powerful Dart R.Da.12 engines of 3,245shp were fitted together with larger 14ft 6in Dowty-Rotol propellers. The fuselage centre section was widened and the floor reinforced to allow vehicles to be carried. Larger wheels were employed on its unique 'kneeling' undercarriage which enabled the angle of the fuselage to be raised or lowered to allow easier loading/unloading. It could carry 48

Above: HS 748 Andover CC2, XS789, of The Queen's Flight at RAF Benson 1966. This aircraft was a 748 Series 2 and was the first of an order of six for the RAF for VIP and communications duties. It first flew in May 1964 and was then used for hot weather trials before delivery to the RAF in August 1964. It was later converted to Series 2A standard Richard Freail Collection

fully-equipped troops, 40 paratroopers or 15 sitting casualties and 18 stretcher cases.

Hawker Siddeley rebuilt the original 748 prototype, G-APZV, as the new 780 test-bed, without RAF equipment, gaining a new construction number and registration – G-ARRV. It first flew in December 1963 and after completing its test programme in 1965 became a ground instructional airframe. The first full 780 Andover prototype, designated the Andover C.1, was XS594 which completed its maiden flight in July 1965. It met its end on the Otterburn Weapons Range in the 1980s.



Hawker Siddeley rebuilt the original 748 prototype, G-APZV, as the HS 780 Andover and reregistered it as G-ARRV

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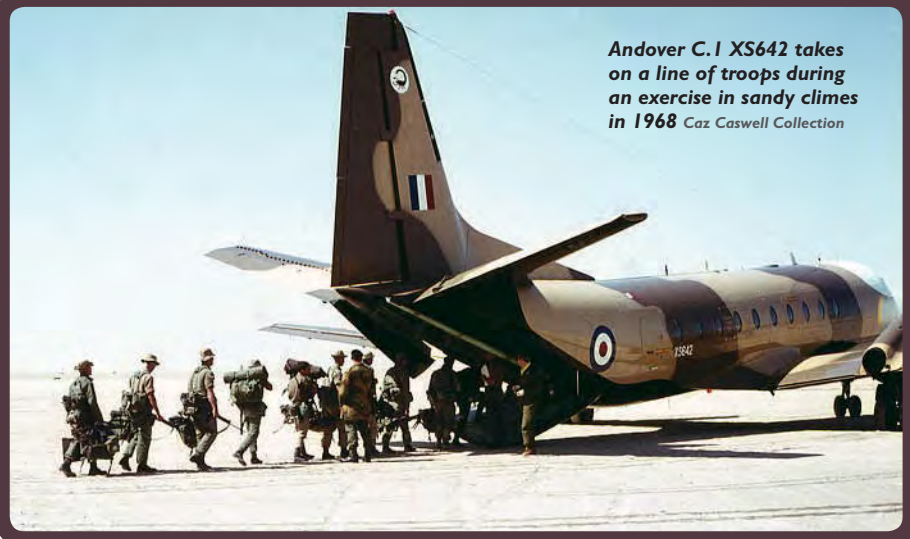


The Andover continued its service well into the new century with a presence at RAF Boscombe Down with the remaining examples serving with units including the ETPS. The last operational flight of an Andover was the ETPS Andover C.1, XS606, which took place on August 31, 2012 Peter Foster

RAF service

The Andover C.1 entered service with the RAF in July 1966 with the Andover Conversion Unit at RAF Abingdon and then with the reformed 46 Sqn in September. The second squadron to form was 52 Sqn at RAF Seletar, Singapore in December 1966 and the third, in August 1967, was 84 Sqn at RAF Khormaksar, Aden which soon moved to RAF Sharjah.

In early 1969, 52 Sqn moved to RAF Changi, but with the UK's shrinking defence commitments and withdrawal from the Far East, the squadron was disbanded at the end of the year. Similarly in the Middle East, 84 Sqn moved to RAF Muharraq in December



Andover C.1 XS642 takes on a line of troops during an exercise in sandy climes in 1968 Caz Caswell Collection



Andover C.1 (PR) XS596 at RAF Brize Norton in 2000. This aeroplane first flew in December 1965 and was used by the A&AEE at Boscombe Down prior to delivery to the RAF in early 1969. It served in the transport role with 46 Sqn and from 1980 as a crew trainer with 115 Sqn. Subsequently it was converted to C.1 (PR) for duties in relation to the Open Skies Treaty

Richard Freail Collection

1970 but was disbanded within a year. The home commitment was set to continue and 46 Sqn joined the training unit, 242 OCU, at RAF Thorney Island in September 1970.

Further defence cuts in the mid-70s resulted in the disbanding of 46 Sqn in August 1975 and the end of the Andover's RAF role as a transport.

In November 1976, 115 Sqn at RAF Brize Norton converted onto the Andover. These were specialised versions for calibration duties designated the E.3 and E.3A. The squadron operated seven such airframes together with some C.1s for crew training. The unit moved to RAF Benson in 1983 and was disbanded in October 1993.

The RAF also purchased six examples of the HS 748 Series 2, designated as Andover CC.2, for VIP duties, which were delivered

in 1964/65. Two of these initially entered service with The Queen's Flight, while the others served with various communication units at home and abroad and, subsequently, with 32 and 60 Squadrons. In later years, these were augmented by Andover C.1s as they became available.

The Andover continued its service well into the new century with a presence at RAF Boscombe Down where the remaining examples served with the ETPS, the Heavy Aircraft Test Squadron and as the UK's designated aircraft under the *Open Skies Treaty*. For this purpose, two aircraft were converted to undertake photo-reconnaissance and designated as Andover C.1 (PR). The last operational flight of an Andover was the ETPS Andover C.1, XS606, which took place on August 31, 2012.

CLASSIC TURBOPROP

Andover C1, XS609, of 46 Sqn on display at Prestwick Airshow in September 1969. This photograph demonstrates the unique 'kneeling' capabilities of the aircraft to facilitate easier loading/unloading. The aircraft was carrying the 'Falcons' parachute team when it crashed on take-off from Ampugnano AB, Italy in April 1972 after an engine failed, resulting in four fatalities.

Richard Freail Collection



The only other air force to use the Andover was the Royal New Zealand Air Force which purchased ten RAF C.1 transports from storage in 1976. NZ7267 began life with the RAF as XS613 and joined the RNZAF in 1977 Key Collection

Other air arms

The only other air force to use the HS 780 Andover was the Royal New Zealand Air Force which purchased ten RAF C.1 transports from storage in 1976 to

replace its ageing DC-3s and Bristol B.170 Freighters. Some of the Andovers served with 1 Squadron as transports while others went to 42 Squadron for VIP and communication duties. In 1984, 42 Sqn took over all of the aircraft when 1 Sqn was disbanded and continued flying Andovers until June 1998.

With the IAF operating the civil HAL 748, in the mid-1960s it examined the prospect of manufacturing the HS 780 Andover under licence in India. However, because of the production delays with the 748 at Kanpur, the IAF's interest waned and it purchased the DH Canada Caribou instead.

End of the line

By the time of the Super 748, orders had largely dried up and production ceased in

1988. After the manufacture of more than 380 airframes, the last aircraft was delivered to Makung Airlines of Taiwan in early 1989.

Operational 748s are now few and far between: the IAF has about 30 still in use and in Canada there are a handful of airlines such as Air Inuit, Air Creebec, Air North and Wassaya Airways which still find the 748 useful as a freighter. However, the best years are behind the 748 and its flying days are rapidly drawing to a close. ●

SPECIFICATION

HAWKER SIDDELEY HS 780 ANDOVER C.1



Crew	2-3
Capacity	52 troops, 40 paratroops or 24 stretchers
Length	78ft 0in (23.77m)
Height	30ft 1in (9.15m)
Wingspan	98ft 3in (29.95m)
Wing area	831sq ft (77.20m ²)
Empty Weight	29,324lb (13,301kg)
Max Take-Off Weight	51,000lb (23,133kg)
Max Speed	278kts (320mph/515km/h)
Ferry Range	1,425 miles (2,300km)
Service Ceiling	24,000ft (7,300m)
Powerplant	Two Rolls-Royce Dart turboprops (3,245shp each)
First Flight	June 24, 1960 (HS 748) December 21, 1963 (HS 780)

Artwork: Andy Hay / www.flyingart.co.uk

In November 1976, 115 Sqn at RAF Brize Norton converted onto the Andover and used the E.3 variant for special calibration duties





TURBO CONNIE

It's a Lockheed Constellation, but not as we know it!
Richard Evans investigates the US Navy's turboprop
 powered R7V-2 Super Connie



When Lockheed's Constellation first took to the skies on January 9, 1943, few could have predicted it would turn into one of America's most iconic airliners.

Development work had begun in 1937 but it was a 1939 order for 40 examples for Howard Hughes' Trans World Airlines (TWA) that accelerated the project.

The original L-049 was designed by a team of engineers including Lockheed's Kelly Johnson and incorporated a high-performance wing based on his P-38 fighter. This gave the new airliner a top speed in excess of 325kts and made it faster than the Japanese A6M Zero fighter of the day.

Other radical design features included three

tail fins – to give the aircraft maximum vertical stabiliser area, but keep the overall height low enough so that it could fit into maintenance hangars; hydraulically boosted controls and a de-icing system for the wing and tail.

The airliner was powered by four enormous 18-cylinder Wright R-3350 radials, each of which produced 3,250hp.

A total of 22 C-69 Constellations were completed before the end of hostilities in 1945, but not all of these entered military service.

Peacetime saw the 'Connie' used extensively by both the US military and civilian owners around the globe.

