



Bloodhound MKII Restoration News and Progress

June to October 2015

Welcome to this edition of BMPG's 'News and Progress'. Perhaps it's not appropriate to call it a first edition as News and Progress combines the format of BMPG's previous engineering reports and newsletters. It is hoped that the new format will be of interest to ex Bloodhound types and anyone with an interest in BMPG's work in restoring a significant part of the UK's Cold War heritage; Bloodhound MKII.

The BMPG own a Bloodhound MKII Launch Control Post (LCP) and radar Type 86 (T86), both are currently under restoration.



85 Sqn A Flt, Black Section, RAF West Raynham

Photo courtesy of Glyn Jackson

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BMPG Open Day

This year's Open Day took place on September 12th when thirty plus visitors made the journey to Cosford. The purpose of the Open Day is to provide access to BMPG's LCP and radar Type 86 and to view the progress being made. It is also an opportunity for old colleagues from the operational days of Bloodhound to meet up and as the expression goes, 'open the hangar doors' to catch up on

times gone by. The Open Day was also an opportunity to view films and documentation now in the possession of the BMPG. A display of items was also available to demonstrate how electronic technology evolved during the operational life of Bloodhound, the display also included electronic packs from the missile. Feedback on the Open Day from visitors was very positive.

The following two photographs are published with the kind permission of Mark Thomas and include the briefing session. As with all things these days there is a health and safety briefing which included, 'no climbing on to the radar roof', we are not as agile as we used to be! The second photograph shows the inside of the LCP and the working Bloodhound simulator.



Arrival briefing
H & S and all that



Bloodhound MKII simulator
Demonstrated by Neil Cartman

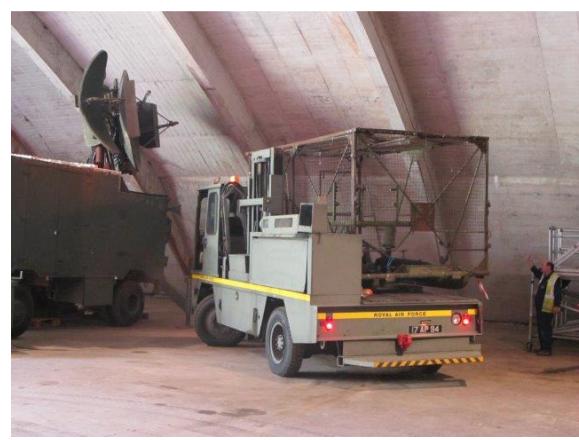
Acquisition of Type 86 aerial cage

In August the BMPG acquired a Type 86 aerial cage. So why were we keen, and fortunate, to get an aerial cage for the radar? When the radar moves from its current location the only way of safely transporting the aerial assembly is with the cage that was specifically designed for that purpose as the aerials cannot be described as a regular shape. Any alternative to the original cage would have involved some complex fabricating, plus a lot of time and money.

The RAF Museum kindly loaned us the use of a Bloodhound sideloader and the staff to deliver the aerial cage to the hangar where BMPG's Launch Control Post and Type 86 radar are kept.



The 'cage' arrives following unloading from its road transport



Unloading and positioning next to the Type 86 radar

Restoration has already commenced on the aerial cage see: 'Restoration of aerial cage' in the section on Radar Type 86.

Bloodhound MKII sideloader

The sideloader (Reg. 17AP94) in the previous photos belongs to the RAF Museum at Cosford and was part of the Bloodhound section donated by the RAF to the RAF Museum in 1991. Now fully

restored by the RAF Museum it is in regular use on their site. The sideloader is of the later type supplied to RAF Bloodhound units and this particular sideloader was used by 85 Sqn, C Flight, at RAF Bawdsey.

Unfortunately the sideloader does not have the missile lifting beam and the rear grab handle has also been removed for safety reasons. No riding on the rear step then!

Web site and social media

Mike Strange has re vamped the BMPG web site by changing its format and making it more current. Also included is a 'news' page to inform on the latest happenings. You will find the BMPG web site at www.bmpg.org.uk.

