The Life & Times of the Avro Vulcan, a British aviation icon

www.vulcantothesky.org

4th Test Flight, 6th May 2008, Bruntingthorpe

Dr Robert Pleming FRAeS
Potsdam July 1945 – the start of the Vulcan’s story. Within a month, the USA had dropped two atomic bombs on Japan, and Tory Prime Minister Churchill had lost a General Election in a landslide to the Labour Party’s Clement Atlee, who by the end of August 1945 had proposed to the Cabinet that the UK develop its own atomic bomb. Meanwhile Stalin was tightening his grip on Eastern Europe, and adopting the doctrine of political expansion. President Truman opposed this expansion, leading to the Cold War.
This is Britain’s first production atomic bomb. Code named “Blue Danube”, it had the same explosive power as those dropped on Japan – about 16,000 tonnes of conventional high explosive. The RAF’s three V-Bombers – the Vickers Valiant, the Handley Page Victor & the Avro Vulcan – were each designed to carry this huge device to Russia, in response to a Soviet nuclear attack – the strategy of deterrence was born.
Avro’s Chief Designer Roy Chadwick first sketched out the innovative delta-winged configuration of the Vulcan over 60 years ago in 1946, just five years after the first flight of his other famous creation, the Avro Lancaster. Sadly he died in a plane crash the following year, and never saw his second masterpiece fly. His work was picked up by Stuart Davies, who took Chadwick’s ideas on to fruition.
The prototype full-scale Avro Vulcan VX770 first flew on 31st August 1952, and spectacularly appeared in public at the Farnborough Airshow just a few days later. This picture is from the 1953 Farnborough airshow, and shows VX770 leading the four 1/3 scale Avro 707 research aircraft & the 2nd prototype VX707.
Here is an advertisement for A V Roe Limited from the early 1950’s, extolling British leadership in aircraft design and manufacturing, as exemplified by the Avro Vulcan.

2009 was the 100th anniversary of the 1st flight of the first all British aeroplane, the Roe 1 Triplane.
In all, Avro supplied 134 Vulcans to the Royal Air Force.

The final version of the Vulcan, the B.Mk2, had gracefully-curved leading edges added to its 34-metre delta wingspan, making a beautiful, instantly-recognisable design.
From 1957 to 1969, during the dark days of the Cold War, the Avro Vulcan was the main British contribution to the NATO strategic nuclear deterrent.

For 24 hours-a-day, 7 days-a-week, RAF Vulcans and their crews stood on “Quick Reaction Alert”, to take off within 2 minutes in the event of a Soviet attack. Each Vulcan had a crew of five: two pilots, two navigators and an air electronics officer.

This picture shows a practice “Scramble”.

Latterly Vulcans were equipped with the British hydrogen bomb, code-named “Yellow Sun”, which had a power of 1 million tonnes of high explosive, or a nuclear-tipped cruise missile called “Blue Steel”.

