

INDIVIDUAL HISTORY

**SEPECAT JAGUAR GR.1 (mod) XX765
MUSEUM ACCESSION NUMBER 1996/0168/A**

- 1975 Built to GR.1 standard as the 62nd production Jaguar to be built at British Aerospace's Warton, Lancs Unit of the 203 delivered to the RAF, of which 165 were the GR.1 tactical strike fighter variant. Serials block XX719 - XX768.
- 13 Jun 75 First flight.
- 2 Jul 75 To No. 14 Squadron at RAF Bruggen, West Germany. Also loaned to No.17 Squadron.
- 3 Dec 75 To No. 226 Jaguar Operational Conversion Unit at RAF Lossiemouth.
- Jun 76 Stored at JMU Abingdon
- 4 Aug 78 Flown to BAe at Warton to be extensively modified from mechanical rod operation of the control surfaces to Dowty Boulton Paul's electrically signaled digital Fly-By-Wire (FBW) standard; this system was envisaged as being necessary to stabilise control of the next generation of air superiority fighters which would be of unstable and of unconventional aerodynamic design. There was no mechanical reversion system.
- 20 Oct 81 Flown by BAe Warton's senior Experimental Test Pilot, Chris Yeo, the Warton based XX765 became the first aircraft to fly with an all digital quadruplex fly-by-wire flight control system with no form of reversionary (back up) control. The actuators were provided by Dowty Boulton Paul. Painted in the traditional MoD (Procurement Executive) 'raspberry ripple' gloss signal red, white and Oxford blue paint scheme with forward fuselage and wing roundels and light grey, outlined in white 'FBW' initials on the fin, plus the RAE crest and BAe badge on the nose. Photos - Air Pictorial May 1991 p.4; Aircraft Illustrated April 1991 p.175; Aircraft Illustrated Sep 1996 p.88; Flight International 12 Sep 1981 p.816; Scale Aircraft Modelling May 1995 p.112 and June 2003; Sepecat Jaguar in Action/Aircraft Number 197, Squadron Signal Publications p.39; Aeromilitaria Spring 2010 p.4. Colour profile and in-flight colour photo; Jaguar Squadrons Ward 2010.

See also profile in Scale Aircraft Modelling May 1995 p.116 and On Target; Profile 10 Sepecat Jaguar in Worldwide Service (Sands/Freeman) p.29.

The test programme at Warton, A&AEE Boscombe Down and Royal Aircraft Establishment Farnborough, Hants progressively expanded the flight envelope from a basic stable configuration to a highly unstable aircraft; this involved fitting, in 1984, large leading edge strakes to move the centre of lift forwards, and provision was made for 5 cwt. of lead ballast to be carried in the rear fuselage to move the centre of gravity aft.

The initial flight and the following four flights completed phase (a) of the project in just five flights when six to ten flights had been expected. These trials comprised a basic shakedown of the airframe, engines and standard aircraft systems; preliminary assessment of the flight control system; confirmation of safe aircraft handling within a limited flight envelope and checks of airdata sensor calibration. For phase (a) of the trials the Fly-by-Wire equipment used Issue 1a control laws in the fixed gains (Training) mode. For these flights the aircraft flew clean of stores.

19 Nov 81 First flight of phase (b) flying using the same Issue 1a control laws in the fixed gains (Training) mode as used in phase (a). Phase (b) added trials involving flutter testing so that the aircraft could clear the flight envelope, rapid rolling and ground attack dives to the limited of the limitation imposed by the trials.

Phase (b) had been programmed for eight to twelve flights and was completed in eight. Over the two phases, which were reported together Aircraft handling was assessed up to 550 kts/1.26 Mach and the aircraft proved to be very easy to fly, with no sign of Pilot Induced Oscillation or overcontrol. General handling assessment, rapid rolling, formation flying, aerobatics, ground attack tracking and turbulence penetration were also assessed, with very satisfactory results. A 'roll hunting' phenomenon at high subsonic speeds and poor handling in Spin Recovery Mode were the only two features of the aircraft criticised in the initial phases of flying.

After these trails the aircraft was cleared for 600 kts at high altitude, and 550 kts below 20,000 ft. This latter clearance was superseded by the Flying Control System being limited to only 500kts at low altitude.

The Flying Control System operated satisfactorily throughout these trials, the only glitch being due to a delay on a quadruplex undercarriage selector switch. For these flights the aircraft flew clean of stores.