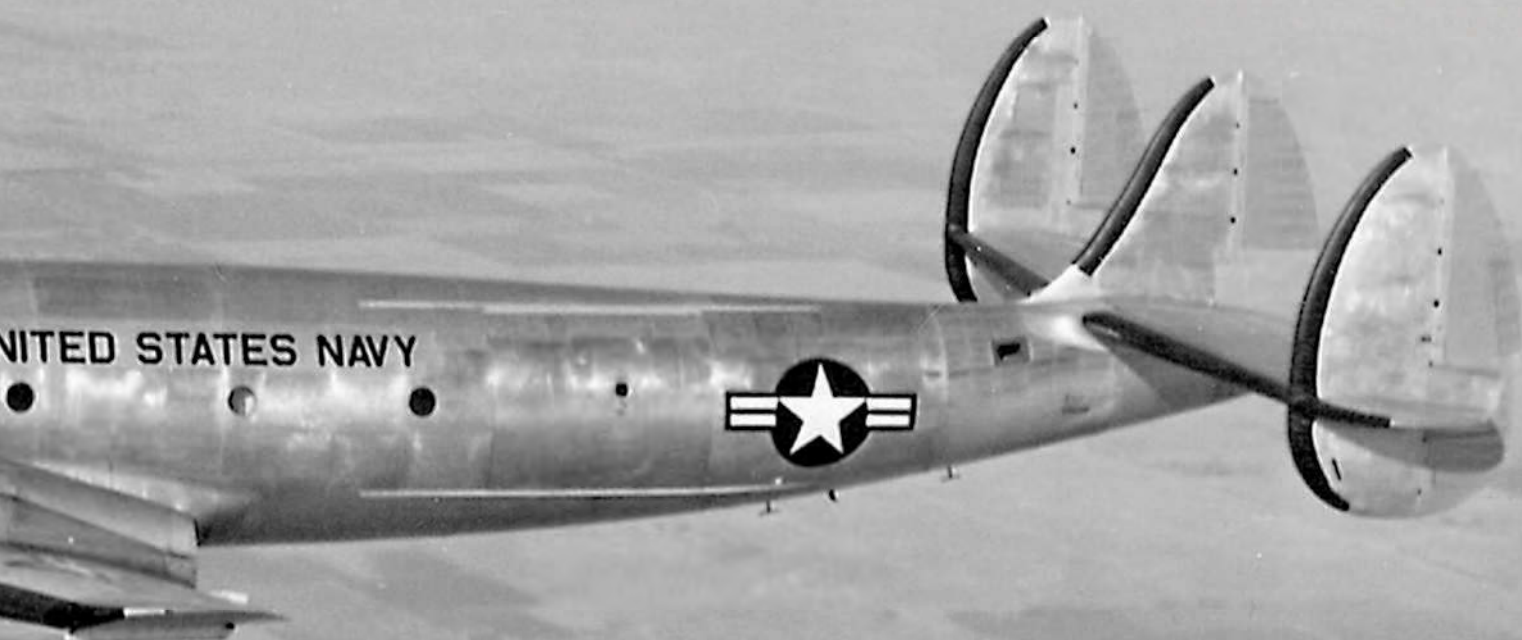
The more powerful L-649 and L-749 commercial variants plied their trade with many of the world's major airlines from the late 1940s and the L-1049

'Super Constellation' which first flew in 1951 boasted a longer fuselage.

Turboprop?

The US military used both the Constellation and the L-1049 Super Constellation extensively and the US Navy also explored the option of re-engining the breed with more frugal and powerful turboprop engines.

The Navy had operated two examples of the early L-749 (as the WV-1) in the late 1940s and the onset of war in Korea led to a further order for the L-1049. The aircraft, which would be designated the R7V-1, used the same powerplants as the Navy's P2 Neptune – thus helping with spares availability and ease of maintenance – and the first of 142 flew in 1951.



Above: The US Navy's first turboprop-powered R7V-2 aloft during a test flight in late 1954

Left: An original 'short fuselage' Lockheed L-749 Constellation aloft with the US Navy in the late 1940s

Below: The US Navy would ultimately operate 142 examples of the piston-powered Lockheed C-121 / R7V-1 Super Constellation. This example is Bu No 131659

Almost immediately the Navy and the USAF began to explore the possibility of re-engining the aircraft with turboprops and chose the Pratt & Whitney YT-34-P-12A for the job. The engines would drive three-bladed Hamilton Standard Turbo Hydromatic propellers, meaning each engine could produce 5,500shp. This took the total thrust available from 13,000hp in the R7V-1 to an astonishing 22,000shp in the new R7V-2 variant.

Two US Navy R7V-1 airframes (Bu Nos 131630 and 131631) were chosen for modification whilst still on the Lockheed production line at Burbank, California. Two other R7V-1s (Bu Nos 131660 and 131661) were transferred to the USAF as YC-121Fs and allocated the serials 53-8157 and 53-8158 as part of their conversion process



at the factory. They differed from the US Navy airframes by having tip tanks.

The first turboprop-powered Connie to fly was R7V-2 Bu No 131630, which took to the skies on September 1, 1954 and immediately became the world's fastest propeller-driven transport aircraft when it reached 380kts.

The aircraft would prove itself to be very capable with a range of more than 4,000 miles and the ability to carry an eight-tonne payload from coast-to-coast in the USA in less than six hours.

Too little, too late

Although both the R7V-2 and YC-121F offered far superior performance and economy compared to the conventional 'round engine' Connies, their days were numbered.

The type's maiden flight came less than a week after that of Lockheed's C-130 Hercules and faced with the choice of refurbishing

Commercial option?

Undeterred by the military's snubbing of the turboprop option, Lockheed chose to explore the potential of selling a turboprop Super Connie to civilian operators. Even by the early 1950s the cost of aviation grade petroleum was escalating and fuel consumption of the big compound radial engines used on the Connie was felt to be excessive.

"70mph faster than any current or forecast piston engine commercial transport"

a 1930s design or buying a state of the art, purpose-built turboprop transport, both the USAF and US Navy shunned the faithful Connie.

The US Navy examples were eventually sold for spares but one of the USAF examples (53-8158) was later leased back to Lockheed to become the test-bed for the Allison 501D turboprop. This was the civil version of the Hercules' T-56 engine and was intended for Lockheed's L-188 Electra – hence the YC-121F was nicknamed Elation.

The L-1149 variant was therefore proposed and would combine the successful L-1049G airframe with four turboprop engines.

Intended to be launched in 1955, the aircraft would have boasted a substantial redesign and Lockheed claimed it would result in a speed "70mph [61kts] faster than any current or forecast piston engine commercial transport (Douglas DC-7C) and 30mph [26kts] faster than any projected propeller-driven long-range commercial transport (Douglas DC-7D)."

Above: The Constellation was always a very pretty aeroplane and the slender turboprop engines only added to its ramp appeal

The project originally called for four 6,000shp Pratt and Whitney PT2 turboprops to be installed but Lockheed surmised that the Rolls-Royce RB.109, Pratt and Whitney T52, Allison T56, or Bristol BE.25 would be equally suitable. The aircraft was projected to cruise at more than 400kts at 30,000ft thanks not only to the new powerplants but also a completely new thin wing that would be 27ft longer in span than that of the original Super Constellation.

However, the onset of Boeing's 707 meant that TWA chose to 'go jet' and the L-1449 did not leave the drawing board. The turboprop-powered Douglas DC-7D (to be powered by the RB.109) suffered the same fate but in the UK, Bristol succeeded in getting its Britannia into production.

Two years later, on December 6, 1957, Lockheed flew its prototype L-188 Electra. The new four-engined turboprop would ultimately spell the end for the Connie. ●



Bu No 131631 was the second R7V-2 to fly for the US Navy

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The first two pre-production Caravelles – F-WHHI and F-BHHH – pose for the cameras in 1956

On Wednesday May 6, 1959 a new era in airline transport commenced when, for the first time, short-haul passengers could fly in a jet. Supplanting turbo-prop Vickers Viscounts, the Sud Aviation SE-210 Caravelle brought jet standards of speed and comfort, previously only enjoyed by passengers on long-haul flights, to Europe.

In the early 1950s, jets were just starting to make an impact on airline travel but most European airlines were still firmly controlled by governments. On October 26, 1951 the Comité du Matériel Civil (Civil Aircraft Committee – CMC), formed by the French Secrétariat Général à l'Aviation Civile et Commerciale (SGACC – the government department responsible for civil aircraft specification and procurement) issued a specification for a short to medium range commercial airliner, capable of flying from Paris to European capitals and to North Africa. The aeroplane was required to be able to use 6000ft runways and to cruise at 324kts at 25,000ft. The aeroplane was also required to be capable of operating two return trips on the busy 1,170 miles Paris to Casablanca route each day, carrying between 55 and 65



F-BHRB was Air France's second Caravelle. The aircraft operated a press trip from Paris to Barcelona, Rome, Frankfurt and Heathrow on April 26, 1959



The Caravelle production line at SNCASE's Toulouse factory

Dassault, Hurel-Dubois, Latécoère, Nord, SNCASO (Sud-Ouest) and SNCASE (Sud-Est). Several of these submissions had rather unconventional configurations, including the use of a mix of both turbo-prop and jet engines, high wings with aerodynamic 'lift struts' and one design even had variable configuration wings. On March 28, 1952 the CMC narrowed the

“The Caravelle broke a number of records for flight time”

passenger and 2,200lbs of cargo on each flight. The aircraft needed to be capable of being flown for 1800 hours per year, and was to cost no more to operate than the Viscounts it was to supersede.

Design machinations

More than 20 proposals were received that answered the SGACC specification, including submissions from Breguet,

competition to four twin-engined aircraft designed by SNCASE, SNCASO and Breguet, plus a tri-jet from Hurel-Dubois. The range requirement of the new jet was upped to a maximum of 2,175 miles and shortly afterwards the CMC instructed the competing companies to submit proposals that used two 9,200lbs/thrust jet engines, or Rolls Royce Avon RA.7 turbojets and booster engines.



Caravelles bound for SAS are completed in the flight test shed at Toulouse. The airline ordered six examples and 19 options at the 1957 Paris Airshow. SE-DAA, in the centre of the photograph, was the fourth Caravelle to be completed and served with SAS as Eskil Viking. Today it is stored without its nose at Stockholm's Arlanda Airport, Sweden and used for fire training. The nose section can be found at the Finnish Aviation Museum, Helsinki

SNCASE submitted its X.210.02.28 design featuring three rear-mounted SNECMA ATAR axial flow turbo-jets. SNCASE stressed that the rear mounted engines represented the optimal configuration, as they allowed for an aerodynamically clean wing featuring high-lift devices, a quiet cabin, a short undercarriage, reduced risk of foreign object ingestion and easy maintenance access. Sud-Est then further refined their design as the X.210.02.34, which featured only two Rolls Royce Avon RA.12 engines producing 9,920lbs/thrust and a range of up to 2,000 miles with a load of 15,400lbs. This project was selected for production by the CMC on November 19, 1952, although initially Sud-Est was directed to share production with Sud-Ouest building the wing. The SE-210 Caravelle was born.

