



Nicola 3 Cave Radio

Progress Report

June 2016

This note will update those interested in what has been happening in the Nicola 3 project over the past year.

At the British Cave Rescue AGM in April 2015, it was reported that testing at various locations had been carried out and that we were now close to going into production.

Some further work was done regarding microphone volume over the summer.

We were then in a position to go in to production last September.

The main signal processing board (using a Spartan 3 board) that had been chosen at the beginning of the development (about 8 years and over 4000 hours of development ago) was becoming difficult to get hold of making us very nervous about continuing with this part. So the discussion started on how to resolve this issue. Sourcing an alternate Spartan 3 board would not be easy and would require some considerable work on Graham's part. Indeed as we looked into the solutions it was clear that Graham would have a tremendous amount to do.

A newer generation processing board (series 7 – some 4 generations on) has been identified and shown to be compatible with the requirements of the Nicola 3 radio. The supplier is confident of future production and anticipates a 10 year lifetime from now. This new board offers massive scope for future enhancements of the device (including texting and routing of signal through mobile phones, transferring data, relaying stored voice and text messages etc.)

Graham, with much valuable help from Pete, spent a considerable amount of work porting the design to the new board and adapting the PCB (around 300 hours of work) to make it ready again for field tests prior to production again (over Christmas - early 2016).

On Monday 15th February 2016, a test was carried out at Peak Cavern. This field test identified some residual issues regarding the receive part of the radio. Graham made the modifications to resolve these remaining issues (some hardware and some in the programming).

Further field tests in Peak Cavern (on Tuesday 15th March) showed successful operation up to 1km from Far Sump to a surface location in the lower part of Cavedale. Clear communications were achieved for more moderate distances.

With this the board layout has now been tested and validated for production.

Many thanks to those members of Derbyshire Cave Rescue that helped with the testing.

Further refinements in the audio quality are anticipated, but these can easily be applied in the programming of the device.

At the last BCRC AGM we thought we were all but there and would have the first production run completed and radios delivered by now. But this was not to be.

But there is a major benefit from the path we have taken. The Xilinx FPGA now used in the Nicola 3z (as we might call it) is much more capable – indeed much much more.

This means that over the next period, as mentioned above we could look to offer connection to Bluetooth radios and mobile phones and to developing the promised text messaging. Because we have a more powerful processor, the software development will be somewhat easier provided we are not too ambitious (at first).

It also means in the future we can look at other requests – for example a number of teams in the continent would like to hook up to medical instruments and communicate with the surface.

It is anticipated ~10 years availability of the parts for this design thus securing production for the foreseeable future. Then around 300 hours work would be anticipated to port the design to future hardware (following obsolescence of current generation hardware).

On Tuesday 10th May 2016, Graham accompanied by Pete went to the CPS (Complete PCB Services Ltd, <http://www.cps-limited.com>) factory near Newbury in Berkshire to see and assist with the first two Nicola 3z radios to come off the production line.

This proved to be a successful day. The test procedure provided by Graham was followed and modified as the plan met reality. We soon had the first radio built with a couple of problems identified – the Bluetooth kept dropping out and the keypad turn on procedure was not working correctly. After investigation, both of these were believed to be faults in the FPGA firmware rather than manufacturing faults.

The second radio was also built successfully. We then adjourned to a local farm where the brother of our contact at CPS allowed us to carry out a field test. This was also successful despite being caught in particularly heavy rain.

With this we felt that the production of the remaining units could proceed.

The faults identified were investigated by Graham. The keypad fault actually proved to be a manufacturing problem – one of the components was not correctly soldered onto the board. We are advised this problem can be easily fixed by altering the speed at which the machine operates.

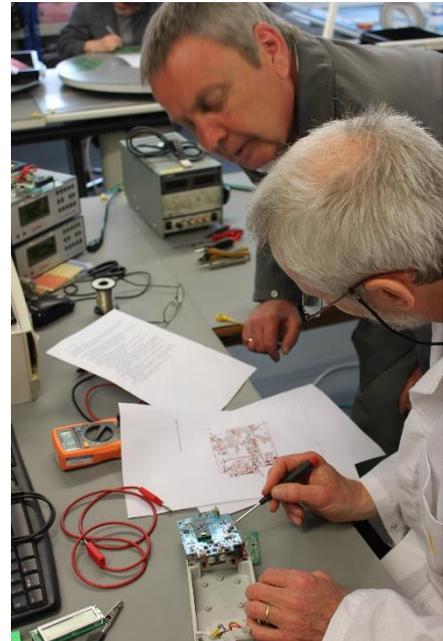
The Bluetooth problem was in the firmware and proved tricky to solve by Graham. In anticipation of further development later this year and next year, we made sure the version of firmware in the Bluetooth module was correct. This however changed some of the underlying operation. Once identified the necessary corrective measures have been taken and the Bluetooth is now fully functional.

So, the go ahead to manufacture the remaining units has been given and we anticipate delivery early June.

Plans are now be made to delivery to the teams as discussed at the AGM with a session in the south on the Mendips – and one in the north probably based at the CRO depot in Clapham.

We also have plans for delivery to the Irish Cave Rescue.

This will include some basic training and hands on with the radios.



Pete Allwright

Graham Naylor

Bill Whitehouse.