The BMPG are now live on Facebook and Twitter. Mike Strange taking the initiative to bring the BMPG in to the world of social media. Facebook and Twitter is another way of promoting our aims, achievements and aspirations and last but not least, reach more people who were involved with Bloodhound. Why not pay us a visit?



<https://www.facebook.com/BloodhoundMissilePreservationGroup>



https://twitter.com/Bloodhound_BMPG

Launch Control Post (LCP)

Running the Bloodhound MKII simulator

The simulator has now been running reliably for several months – more or less. There have been one or two minor faults that are covered later in this report but we are now at the point where the simulator is switched on and the Argus computer boots reliably. Gone are the days of taking a tea break only to return to the LCP and find the simulator has stopped or developed a fault, 'flaky' was the correct description of the whole system when it was first run. If anyone is wondering, the LCP was not just switched on, it had to be fully restored!

Following three years of restoration the simulator, consisting of the computer racks and the display console, are operating normally. One of the main challenges in achieving this state was the replacement the original 'shoe box' disk system with a SCSI interface to the Argus 700 and then moving from rotating disk technology to solid state. The LCP/simulator software now runs from a CF card!

The work on maintaining the Argus 700 and the display

system continues as no system will continue to run without spares and the means of repairing the various PCB's etc.

The restoration of the Argus 700 computer and display consoles could not have been achieved without the support and help of a number of companies and individuals. The BMPG will always be grateful for their support.



Computer Racks in the MK2A LCP

The full story of the restoration of the simulator has been covered in previous BMPG engineering reports.

Testing the display system (CHARGE)

The four LCP/simulator's display VDU's are driven by Ferranti's CHARGE (Compact High-Resolution Advanced Raster Graphics Equipment) system. For the past year the display system has exhibited a few 'wobbles' from time to time usually in the form of software errors or the display sync being lost on one or more of the VDU's. After much head scratching and testing the problem was discovered to be the mains supply to the hangar in which the LCP is kept. Running the LCP and hence the Bloodhound simulator on a diesel generator, now for a second time in two months, has confirmed the display problems are due to a poor quality mains supply. The Bloodhound simulator ran faultlessly when powered by a generator for the recent BMPG Open Day, with no display or any other problems being experienced. The display system is tested from time to time and can be reset by running Ferranti's in built CHARGE test program, initiated from the FT81 system monitor.



Display Console –CHARGE Testing
A display that is not used operationally!

System monitor (FT81) fault

Recently the system monitor failed, not a 'stopper' for running the Bloodhound simulator as the Ferranti FT81 system monitor can be replaced by a laptop (Windows 7 in this case) running a VT100 emulation with a USB to serial adapter. A set up that is not designed as a full emulation of the FT81 but one that works, at least it runs the simulator.

The system monitor is now serviceable again following several hours of fault finding which resulted in the replacement of a faulty 74 series TTL device on the monitor's video card. The video card is based on the Z80 microprocessor design. Ferranti used the Z80 almost exclusively for the Argus 700 Input/Output (I/O) cards and the FT81 video card, anywhere that some processing was required. Being able to fault find Z80 microprocessor systems is a must.



FT81 - Faulty Display
Not exactly readable!



FT81 - Correct Display
Refitted to L Rack in the LCP

The need to repair items such as the FT81 is a good example of the work now undertaken by the BMPG. In operational use a faulty monitor would mean an exchange of the item to maintain operational readiness. The situation today is that the BMPG have to maintain the simulator by fault finding to component level – on everything. Where a spare is available a swap out does happen to keep the simulator running but the faulty item then has to be repaired, to component level.

Tracker ball fault

A recent but minor fault with the Bloodhound simulator was the Engagement Controller's tracker ball. The tracker ball would initially move the display marker in the horizontal plane and then stopped moving altogether. The fault was eventually traced to a poor connection in the 8 Port Serial Line Drive unit in the Argus 700's I/O rack. The +5V supply to the tracker ball encoder dropping to +3.5V, not enough to drive the TTL used by the encoder. The poor connection was down to oxidation on a spade terminal in the line drive card. It is not surprising that oxidation causes problems, before being acquired by the BMPG the LCP was exposed damp, even wet, conditions for twenty two years.



