EME on 2m, 23cm, 13cm and 3cm

2m 3cm

EME on 23cm

2007 2006

Family matters have kept me away from radio for a lot of 2007, as well as the end of 2006. I've had occasional short periods of clear space where I've done odd bits of work on the dish and system, generally to improve control. Unfortunately, I've missed most of the activity, and the dish is still not calibrated in Az and El! SUn is rather low in the sky now to set it up, as well. I really need to go through the whole system to re-check everything.

2006

During the summer of 2005, I started to map out the best location in the garden for the mount for the 3.7m dish. I got as far as laying the four concrete corner pads for it and getting the steel base laid on them before winter set in! With the arrival of spring, and better weather, Darryl, M3IKR, and I have been out working on it again - the base has been levelled and the 115mm dia central support pillar has been bolted and concreted into place. This will form the guide around which the whole support structure for the dish will rotate.

Having done that I suddenly realised that the support pillar is exactly the same size as the head unit of a 2.4m sectional dish I have in storage - after a bit of rapid calculation and measurement, a design has been made for a conversion of the fixed head unit to full az/el motion - and we are now in the process of assembling the mechanics. This is based around an Az drive built from a motorcycle chain and sprocket set, and an 18" actuator for elevation. Shaft encoders are used on both axes to feedback positional information to the W2DRZ controller.

The dish is 0.4 f/D, so should feed very nicely with the existing RWST feeds that I have for 23 and 13cm - although I am tempted to move to a circular profile horn, rather than rectangular.



Me building corner pads



Placing pallet on pads



Completed base showing track for large dish wheels



Az bearing for 2.4m dish - steel plates with 16 balls running between them



Az drive motor and gear assembly - motor is a capacitor-run reversible 230V AC type. Shaft encoder is on the same shaft as the sprocket, and runs at 3 times dish speed



M3IKR attaching dish back plate to head unit



dish petals ready for assembly



Chain and tensioner in place. The main column bolts just above the motor platform have the ends drilled out and also have greased balls in them to provide a lower bearing.



first petal in place



three-quarters done!

Progress update 9 May 06

Having got the dish assembled, I now need to sort out one or two small issues with the azimuth drive - at the moment the drive sprocket is slipping on the shaft at some points - a bit of attention with a drill will ensure that the grub screws bite properly into the shaft! I've also got to get on with the control electronics now - I can drive the dish around manually, but need to get interfaced to the controller. The elevation also needs a bit of work - at the moment it can't quite be brought down to 0 degrees because a bolt head from the column fixing fouls it - shortening the bolt will be sufficient, and will allow me to reach 0 degrees for calibration purposes.



final assembly and tightening up



elevation drive jack fitted



rear view of completed dish assembly



And it elevates under motor control!

Progress update 14 May 06

The slipping az drive has been corrected - the screws now bite into the shaft and this has cured the problem completely. The motor assembly is now covered to protect it from the weather, and the elevation jack has been wired up. I'm now expert in stripping down sat jack motors! The jack has not been used for 12 years, and refused to run in both directions so I spent a few hours sorting that out! The elevation encoder has been added, with a rain cover. Now need to fit the az limit switches and then interface the controls to the W2DRZ system.

Progress update 20 May 06

Not so much visible progress this week - partly due to weather, and also due to getting on with some of the electronics. Elevation relay and azimuth limit switch boards have been built - now need testing and installing - which does need an improvement in weather, and that, based on current forecasts looks like it may not be this coming week! Plates to mount the feed support spider to the dish are being made up.

Progress update 4 June 06

Not much progress in the last two weeks, due to bad weather and vacation. Have got the duct installed from shack to dish, and the Tx feeder in place. Perhaps a little premature, but as it's LDF6, then it goes in first and everything else follows! Control cable (Cat5) is also ready to be pulled in.

Progress update 11 June 06

A bit more progress! The control cabinet has been installed, and mains power run out on a permanent basis via an RCD. Tx & Rx feeders, Cat5 and control cables are installed, as are PSU's for 36V and 12V for the control electronics and motors. EL drive has been re-wired, and relay control tested on the bench. Lack of light prevented testing on the dish today!

Progress update 18 June 06

All control cables now installed and dressed between shack and dish, and at the dish. The control electronics for the limit switches have been tested and installed as well as the RS485 converter for the AZ and EL encoders. The limit switch opto-couplers remain to be installed.

Progress update 25 June 06

Limit switches installed and aligned. Mountings for the feed support frame have been attached to the dish, and the feed box is under design. The feed will be adjustable using the carriage assemblies from 2 ink-jet printers driven by a 6" sat jack.