Nosing ahead

Following its successful bid for the CMC project, Sud-Est received a contract for the construction of a prototype on July 3, 1953 and started to build the first Caravelle,

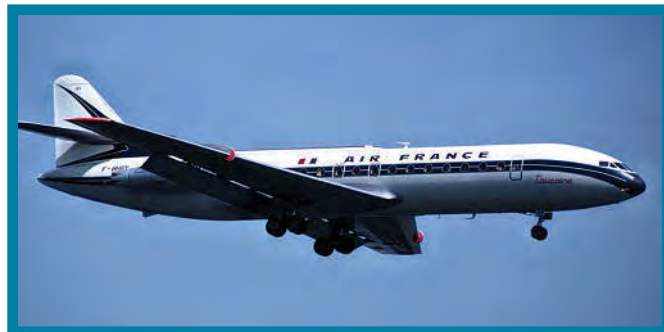


A fascinating view of Royal Air Cambodge Sud SE-210 Caravelle III XU-JTB, possibly in Thailand. The aircraft was built for Air France as F-BJTA in 1960 and joined the Cambodia-based Royal Air Cambodge in 1973. Visible in the background are an Alia Royal Jordanian Airlines Boeing 707, an Air Siam DC10, a Union of Burma Airways 727 as well as military C-123 Providers, C-47 Dakotas and Convair C-131s Key Collection



Air Inter became the last airline to order the Caravelle when it purchased five Super 12s in 1971. This carrier already operated a number of earlier examples, many of which were ex-Air France Machines such as Caravelle III F-BNKG. The aircraft was built in 1967 and served Air Inter until 1985 when it became 9Q-CCP with IAC Airlines in the Democratic Republic of Congo. The aircraft was eventually withdrawn from use in 1995 at Kinshasa

Key Collection



Air France Caravelle III F-BHRY lands at Heathrow on June 7, 1975. Six years earlier this aircraft had been badly damaged during a take-off accident at Marseille-Marignane Airport, France. Shortly after retracting the gear the airspeed dropped and the aircraft landed on its belly before skidding off the end of the runway – the accident was attributed to wind shear. Today this aircraft can be found at the Musée de l'Épopée de l'Industrie et de l'Aéronautique, Albert, France Adrian M Balch

targeting May 21, 1955 for a first flight and airline service in late 1956. The aircraft was designed to meet French AIR2050, UK ARB and US CAR 4b airworthiness standards, indicating that Sud-Est saw a market for the Caravelle outside of Europe. Sud-Est refined its X.210.02.34 design to include an unsymmetrical laminar-flow wing, integral fuel tanks and a main undercarriage that retracted into the fuselage to preserve wing strength. The horizontal stabilisers were raised to mid-fin level to ensure they were well removed from efflux from the two rear-fuselage mounted engines, and glider-style air brakes were installed above and below the wing. Sud-Est bought two complete Comet nose sections from de Havilland as it was intended to base the Caravelle's cockpit design on that of the Comet. Although the Caravelle's nose looks similar to that of the Comet, Sud-Est redesigned the cockpit layout following the Comet disasters. The newly designated SE-210 Caravelle could be operated by a flight deck crew of two, although a third seat was provided for an observer who could also operate as a crew member depending on individual airline requirements. Sud-Est had access to the Comet's technical documentation and one of Air France's Comet aircraft, but decided to strengthen the Caravelle beyond that of the Comet

using much thicker skin plates and triangular cabin windows with rounded corners. Although initially thought to be over-engineered, the Caravelle's structure was ultimately proven to be one of the most durable ever incorporated into an airliner:

In a flap

Prototype Caravelle F-WHHH was rolled out of SNCASE's Toulouse factory on April 21, 1955 although the two Rolls Royce Avon RA.25 Mk 521 engines weren't installed on the airframe until early May. With low and

instrumentation in the cockpit and external visibility, and on the 64th flight test the aileron controls 'froze' due to the cold increasing the viscosity of the hydraulic fluid – engine bleed air was used to resolve that problem.

Record breaker

On November 16, 1955 it was announced that Air France would order 12 Caravelles. They were to be delivered from 1958 onwards, with the first entering service that year and the remainder starting to be used during 1959 and 1960. Contracts

“A total of 282 Caravelles were produced”

high-speed taxi tests completed successfully, Caravelle No.01 took to the air for the first time on Friday May 27, 1955. After a trouble free first flight of 22 minutes, the prototype was flown again for 1hr 36mins the following day although the wing flaps stuck in the retracted position resulting in a flapless landing. The same problem occurred on the Caravelle's third flight on June 1, 1955, after which investigation revealed a nut was snagging as a result of wing flex and a rapid redesign allowed the Caravelle to appear at the 1955 Paris Salon. After that, testing of the prototype continued mostly successfully, although the Centre d'Essais en Vol (CEV – the French flight test centre) criticised the

were signed in early 1956, at which time Air France placed a further 12 Caravelles on option. A restricted certificate of airworthiness was awarded to the Caravelle on May 23, 1956 after which Caravelle No.01 F-BHHH was handed over to Air France for 1,500 hours of flight trials that were required before revenue service could commence. During these tests, the Caravelle broke a number of records for flight time by an airliner between Paris-Algiers, Paris-Oran and Paris-Casablanca, including several flights during which one engine was intentionally shut down. The Caravelle also paid visits

Aero Lloyd Caravelle 10R D-AAST lands at Munich in October 1980. This aircraft was built for Iberia as EC-BIE and also served with Aviaco before joining German carrier Aero Lloyd. It was retired in November 1980 and is now stored at Bordeaux Caz Caswell Collection





Heads of Government also chose Caravelles, including the Government of Rwanda whose Caravelle III 9XR-CH is seen here in April 1984. The aircraft had previously served with SAS (LN-KLN), Air Mali (F-BRUJ), Inex Adria (YU-AJE) and Tunisair (F-BUFM) before joining the Rwandans in 1974. In 1992 it was passed to Trans Zaire Cargo as 9Q-CVO and later became 9Q-CWK with Wetrifa Airlift before being scrapped at N'djili Airport in the Congo Caz Caswell Collection



This Caravelle III began life in 1962 as HB-ICU 'Argau' with Swiss Air but in 1971 it was leased to Sobelair as OO-SBQ. In 1974 the lease passed to Aerotechnique International as F-BUFG and five years later it passed to Aerotour, in whose markings it is seen here. The jet eventually passed to Inter-Fret Transport Aerien as 9Q-CZL in the Democratic Republic of Congo in 1981 but had been broken up at N'Djili Airport by 1986 Key Collection



Caravelle III HS-TGF Suranaree was operated by Thai International in co-operation with SAS when it was photographed at Hong Kong's Kai Tak airport on August 31, 1965. It had previously flown with SAS as Alrik Viking and carried the Swedish registration SE-DAE Barney Deatrick via Adrian M Balch collection

to Lufthansa in Hamburg and Sabena in Brussels, and the aeroplane also flew into Rolls Royce's airfield at Hucknall in the UK on July 20 1956. The aeroplane was flown to Toulouse on November 16, 1956 for a complete tear-down and rebuild, allowing Sud-Est to inspect the airframe structure and confirm its ability to withstand the rigours of regular flight operations.

On tour

With flight testing largely complete, Sud-Est was able to focus on refining the Caravelle's design into a production version. More powerful Rolls Royce Avon RA.29 (Avon 522) engines producing 10,500lbs/ thrust had become available, allowing the operating empty weight, the maximum zero fuel weight, the maximum landing weight and the payload to all be increased. The fuselage was also lengthened by 18ins, and seating capacity increased to a maximum of 80 in 16 five-abreast rows.

Caravelle No.02, F-WHHI, flew for the first time on April 16, 1956. After 50 flights totalling 100 hours, the aeroplane returned to the hangar to have sound insulation and a passenger interior installed. After a brief further flight test program Caravelle No.2 set out on a sales trip to North and South America, starting by flying from Dakar to Recife on April 20, 1957. The Caravelle was demonstrated in Argentina, Brazil, Uruguay and Venezuela after which No.2 was flown to the USA where it visited Miami, New York, Los Angeles, San Francisco, Seattle and Minneapolis. It then paid a brief visit to Canada before returning direct to Orly from Gander on June 25, 1957. During the tour, the Caravelle had been the first twin jet to cross both the North and South Atlantic. After it returned to Europe Caravelle No.02 was assigned to further sales visits. These included a visit to Copenhagen to perform a demonstration to Scandinavian Airlines System (SAS),

after which it flew to the 1957 Paris air show where SAS signed a contract for six Caravelles with 19 options.

Into service

The first production airframe for Air France – F-BHRA – was rolled out on January 4, 1958 and flew on April 4. Following further flight testing at CEV, it performed a six-day 50-hour reliability test between Orly and Algiers, Nice, Oran and Bordeaux in early 1959. The Caravelle was awarded a full SGGACC certificate of airworthiness on April 2, 1959. FAA certification followed six days later. On April 26, 1959 Air France's second Caravelle F-BHRB operated a press trip from Paris to Barcelona, Rome, Frankfurt and Heathrow. Then on May 6, 1959 F-BHRA 'Alsace' operated the type's first revenue services, Flight AF604 from Paris to Rome, Athens and Istanbul, followed by AF615 back to Paris via Milan. Rome and Nice was added to the Caravelle network on Jun 1, 1959 and London Heathrow service began on July 27, 1959. Caravelles had replaced Lockheed Constellations, Vickers Viscounts and Douglas DC-6s on these trips, and service reliability was vastly improved, with only 23 delays being recorded out of 425 Caravelle departures in June 1959.

SAS was the second airline to put the Caravelle into service. It flew its Caravelle inaugural from Copenhagen to Beirut via Dusseldorf, Vienna and Athens, also on April 26, 1959, but its regular revenue services didn't start until May 15. Swissair came next, with its first Caravelles entering service in May 21, 1960 between Zurich and London.

Refinement and development

With Caravelles proving themselves in revenue service, orders started to flood in to Toulouse. Thai International, Varig, Finnair, Air Algerie, Royal Air Maroc and Tunis Air all became early Caravelle customers.



This Caravelle IIR was built for New Air Zaire in 1968 as 9Q-CLD and later passed to the French military becoming F-RBPS. In 1996 it was sold to Eureka Aviation and three years later it became 3D-SEP with Air Gabon. It ended its career with Tran Air Cargo Service as 3D-KIK but was written off in August 27, 2004 while landing at Goma in Rwanda

Key Collection

Sud Aviation (as they had become in 1957 following a merger with Sud-Ouest) wasn't resting on its success though, and increases in thrust available from enhanced Rolls-Royce Avon RA.29 Mk527 variants and structural strengthening allowed the Caravelle III to be introduced from airframe number 35. The prototype Caravelle III, the 19th Caravelle built, had actually flown on December 30, 1959; it offered an increased gross weight of 46 tonnes as well as improvements in cruise speed and range. Next came the Caravelle VI, powered by 12,125lbs Rolls Royce Avon RA.29 Mk531 engines. Sud Aviation made the VI available from 1961, offering airlines a gross weight increase to 47 tonnes. Sabena became the first airline to take the Caravelle VI-N (N – Normal) with an order for four plus four options, which initially entered service in February 18, 1961 from Brussels to Nice. Alitalia, Aerolineas Argentinas, Jugoslovenski Aerotransport (JAT), Middle East Airlines (MEA) and Indian Airlines followed Sabena with orders for the VI.