No British bomber ever flew with a live nuclear weapon; the deterrent strategy was a success.
In 1969, the RAF handed its strategic deterrence responsibilities to the Royal Navy’s Polaris submarine fleet. Vulcans flew on through the 1970’s as tactical nuclear and conventional bombers, but the design was so strong and adaptable that some aircraft were converted to entirely different roles. This picture shows a Vulcan carrying a Concorde Olympus engine for tests. Other Vulcans were converted into Maritime Radar Reconnaissance and Air-to-Air Refuelling roles. However by 1984, all but two Vulcans had left RAF service.
The only time the Vulcan was used in anger was during the South Atlantic Conflict in 1982, when Vulcans, each supported by 13 Victor air-to-air refuelling tankers, flew 7 missions from Ascension Island to the Falkland Islands. The 1st “Black Buck” sortie, with the Vulcan armed with twenty-one 450kg conventional bombs, placed one bomb in the centre of the runway at Port Stanley airfield, proving its vulnerability and causing the Argentine invaders to change their plans. These raids captured the world record at the time for the longest-ever bombing mission: a return journey of nearly 8000 miles (12,500km), taking 15 hrs 45 mins.
This is Avro Vulcan XH558 on 1st July 1960, painted in “anti-flash” white, during her delivery flight from the factory at Woodford, near Manchester, to RAF Waddington near Lincoln. XH558 was the first Vulcan B.Mk2 to be delivered to the RAF, and she is now the oldest complete Vulcan in the world.
XH558 was also the last Vulcan to leave RAF service, flying on from 1986 to 1993 as the single RAF Display Vulcan, a career of 33 years. Her final flight was on 23rd March 1993 to Bruntingthorpe Aerodrome in Leicestershire, having been sold off by the Ministry of Defence to C Walton Ltd, a family firm who purchased and maintained her, with the thought that one day, she might be returned to fight. In 1997, a small team headed by Dr Robert Pleming started to put together an audacious plan to return her to flight, but it was clear from the start that the project would be technically challenging & enormously expensive. Never deterred, the team set off down the path that led to XH558’s return to the air.
Over 1998-2000, the start-up team confirmed the formal support of all the manufacturers needed to help XH558’s restoration, and completed a technical review which showed there were no show-stoppers. The real challenge was money – first estimates were that over £3.5million would be required to pay for the restoration.

Eventually a successful bid was made to the Heritage Lottery Fund, who in December 2003 announced a grant of £2.7million for XH558’s restoration, and a large grant for a sister project, the exciting new National Cold War Exhibition at RAF Cosford near Wolverhampton, shown here:
This is the engineering project team in the hangar at Bruntingthorpe Aerodrome alongside XH558, which was purchased for the Nation by the Vulcan to the Sky Trust, a Registered Charity, in March 2005. The team, some of whom worked on Vulcans in the RAF, eventually started work on the aircraft in August 2005.
Non-destructive inspection of wing using X-Rays

The first phase of the restoration was a detailed and complete inspection of the aircraft, her structure and her systems, especially the electrical wiring. The inspection yielded a list of rectification tasks that had to be completed to return XH558 to full airworthiness.
In addition to the Vulcan to the Sky team, many hundreds of people from all around the United Kingdom have contributed to the return of XH558 to flight. This is a list of some of the companies and organisations that have been involved, most of them undertaking significant amounts of work free of charge or at cost.
As an example, here is the team from Goodrich Engine Controls, who overhauled the Fuel Systems from each of the Trust’s eight Rolls-Royce Olympus turbojet engines. This work was done at no charge.
On 31st August 2006, XH558 rolled out of the hangar for the first time in 7 years. This had coincided with a critical funding crisis, but in the last 3 weeks of August, the Trust, with the drive, energy & enthusiasm of XH558’s supporters in the Vulcan to the Sky Club, managed to raise over £1.3million to save the project.
Here is Vulcan XH558 in her hangar at Bruntingthorpe in March 2007, about three-quarters of the way through the two year programme of work to restore her to flight. You can see that the rudder on the fin and the elevon control surfaces on the rear of the wing have all been re-fitted. On the top of the wing, the metal skin has been peeled back to expose the main structure of the wing which provides it with its great strength. Some of this structure was corroded and had to be replaced. At the bottom left in their protective bags are three of the Rolls-Royce Olympus engines, each of which can produce 8.5 tonnes of thrust.
The Vulcan to the Sky Trust has been pleased to welcome many visitors, but one of the most important was Baroness Thatcher, who was British Prime Minister during the South Atlantic Conflict in 1982. Thatcher visited XH558 in March 2007, as part of the 25th anniversary commemorations of the Conflict. She met for the first time some of the Vulcan aircrew who had flown “Black Buck” missions to the Falklands.
The completed cockpit, with modern avionics including GPS.
After extensive tests, XH558’s Olympus engines were started up for the first time in August 2007. A further two months of testing on the ground followed, to ensure that XH558 was 100% ready for flight.
Finally, 14 years after its last flight & with over £7million spent, Vulcan XH558 roared into the air again on Thursday 18th October 2007, a perfect day for flying. An unforgettable day for the Vulcan to the Sky team. A great British project, owing its success to optimism, determination, teamwork and a little bit of paranoia!
Some Press Cuttings from the following day…