10 Nov 82 First flight of phase (c) flying. This phase was to assess Issue 2 fully scheduled control laws in Normal mode across the flight envelope. Although engine problems were encountered the aircraft completed flutter testing to clear the full flight envelope of the standard Jaguar, verification of secondary sensor operation and an assessment of Training mode and Spin Recovery mode in nine flights. The aircraft flew clean of stores.

10 Mar 83 First flight of phase (d) flying. Objectives being the extending the Issue 2 fully scheduled control laws in Normal mode to assess the aircraft when fitted with underwing fuel tanks, at normal and reduced levels of longitudinal stability.

Phase (d) was completed in five flights, with a sixth and a seventh flight being flown by a Royal Aircraft Establishment test pilot. The sixth and seventh flights were flown with and without stores respectively.

The flight envelope was extended up to 625kts/1.25 Mach for the clean aircraft and 580 kts/0.95 Mach when fitted with underwing tanks. Handling was assessed as very good when clean and better than a conventional Jaguar when the underwing tanks were fitted. Rectifications to the issues shown in phases (a) and (b) of flying were seen to be successful.

Rapid rolling, formation flying, air to air and air to ground tracking and turbulence response were assessed. All were found to be very satisfactory except rapid rolling which was assessed as excellent.

Criticisms were a slightly harsh pitch response, a 'looser' response in turbulence compared to Issue 1 control laws and a reverse trim effect in pitch.

Flying control system continued to perform very well with the only issues caused by faulty sensors.

Feb 83 Start of phase (f) of flying. Objective being the inclusion of the Stall Departure and Spin Prevention Function in the Flying Control System control laws.

Conditions of these trials included extensive test deployments of spin recovery parachute both on the ground and in flight. These showed up a weak link in the parachute delaying the project.

April 83 Trials resumed after rectification of the parachute assembly. Phase (f) of high incidence flying was completed in ten flights with excellent results. During the 7 high incidence test flights, 43 manoeuvre sequences were performed at full back stick, and despite very aggressive manoeuvring, there were no signs of control loss, the aircraft being completely under control throughout. A progressive series of tests was performed by the two pilots working up to very severe dynamic manoeuvres, and concluding with a simulated combat assessment by each pilot.

These test generated a high level of confidence in the Stall Departure and Spin Prevention Function control laws. Flying Control System performed adequately but one flight was cut short due to sensor warnings.

4 July 83 Start of phase (e) of flying. Flew with Issue 2 control laws in a stable configuration. Tailplane jack altered for later tests and required load testing before the alteration of control laws.

Transferred to A&AEE Boscombe Down for High Frequency susceptibility testing during the remainder of July and early August.

15 Aug 83 First flight with Issue 3 control laws in a longitudinally unstable configuration. Test phase was completed in 9 flights, of which 2 were in the nominal 0% c configuration (underwing tanks with auto fuel sequence), and 6 in the nominal -3% c manoeuvre margin configuration (underwing tanks with manual fuel sequence).

Trials were completely successful. Handling qualities were excellent throughout the envelope assessed (580 kts/Q.95 Mach), in Normal mode, and manoeuvre margins of -4% c were achieved. Issues with Issue 2 software had been eliminated. Training mode was assessed again and viewed as an adequate 'get you home' backup function.

Air to air, ground tracking, acrobatics, formation flying and turbulence penetration were all assessed as being very good. The unstable configuration was undetectable by the pilot.

16 May 84 Start of phase (g) of flying. Aircraft fitted with large leading edge strakes and moveable internal weights to make it highly unstable.

For these trials the aircraft would fly clean for seven flights over a three week period.

Handling was assessed as excellent across the whole flight envelope with both BAe pilots saying the control laws were the best achieved on the programme, though there was a slight over compensation in yaw, roll and some issues when on approach with undercarriage up. Ground attack dives were assessed as being good and flying control systems behaved faultlessly.

20 June 84 Start of phase (h) of flying. Aircraft retained the leading edge strakes and moveable internal weights to make it highly unstable but gained the underwing fuel tanks to make it the most unstable it could be.

Trials in this configuration included an assessment of air-to-air refueling with an RAF Victor tanker (no fuel was passed between the aircraft), formation flying, air to air and air to ground tracking. Aircraft handling qualities were generally very good, particularly so at high incidence where behavior was described as excellent, much superior to the standard Jaguar with underwing tanks. The air-to-air refuelling task was very easy and straightforward to fly, and there were no adverse aerodynamic interference effects between the refuelling basket and the aircraft ADD probes. In close formation, and air-to-air tracking, the aircraft could be flown easily and accurately, and spot tracking during a ground attack dive in turbulence was assessed as excellent, twice as good as a standard Jaguar. As with the clean configuration, the aircraft tended to over-respond to turbulence, but was still rated as easy to fly, even in heavy turbulence. FCS behaviour was very good.