Whilst initial Caravelle orders came primarily from airlines that operated in traditional French markets, Sud Aviation didn't ignore other areas. Following the American sales tour, United Airlines had shown significant interest in the Caravelle but demanded a North American-based service and support network be established before it would place an order. After courting Republic Aviation and Convair, Sud teamed up with Douglas which became the Caravelle's sales and post-delivery support agent in North America. Douglas agreed to set up parts warehouses for the Caravelle on the West and East coast of the USA, and in return Sud Aviation agreed to market the DC-8 in Europe. With a reliable support network in place United Airlines ordered 20 Caravelle VI-Rs, plus 20 options, on February 25, 1960. The VI-R was based on the VI-N but featured Avon 531R engines with

thrust reversers (noteworthy is the fact that earlier Caravelles had a tail-mounted parachute that assisted with braking on short runways) and substantially redesigned flight deck windows that provided much better visibility than those on earlier models. Although Sud Aviation initially saw the United order as a breakthrough, it was to be a short-lived success as later the same year United ordered Boeing 727s for its short and medium range services and relegated the Caravelle to an interim type in its fleet. United's first Caravelle VI-R N1001U was handed over on June 10, 1961 and the 'Caravelle Jet Mainliner' service started on July 14, 1961. N1001U operated the inaugural flight UA601 on the highly competitive New York Idlewild to Chicago O'Hare route, whilst N1002U operated the reverse trip departing at the same time. Passengers loved United's Caravelles, and during the first year they carried 734,000 passengers with a load factor on the initial New York to Chicago route exceeding 90%.

The improved performance offered by the Caravelle VI-R enticed a number of

other airlines to order that variant. Iberia ordered the Caravelle VI-R in November 1960, followed by Transportes Aereos Portugueses (TAP), Panair do Brasil, Cruzeiro do Sul, LAN Chile, Austrian Airlines, Libyan Airlines and Luxair.

Super Caravelles

Keen to develop the Caravelle further, Sud Aviation started to study other engines that could provide more power and allow the Caravelle's performance to be improved. The Caravelle VII, aimed initially at Trans World Airlines, was to be powered by two General Electric CJ805-23 turbojets that shared a great deal of commonality with the airline's CJ805-3 powered Convair 880s. The Caravelle 10 was also announced, powered by either two CJ-805-23A (16,100lbs/thrust) or two Pratt and Whitney JT8D (14,000lbs/thrust engines. Gross weights were increased to 52 tonnes. The GE powered Caravelles never entered volume production, but production of the P&W powered Caravelle 10B commenced when



Alitalia's Caravelle III I-GISE retained the remnants of its former Air Inter colour scheme when seen here at Luton. The aircraft flew as F-BNKB with both Air France and Air Inter before joining Alitalia in 1982. The aircraft was retired in October 1985 and turned into a Pizzeria Falconara in Porto Recanati, Italy Martyn Cartledge



Corse Air's Caravelle 10B F-GEPC began life with Syrian Arab Airlines, with whom it flew as YK-AFA. The aircraft ended up in South America by the mid-1990s and flew as HK-3962X with Ibero Americana. In April 1995 drug runners landed the aircraft on a dry lake bed near Todos Santos in Mexico while wearing a fake registration. Mexico Federal Police later cut off its wings! It is seen here at Munich in June 1984 Caz Caswell Collection

The French Air Force was among the military operators to fly the Caravelle. This example, F-RAFH, is seen in April 1992 in the twilight of its career. The jet was later sold to Lineas Aereas Suramericanas and became HK-3932X. It was written off on January 31, 2001 when it crashed 3 miles short of Yopal airport in Colombia after attempting an emergency landing with gear retracted Jean Lipka via Adrian M Balch Collection



Finnair ordered six (plus two options) in October 1962. Finnair wanted to place the aircraft into service at the start of the 1964 summer season as their increased range allowed them operational flexibility on longer flights to all major European capitals. The Caravelle 10B received its certificate of airworthiness on July 10, 1964 and Finnair placed the type into service between Helsinki and Copenhagen on August 15. Syrian Arab Airlines, Alia, Union de Transports Aériens, Iberia, Lufttransport-Unternehmen (LTU), Sterling and SATA of Switzerland also ordered Caravelle 10s.

Sterling was noteworthy for operating Caravelles well outside of their optimal design range – the airline's Caravelle network included destinations such as Colombo, Bangkok, Hong Kong, New York, Toronto and Chicago, and the airline's Caravelles even visited California and Florida, albeit with refuelling stops en-route.

The next variant offered by Sud Aviation was the Caravelle 11R. Stretched

configuration in April 1969, later adding another three plus four options to its order. Air Inter ordered five 12s on May 6, 1971, after which the airline switched its attention to the Dassault Mercure. These were the last Caravelles to be ordered, and production of the SE-210 ended when F-BTOE was delivered to Air Inter on March 16, 1973. A total of 282 Caravelles were produced, including the two prototypes.

The end of the Caravelle

Air France operated its last Caravelle service, a return trip from Paris to Amsterdam, on March 28, 1981 using F-BHRY. The slow decline of the Caravelle had begun as the type was slowly overtaken by newer, more efficient and more modern Boeing 737s and Douglas DC-9s.

As these newer designs came into airline service, used Caravelles started to see employment with second tier airlines. The only major areas untouched by second-hand Caravelles were to be the

Among the last few Caravelles to fly regularly were three 11Rs formerly used by the French military. They were sold to Eureka Aviation of Belgium in 1996 and after spending a while stored in Europe, they found use with a variety of small operators in Southern Africa, including Malu Aviation, Air Espace and Transair Cargo. Gabon Express operated the world's last regular scheduled passenger Caravelle services in 2001 between Libreville and Point-Gentil, after which their aeroplane worked contract services in Angola. Waltair of the Congo was the very last Caravelle operator – it operated former Sterling and Air Toulouse Caravelle 10s, and the former French military 11Rs, in a part-cargo part-passenger configuration. Caravelle 10R 9Q-CPI was parked in early 2005, bringing the career of the Caravelle to a close.

Farewell, La Belle Caravelle! ●

“Caravelles found notoriety with the Colombian drug cartels”

by 3ft over the Caravelle 10, the 11R featured a 10ft 10.5ins x 6ft 9ins upwards opening cargo door in the forward fuselage and could be operated in a convertible configuration. The 11R could accommodate six standard pallets or 89 seats, and was powered by Pratt and Whitney JT8D-7 engines offering improved hot and high performance. Air Afrique, Air Congo and Transeuropa were the only customers for the 11R.

The last variant of the Caravelle put into production by Sud Aviation was the Caravelle 12. The 12 was a heavier stretched version of the 10B featuring a fuselage lengthened by 10ft 9ins, an increased gross weight of 56 tonnes, and Pratt and Whitney JT8D-9 engines. Extra over-wing emergency exits were installed, as was a strengthened undercarriage. Seating capacity was increased to 128 in an all-economy configuration. Sterling of Sweden ordered four 12s plus four options in a 131-seat

UK, the CIS and Australasia. The Caravelle became popular with European charter airlines, particularly in France, Germany, The Netherlands, Spain, Switzerland, Sweden and Norway. Heads of Government also chose Caravelles, including President Tito of Yugoslavia. The last few Caravelles disappeared from Europe in 1996, and the last European operator Air Provence retired its final example in Marseille on October 6. After that, most Caravelle operations were concentrated in South America – Colombia in particular – and in Southern Africa. Late model Caravelles found notoriety with the Colombian drug cartels, being used to fly illicit cargo north primarily into Mexico from where it could be moved over the border into the USA on the surface – Caravelles were seen as ideal for such operations, as they had a good cargo capacity enhanced by locally designed and installed cargo doors, and were cheap and expendable should the flights be intercepted.

SPECIFICATION SUD AVIATION CARVELLE III



Crew	3
Capacity	Up to 80 passengers
Length	101ft 7in (31.01m)
Height	28ft 6in (8.72m)
Wingspan	112ft 6in (34.30m)
Wing area	1,579sq ft (146.70m2)
Empty Weight	65,036lb (29,500kg)
Max Take-Off Weight	65,036lb (29,500kg)
Max Speed	435kts (500mph/805km/h)
Ferry Range	1,060 miles (1,700km)
Service Ceiling	39,370ft (12,000m)
Powerplant	Two Rolls-Royce Avon Mk 527 turbojets (11,400lb/thrust each)
First Flight	May 27, 1955 (Prototype) December 30, 1959 (Caravelle III)

Artwork: Andy Hay / www.flyingart.co.uk



BRITAIN'S STOP-GAP BOMBER

SHORT SA.4 SPERRIN



One of life's understudies, the Short Brothers' SA.4 was conceived as a stop-gap, emerging with seriously dated technology. Yet the Sperrin was docile and flew beautifully, as *Pete London* reveals

After World War Two, by March 1946, the international situation had crumbled sufficiently for Winston Churchill to make his famous 'Iron Curtain' speech. In terms of Britain's future bomber procurement, that year saw the Air Staff formulate its requirement intended to replace the Lincoln four-engined piston type, with the drafting of Specifications B.14/46 and B.35/46.

Released by the Ministry of Supply during 1947, both specifications sought a medium-range jet-powered bomber suitable for worldwide use. In fact B35/46 appeared first, finalised in January and issued in March. Manufacturers responded with numerous proposals, the majority incorporating aspects radical by existing standards of the day.

To varying extents most of the submissions reflected recent percolation into British aviation of advanced thinking on swept-wing technology, and the delay of compressibility onset at high subsonic speeds. Of the B.35/46 competitors, Armstrong Whitworth, Avro, Bristol, English Electric, Handley Page, Short Brothers and Vickers, two companies' tenders were chosen to progress.

In their winning proposals, both Avro and Handley Page included much new and untried technology. The Avro Type 698 employed a huge delta wing and dispensed with a tailplane; Handley Page's HP.80 design embodied a markedly-swept crescent-shaped wing. To complicate matters, in August 1948 Specification B.9/48, intermediate between B.14/46 and B.35/46

in the level of technology sought, was issued to Vickers; it yielded the Valiant, the third of Britain's eventual V-Bomber types.