Trackerball and E.C.'s keyboard
Removed and inverted for fault finding

Computer rack - Farnell G15-16S power supply failure

Now and then a fault can occur with the Bloodhound simulator that can have a spectacular result. In this case all the lights on the display console came on at the same time. Such dramatic faults have one benefit, it is usually straight forward to find the fault. In this case the fault was a failed power supply in the main computer rack, easy to spot as its 'output present' LED was not illuminated!

The faulty power supply was a Farnell G15-16S giving 0V output instead of the rated +15V DC. Experience has shown that any fault (so far) on a Farnell G series power supply shuts down the output.

For the technically minded the fault was eventually diagnosed to a faulty '2-Input NAND Gate with Schmitt Trigger Input' (SN74132N) TTL device on the power supply's control card. Power supply now repaired was refitted to the computer rack.

Fitting an extractor fan to the LCP cabin

When running the Bloodhound simulator for a period of time with the LCP doors are closed, it gets warm! In operational use the LCP was attached to a large 'No 54 Mk2' air conditioning unit. Such a large A/C unit is not a practical option for running the LCP with its simulator in preservation. The solution is to fit a thermostatically controlled exhaust fan in the existing air conditioning extractor vent. The thermostat used to control the fan is the original as used by the No 54 Mk2.

Pete Murray used his engineering skills to fabricate a fitting to mount the extractor fan.



Power Supply G15-16S – Control Card
Bead tantalum capacitors also changed as a matter of course when a fault develops on the control card



New LCP Extractor Fan
I made it (the fitting not the fan) – Pete Murray

Paint stripping the LCP cabin

Paint stripping the LCP cabin continues and will last over the winter months. The method of stripping is to use a hot air gun, perhaps a popular task for the cold winter days. The adjacent photo shows a completely stripped cabin wall. Over the years the many coats of paint applied to the LCP became cracked and was also lifting at the joints in the cabin wall. There was no alternative but to remove the many years' worth of repaints. The original LCP colour and the rest of the Bloodhound equipment was Bronze Green. By the time it got to the conversion of the LCP to a MK2A (Argus 700 and digital display system) the paint colour was IRR (Infra-Red Reflective) NATO Green and that is the colour it will be repainted in.

Refurbishing the exterior of the cabin is not only removing old paint but also the refurbishing of the stretcher bars, for the original canvas awning, and roof securing brackets.

There is also a balance to be had with restoring the LCP cabin. Should the LCP be made to look 'new' or as it would look after 27 years of RAF service?

A compromise here as some broken items will be replaced, where possible. Typical of this approach is the replacement of the chromed fittings that cover the locking key access holes in the various cable hatches. Many have been snapped over the years but the BMPG have been fortunate in acquiring identical covers so as many of the chrome fittings as possible will now be replaced.

Fitting a mains socket to LCP cabin

The BMPG do not have any of the original cables for the LCP so the existing three phase mains input socket on the LCP's cabin wall is very much a socket without a plug. There is also a change to the mains required for the LCP as only a single phase is used. The computer racks and display system in the LCP only one of the three phases supplied so one of the first tasks was to change any supply running on a different phase to the one common phase, namely the cabin lights supply. All the restored equipment in the LCP now runs off a single phase so there is no requirement for a three phase plug and socket so it has been replaced with standard 32 Amp single phase plug and socket.

Once again Pete Murray machining skills were needed to manufacture an adapter to fit the 32 Amp socket to the LCP.

Where essential 'non original' items are replaced the policy is to retain the original items so they can be re fitted if and when required.



End wall of LCP cabin

Showing some of the chrome locking key covers



Industry standard 32 Amp plug and socket

The second cable in the previous photo is the earth strapping to an earth spike in the ground outside the hangar.

Re chroming of LCP D handles and drawer latches

Leave chromed metal handles and latches in damp and wet conditions for twenty odd years and the result is shown in the adjacent photo. Chrome has corroded and peeled away from the base metal. To leave the equipment drawers and covers with handles and catches in this condition would certainly detract from the internal appearance of the LCP. Action was needed.

