Jindalee, my days at Mt Everard and the odd time at Harts Range.

In the early 1980's I found myself in Alice Springs working for an electronics repair company, during that time I met a few fellow ham's that worked at a place called Jindalee. One of these chaps was Roy, he had a keen interest in the Tandy CoCo (Colour Computer) which we were the local retailer for (Tandy) I also had a CoCo but Roy had a 'magic cartridge' for RTTY that plugged into his CoCo and I had a very soft spot for RTTY since my SWL days. So many trips to Roy's place and cool beverages later he suggested I apply for a position at Jindalee. In May 1987 I started my new life as part of the Jindalee team.

At this stage my final security clearance had not come through, so I was mostly cut off from the interesting stuff (as I saw it) and based in the electronics workshop, from here bench jobs were assigned to me.

Now the spares and equipment racks in the workshop were full with a backlog of repairs as there had been a few people leave so the first two months there were hectic with fault repairs but I did turn up some treasures, who would expect to find a pair of Colins KWM2A's on the shelf, albeit in rough condition but fully working.

Finally, the long-awaited day arrived, my clearance was through, I was given the keys to the kingdom, well just the codes to get me through the next set of doors into the Operations and RF rooms.

In 1987 Jindalee was powered by DEC PDP-11/84 mini computers (http://www.conservatique.com/pdp/dec-pdp-1184) and its slightly older brother the PDP-11/34 none of which I had ever seen before. Disks were the now extinct 5 platter DEC RM02. Yes, a chest high washing machine looking cabinet with two big MASBUS cables (24 mm in diameter) going off to the controller cards in each PDP min computer.

Now the more interesting bits are the RF racks… this was a place where RF and baseband signals were measured down to milli Hertz so when I see mHz written it is not the same as MHz (smile) in my world. There were 32 custom made receivers by SRI (Stanford Research Institute) and all the signal sources for the receivers, test equipment and signal routing was under full computer control, cables, cables and more bleeding cables was all you saw under the floor.

On many occasions the scientists from DSTO Adelaide would come to site and often this was where the real fun happened, there would be weeks at a time where the equipment and our concepts of what it was supposed to do was turned on its head. Experiments plotting the effects of meteors on OTHR and looking for stationary objects were a couple that come to mind. I recall thinking I was in heaven as far as a workplace went and often had to be dragged away from an experiment in progress when the communal car was due to leave for town at the end of a shift.

Some nice person went and bought a couple of Icom R-9000 receivers for use on site as general monitoring receivers, with one living in the RF room near the antenna patch panel for the FMS antennas. Ah now to explain, at that point Jindalee was split into two differing systems, the FMS or Frequency Management System was responsible for HF backscatter sounding (5 – 30 MHz), Oblique sounding (2-30 MHz) and channel occupancy analysis so the main RADAR could be advised of the best 'clear channel' when needed. Then of course there was the main RADAR that was operated as needed. I was able use a split of the FMS antenna array to listen on and around 50MHz… it is hard to explain how strong the Russian and Chinese TV signals were on this system in the late 1980's early

1990's when listening in the RF room during an arvo shift. I will admit to making many a phone call over the years advising fellow hams to bypass the TV and head to the shack that night.

If you would like to see some of the display the FMS system gave to us in near real time, have a look at this public document: https://www.dst.defence.gov.au/sites/default/files/publications/documents/DST-Group-TR-3477.pdf I did not need IPS or any other service as the back scatter sounder system covered a wide enough azimuth to include most paths that really interested me as a six meter operator. About every 30 minutes or so a new set of Ionogram's would be displayed, some days it become too much to bare as the display would show the red intensity as a thick band going way past 30 MHz, please someone take me home I am feeling a bad case of DX-itis

Antennas and more antennas, so the main RADAR array was (still is I guess) 2.667 KM long, this consisted of 462 pairs of what was called a FAN Monopole and I can say I knew each of the poles personally as one of our jobs during 'refurbishment' was to check that each pole was vertical, who the hell wrote that work package still has me bewildered. Out of the team, I was the 'youngster' and drew the short straw, from what I recall was a very one-sided ballot. Off we went, a team of three, one with a spirit level (me) and the other two checking guy rope tensions. You can see some pictures of the Jindalee array at this web link https://adbr.com.au/over-the-horizon/ scroll down to where you see the ones with rope guys, that is the array at Alice Springs as I knew it.

To keep the antennas switching equipment cool the feedlines all came to a 'bunker', 17 of them in total, which was essentially a custom-made metal tank that was put in a huge hole in the ground and covered over. You opened a hatch and climbed down the ladder, the roof of the bunker would have been 1.5 metres below ground level, you could really notice the change in temp as you went down the ladder. In all the bunker was around 3 metres in diameter and had racks of relays with coax delays lines stretching across the diameter with just enough room to squeeze around one edge. There was no actual cooling, just two 70 mm pipes (one from the floor level and one from the roof level) that protruded into a ground level cabinet that allowed air to circulate naturally. On a hot day a trip to a bunker was a nice treat.