Instructions for Inbetweener

While the unproven designs were developed though, the Air Staff felt it prudent that as an interim measure, a relatively conventional new bomber should proceed under B.14/46. Despite the threat of early obsolescence, such an aircraft would act as insurance against the possibility of problems and programme slips with the more radical aircraft.

The new type must be capable of flying at maximum continuous cruising power at heights from 35,000 to 45,000ft, at a speed of 390kts. Maximum speed in level flight was to be "as high as possible", and regardless of the



The first aircraft was finally rolled out during the spring of 1951 and first flew on August 10 of that year. Here Short's senior test pilot Tom Brooke-Smith and his crew are seen prior to take off that day



Sperrin VX158 shows off its somewhat tubby appearance at altitude during Gyron engine testing

desire for a comparatively conservative design, a maximum Mach number was mentioned of 0.85 (in a dive), faster than that of any aircraft then flown in Britain except de Havilland's DH.108. Greatest operational radius of action was to be 1,500 nautical miles with a 10,000lb bomb load, and ceiling 45,000ft.

In terms of armament B.14/46 was a departure: no defensive weaponry was to be included. "The aircraft will rely upon speed, height and evasive manoeuvre for protection against interception. Adequate warning devices to detect the approach of ground weapons, and radar countermeasures to deflect a beam on which a controlled weapon may be launched, will be required." A total bomb load was stipulated of 20,000lb, in combinations of 10,000lb, 5,000lb and 1,000lb,

or alternatively one Special (a euphemism for nuclear) bomb. The aircraft would be able to bomb from all heights up to 45,000ft, using visual or electronic bomb sights.

Crew would consist of a first pilot, second pilot, two navigator/bomb-aimer/radar operators, and a wireless warning and protective device operator. The crew would sit in a single pressure cabin, its 9lbs/sq in environment giving an equivalent altitude of 8,000ft at 40,000ft, reducible to 3.5lbs/sq in (25,000ft equivalent) when under threat of attack.

On engine arrangements, the Specification's first issue was indefinite: "It is preferred that the aircraft has not less than four and not more than six engines." Radio and radar provisions were more tightly

defined: long-range H2S scanner with NBC, Rebecca/BABS or the SCS.51, VHF and IFF. Also required was a supplementary visual bombing position in the nose.

Final Design

In terms of its airframe, Short Brothers' response to B.14/46, their SA.4, was reasonably conventional; the specification had urged avoidance of unproven techniques and materials. The SA.4 adopted a straight-wing layout (though its leading-edge was raked) and traditional tail surfaces, rather akin to an advanced piston-type. In January 1948 the company received Contract 6/ACFT/656/CB.6(b) for two prototype aircraft and a static airframe test specimen (a complete fuselage with stub



The first Sperrin, VX158, under construction at Shorts' Belfast premises, revealing its unusual engine configuration Pete London Collection

wings), all to be built using production-type jigs geared for high-rate output. The project's technical director was Claude Lipscomb, and the chief designer David Keith-Lucas.

In fact though, the final iteration of B.14/46, issued to Shorts over three years later in March 1951, fundamentally changed the SA.4's role to that of a flying laboratory. Production tooling or not, by then the Valiant, Victor and Vulcan programmes had all progressed greatly; the Valiant prototype was two months from a first flight. Though the Ministry didn't cancel Short's erstwhile bomber, feeling it would be useful for future equipment trials, the order remained for just two examples plus the test specimen.

The first SA.4 would be fitted with four Rolls-Royce Avon RA.2 engines, the second with RA.3s. Bomb load would comprise

nine 100lb practice bombs and nine 1,000lb bombs for the first example, but remain unchanged for aircraft No.2. Radio and navigation equipment for the first aircraft would consist of W/T HF (ARI.5332) and Green Satin Doppler radar; H2S Mk.9A with NBC Mk.2 and VSH Mk.1. The second would include Rebecca Mk.4.

Disruption

But the SA.4 programme was hindered by Short's relocation. In November 1947 Short Brothers (Rochester & Bedford) Ltd was reconstituted to become part of Short Brothers & Harland Ltd. As Rochester's workforce moved to their new works at Belfast, the project's timescale was set back by around four months. A long industrial dispute added to the problems.

Delays also arose from modifications to the aircraft, cut into the programme as it developed, and changes in the required bomb loads. On top of that Shorts had no wind-tunnel of its own, previously relying on RAE Farnborough and the National Physical Laboratory for assistance. At the time, those facilities were in demand while the transfer from Kent to Northern Ireland disrupted co-operation with other bodies.

The SA.4s were built wholly at Belfast, receiving serials VX158 (construction number SH.1600) and VX161 (c/n SH.1601). Meanwhile, a specially-built cabin chamber was tested to nearly three times its planned pressure differential before

distortion occurred. The static test specimen convincingly proved the airframe design, its wing finally failing at 104% of the ultimate load, the fuselage at 108%.

VX158

The first aircraft, VX158, was finally rolled out during the spring of 1951. Over the summer, lengthy taxiing trials assessed its flying-control system, brakes, tyres and wheel temperatures. Transported to nearby RAF Aldergrove, VX158 was first flown by Short's senior test pilot Tom Brooke-Smith on August 10, 1951, three months after the maiden flight of Valiant prototype WB210.

The SA.4's structure was a conventional stressed-skin, light-alloy assembly, incorporating hot dimpling and rivet-head flush milling techniques developed by Shorts. Its fuselage consisted of nose, centre and tail sections, but was constructed as a single unit. In the nose section was incorporated the pressurised circular-section crew compartment. The central fuselage carried four heavy transverse booms to which the inner wings were attached, while the aft section mounted the fin and tailplane.

The cockpit was dual-control, the pilots sitting side-by-side with the windscreen set around the front of the pressure drum. The three other crew members faced aft, and worked on a full-width consol at the rear. From the cockpit, a tube accessed a space in the extreme nose for a prone visual bombing station. At first though, neither aircraft was



Sperrin VX158 over the Northern Irish landscape, accompanied by the Short Sherpa and a Seamew

fitted out with such a position and both had solid noses. An equipped mock-up of the cockpit was made at Rochester, and used as a familiarisation and training model.

Safety First

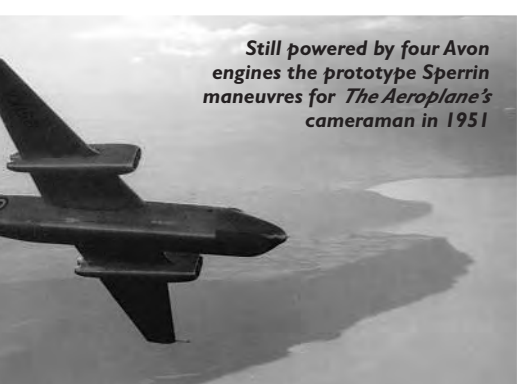
Much thought was given to methods of crew escape in an emergency. Only the first pilot was given an ejection seat, a Martin-Baker Mk. 1D firing through an escape hatch in the left side of the cockpit roof. Over the summer of 1948 (by when the SA.4's basic design was well advanced) the notion was contemplated of making the whole nose section jettisonable.

With a sloping break line, the detachable portion's top would be shorter than its bottom. This would allow a clear fall-away on jettison, as the rest of the aircraft reared upwards with the sudden shift in centre of gravity. Explosive separating bolts, nose stabilisation using a checking drogue, canopy configurations to bring the nose safely to earth, all were considered. But difficulties arose around nose instability following the jettison, revealed in model tests, and an unresolved weight penalty. The idea was dropped; in an emergency everyone except the first pilot would have to use parachutes.

Inside...

The SA.4's control system was non-powered, using aerodynamic servo-tabs to deflect the flying control surfaces. Cables from the cockpit drove irreversible screw-jacks at each tab,

Below: The Sperrin lands at the Farnborough SBAC Airshow, its stacked engines most evident



Still powered by four Avon engines the prototype Sperrin maneuvers for *The Aeroplane's* cameraman in 1951



Sperrin VX158, re-engined with two Gyron powerplants installed in the lower positions, seen at the 1956 Farnborough display



With flaps down Sperrin VX158 streams its brake 'chutes on landing at Aldergrove

with artificial feel on all three axes induced proportional to speed and a g-restriction unit incorporated in the elevator control. The cable runs were fitted with automatic tensioners to compensate for variations in temperature. There was no direct connection between the pilot and the control surfaces.

Below the SA.4's cockpit was its large radome, blended with the fuselage underside. Between the nosewheel bay and the forward bomb-bay bulkhead was the crew entrance hatch, opening into a floor-level air-lock and also serving as an emergency escape chute for those without ejection seats. The outlet was protected against the airstream by its power-opened door.

Extending under the wing along the fuselage mid-section was the bomb-bay, just over 30ft in length. Hydraulically-operated winches were incorporated to load the bombs, introduced

engines toward the ailerons were fitted simple flaps, the outer units incorporating split air-brakes which opened above and below the wing trailing edge, all operated hydraulically.

Mounted unusually in two vertical pairs, the four Avon axial-flow engines were set one above and one below each wing at a slightly nose-up attitude, and separated by vertical and horizontal firewalls. Their mountings were carried on steel tube space frames attached to the main spar. Long jet-pipes extended to nozzles behind the trailing-edges, which were later moved further aft to eliminate mild aerodynamic buffet.

Originally the SA.4 had been intended to receive the Avon RA.3, but that version wasn't available in time for VX158 so it was fitted with the RA.2, each engine producing 6,000lbs/thrust. The change involved modifications to the starting controls while some 12 inches

"The SA.4's role changed to that of a flying laboratory"

late in the day when the aircraft were under construction. Behind the bomb-bay were Vinten K and F.52 vertical strike cameras, whose bay doors opened in sequence with the bomb-doors. When the bomb-doors were closed though, the camera bay remained open for business. Aft again, the tail cone housed a braking parachute assembly.

... and Out

The SA.4's wing structure was arranged around a torsion box main spar and aft auxiliary spar. Shorts adopted the symmetrical AD.7 section aerofoil, which gave good laminar flow and high-speed control characteristics. From root to tip the wing was uniform in taper, with 1° dihedral. To maximise bomb-bay space, the wing joined the fuselage at high-shoulder level. Between the fuselage and the engine nacelles, and outboard of the

were also added to the width of the nacelles, in anticipation of housing revised ancillaries. The increase was not eventually required, and consequently the SA.4 had nacelles one foot wider than necessary.

