

My TSR.2 Memories

As a 26-year-old engineer, with expectant wife, in 1960 I joined a team at Kelvin Hughes (part of the Smiths Group), led by Charlie Glass, designing and developing what we knew as the OR343 Airborne Rapid Photographic Processor, to go into the new TSR.2 aircraft being designed and developed by BAC.

The Royal Radar Establishment at Malvern let the contract under the leadership of Mr. D.McKay, with whom I am still in touch. The aim was to provide the navigator with a real time moving map display, using live data from the sideways looking radar. The equipment took the form of the left hand half of the navigator's console that sat immediately in front of him, and between his legs, with a sloping front, down which the developed radar photograph passed. The philosophy was to record the sideways looking radar line scan information onto photographic paper that was moved in front of a small EMI CRT display, at a speed proportional to the aircraft's ground speed. This latent image was then developed, fixed, and dried in order to generate a photographically stable image, which could then be immediately compared with the navigator's pre-printed moving map on the adjacent display.

The equipment (using the then new fangled transistors) had to enable the navigator to mark co-ordinates located on the radar image, and compare them with those on the conventional moving map display, and update and correct for any errors caused by drift etc, and also confirm the radar shape and position of potential targets. (There was no Satellite Navigation in those days).

The concept was cutting edge, and presented both novel and potentially hazardous problems, not the least of which was having

corrosive liquid photographic chemicals flowing over the photographic paper, on board a mechanically unstable environment. We were eventually enabled to find a solution thanks to the efforts of the Ilford Film Company, who designed a special blue sensitive paper and film emulsion, that was sufficiently robust to stand up to the physical abuse the equipment piled upon it.

Over the next 4 years (perhaps the most exciting and interesting time of my working life) I attended a number of rather large (and sometimes lavish) project meetings at BAC Weybridge, Farnborough and Boscombe Down, where I got to know some of the dedicated designers. One of the BAC staff that I vividly remember was a quiet Chinese gentleman by the name of Mr. Yee, who I must admit, surprised me by speaking perfectly in a broad Lancashire accent.

Having actually sat in the navigator's seat in the wooden cockpit mock up at Weybridge, it was obvious to me quite early in the project, that this aircraft was going to be something really different and very special. The cockpit seemed to be miles in front of the wings, and whose wingspan was similar to that of a Spitfire. It had a novel fully pivoting tail plane, to provide awe-inspiring manoeuvrability, and two engines (one of which had been shown to be sufficiently powerful to actually drive a Vulcan Bomber) with sufficient static thrust (which we reckoned would enable it to take off vertically) to provide a mind-blowing rate of climb.

One particular test I remember was when I had to sit in a special mock-up of the navigator's cockpit at labs in Virginia Waters. Hydraulic rams threw the whole contraption about to simulate the terrain following profile, (thankfully somewhat attenuated) in order to test whether the film's processing fluids would leak out. Our design proved up to the task, but it was one hell of a ride. I reckoned it was rather like sitting on the

backboard of a pick-up truck travelling diagonally across a ploughed up field at high speed. I reckoned that if and when the terrain-following task was done in anger it would probably shake the crew's teeth out.

But in 1962 a shadow fell was cast over the project when the Shadow Defence Minister in the Labour opposition Dennis Healy, prophesied that if and when Labour ever came to power he would cancel the project. In fact there was one story that said that a BAC team had travelled to Australia on a TSR.2 sales mission, and when they landed they were greeted with "we don't know why you have come over here, your next government have told us they intend to cancel the project so bye bye!" We really could not believe that anyone could be that short sighted and naively pressed on in haste to get the design "set in concrete" before the next election.

In the autumn of 1963 the design was complete, and I was asked to organise and run an AGREE reliability test on the equipment at a facility at BAC Stevenage. The facility was built specially to my specification to enable myself and one other chap to freeze the equipment overnight at -40°C in an environmental test cabinet that had been built and used to test the Blue Streak Missile, (another brilliant piece of kit that was cancelled). Then when we arrived on site at 08.30am we would immediately wheel our kit out and straight into the neighbouring test room, which was kept permanently at $+35^{\circ}\text{C}$, and switch it on! This was obviously not to the equipment's liking and it would tend to creak and groan whilst it started to work. The idea was to thermally shock the equipment to simulate a rapid start up on a cold airfield, so as to iron out any potential bugs. After setting to work everything went well and the equipment performed perfectly without a single significant failure.

But on Tuesday April 6th 1964 (Black Tuesday) despite all the

progress that had been made, Mr. Dennis Healey, now Defence Minister in the new Labour Government carried out his threat and cancelled the whole TSR.2 project on the totally spurious excuse that we couldn't afford it!

