



*BLEU Comet 3B XP915 in 1966 (neg B1912)*



*The cover of RAE News from Oct 1956 (See items below about RAE Life & Times, and Web Site)*

**The Versatile Auto-Pilot (VAP) at RAE Bedford (some recollections by Nick Cooke)** The “Versatile Auto-Pilot” (VAP) made its first flight in Comet 3B XP915 some 50 years ago, on 11 September 1968. I had joined the Blind Landing Experimental Unit (BLEU) earlier that year. This article describes how BLEU, for its research on new aircraft autopilot control laws, needed a computer that was easily programmable and capable of being installed in the limited space of a research aircraft’s cabin and most importantly able to carry out the necessary calculations in ‘real time’.

In BLEU, the latest digital computer from Elliott Brothers Ltd, an Elliott 4130, was installed in the old drawing office during 1968. Although the 4130 had progressed from using vacuum tubes in the processing unit to using transistors, the space required to accommodate the machine was large (about 20 ft x 10 ft) and air conditioning units were necessary to control the temperature and humidity in the computer room. This could not be installed in an aircraft. As digital computers were not yet viable for airborne use, the only solution was to use an analogue computer, a very different beast from a digital computer. Whereas a digital computer calculates using numerical representations, an analogue computer processes the same parameters in a scaled-voltage form, with basic mathematical functions performed by specific electronic modules. The analogue computer chosen for BLEU’s airborne research was the Electronic Associates Inc. PACE TR48. This American analogue computer, introduced in 1962, was used in the Apollo moon programme. The TR48 measured 4 ft wide x 2 ft deep x 2 ft high and weighed 420lb with the full complement of electronic modules installed. These plug-in modules consisted of amplifiers, integrators, multiplying units, variable potentiometers, reference voltage points and input/output junctions.

Programming the TR48, for example with a new pitch control law, required appropriate modules to be linked together by inserting “patch leads” into the appropriate sockets on the master patch panel. On a complex program, such as a new pitch or azimuth control law, the patch panel looked like a ‘muddle’ of leads joining various modules together. The patch panel was removable, held in place by an endless chain-driven ram. In all the time that I was programming the TR48, the chain only broke on one occasion, just before the patch panel was required for a flight test!



BLEU purchased three TR48’s, which at \$25,000 per computer was a considerable outlay. One of these was installed in the rear of Comet 3B XP915 (see photo, *neg B2674A*) and the other two were installed in the ‘PACE Lab’ on the ground floor of BLEU. In the lab, one computer represented the aircraft aerodynamics (in a simple form) and the other represented the aircraft’s new control laws being studied. Before flight testing commenced, a considerable amount of laboratory testing was conducted, and then the control law patch panel, from the ground-based TR48, was installed on the Comet’s TR48.

To stand the harsh environment of the aircraft, a special platform was designed at Bedford and manufactured in the airfield workshops. The TR48 was also enclosed in a metal ‘jacket’ and supported on the floor-mounted platform by six heavy duty anti-vibration mounts, three at each end. Installing the TR48 in the cabin of XP915 was not easy. It entered the cabin via the rear starboard door, with only inches to spare. I can remember that it was made as light as possible by removing all of the modules. Even so, an amateur body builder in BLEU was used to assist in the lifting!

The VAP was used for various projects, including improved autopilot glide-path control laws, up to the last flight of XP915 on March 30th 1972. This was Flight 50 of the curved approach path research. The report of this pioneering

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work is documented in RAE Technical Report 73154. The VAP installation was transferred to the Comet's replacement, BAC 1-11 XX105. Similar research continued when XX105 commenced flying in October 1973. The TR48 was finally replaced by an HP digital computer. Digital computers had now reduced in size and increased in operational speed to the extent that analogue computers had been surpassed by modern technology.

It appears from a search of the Internet that only three TR48 analogue computers now exist. One is in the National Museum of Computing at Bletchley Park, the second is in a computer museum in Padova, Italy and the third is in a computer collection in California, USA. The final resting place of RAE Bedford's TR48's is currently a 'mystery'. (A full version of this article is held in the BAHG Archive and is available on request.)

### **New Book - The Life of the Royal Aircraft Establishment Bedford**

Readers will recall that in the March 2017 Newsletter Mike Dobson outlined his work on a compilation called "The Royal Aircraft Establishment – Its Life and Times". This four-volume opus (running to nearly 700 pages) exists only in digital format and currently resides in the care of BAHG. Volume 1 is now accessible, as a down-loadable pdf file, via our web site (see below).

Recognising that much of the content of the compilation was worthy of broader exposure, Mike has now produced an edited version published in the form of a one-volume book. With great help from Tony Manning, he has spent the past year preparing this. Its three parts deal firstly with the creation and construction of the Establishment, secondly with the personnel and social aspects of the Establishment and thirdly, with its final evolution. Much of the material is taken (often by direct photocopying) from the RAE house magazine "RAE News". The largest part by far is the "personnel and social" part of the book, referencing through a comprehensive index over 800 individuals. Mike states that the book has been written primarily to provide a record of events rather than in any expectation that it will appeal to an extensive readership but for any who might be interested, a copy can be obtained via Mike ([mike@mddobson.co.uk](mailto:mike@mddobson.co.uk)) at £15 plus p&p. He is happy to discuss by email before commitment.

**The Higgins** We are currently working with Bedford's Museum, The Higgins, to enhance their exhibit dealing with RAE Bedford - currently called "The Skies Over Bedford" (see image, right) - by adding more about flight research and the airfield. We are also aiming to create a new, separate (short-term) display, hopefully to be ready by March 2019, to tell the story of RAE Bedford's contribution to Concorde. Next year, 2019, will be the 50<sup>th</sup> anniversary of Concorde's first flight. Bedford's research for Concorde included extensive wind tunnel testing and flight research using the HP115 and BAC221 aircraft. Another example is Lightning XN725 (see image, *neg B3345H*), used to explore Concorde's climb profile. Can anyone tell us more? Does anyone have stories about the HP115 or BAC221? If anyone has recollections of this work to pass on to us, or any relevant objects which could be exhibited, we would be very pleased to hear from you. We will keep you informed on progress.



**FASTA AGM** FASTA is the membership part of the Farnborough Air Sciences Trust, our "parent" body. The FASTA AGM will be held on 20 Nov 2018, at Farnborough. As usual, we will give a short report on our activities over the year.

**Talks** During the past year we have continued to give talks about RAE Bedford to local societies, including the Bedford Architectural, Archaeological & Local History Society, the Amptill & District Local History Society and Thrapston Vintage Tractor Group. We are open to further invitations.

**BAHG Web site** We continue to update this site. The most recent posting is Life & Times Volume 1, for the period March 1948 to December 1959, in down-loadable pdf format. This was compiled initially by Mike Dobson (as outlined above) and has been reviewed and edited by the BAHG team. We in BAHG hope it will be of interest to past employees and their families. Further volumes will follow. We would like to hear your reactions.

**Early Days** The picture here shows an aerial view of the wind tunnel site during construction in November 1955. The 8ft tunnel is well under way, in the centre of the picture, with cranes (*neg B3428-Bk1A*). The 13x9, the Vertical Spinning Tunnel and the High Speed Lab were already complete and in use.