Fuel was carried in self-sealing flexible tanks, pressurised to prevent distortion when diving. Each wing carried seven tanks, two in the root leading edge, the others between the spars. A further eight tanks were set in the fuselage above the bomb-bay, fore and aft of the wing spar box. All told a total tankage was provided of 6,170 gallons, with automatic selection between them to keep the centre of gravity within permitted limits.

Because of its high wing position, the SA.4's main undercarriage was markedly long. Initially, huge single wheels had been considered for the main members but finally, for reasons of weight and retraction space, two four-



Above: Sperrins VX158 and VX161 over Aldergrove during 1952; VX161 is the nearer aircraft



Below left: The Sperrin's bomb bay is seen to good effect in this image, taken during bomb loading trials

wheeled members were adopted, fitted with Maxaret brakes and retracting sideways into the inner wings. Below the cockpit the steerable twin nosewheel retracted aft; all members were designed by British Messier. Messier also developed the 4,000lbs/sq in hydraulic system which powered the flaps, air-brakes, dive-brakes, undercarriage retraction and doors, wheel-brakes, bomb-bay doors and bomb-loading jacks.

The SA.4's tail unit consisted of a single fin and rudder; and a tailplane with 13° dihedral. To assess the rudder's likely behaviour, Shorts fitted Sunderland Mk.V flying-boat PPI 51 with a fin and rudder similar to that visualised for the bomber; between November 1950 and May 1951 successful (though of course low-speed) test-flights were made from Belfast. During that time too the rudder leading-edge seals were evaluated, both flexible and wiping types. They behaved similarly; the first SA.4 received a flexible arrangement, the second a wiping seal.

Flight Trials

Flight trials of VX158 revealed few real worries and in September 1951 it appeared at Farnborough's SBAC Show. Testing was shared by Tom Brooke-Smith and company



Further buffeting around the engine nacelles resulted in the addition of leading-edge fillets, and modest fairings between the tailpipe exit shrouds. Pressurisation of the fuel tanks was increased after distortion occurred during dives. By May 1953 manufacturer's trials were complete. Later in life, VX158 received a new nose-cone with three small downward-looking windows for the bomb-aimer, the central of which was flat.

The second aircraft was almost identical to the first, but was fitted with Avon RA.3s. It lacked radar and had a light alloy lower nose skin. VX161 first flew on August 12, 1952,

up weight of 115,000lb, an engine cut-out at take-off caused only modest directional change and three-engine climb-out was adequate. Stalling behaviour was found acceptable with no tendency for either wing to drop. During 1954 the aircraft finally received a name: Sperrin, after the heather-clad mountains dominating the Northern Irish counties of Tyrone and Londonderry.

In the summer of 1953, VX158 had travelled to RAE Farnborough, where it was used for radar navigation and bombing system trials in support of the V-bomber programme. Though it was fully fitted with radar its bomb-bay was non-functioning; during the trials, marker flares were released through a small aperture in one of the bomb-doors. By the end of the year the aircraft had returned to Belfast, where it was stored.

Test-bed Duties

But a second career emerged. The Sperrin's unusual engine layout allowed reasonably straightforward adaptation of the aircraft for use as a test-bed for other powerplants. Plans were made for VX158 to help assess a large 15,000lbs/thrust de Havilland D.Gy.1 Gyron axial-flow jet. In preparation for its new engine the lower port nacelle was

“The Sperrin sailed by comfortably on the power of the single Gyron”

pilot Walter Runciman, until the latter's death in a Short Seamew crash during June 1956. Early on, the elevator trim tab gearing was revised to decrease sensitivity. Aileron flutter above 42,000ft prevented the predicted Mach 0.85 being reached, the aircraft restricted to Mach 0.78, though it was subsequently raised to Mach 0.81 on VX161. The dive recovery flaps led to buffeting if opened above Mach 0.75, so were simply locked closed.

again from RAF Aldergrove. By then the runway at Sydenham airfield next to Short's new Belfast works had been extended, which allowed use by the SA.4s during their later trials and visits.

Testing found the SA.4 could climb from take-off to 45,000ft, dive at Mach 0.80 with a descent rate of 20,000ft/min, and then fly at low altitude at 390 knots indicated, all without touching the trimmers. Even at all-



Above: VX158 was used to assess the large 15,000lb/thrust de Havilland D.Gy.1 Gyron axial-flow jet. In preparation for its new engine the lower port nacelle was reshaped, mountings and jetpipe amended, wing structure reinforced and revisions made to the fuel system and engine controls

Above right: de Havilland engineer Robert Teckel pre-flights the Gyron engine prior to the Sperrin's display at the 1956 SBAC Airshow



Later a second Gyron was fitted in the lower starboard nacelle, a first flight in that form being made by Eassie on June 26, 1956. During the flight, unfortunately the port outer undercarriage door fell away over the Irish Sea; a replacement was taken from VX161. An appearance followed at that year's SBAC Show but sadly, the Gyron programme later came to a halt. Engine trials ended; despite that, during September 1959 the Sperrin was sold to the de Havilland Engine Company, but was later scrapped.

Dropping 'Bombs'

Meanwhile, by April 1953 the second SA.4 had been taken on charge by the Ministry of Supply, moving to Woodbridge for trials involving the loading, aiming and dropping of various bomb loads. These lasted three years, the weapons in dummy form made of concrete. Among the bomb types used in the trials were the free-fall Blue Danube nuclear weapon, and the overweight Vickers/EMI Blue Boar winged bomb guided by TV.

After VX161 experienced buffeting around its open bomb-bay doors, small anti-buffet gills

were introduced just ahead of them, which also improved the stores' release behaviour. The doors operated in the classic manner with no internal folding but when they were opened, the Sperrin's trim and directional stability remained good. After the bomb trials, for a time VX161 was stored at Farnborough. Subsequently it returned to Belfast, though after donating its undercarriage door to VX158 it never flew again. In June 1958 the second aircraft too was sold for scrap.

Sum Contribution

The Sperrin was an unsung aircraft, the role of which changed completely before it even flew. It could be said £3.5 million of tax-payers' money was spent on an accidental flying laboratory, but behind the scenes the aircraft made a substantial contribution to the effectiveness of Britain's V-Bomber force. Today there are few reminders of the Sperrin, but displayed at the Ulster Aviation Society at Long Kesh, just outside Lisburn, is a carefully-preserved Shorts model of the fatigue test specimen in its rig. ●



Seen at Belfast, Sunderland Mk.V PPI51 was fitted with a fin and rudder assembly similar to that envisaged for the SA.4, to help prove the behaviour of the jet's flying-control system. The eventual Sperrin fin profile adopted a smaller curved leading-edge fillet Pete London Collection



Wearing its early paint scheme Sperrin VX158 reveals a huge bomb-bay, originally intended to house a variety of weapons including a nuclear bomb

SPECIFICATION SHORT SPERRIN



Crew	5
Length	102ft 3in (31.16m)
Height	28ft 6in (8.68m)
Wingspan	109ft 1in (33.20m)
Wing area	1,896sq ft (176.1m ²)
Empty Weight	72,000lb (32,659kg)
Max Take-Off Weight	115,000lb (52,164kg)
Max Speed	490kts (564mph/907km/h)
Ferry Range	410 miles (660km)
Ceiling	45,000ft (13,716m)
Powerplant	Four Rolls-Royce Avon RA.2 axial flow turbojets (6,000lb/thrust)
Armament	20,000lbs of bombs
First Flight	August 10, 1951

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The US Navy Blue Angels demonstration team used the short-nosed Grumman F11F-1 Tiger from April 1957 but soon upgraded these for long-nosed examples (as illustrated). The Tiger was the first supersonic aircraft operated by the team and it was retained until 1969 when it was replaced by the McDonnell F-4 Phantom

Adrian M Balch Collection



TIGER vs SCIMITAR

Grumman's Tiger and Supermarine's Scimitar were destined to have short service lives but both made ideal formation aerobatic mounts. Sebastian Morgan looks at a pair of swept-wing carrier-borne fighters

Supermarine Scimitar F.1 XD265 appears on static display at RNAS Brawdy while in service with 736 NAS. On November 15, 1962 the jet crashed into the Moray Firth after a bird was ingested and started an engine fire. The pilot ejected safely at 500ft and was rescued by helicopter Adrian M Balch Collection



By the 1950s the Grumman 'ironworks' had quite a reputation for producing successful fighter aircraft for the US Navy.

The majority of Grumman's World War Two fighter aircraft bore the name of cats, beginning with the F4F Wildcat and going via the F6F Hellcat and F7F Tigercat to the super high performance F8F Bearcat.

This tradition continued into the jet era with the straight winged F9F Panther and swept-winged F9F Cougar so when the Navy issued a requirement for a supersonic fighter, it was inevitably going to be named after a cat. Thus the F11F became the Tiger.

Jaguar

Astute readers may have noticed that Grumman jumped from the F9F to the F11F. This was due to the F10F Jaguar being a rare example of failure by Grumman's development team. The Jaguar came about in response to the Navy's interest in the variable geometry wing concept and it was felt this could overcome problems landing ever-heavier jet fighters aboard aircraft carrier decks.

Dating from the late 1940s, the Jaguar was based on the Panther airframe but had a T-tail and a shoulder-mounted wing that could move between two positions: 13.5-degree sweep for take-off and landing and 42.5 degrees for high-speed flight.

The wing showed much promise – and would ultimately be employed on Grumman's F-14 Tomcat, but the unusual tail, which was aerodynamically (rather than mechanically) controlled resulted in sluggish pitch control, especially at low speed. It only flew 32 times before the programme was cancelled.

Area Rule

While the F10F had proved of little interest, the US Navy still required a supersonic fighter and in 1952 Grumman self-funded a study to look at the possibility of adapting the most advanced Cougar (the F9F-6/7 variant) to use the Area Rule system.

Area Rule was a system of reducing transonic drag and enabling the aircraft to more easily achieve a supersonic performance; the project was given the company designation of G-98.

Investigation soon revealed that the Cougar airframe was actually unsuitable for such radical modifications and by the

The Grumman XF10F Jaguar trialled variable geometry wing technology



spring of 1953 the G-98 had evolved into a completely new aircraft.

It now boasted a thin-section, mid-mounted swept wing and a cylindrical fuselage that narrowed in width at its mid point in accordance with the Area Rule theory.

A downward-sloping nose offered good forward visibility during deck landings and the sturdy undercarriage consisted of twin nosewheels and single mainwheels that retracted into the fuselage in order to keep the wing as thin as possible.

