

## Ferranti and the Buccaneer S1 Weapon Delivery System.

It is fair to say that many people consider Blue Parrot as a modified AI23, the worlds first Monopulse Tracking Radar to go into Squadron Service, and indeed there is some justification for this. The Admiralty had the initial idea of making use of a system that was already well into its development. Monopulse Tracking would in fact be an essential part of the Weapon Delivery System envisaged.

This aspect, and the detection of the Russian Sverdlov Cruiser, would form the basis of a commission, placed upon Ferranti Crewe Toll in 1956, with reference to the NA39 Project.

There were some internal differences of opinion within Ferranti, as to how best to approach this objective. Donald McCallum's, (later Sir Donald), intention to utilise AI23 technology, wherever possible, thereby avoiding unnecessary duplication of design and effort, prevailed. However, RRE Malvern's insistence in the incorporation of certain notable design changes, that in the end would be designed out, and the Nose Break Radar accommodation dimension and shape, would render Blue Parrot as an entity in its own right. AI23 would contribute Transmitter design, the main RF Block, providing a three-channel output of Sum, Azimuth and Elevation, the Lock Follow Range Gates system, the Scanner drive system, via magnetic clutches, and the original Aerial type. The AI23 design team have long since entered into the Ferranti folklore as engineering giants in the Airborne Radar world. The different shape and dimensions of the resulting design would allow most of the major subassemblies to be removed by simply unplugging one or two McMurdo connectors, and unscrewing a few bolts. In AI23, it was mostly a case of unwrapping 60 or so joints, and hope that you have removed the subassembly with the fault.

Wrapped joints had their place; and were used as the most reliable method of connection in what was a fairly

hostile environment. The final element in the definition of Blue Parrot as an entity, was its interface with the Ballistics Computer system, code named Strike Sight, and with the Blue Jacket Doppler Air Data System.

The initial flight trials of Blue Parrot were carried out using the Ferranti Flying Unit's Dakota, TS 423. The Pulse length to start with was 1 uSec, a la AI23, against such targets, as a Trawler with area enhancing reflectors, to simulate the returns from larger vessels. The results were very encouraging, but due to the altitude limitations of the aircraft, practical demonstration of detection at longer ranges was not possible. With the predicted ceiling height of the NA 39 given as 35,000 ft, the maximum theoretical range to the earth's surface was accepted as 240 Nms. To utilise this, a PRF of 316 pps was adopted, and to test this to the limit, the trials aircraft was changed to a Canberra, to be followed latterly, by Buccaneer XK 487. As in AI23, Ferranti decided to stay with X-band as their preferred option, using a 4J50 style Magnetron from English Electric, the CV 2427. This was a fixed frequency device at 8.916 Ghz with a peak output of 180 Kw. The preferred option of a 1 uSec pulse length, for better target resolution, did not prove to be totally ideal when operating to the 240 Nm limit.

The results of long-range detection trials, based on the objective to detect the Russian "Sverdlov" Class cruiser, at as great a range as possible, showed that a 2-uSec pulse length was necessary.

When the Intensive Flight Trials Squadron, 700 Z, was formed at R.N.A.S. Lossiemouth in 1961, the avionics system of Blue Parrot/ Strike Sight along with Blue Jacket, did not exactly cover itself in glory. Many pain-staking hours were devoted by RN and Ferranti onsite and home based engineers, in the pursuit of working calibrated systems.

There can be no doubt about the major contribution, in terms of the quality and quantity of the effort, afforded by 700Z. The Buccaneer and all the participating Companies owe an immeasurable vote of thanks to the I.F.T.Units'

never say die attitude. As Commander Leahy commented in one of his monthly reports, "dark haired men have gone grey".

The first real opportunity that Buccaneer crews had to test the system, was their participation in Exercise Fairwind Seven in June 1962. A total of 14 Sorties were flown against a North Sea convoy, and apart from the first, all other sorties located and carried out simulated attacks against individual ship targets. Heavy cloud cover on the earlier sorties, resulted in shorter initial detection ranges by Blue Parrot, from 100 to 140 Nms, whilst in clear conditions, ranges of 180 Nms were achieved.

The long-range detection capability of Blue Parrot was further verified, flying at 35,000 ft, the coastline and high ground of Norway could be "seen" at 240 Nms, even the low lying parts of Denmark came up at 220 Nms. The Moray coastline could also be painted at such ranges, whilst the Buccaneer remained undetected by the Type 80 Ground Radar at RAF Buchan.