A few years after leaving my Jindalee related employment I came across a conspiracy web site that had an aerial photo of the receiver array at Jindalee and they had noted the white lids for the equipment bunkers and tried to convince the reader these were indeed the doors for a missile defence system and that Jindalee was just an extension of some USA facility, oh my, how wrong this silly beggar was.

My time at Jindalee also saw the need for me to travel to the transmitter site, early on all the transmitters were BIG valve based amps that came from a defunct sounder facility somewhere in the Pacific run by the Yanks, it was often said they were donated to the DSTO boys to keep them busy as they had no hope of making HF OTHR work and the real scientists in the US could get on with more important work. Thus, this collection of Continental FRT-80's was turned into the work horses of the Jindalee transmitter site as I initially knew it. They could be temperamental when they wanted to be, each transmitter hall had a large rubber mallet on the floor to be used when one TX did not want to complete its auto tune at RADAR start up. The spot was not hard to miss on the rear of the big grey TX cabinet, it had the marks of hundreds of previous hits on it. At each RADAR start there was often a call across the VHF full duplex voice link from the RX site, "Left 5 failed tune" several door slams later a slightly puffed voice would reply to them "try tune again". The rubber hammer fix strikes again.

Sharing one TX hall was the wideband amp used for the Ionospheric sounder amp, it was a marvel of simplicity and I was constantly surprised this thing worked given the lack of tuned circuits to be found any ware around the P.A valve. I had the joy, if you can call it that of assisting one of the long serving transmitter staff work on it one day and being often reminded by him to use the earthing stick between tests runs, BANG FLASH Crack yep that's safe now.

The transmitter site received a birthday in the late 1980's as part of the risk mitigation strategy for the new OTHR systems being planned (now universally referred to as JORN). We received many large crates of new solidstate amps from the manufacturer… These Marconi amps were custom built units from a UK design that had been adapted for Australian conditions. Yep they all had problems, from P.A transistors unsoldering themselves by the truck load, runaway overheating problems. Each of the major units were made up from multiple 1.6 KW units (we called them Daleks) that in turn were made from multiple 400 watt modules that contained two active bipolar devices.

One memorable day an engineering representative from the UK branch of the company came to site, complete with his heavy woollen suite to see what the 'hoo ha' was about as there was no way his design could not work and we had to be doing something wrong. It did not take long for the finger pointing to start and his constant complaints about the heat are still ringing around the TX halls. I must admit it was a 44-degree day and most of us were feeling the heat also but he would not take his heavy woollen jacket off.

Time, time, and more bleeding time.

Any bistatic RADAR (where the RX is separated from the TX) system like Jindalee need to have time sync between the two sites but how do you do that using 1970's or 1980's technology. No GPS, No Rubidium or Caesium standards. just WWV / VNG and a VLF receiver is the answer… Main system reference was a HP 105B ovenised frequency reference at both sites, and IRIG-B time code clock that could be read by the computers. The ritual of 'Site Sync' would become a part of our daily life or as needed. Initially both sites would set the main digital clock to the time given by VNG using a CRO to look at the 1PPS from the IRIG-B clock and on the 2nd CRO channel the audio from the RACAL receiver tuned to VNG looking at the second tone. Maybe this is where my obsession with time all started : -)

Now had the inter site time difference to within 100 milli seconds if we were lucky but that is not good enough for a doppler RADAR, time is key to measure distances.

Each site had a KAT "Keep Alive Timer" which had a battery backup and was responsible for providing our accurate 1 second pulses. It was a custom built DSTO marvel of the time in a 2RU cabinet. Each KAT could be told to advance or retard its 1PPS via from commands from the main computer system but how did we get the KAT at the TX site in sync with the one are the RX site? Fire up the main Radar in a special mode called Site Sync. Here a TX frequency low enough to ensure only groundwave was received was selected and the TX signal was told to slowly sweep up over a 5 KHz channel, the RX system looked at the resolved signal in the A/D converters and the time delay or advance was calculated from the offset in frequency we saw. Now tell the KAT at the TX site to advance 50 mS (or what we thought was needed by the on-screen display) and do it all over again until 'site sync' was achieved. Turn the Transmitters off and go and carry on with the other jobs.