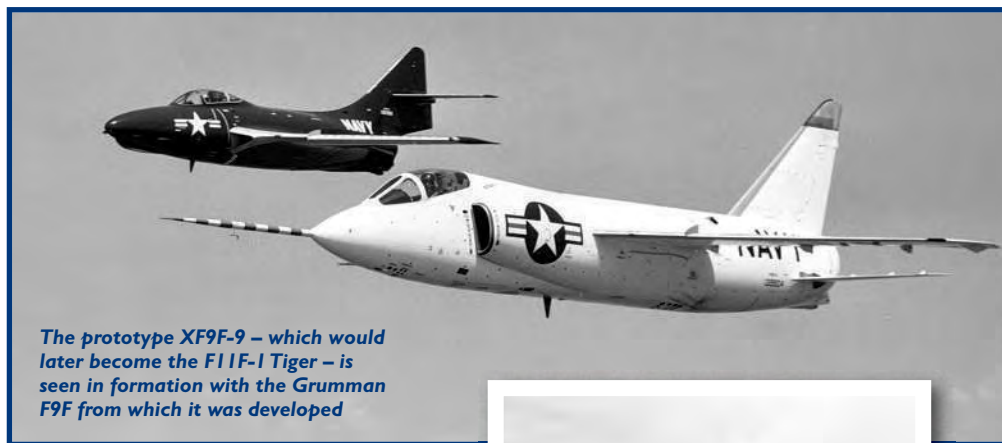
The wing itself was built from aluminium with the main spar boxes milled from solid metal to reduce weight and increase strength. The wings had leading-edge slats and full-span trailing-edge flaps to reduce the landing speed, and the wingtips could be manually folded downward for stowage aboard carriers. Power came from the afterburning Wright J65, which was a licence-built version of the Armstrong Siddeley Sapphire.

Prototypes

The Navy was sufficiently interested to order a pair of flying prototypes (BuNo 138604 and 138605) plus a static-test airframe (BuNo 138603) in April 1953 and although the G-98 now bore little resemblance to the F9F Cougar, these prototypes were initially designated as the XF9F-8.

Aerodynamic tests began immediately and used scale models that were both rocket-launched and mounted on the nose boom of a F9F-6 Cougar. With everything performing as advertised, the Navy placed an initial order for 42 test and early production aircraft in September 1953.

The first XF9F-9 (BuNo 138604) was ready for flight-testing in July 1954 but delays meant the afterburning J65 was not available. A non-afterburning 7,500lbs/thrust J65-W-7 turbojet was therefore fitted for the initial trials and Corwin 'Corky' Meyer took the prototype into the air for the first time on



The prototype XF9F-9 – which would later become the F11F-1 Tiger – is seen in formation with the Grumman F9F from which it was developed



Above: Test pilot Corwin 'Corky' Meyer poses in the XF9F-9 cockpit, ably demonstrating the large distinctive nose-boom carrying the pitot head

Left: The first prototype XF9F-9 takes to the skies on its maiden flight on July 30, 1954

Four Grumman F11F-1 Tigers from VF-21 Mach Busters in late 1959 US Navy

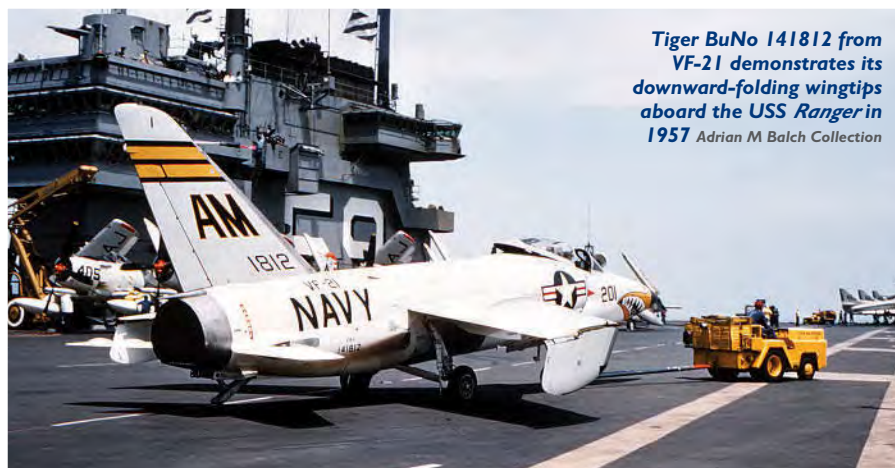


A pair of Grumman F11F-1 Tigers from VF-33 aloft in 1959 US Navy

July 30, 1954. Even without the reheated engine the aircraft almost achieved Mach 1 on its first flight and the second prototype (BuNo 138605) flew for the first time on October 2, 1954.

Test-bed down

Just 18 days later the first XF9F-9 crashed following an engine flameout. Although the pilot, Lt Cdr WH Livingston, survived the crash, the aircraft was written off. Undeterred, Grumman moved the second prototype to Edwards AFB in California for further testing and it was almost immediately fitted with an afterburner. This meant BuNo 138605 was now able to breach Mach 1 in level flight, however (contrary to some sources) it had lost out on the honour of being the Navy's first



Tiger BuNo 141812 from VF-21 demonstrates its downward-folding wingtips aboard the USS Ranger in 1957 Adrian M Balch Collection



The F11F-1F 'Super Tiger' showed much promise but was not ordered by the US Navy or any of the export customers Grumman targeted

supersonic fighter: this honour belonging to a Douglas F4D-1 Skyray that broke the sound barrier in level flight in June 1954.

Ongoing testing revealed a couple of design deficiencies and the first production variant (BuNo 138606), which flew on December 15, 1954 had a modified tailplane, smaller rudder and a splitter plate for the air intakes. It also had a one-piece sliding canopy to improve rearward visibility and a slightly longer nose to aid aerodynamics.

By the time the first production variant had flown, the US Navy had ordered an additional 388 fighter variants and 85

reconnaissance versions of the XF9F-9 – all to be powered by the Wright J65-W-18 turbojet. The fighters were armed with four 20mm cannon mounted around the air intakes and had hard points to carry either four Sidewinder missiles or missiles and a pair of 150 US Gal drop tanks.

Renamed & re-nosed

It would be April 1955 before the US Navy finally conceded that the XF9F-9 was no longer an upgraded version of the Cougar. It therefore issued a decree that the type should be redesignated as the F11F-1 Tiger.

Deck trials began aboard the USS Forrestal on April 4, 1956 and this revealed further design deficiencies. As such, the second batch of Tigers included additional fuel tanks in the engine intake walls and within the tail fin. From aircraft BuNo 141728, wing root fillets were added to the leading edge and the nose was extended by 6ft to accommodate an AN/APG-50 radar; although this was never actually installed in service.

A total of 200 Tigers were built for the US Navy. These examples, seen in mid 1960, are from VA-43 Challengers



Shoot down

Although the Tiger was destined to never fire its weapons in anger it did claim one aerial 'kill' – but sadly it was one of its own! On September 21, 1956 Grumman test pilot Tom Attridge shot himself down when he flew into a gaggle of his own bullets. Flying BuNo 138260 he was undergoing test-firing trials when shells impacted the cockpit canopy and the engine intake.

He slowed to 200kts and returned to base but the engine failed on final approach and the aircraft crashed into trees and caught fire. Despite his injuries Attridge managed to exit the jet and was picked up by Grumman's rescue helicopter.

Short service

In time the Tiger would serve with both the Pacific Fleet (with VA-156/VF-111, VF-24/VF-211, VF-51, VF-121, and VF-191) and the Atlantic Fleet (VF-21 and VF-33) aboard the USS *Ranger*, *Intrepid*, *Saratoga*, *Forrestal*, and *Bon Homme Richard*.

The type's service life with the Navy was destined to be only four years and the last Tigers were phased out by VF-33 and VF-111 in April of 1961. The F11F-1 entered service at the same time as the Vought F-8U Crusader, which was both appreciably faster and proved itself to be a much superior gun platform.

This, combined with the unreliability of the Wright J65 and the Tiger's inability to be upgraded and modified, was to prove its ultimate downfall. Only 199 F11F-1's were built and the project cancelled on January 23, 1959 while examples were still on the production line.

Super Tiger

Grumman was aware of the Tiger's deficiencies and during the mid-50s it had explored the option of producing the F11F-1F 'Super Tiger'.

Dubbed the G-98J, the new aircraft was an advanced version of the Tiger airframe and was to be powered by a new General Electric J79 engine. The Navy allowed two F11F-1s to be modified with enlarged air intakes and YJ79-GE-3 engines and the first example flew on May 25, 1956.



The sole Supermarine Type 508 was developed from the stillborn undercarriage-less Type 505

The second prototype (VX136) was sufficiently modified to warrant a new designation and the Type 529 first flew on August 29, 1952

After the addition of wing root fillets, and a 13.5in fuselage extension, the F11F-1F reached Mach 2.04 in 1957, thus becoming the first naval aircraft in the world to exceed Mach 2. It also established a world altitude record of 76,938ft but the Navy chose not to order the Super Tiger into production.

Undeterred, Grumman chose to market the Super Tiger to foreign customers and although it outperformed the Saab Draken, Lockheed F-104 Starfighter, Dassault Mirage III and Fiat G.91, in a tender to equip the Swiss Air Force the Mirage was chosen on cost basis.

Interest was also expressed by the Luftwaffe, Japan Air Self Defence Force and Royal Canadian Air Force but eventually the Lockheed F-104 Starfighter was chosen – although accusations of alleged bribery by Lockheed staff would later bring the orders under scrutiny. But it was too late for Grumman, who had by then long scrapped the Super Tiger programme.

Blue Angels

Following its withdrawal from the US Navy fleet in the late 1950s, the Tiger

soldiered on for a while as a training aircraft and in September 1962, the F11F-1 was redesignated F-11A in accordance with the new designation scheme. However, by this time, just a handful remained in service and most of those were with the US Navy Blue Angels demonstration team.

The Blue Angels began operating short-nosed F11F-1s in April 1957 and soon upgraded these for long-nosed examples. The Tiger was the first supersonic aircraft operated by the team and it was retained until 1969 when it was replaced by the McDonnell F-4 Phantom. The Tigers were immediately placed into storage.

Revived

Three years later a pair of ex-Blue Angels Tigers were removed from storage at Davis Monthan AFB and issued to Grumman for use as test-beds to evaluate inflight thrust control systems. The trials continued until 1975 when the aircraft returned to the 'bone yard' – the Tiger's flying career was over.