This level of capability would subsequently be a godsend, to many an Observer or Navigator in the years to come, on occasions where violent evasion manoeuvres at low level had resulted in the Nav System being less than accurate as to the present position.

Many thought provoking aspects and ideas came out of those 16 months or so; some being addressed within that time frame, the local introduction of a 15 Nm range being one.

In time the Double Parabolic Aerial would be replaced by a Cassegrain design, a Monopulse Resolution Enhancement (MRE) would be introduced to sharpen coastline contours, the Range Marker twin lines would be replaced by a single "pip" to give more accurate Target Range designation. The Observer's Control Radar Set would also be re-designed, again all as a result of genuine feedback and sometimes adverse comment by 700Z.

The most difficult assembly to calibrate, and the one that possibly gave the most tearing out of hair, was the Target Marker Computer (TMC). It became the subject of various studies and resultant modification. Solid-state assembly modules would be introduced to improve reliability and increase the period of time in which it would remain "in spec". To me the real irony was, that in the Bay Servicing Schedule, the TMC was given Chapt 13.

When the system went on to Post Design Service (PDS), there was no let-up in the drive for improvement and enhancement. The 1970's introduced a Corrector Unit for the Ground Position Indicator, GPIC. Designed and built by Ferranti PDS, utilising the Motorola 6800 8 bit Micro Processor, it endowed the Buccaneer with a better than 1<sup>st</sup> Generation Inertial Nav system capability. This enhanced its overland role, as the Red Flag competitions amply demonstrated. The 1980's say the end of Blue Jacket and the TMC, as part of the ASR 1012 austere package.

The then state of the art Digital Inertial Nav System, the Ferranti FIN 1063, was introduced.

To accommodate this new form of Air Data, the Parrot would gain, in place of the TMC, a new Interface Unit with A to D, and D to A capability, 1950's valves to 1980's I.C.'s and vice versa. With the Buccaneer was now back to its original maritime role, with the Sea Eagle missile, the old TMC and Blue Jacket could not be relied upon to deliver the level of accuracy required in order to utilise this new missile to the maximum. Apart from the new Interface Unit, the Blue Parrot was also modified to provide Scanner Azimuth Angle information to a higher degree of accuracy. The three balanced Mixers in the Sum, Azimuth and Elevation Channels, were fitted with matched pairs of point contact diodes, further reducing the Local Oscillator Noise.

The combination of Long Range target detection of the Parrot, and the consummate Target Data Store and Air Data capability of the FIN 1063 put the Buccaneer back

where it really belonged, at the top of the league in maritime strike.

Had the full ASR 1012 gone ahead, Blue Parrot would have been changed to a 1 uSec Pulse, had a maximum range of 120 Nms, and a Digital Multi Function Scan Converter. This new Display would not only have resulted in the ditching of both the Pavestrike Display, from between the Navigators knees, and the Mattel Display, but given such facilities as "single sweep Freeze Frame".

The target returns would also have had a greater degree of signal processing, than was ever possible with the analogue system, a case of what might have been.

Had the call to the Gulf come just a little later, the laser designator, Pavestrike, would have been Ground stabilised by the FIN 1063, thereby relieving the Navigator the task of keeping the designator on target by hand. Targets such as bridges, found by Blue Parrot, and marked and stored by the FIN at night, would also have been a distinct possibility, as another string to the bow.

In the latter days of the search for a Buccaneer replacement, a Tornado GR aircraft with the T.I. Radar was trailed against Blue Parrot on an 85 Nm range, not quite fair you might think. The Parrot was still the king re long distance detection, the Radar that reached parts no other Radar could, as it were. In heavy precipitation the T.I. with its higher frequency against the Parrot's X-Band, was fighting physics to a greater degree, but when detection was made by the T.f. then new technology prevailed in target discrimination.

I think the final word should go to TOOZ's Commander Leahy, from his summary in his last report, No. 16, dated the 19<sup>th</sup> of December 1962, and I quote:-"Forgive us for teaching our grandmother how to such eggs, but this is our chicken - to continue the metaphor -and we like it, believe in it and want it to be the success we are convinced it can be".

What more can anybody say, the Buccaneer was indeed a success, and could more than likely have remained in service for a good few more years. Many on that last day at Lossie, shed a quite a few tears for the last truly British Bomber. In truth, the only thing that could have replaced the Buccaneer was another Buccaneer.

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