Over 300 chrome 'D' handles, spacers and latches were removed over two days, all were badly corroded. Once removed the handles and latches were sent for re chroming and have now been returned and work has already started on re fitting.

The company carrying out the re chroming advised us that the original process used for chroming contributed to the terrible state of the chrome fittings when the BMPG took ownership of the LCP. When re chroming all items were treated to an acid bath, polished, coated with copper through electrolysis and finally chromed. When the LCP was originally built the metal handles did not receive a copper coating resulting in the severe deterioration of the chrome over time.

Radar Type 86

The main effort to date has been on the LCP but this does not mean the Type 86 has been completely ignored. As with the LCP the first task was simply to get the lights on. A simple enough task you may think but with a wiring system that has a mains wire colour system that leads to earth being treated as neutral and vice versa there will be problems.

One issue is that mains supply is now protected by an RCD. When the Type 86 was first designed it didn't matter too much if there was a bit of earth leakage, it does now! If you want to trip the RCD, switch on the fan which sits on top of F Rack (power supply rack).

Another essential task on the radar was to supply 24 Volts to the aerial brake system. The 24V is needed to release the aerial brakes and move the aerials. Information regarding these tasks has previously been given in BMPG Engineering Reports.



Comparing the refurbished and original chrome handles
Before and after



BMPG's Radar Type 86, ex 85 Sqn C Flt, Yellow Section
Lights 'On'

Replacing the roof decking

Now complete and looking good with a coat of white primer. The original rood decking was completely rotten and unsafe to walk on.

Again, the progress on remanufacturing the roof decking is carried in previous reports but the task is now complete. A lot of the work, and painting, was carried out by Ian Gibbon who made such a good job of it that anything to do with wood is immediately allocated to him. The wooden rubbing strakes along the top edge of the cabin walls also need replacing. Not an immediate task, just needs to be done at some time - Ian.

Talking about cabin roofs, both LCP and Type 86; they certainly are not strong enough to walk on without decking and both have a good number of rivet heads missing. It is obvious that over time the rivet heads have simply corroded off as water gets under them. Yet another job; re drill the rivet holes and replace.



Type 86 cabin roof with decking being replaced

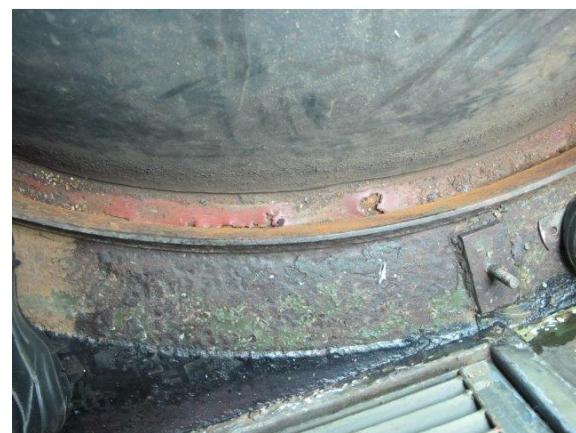
Treating corrosion, pedestal roof section

The most important restoration task for the BMPG is to treat the corrosion on the cabin roof section around the aerial pedestal. The radar cabin is constructed from aluminium sheet, except for the roof under the pedestal which is mild steel. Unfortunately the condition of this roof section only became apparent once the roof decking was removed.

The degree of corrosion is shown in the photographs below. Fortunately, it is the thin mild steel sheet that has corroded through and all load bearing points are still sound. Treating the corroded areas will eventually involve the cutting out and welding in new plate. For now the corroded plate has been treated with an anti-corrosion solution.



Corrosion in the mild steel sheet – pedestal roof section



Corrosion around the pedestal ring

Restoration of aerial cage

At some time the Type 86 radar and LCP will need to be moved from their current location. When this happens the biggest challenge will be removing and transporting the Type 86 aerial assembly. It was with tremendous relief that the BMPG recently acquired an aerial cage for the Type 86 aerials. Prior to acquiring the cage it was a case of, how can we build a frame to support the aerials for transit. Not an insignificant task but that problem is now solved.