Swept-wing Supermarine

Meanwhile, across the Atlantic the Royal Navy was also searching for a swept-wing jet fighter for its new generation of aircraft carriers. For this it turned to the Supermarine Division of Vickers-Armstrongs, which had



The Type 544 (WT854) performed its maiden flight on January 20, 1956 with Mike Lithgow at the controls. The tailskid was locked down during early flights and the aircraft was also fitted with a large distinctive nose-boom carrying the pitot head and yaw vanes



The third prototype (VX138) adopted a more conventional single tail fin but did benefit from a swept wing



Provision was made for inclusion of flight refuelling equipment, which allowed the Scimitar to operate as a tanker aircraft. A Flight Refuelling Ltd Mk 20A pod could be installed on the starboard inner pylon, carrying 145 Imp Gal and operated from a cockpit panel replacing part of the armament control



In 1961 the Navy's 800 Sqn formed the Red Blades aerobatic team to perform at events across Britain and that year's Paris Air Salon

delivered countless successful aircraft to both the RAF and the Fleet Air Arm.

When it entered service, the Scimitar would be the heaviest and most powerful aircraft to have been built for the Royal Navy, as well as the largest type to have yet landed on a British aircraft carrier. It would also be the Navy's first nuclear-capable aircraft.

Types 505, 508 & 529

The Scimitar traces its history back to the Admiralty's (frankly bonkers) 1947 project to create a jet fighter that could land aboard a rubber deck without the use of an undercarriage!

Testing with a modified de Havilland Vampire went well and in response to a Ministry of Supply (MoS) specification, Supermarine drew up plans for the undercarriage-less Type 505 interceptor. Powered by two 6,560lbs/thrust Rolls-Royce AJ.65 axial-flow engines (later named the

Avon), the straight-winged fighter had an unusual butterfly tail.

However, the rubber landing project was, predictably, scrapped in 1947 and Supermarine redesigned the Type 505 to include an undercarriage, thus the Type 508 was born. The aircraft also increased in size and weight but the top speed fell to 565kts.

The company received an order for three prototypes (VX133, VX136 and VX138) and VX133 made the type's maiden flight on August 31, 1951. Less than two weeks later it was exhibited at the Farnborough Air Show.

The second example (VX136) was sufficiently modified to warrant a new designation and the Type 529 first flew on August 29, 1952.

Both aircraft were used extensively for testing at RAE Farnborough and carrier trials aboard HMS Eagle between late 1952 and late 1953 but on December 2, 1953, VX136 was damaged in a landing accident and was struck off charge.

Type 525

Assessment of the type's flight characteristics was best described as 'mixed', especially at high speeds, and the project was delayed due to aileron flutter.

By early 1954 the third example, VX138, was ready for testing; although the configuration had much changed. A new 45-degree swept-wing was incorporated

and a more conservative single tail fin was employed – with the resulting aircraft designated the Type 525.

Power for the Type 525 came from two 7,500lbs/thrust Rolls-Royce RA.7 Avons and VX138 first flew from Boscombe Down on April 27, 1954. It introduced double-slotted flaps, lift spoilers and tapered leading-edge slots from wingtip to root.

A flap-blowing system was also fitted which saw surplus air taken from the engine compressors being blown at high pressure through slots in the upper wing surfaces. The result was a reduction in approach speed, a reduced angle of attack and lower stalling speed, while stability and control were also improved at low speeds.

On July 5, 1955 the Type 525 was lost during a slow speed handling flight. It entered a spin and despite the efforts of its A&AEE pilot, Lt Cdr Tony Rickell, the canopy refused to jettison. He finally left the aircraft at around 200ft but died of his injuries.

Type 544

By this time the programme had progressed somewhat and the Type 544 was taking shape for the Navy. Three development prototypes were ordered in 1951, with the aircraft designed as a Naval interceptor and strike aircraft capable of operating from carriers or airfields at day or night.

The area rule had not applied to the Type



Scimitar XD240 lands aboard HMS Victorious on September 25, 1958 in front of press there to witness 803 Sqn embark on the carrier. Moments later the arrestor wire would fail and the aircraft would drop off the side of the ship. The pilot, Cmdr Russell, was trapped in the cockpit and drowned despite efforts of crewmen from the rescue Whirlwind helicopter



Scimitar F.1s XD249 (foreground) and XD243 pose for the cameras high above the cloud. XD249 crashed into the Moray Firth off Lossiemouth on January 28, 1964 after the pilot safely ejected when a hydraulic leak prevented the undercarriage from lowering. XD243 was eventually retired to the ranges at Pendine where it was destroyed

525, restricting its capability despite the powerful engines, but the Type 544 featured a 'tight waisted' fuselage cross-section which improved performance.

The first Type 544 (WT854) performed its maiden flight on January 20, 1956 with Mike Lithgow at the controls. Its gun barrel ports were faired over and the tail skid locked down during early flights and the aircraft was also fitted with a large distinctive nose-boom carrying the pitot head and yaw vanes.

The tailplane on the first prototype had ten degrees of dihedral but this was subsequently modified to ten degrees anhedral on subsequent aircraft to help overcome a tendency to pitch-up.

A saw-tooth wing leading-edge, boundary layer fences and changed wingtips were also introduced from the third Type 544 (VWI34). The second example (WT859) was later retrofitted with the Type 525's flap blowing system and VWI34 sported the system from new.

Scimitar

In March 1957 the Type 544 received the name Scimitar and a month later deck trials commenced aboard HMS Ark Royal.

During testing, the Scimitar achieved supersonic flight in a shallow dive and soon the first of 100 Scimitar F.1s on order was rolling off the Supermarine production line at Chilbolton.

Production variants were powered by Rolls-Royce Avon RA.202s and although the aircraft had been conceived as a fighter, the Royal Navy's changing operational requirements meant a shift in role towards low-level strike missions. The first production Scimitar F.1 (XD212) first flew on January 11, 1957 but of the original order only 76 were actually built, the final example appearing toward the end of 1960 and the balance was cancelled.

In service

In squadron service the Scimitar could carry various loads, including: four air-to-ground Bullpup missiles; four Sidewinder air-to-air missiles; four 1,000lb or 500lb bombs; 96 unguided air-to-air rockets or four 200Imp Gal drop tanks.

The aircraft could also carry the 25-kiloton *Red Beard* free-fall tactical nuclear weapon, but this involved the removal of the aircraft's cannon and associated equipment. When carrying *Red Beard*, Scimitars operated from land bases only and employed the LABS (Low Altitude Bombing System) toss-bombing attack method.

The Navy formed 700X Sqn at RNAS Ford as a trials unit in August 1957 and in May 1958 this became the first squadron to fly the aircraft operationally.

A month later 803 Sqn formed at RNAS Lossiemouth and in September of that year it embarked on HMS Victorious for the first time. Further Scimitar operators were 736, 764, 764B, 800, 804 and 807 Squadrons.

On display

Like the Grumman Tiger the Supermarine Scimitar proved itself adept at formation flying and in 1961 the Navy's 800 Sqn formed the Red Blades aerobatic team to appear at events across Britain and that year's Paris Air Salon.

Over the next five years the Navy's Scimitars toured the world on detachments and exercises but the type would never fire its weapons in anger.

In October 1966 the disbandment of 803 Sqn at Lossiemouth brought to an end the Scimitar's front-line career. For the next four years the type would soldier on in second-line roles, and it would fall to the Airwork-operated Fleet Requirements Unit at Hurn to make the last Scimitar flight in December 1970. ●

Left: An impeccable four-ship of Scimitars from 803 NAS led by XD243. All four jets were delivered in late 1958. XD267 was sold to MinTech in 1969 and subsequently scrapped at Shoeburyness in 1991. XD248 was struck off charge at Brawdy in July 1969 after suffering CAT 5D damage, whereas XD250 was written off on February 17, 1966 when it crashed into the Indian Ocean 90 miles off Mombassa while operating off HMS Ark Royal during the Borneo Campaign. The pilot ejected after hydraulic failure and a fire and was picked up by a Wessex from 815 Sqn

SPECIFICATION GRUMMAN F11F-1 TIGER



Crew	1
Length	46ft 11in (14.30m)
Height	13ft 3in (4.00m)
Wingspan	31ft 8in (9.60m)
Wing Area	250sq ft (23.00m ²)
Empty Weight	13,810lb (6,277kg)
Max Take-Off Weight	23,459lb (10,663kg)
Max Speed	632kts (727mph/1,170km/h)
Service Ceiling	49,000ft (14,900m)
Ferry Range	1,275 miles (2,050km)

Powerplant One Wright J65-W-18 reheated turbojet (7,400lbs/thrust dry / 10,500lbs with reheat)

Armament Four 20mm Colt Mk 12 cannon and Four 20mm Colt Mk 12 cannon and four hardpoints for rockets or AIM-9 Sidewinder missiles

First Flight July 30, 1954 (XF9F-9)
December 15, 1954 (F11F-1)

SPECIFICATION SUPERMARINE SCIMITAR F.1



Crew	1
Length	55ft 3in (16.84m)
Height	17ft 4in (5.28m)
Wingspan	37ft 2in (11.33m)
Wing Area	485sq ft (45.06m ²)
Empty Weight	23,962lb (10,869kg)
Max Take-Off Weight	34,200lb (15,513kg)
Max Speed	640kts (736mph/1,185km/h)
Service Ceiling	46,000ft (14,000m)
Ferry Range	1,422 miles (2,289km)

Powerplant Two Rolls-Royce Avon 202 turbojets (11,250lbs/thrust each)

Armament Four 30mm Aden cannon and four hardpoints for bombs, rockets or Bullpup or Sidewinder missiles

First Flight January 20, 1956 (Type 544)
January 11, 1957 (Scimitar F.1)

Left: The last Scimitar operator was FRU at Bournemouth (Hurn). This example, XD236, is seen over the Isle of Wight on June 5, 1968. Three weeks later, on June 26, the radio altimeter failed in bad weather during a sortie for HMS Corunna. The jet flew into high ground in cloud on St Catherine's Down, Isle of Wight, killing the pilot Adrian M Balch





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COMING UP IN THE JULY/AUGUST 2015 ISSUE OF *JETS*



Bronco Demo Team

Bronco

As it marks its 50th anniversary we look back at the career of the Rockwell OV-10 Bronco and Jamie Ewan speaks to Tony de Bruyn about his famous (and immaculate) Bronco warbird

Tactical Fly Off

Paul Fiddian discusses the twin-jet-engined Boeing YC-14 and McDonnell Douglas YC-15, which competed for the United States Air Force's Advanced Medium STOL Transport (AMST) competition to replace the C-130 Hercules



Project Terminated

Pete London looks at the ill-fated FFA P-16 ground attack fighter, which was designed to replace the piston-engined types then in service with the Swiss Air Force. Although it didn't make it into production it did, strangely, spearhead the innovative Learjet programme



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