**The Times**

**Vulcan flies again after restoration**

**Daily Telegraph**

**The Lord of the Skies**

**Daily Mail**

"After a £6m restoration, the last airworthy Vulcan roars back to life…"
The news of the return of the Vulcan to flight spread right around the world.

Here, celebrating in Ethiopia, is one of our wide range of supporters: a Gelada Baboon, who has the shape of a Vulcan on his chest as a natural marking!
XH558 was finally granted her Permit to Fly on 3rd July 2008, and returned to air displays two days later at a packed RAF Waddington Airshow, her former home. Here she is on that day, in formation with Roy Chadwick’s other famous creation, the Avro Lancaster. There was not a dry eye on the airfield!
Inspiring a new generation of the young in design & engineering

As well as flying Vulcan XH558, the Vulcan to the Sky Trust has major educational objectives: inspiring the young in engineering, and helping people to understand the history of the Cold War (1946 – 1991).

Telling the story of the Cold War
Avro Vulcan, stretched by 2.7 times

First flight: 31st August 1952

Avro Vulcan

First flight: 2nd March 1969

Concorde

This is the X-48B, a 3-metre wingspan scale model of a new design of more environmentally-friendly aircraft known as “blended wing body” aircraft. The model was built by Cranfield Aerospace to a Boeing/NASA design for wind-tunnel tests in 2006. A bigger 11-metre version has subsequently been flown in the USA. Note how similar its shape is to the Vulcan, which was designed over 60 years previously.
But in late 2008, lack of funds due to the economic conditions put the future of XH558 in grave danger.

However with the help of the Vulcan to the Sky Club and the publicity from extensive media coverage, especially in the Mail on Sunday, VTST was able to announce the successful conclusion of the campaign to raise £1 million in pledges on 6th March 2009. In an incredible final six days, over £500,000 was pledged. XH558 survived yet another financial crisis, and flew the 2009 season.

A similar funding crisis threatened to end the flying life of XH558 at the start of 2010, but thousands of supporters rallied to her cause once again, and with two significant legacies, sufficient funds were raised to fly through the 2010 display season.
Avro Vulcan XH558, the only flying Vulcan in the world, has now displayed in front of over 5 million spectators at over 60 events since she returned to the sky in 2007. See http://www.youtube.com/watch?v=IS-Q2UCg9yU

Photo: Neil Bury
For her 50th Birthday on 23rd May 2010, XH558 was named “Spirit of Great Britain”.
XH558 opened the 2010 Farnborough International Airshow accompanied by the Red Arrows on 19th July. In 2012, both Her Majesty the Queen and the Avro Vulcan celebrate their Diamond Jubilees; we are striving to ensure that XH558 achieves her destiny of flying for the Nation that year.

Great progress has been made since XH558 returned to flight: the aircraft is proving highly reliable, and many of the investments in new revenue streams are slowly beginning to bear fruit. But now that the 2010 display season has ended, the current lack of cash is once again putting the flying future of XH558 in grave danger.
To keep XH558 flying at air shows & events and to deliver our inspirational educational activities, the Vulcan to the Sky Trust has to raise over £2million each year, equivalent to about 60p from each spectator who sees her fly.

We are reliant on regular donations from the public and on many small sponsorship contributions; we do not receive any Government funding.

If you enjoyed this presentation, please make a donation, or join our Supporters’ Club, by visiting: www.vulcantothesky.org

If you would like to discuss sponsorship please email: mtrotter@vulcantothesky.org or call +44(0) 7803 141483

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