Work continues on the T86 Ae cage



Neil Cartman and Dave Scobie
Note the BIG hammer!

Running lights - replacement

A task that lies ahead is the replacement of the radar cabin's four running lights, one fixed to each corner of the radar cabin. These lights were not a top priority even when the radar was operational, a photo of BMPG's Type 86 while at Bawdsey clearly shows at least one running light was broken when in service. The twenty plus years the radar was left in the open after being retired from RAF service, the running lights end up like the one shown; damaged, no lens glass left and rusty.

A minor item but important to the overall presentation of the radar.



Radar Type 86 running light
Unbolted from its mounting bracket

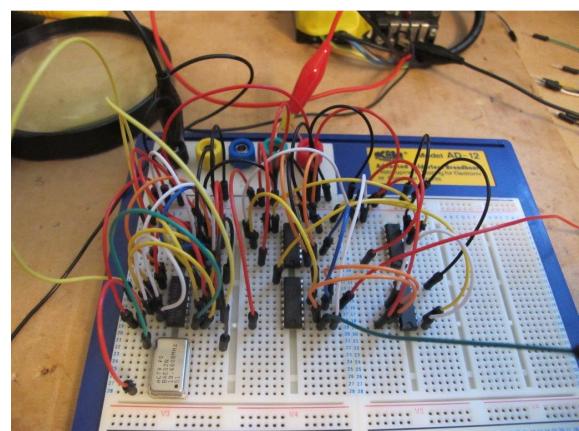
From the workshop

A lot of work takes place away from Cosford to both repair and test items. Testing items is a bit tricky as the BMPG have no test rigs so even after a repair the ultimate test is always – plug it in and see if it works!

PeriBus emulation

PeriBus is a 'sort of' serial bus that connects the Argus 700 to all its I/O PCBs and there are a lot of them. The reason for attempting a PeriBus emulator is to see if the various I/O cards can be communicated with and hence initialised without the Argus 700. Once I/O control is achieved over the PeriBus then the addressing, processing and replies from any I/O card can be tested.

While on the subject of the PeriBus, Mike Strange is currently in the process of constructing a test rig and writing a test procedure for the ME186 card. As with all the hardware this process is not easy when we have no idea how the original designer had intended the hardware to be tested. The ME186 is the interface between the serial PeriBus and the parallel bus of the Argus 700.



Prototyping the timing logic to drive the Serial PeriBus

Obituaries

No one gets any younger so it is inevitable that the time comes when we lose stalwarts of the Bloodhound world. Two such stalwarts are recorded here; Les Waddington and Mike Ford.

Les Waddington

I used to call Les 'Mr Type 86'. One of Les's claims to fame was his bit part in the RAF 'Introduction to Bloodhound' film which must have been seen by everyone who went through Bloodhound training in the RAF. In the film Les was the man in the Type 86 studiously pushing a button on the transmitter rack. I first met Les when he was my Type 86 instructor at RAF Newton, a post I replaced him in, in 1976, when he left RAF Newton for 25 Sqn B Flt, RAF Wildenrath. To say Les was an experienced Type 86 man is an understatement. Les passed away late last year.

Mike Ford

You may know of Mike Ford even though you may never have met him. Mike was the man behind the web site (www.rafaberporth.org.uk) which records the history of RAF Aberporth and the Bloodhound Firing Unit. Mike was a missile and instrumentation man who spent nine years at RAF Aberporth, it must have been a good posting for him as he settled in Cardigan to open his Variety Store (www.mikesshop.co.uk) now run by his son, Chris. Mike died suddenly a few days after attending the BMPG Open Day in September.

Les and Mike's contribution to the Bloodhound world will be remembered and hopefully be of some consolation to their families and friends.

....and finally

It's not all hard work at Cosford.



Posh dining!

A first as quail's eggs appear in the lunchtime sandwich box



Dave Scobie celebrates his XX (Classified) birthday

A clue – it's not a multiple of the four candles on his cake

Pete Harry

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