Supervisor Exit

The FMS and RADAR systems were running on an old DEC operating system called RSX-11M and the management console had a process called the Supervisor. On the FMS system that ran 24x7

gathering information the management console would sometimes exit and show a message "Supervisor Exit" which meant all the data gathering had halted. We would get regular dressings down from the DSTO scientist about why the FMS was sitting idle. As no one sat there watching the FMS console all day, we would just stumble over the error message and scramble to get things going again, knowing full well a fresh ear bashing would be coming our way. Each "supervisor exit" had to be logged in the written logbook and signed by the person doing the work. In fact each action we did was logged in this book. One DSTO scientists in particular was the regular person to chew us out and at times he would come to site to carry out experiments. On one of these late night experimental periods the visitors were feeling the pinch of burning the wick at both ends as by day they had been holding meetings with on site staff and at night the systems were theirs for experiments… So here we are, the site support staff, which I was one of, were in the work shop, which was close enough to the operations room to hear any loud noises, we are like wise a bit weary but doing our bit as you do on a night shift. A faint be unmistakable high pitched tone had become audible at around 2am, we all looked at each other trying to work out what it was, maybe an air conditioner alarm, nope they go beep beep, hmm maybe it's the UPS alarm, nope that was a Buzzer sound. After opening a few doors we tracked it to the operations room and find that DSTO scientist asleep on the keyboard of the FMS management console which is screaming its lungs out BEEEEEEEP (from his head asleep on the keyboard pressing numerous keys) and the screen proudly displaying "Supervisor Exit". He must have been dead to the world as the noise these consoles made is considerable when you keep a keyboard key pressed. We could not resist it, one of us shook him awake and once he was with it asked him to fill out and sign the log book as to why there had been a supervisor exit. After this event he was a bit more lenient with us on future "supervisor exit" events.

I left Alice Springs in June of 1994 but returned often to both the RX and TX sites as part of my jobs with BAE Systems in Adelaide over the next 12 years. This was one job where I felt I was a valued part of some larger entity and still feel proud about what has been achieved in Australia with OTHR.

Site background noise monitoring

The then new JORN RADAR sites in QLD and W.A had an independent noise monitoring system commissioned and installed for DSTO to monitor the background noise levels on the site as they were being built and developed. This was to ensure that any new equipment or structures that were brought onsite did not compromised the RF quiet locations for the receiver sites.

As Telstra, then Lockheed Martin were the civilian contractors for the new sites, the background noise systems were looked after by a third party, which ended up being BAE Systems. I came late to this party and was asked to make a trip to the QLD receiver site from our Adelaide base to see if I could find why the system kept going off-line. So here we go, my first ever trip to QLD and deep into rural QLD to boot.

Now the hut for this system is a true marvel, a multi skin building with air channels designed to maximise the passive cooling effects gave it quite an odd look once the outside door was opened. I wish I had taken more notice of the design but in those day's you did not take a camera to these sites. When I work on equipment I get 'invested' in the activity and start talking the gear, have never worked out why I do this but it seems to work for me. The computer controlled receiver and the associated VME crate micro computer seemed okay (VME was a standard backplane for interface boards popular during the 1990's) so next was the CODAN satellite link. Outside was a nice 3 metre Cassegrain feed dish with a CODAN satellite Out-Door-Unit transceiver on the rear aimed at one of

the AUSAT satellites. This was under the control of the VME crate computer and was supposed to be brought online twice a day to download the data back to the mother ship at DSTO but the lack of a RX link indicator showed me we had a problem with the outdoor unit. Hmm um er this was my first time looking at one of these, maybe I was the wrong bloke for this particular job. Time to pull the cover off and noticed there was signs of moisture ingress as the inspection window was marked with the tells tale signs of moisture. Time for lunch, so I tell the gear I will be back in an hour and not to fret about being left alone again. After lunch true to my word I was back and continued my one sided dialogue with the equipment. I am sure any onlooker would have been straining to see where the second person was while I was busy yacking to the objects around me. After drying out the CODAN unit and checking the many SMA connectors I put the cover back on the unit and prepared to go back to the camp for the night but in my usual manner told the gear I would be back in the morning and would see it then. This went on for a few days as we did tests and waited for multiple scheduled connections back to DSTO to complete successfully, each time I locked up the building I would tell the gear ' back soon see you then' On the last day I carried on as usual and was busy doing some final check's, watched the last upload for the day to go through and then did a final lock up of the gear and building. Without even thinking about it, I told the gear be back later and to behave itself. I arrived back in Adelaide and not thinking much about the trip carried on with my normal work. Five months later my boss asks to see me (oops what have I done) and asks me for more details about what I did at the QLD site as the DSTO boys have been on the horn to him congratulating him on a job well done as the system had never been online continuously for this long without an issue. My answer, well the gear thinks I am coming back and I told it to be on its best behaviour, he laughed and then asked me if I was available to go the W.A facility to repeat my magic.

There is a Wikipedia page about Jindalee here :
https://en.wikipedia.org/wiki/Jindalee_Operational_Radar_Network if you would like to know more.

A public PDF describes a OTHR-B (B is for backscatter, which all Jindalee's are) in far more detail that I am able to divulge:
https://digital.library.adelaide.edu.au/dspace/bitstream/2440/19239/2/02whole.pdf

Look in Chapter 7 for a good Jindalee overview, there is information in there that should wet the appetite of anyone wanting to know more about OTHR-B. Some of the graphics appear to have been taken from actual RADAR consoles of the time (now obsolete).