11 July 84 First flight in most unstable configuration possible. Flight trials completed successfully in just five flights. The detailed handling and rapid rolling assessment was performed, together with a more operational assessment comprising air-to-air and air-to-ground tracking, formation flying, air-to-air refueling with a VC 10 tanker, and aerobatics. Pilot comments were very favourable, with handling characteristics being rated as generally very good, and better than a standard Jaguar by a significant margin. In particular, the operational assessment gave generally excellent results; only in fine tracking was the aircraft less good, with a pitch bobble, and somewhat poor initial roll response. Although the aircraft exhibited the same tendency to over-respond in turbulence as the other unstable configurations, when compared with the Hunter chase

aircraft, the FBW Jaguar response to turbulence penetration was very good. FCS behaviour continued to be very good.

Four extra flights (two clean, two with tanks) were flown by an RAE pilot after the BAe trials ceased. The findings of this pilot predominantly backed up the BAe findings though he found the aircraft more difficult in turbulence and in the circuit.

Sep 84 Appeared at the SBAC Show, Farnborough. Demonstration flights were made.

15 Mar 84 First flight in this further modified form-fifth series of tests. Used for EAP and Eurofighter control systems development work. Photo in this form – Aeromilitaria Spring 2010 p.5.

Destabilising ballast was also carried in the underwing fuel tanks for some tests. A test probe was mounted on the nose. The RAE test pilot on the Jaguar was Squadron Leader Jon Pierce. The demonstration of the automatic stall departure and spin prevention system produced some impressive aerobatic manoeuvres, never previously attempted on a Jaguar. Test pilots tried to beat the system and make the aircraft spin, but did not succeed.

Latterly known as the Jaguar Active Control Technology (ACT) demonstrator aircraft. Once this aircraft had successfully proved the concept the systems developed were incorporated into the Eurofighter 2000 (Typhoon) project.

Sep 84 Appeared at SBAC show, Farnborough. Flight trials concluded, XX765 having made 96 flights in its modified form.

Nov 84 Withdrawn from use and stored.

86 Acquired by British Aerospace and used for ground tests relating to Electro-Magnetic Compatibility (EMC) technology development work.

The aircraft was also used to assess modern techniques of dry paint stripping, and was re-sprayed in a dark green camouflage scheme with 'ACT' on the fin (replacing the original 'Fly-by-Wire - FBW' markings) and the British Aerospace logo in place of the forward roundels. In storage by May 1987.

- 16 Jan 91 In a ceremony at Warton Aerodrome, British Aerospace (Military Aircraft) Ltd., Warton Unit, handed over XX765 to the Loughborough University of Technology, Leicestershire for use as a ground teaching aid for students from the University's Department of Transport Technology (later the Department of Aeronautical and Automotive Engineering and Transport Studies) studying System Engineering and Aeronautical Engineering. Photo of presentation - Air Pictorial May 1991 p.4.
The Jaguar replaced the prototype Jet Provost 1 G-AOBU which initially moved to the Shuttleworth Collection.
- Jan 91 Moved by road to Loughborough. Photo being unloaded on arrival; Aviation in Leicestershire and Rutland p.230.
- 25 Jun 96 By road to the Aerospace Museum, RAF Cosford, Salop on loan from British Aerospace. Joined the collection of research and development aircraft displayed at Cosford, on show from 18 Sep 1996. Photo as displayed at Cosford November 1996 - Wrecks And Relics 16th Edition 1998; Flypast Dec 1996 p.15 and Flypast March 2000 p.110.
- The aircraft was replaced at Loughborough by the Experimental Aircraft Programme (EAP) Development aircraft ZF534 which arrived two days later.
- 13 Sep 99 Following dismantling the previous week, returned to BAe Warton for repainting in original 'Raspberry Ripple' colour scheme. Moved by road by team from RAF Abingdon.
- 10 Nov 99 Returned by road to Cosford following the repaint and placed on display from 17 November. Photos as completed - Flypast January 2000 p.9; Flypast March 2000 pp. 110 - 111; Aircraft Illustrated January 2000 p.86.

TEXT; ANDREW SIMPSON and NICK STURGESS

© ROYAL AIR FORCE MUSEUM 2013