One of the arguments put forward was that if the plane was ever used in anger, it would be a suicide mission, because it did not have the fuel capacity to return from the likely target area (in Russia). But that was not part of its requirement, and they didn't admit that if it were ever used in anger, then the whole world would have gone mad, and there wouldn't have been an airfield for it to return to anyway! No I firmly believe it was only cancelled to satisfy the demands of the far left of the Labour party, who did not want the UK to have its own independent nuclear deterrent, so as to prevent a serious split in the party.

The cost of designing and building the development squadron of 20 aircraft was estimated to be going to be in the order of £500M, and this was argued to be unsustainable. But XR219 (the engine test bed) had already flown many hours at Boscombe Down – which in the hands of “Bee” Beamont was witnessed by a compatriot of mine, to easily outmanoeuvre the best fighter that we had at the time – the English Electric Lightning, two of which were being used as chase aircraft in the early flight trials. The second, third and fourth aircraft were already well into their ground trials, and I heard that the second was only prevented from taking off by fog on the morning of Sunday 4th April 1964 only two days before the cancellation. It was stated at that time that we had already spent £350M, and that the estimated project completion costs for all the twenty development aircraft had increased to about £200M making a total of £550M, making an overrun of only 10% - not bad by modern standards. However it was admitted that the cancellation costs were

going to be over £160M above the £350M already spent, making a total of £510M. Thus the saving would only be £40M. I had already seen the first 18 aircraft taking shape in the Weybridge Hangar, and all the subcontractors had virtually completed their required 20 sets of parts for the full development flight programme. So this additional sum of only £40M, we could probably have completed a development squadron (certainly a reduced one). Which could then have used flight tests etc and even cannibalised, if necessary to complete the design.

Another of the government's spurious arguments supporting cancellation was that the US swing-wing F111 aircraft was equally good and in fact cheaper – so we would buy that instead. But it was not designed to do the same job, and surely we had already committed £510M on a large scrap heap. Now before the cancellation was announced there had been an official assessment of the two aircraft's relative performances, in order to justify the decision. One of the RAF officers on the assessment team that I knew quite well told me that in his view the questionnaire was carefully rigged. For example one of the questions asked of the assessment team was could the F111 fly at 600 feet at 600 mph and terrain clear like the TSR2. Well of course it could – no problem – but the next question that should have been asked was not included, namely could the F111 fly at 60 feet at 600mph and terrain follow – the answer to which would have been of course not! So where was the real comparison? How could we possibly afford to buy the preferred replacement, which the industry knew would be a white elephant? From where did they get their economics? In fact it was not many years after that that we were to learn that the F111 was unreliable, and some said could even be shot down with a rifle!!!

Now you have to appreciate dear reader that when so many

people put their heart and soul into a project over so many years, only to have it cancelled for anything other reason than a failure to meet its requirements, is a colossal psychological as well as financial blow. On the Tuesday when the cancellation announcement was made, the whole industry was in a state of incredulous shock, and grown men at Weybridge walked out in tears, just switching off the power breakers and slamming the doors in frustration.

But as if cancellation was not bad enough by itself, the government then ordered that all the aircraft (except XR219 and apparently XR222) were to be destroyed in such a way that the parts could not be re-used! I saw things like the massive (and very expensive cable forms with the latest high tech cable and connectors) being cut up with hacksaws. I just could not believe my eyes. Later I learnt that the airframes were taken by road overnight to Shoeburyness and used for target practice for rockets under the excuse that they had to test their efficacy! But hang on only a few weeks before the cancellation, some 112 Valiant V Bombers had been grounded because of an inherent airframe fatigue fault, and so they could have used those!

I also learnt from someone at Weybridge that the US Air Force had in fact negotiated a provisional order for 100 TSR2's some time before, and that within 24 hours of cancellation they had instead bought 100 of the Elliott TSR2 Inertial Navigation systems to fit to their Crusader aircraft!

By now I had 3 children (1 pair twins) and one of the direct effects of the cancellation meant that Kelvin Hughes lost some 30% of its business overnight, which almost collapsed the company. This meant that Smiths (which was a major shareholder) had to take us over completely, whilst the management fought to keep the business going. Naturally I

was most concerned as to how I was to keep going, particularly during the series of 7 declarations of redundancy over the next 8 years accompanied by much uncertainty and unrest. However unlike many I was able to stay employed, and having changed my company finally retired in 1998. But the rest of my working life was never like those exciting days again, and having changed employers my pension suffered. But am I bitter? You bet your sweet pension on it. I only hope that one-day the real truth will come to light, and the reasons given for cancellation be shown to be nothing more than political opportunism, and official vandalism of the highest order.

Best wishes to all the TSR.2 designers, engineers, and technicians.

Cliff Frost.