

A Happy & Safe Christmas to All Our Readers



Gnat XP505 (neg B4849E, Oct 1978, pilot Flt Lt George Ellis) showing air data probes at wing-tips and on the nose



Tornado Model 872, with stores, in 8x8 tunnel, (neg B9683-Bk1A, 1971)

Covid-19 Some 21 or so months into the coronavirus pandemic, it's still with us as the latest *omicron* variant takes hold. The work of the Bedford Aeronautical Heritage Group has been in abeyance in this period, apart from a few talks about RAE's history and legacy, some given by Zoom (to Societies in Norwich and Bristol) and recently, some live in Bedford.

306 Bomb Group Memorial The 306th Bomb Group was a US Army Air Force unit, based at Thurleigh airfield in World War II. It is remembered by a museum on the airfield (see <https://www.306bg.co.uk/>). We learned recently of plans for a memorial to be erected in the village of Bletsoe to nine men killed (only the tail-gunner survived) when their B-17G aircraft crashed near Bletsoe shortly after take-off on 26 April 1944 on a mission to Germany. After some discussion, BAHG decided to make a significant donation towards the cost of this memorial. A video about the appeal can be found at <https://youtu.be/7719kUCslZY>.

Gnat XP505 (with thanks to Graham Foster, Roger Beazley and Dennis Stangroom for additional information) Flight research at RAE Bedford often involved unique aircraft like the Handley Page HP115 and the Hunting Jet Flap. However, other "work horse" aircraft also made major contributions. One example is Folland Gnat XP505, which arrived at Bedford in 1970 and left in 1983.

Gnat XP505 was involved in several research programmes, covering aircraft stability and control, and extensive measurements of atmospheric turbulence.

One of the earliest activities was to extract aircraft stability and control parameters from dynamic flight test data in *calm air*, to generate a mathematical model of the aircraft's behaviour. To support this work, the Gnat airframe was mounted



on a special rig in the hangar (see picture, neg B4705A, May 1978) in order to measure its moments of inertia. Differences from the aircraft manufacturer's predictions helped explain discrepancies between flight and wind tunnel measured values of stability and control parameters. The Gnat was also used to explore the phenomenon of "wing rock", consisting of sustained or even divergent roll oscillations, a form of



behaviour exhibited by many aircraft types during flight at high angle of attack. For this work, Dr Jean Ross (pictured standing by XP505, neg B4718) was awarded the Busk Prize by the Royal Aeronautical Society in 1978.

Later, around 1982, the work on parameter identification was extended to include identification of aircraft stability & control parameters from flight data in *turbulent air*, work which enabled Graham Foster to gain his PhD. Apparently, some of the necessary manoeuvres were very uncomfortable for the test pilots.

In the late 1970s, Gnat 505 had a major refit, which included the installation of new nose & wing-tip incidence/sideslip sensors (as can be seen in the picture above) and a new digital data recording system occupying the rear seat location. With this new equipment XP505 was used to gather time-histories of atmospheric turbulence in a range of weather conditions at low altitude (below 1000 feet radio height) over varied terrain including the Bedford local area, the



Malvern hills, the Welsh mountains (left, *neg B6231P, March 1983*), the Scottish mountains, and over the sea and mud-flats.

An unusual task in 1980 took Gnat XP505 (together with Gnat XP513) to Gibraltar for a trial with the Royal Navy in which a Gnat, flying at 50ft over the sea, simulated an aggressive cruise missile



attacking the Navy's Type 22 Frigate HMS Broadsword, to test the ship's Seawolf defensive missile system.

The picture right (*neg B6257A*) shows the aircraft and its support team – aircrew, ground crew and boffins – after its final research flight on 28 April 1983 (flown by Dennis Stangroom). XP505 was the last flying Gnat in UK service, and is now in the Science Museum store at Wroughton, near Swindon in Wiltshire. This is now open to visitors.

Homage to the Model Makers The four main wind tunnels at RAE Bedford – the 3x3 supersonic, the 13x9 low speed, the 8x8 supersonic and the 3x4 high supersonic – were crucial tools in RAE's aerodynamic research programme and in testing aircraft designs during development by industry. A common factor for all tunnels was that the models to be tested had first to be *made*. This was the role of the model makers, a highly-skilled workforce, using the most advanced machine tools and a variety of materials (see picture of Concorde model being machined, *neg CL3, 1963*). The FAST collection at Farnborough holds many models used in Bedford's wind tunnels.



Models for the supersonic tunnels were generally made of high tensile steel, able to withstand the forces generated at high speeds (left, FD2 model being finished, *neg B4864-Bk1A, 1958*). Wooden models were appropriate for low speed testing in the 13x9.

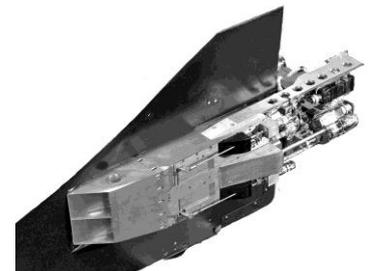
Composite materials were also used, as a finishing layer on a steel core, for tunnel models, and also for free-



flying drop models (Tornado, *neg CL536, 1978*). Depending on the size of the real aircraft, wind tunnel models were typically made at a scale of 1:30 or 1:36. Specialised and complex highly-detailed models, such as Concorde air intakes, below, right (*neg C8976, 1964*), were made at other scales. Models were also made with variable configurations of stores – weapons and drop tanks – as in the heading picture of a Tornado model.



All models had to be finished to a high degree of accuracy, to avoid any blemish on the model that might distort the results. Typically this involved machining to a thousandth of an inch. For some trials, models were made as a “kit of parts” so that a range of alternative configurations could be tested (see picture



left, Gliding Bomb Model 2335 components, *neg A10070, 1994*).

The book “*Wind Beneath the Wings*”, gives more information about the Bedford tunnels themselves, and can be purchased from BAHG (see web site).