RL 868-1953

Auto 720 and its Variants

Auto 720

This was the first project that I supervised as Head of Initial Projects when I took over this job in October-1951. It started with an OR (Operational Requirement) for an interceptor which was required to climb from sea level to 60,000 ft. in under 3 minutes, intercept an intruding aircraft and destroy it, and return to base and make a dead-stick landing. There were other requirements for airfield basing and manoeuvrability but the rapid climb was the prime requirement. Multiple rockets were to be the armament in some sort of retractable "egg-box" container. The power plant was to be a rocket motor and at the time two candidates were being developed. One was the Armstrong Siddeley "Screamer" utilising Liquid Oxygen as the oxidant and Kerosene the fuel; the other was the de Havilland "Snarler" which used HTP (High Test Peroxide) and Kerosene. Both engines were about 8,000 lb thrust at sea level (slightly more at 60,000 ft.) and were throttlable for varying thrust. The proposals had to be submitted by about March 1952 but before this time the Ministry altered the specification to include a separate turbojet to give the aircraft more flexibility by allowing a 2 hour "stooge" at 40,000 ft. on the jet, then a rapid climb to 60,000 ft in less than 1 minute plus acceleration to supersonic speeds (top speed M = 2.2) then a descent with the jet alone followed by a normal landing. The armament was also changed to include a pair of 'Firestreak' infra-red homing missiles (heat seekers) plyon mounted, one under each wing.

Our proposal included studies of both rocket engines together with a single Armstrong-Siddeley 'Viper' turbojet as an interim measure. Late versions would have the de Havilland Gyron Junior (8,000 lb. S.L. thrust) giving it a thrust to weight of ~~about~~ about 1.0 with the rocket engine once the aircraft weighed

about 17,000lb. fully loaded. The Gyron Junior could also confer better subsonic performance without the rocket. We preferred the liquid oxygen/kerosene aircraft because of the better Specific Impulse, but on the negative side the boil-off of the cryogenic LO_2 at -297°F compared with the non-cryogenic nature of HTP was a problem for aircraft at readiness. To achieve a low structure weight of less than 20% of the gross weight, AVRO developed an aluminium honeycomb capability including a machine to manufacture the honeycomb core. 85% of the structure was honeycomb sandwich construction including most of the fuselage, wing and vertical stabilizer. The aircraft was a tailless 60° swept delta configuration with a 4% thick wing into which the whole landing gear was retracted without any external excrescences whatsoever. Operational empty weight including armament was 8,051.5 lb which with 9,763.0 lb of 'fuel' gave a take-off weight of 17,814.5 lb. Interestingly, this aircraft had almost identical performance (ie T.O Weight) to the F-16 Fighting Falcon except it was <u>20 years</u> ahead in time and could actually fly much higher but had less subsonic range.

There were, I believe, 13 proposals submitted by all the major aerospace companies in the U.K. (at that time there were about 22 companies) but <u>Avro</u> with the 720 and <u>Saunders-Roe</u> with their HTP/Kerosene proposal won the Competition to build aircraft. Avro were told to design the LO_2/kerosene version so that there could be a comparative evaluation of the two different propellants. In the event, both were overtaken by rehead developments and the next interceptor to be developed was the 'English Electric' Lightning (F3/49). The Saunders-Roe aircraft did fly and the Avro 720 very nearly got there but later both were cancelled, the 720 in the infamous Duncan Sandys era of 1956. Before this happened, several versions of the ~~Avro~~ 720 were projected including the following:-

Avro 725 - Advanced Trainer

This version utilised the basic layout of the 720 wing, fuselage and tail unit but added a second tandem seat where the LO_2 tank was located, removed the rocket engine and had either a single de Havilland P535 or ~~Armstrong Siddeley~~ Bristol B.E.21c ~~Viper~~ turbojet. With the lower weight resulting from the removed rocket and LO_2 fuel the 8,000lb thrust jet still gave excellent performance in the subsonic and low supersonic range. This project was initialled in November 1953.

Avro 726 – Lightweight Fighter

Another version projected at the same time as the Avro 725 (Nov 1953) featured a single seat inexpensive, single engine fighter, again using mostly 720 structure. The preferred engines were either the PS35 or the Armstrong Siddeley AS-P151 turbojets. This aircraft had good subsonic manoeuvrability and some low supersonic capability and was intended for 'third world' sales, like the MIG-21 and Northrop F-5.

Avro 727 – Ground Attack Aircraft

In late 1953, NATO issued a specification for a high subsonic ground attack aircraft and AVRO responded with a version of the 720, but using a single Bristol "Orpheus" turbojet and loaded with armament (rockets and bombs etc). I went several times to NATO headquarters (then in Paris) and we had a very good candidate, but it was obvious that they wanted to build up the German and Italian aircraft industry. As a result the Fiat G-91 aircraft, designed from scratch but also using the 'Orpheus' engine was chosen and was built in Germany (by Dornier) and Italy and I believe bits were made in several other countries of NATO.

Avro 728 – Navy Version

This version was developed in Canada 1955 after I had left AVRO to join Fairchild in the U.S.A. so I am not familiar with the details.

- None of the AVRO 720, 725, 726, 727 or 728 variants were related to Project 'Y', although the alternate reflected by the Avro 724 did utilise the wing planform and thickness of the 720 but with a clipped tip to reduce span from 27.3 ft. to 24 ft.
- The Avro 720 proposal consisted of two volumes each 3" thick and for about 6 weeks we in the Project office spent night and day in shifts preparing all the fold-out drawings and typewritten script.