<table>
<tr><td></td><td></td></tr>
<tr><td>Tx feeder ready for installation</td><td>Elevation encoder and weather shield</td></tr>
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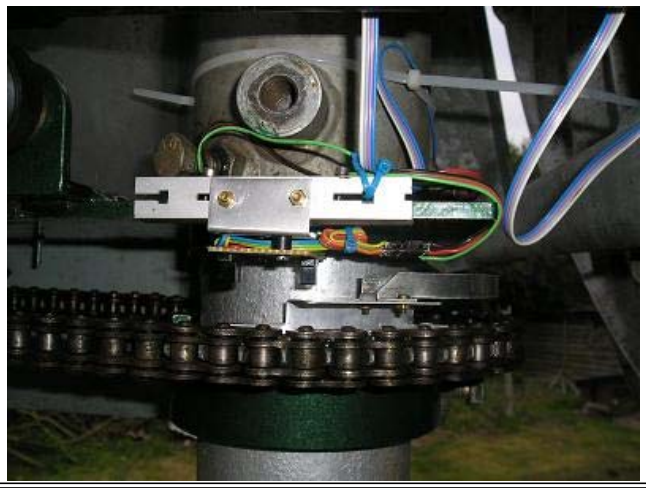
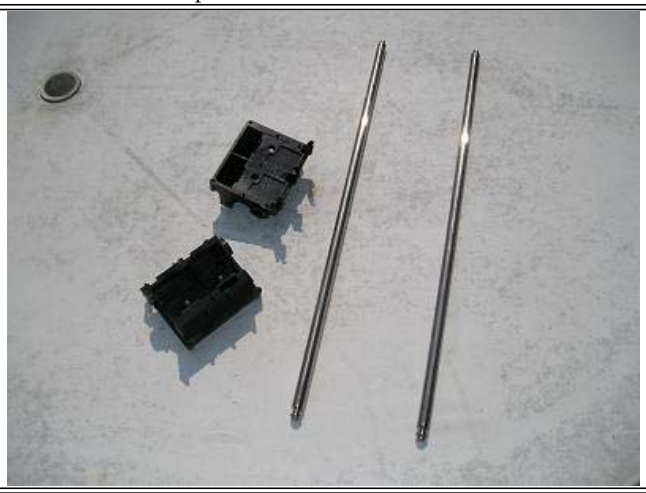
Limit switch bracket before installation



Completed limit switch installation



System power box - mains and control system electronics



Salvaged parts from HP 500 series printers - used for the sliding carriage

Progress update 2 July 06

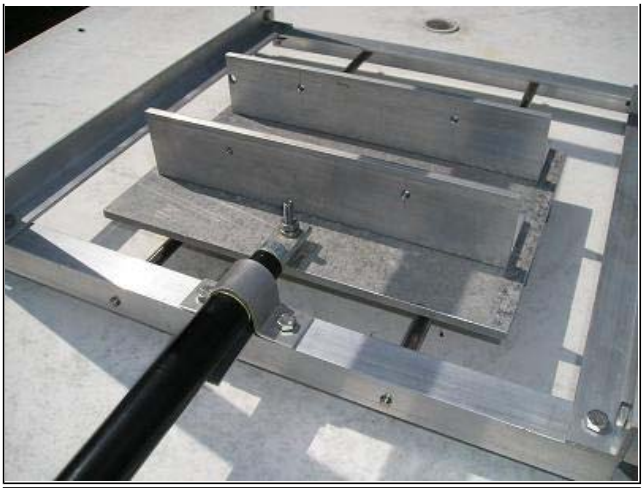
The weather shield has been added over the limit switches - this is also necessary to reduce the ambient light levels on the opto-switches. Installation of the shack end of the control system has begun, and will be completed in the next day or two. Design of the feedbox is completed and assembly will start in the next week. The slide bars have already been prepared by removing a shoulder at one end of each bar, allowing them to fit fully into the feed box.

Progress update 9 July 06

During the week the tracking system has been checked out and after fixing a couple of minor faults is now working. The dish has been calibrated against a compass, and a 'cross-hair' has been produced on the dish by stretching string across between the feed support mount points. By using the shadow cast by the sun on the centre of the dish I can see that the tracking is within a degree on both AZ and EL - furether tests with SUn noise will be made once a feed is installed. The metalwork for the feedbox is now all prepared and drilled, and assembly will take place during the next week

Progress update 16 July 06

The feed support structure has been completed this week, and mounted onto the dish, along with the 23cm RWST feed, ready for initial sun noise testing and calibration. The motor driven feed adjustment appears to work well mechanically, although RF testing is yet to take place. Total movement is just under 15cm, which should be plenty to ensure the correct positioning of the feed phase centre at all bands above 23cm. A weather cover has been made from a surplus plastic barrel, of the type used in the food industry - microwave oven testing confirmed that the material had no effect on the passage of RF waves. Initial RF alignment and testing will take place during the next week, and maybe I will even be ready to listen for stations in the coming activity weekends.....



View of sliding carriage within Feed frame



Side view of the completed feed assembly on the dish with 23cm RWST in place



23cm feed tracking the sun



Feed cover fabricated from plastic barrel

Progress update 23 July 06

During the week the preamp (WD5AGO with NEC 38525) has been checked - previously measured at approx 0.5d NF and with just over 20dB of gain. To prevent oscillations I had put some anti-static foam in the lid of the box. Apart from some small tweaking of the inductors (input inductor - minor change, interstage inductor - larger change) resulting in about 0.05dB improvement in NF, a major improvement was gained by replacing the foam with proper microwave absorber material - the NF dropped to less than 0.3dB! When measured with the relay and all adaptors that will be used with the feed, the complete LNA assembly comes in at around 0.45dB - thoroughly acceptable! The RWST feed was also checked for reflection coefficient, measuring 0.05 on the TX port and 0.07 on the Rx port - similar results have been seen on other samples with different connectors on the ports (7/16 and SMA). Isolation between Tx and Rx was 22dB. A second stage preamp using the G0MRF design with ATF54143 was assembled to ensure that there was no degradation due to the 20m RG213 run back to the shack. Everything was assembled onto the dish ready for testing - the feed was aligned for centre using a laser level, and the two stages of preamp attached to the support. At switch on on Saturday morning, after checking that the local beacon could be heard I tuned to the EME segment - and very quickly found G4CCH in QSO! **First Signals Heard via the Moon!!** Howard was not strong but was copiable in QSB. Once I got Spectran running he was about 10dB above noise on average. More signals heard this morning, so now it is time to get into the serious stuff of sun noise measurements and feed optimisation (do I need a choke ring or not?) to see if I can pick up another fraction of a dB or so. I also checked through the cables that will be used to connect to the feed on Tx and found a crushed 7/16 plug - so I need to find another plug for FSJ4 before I can complete that side of the system

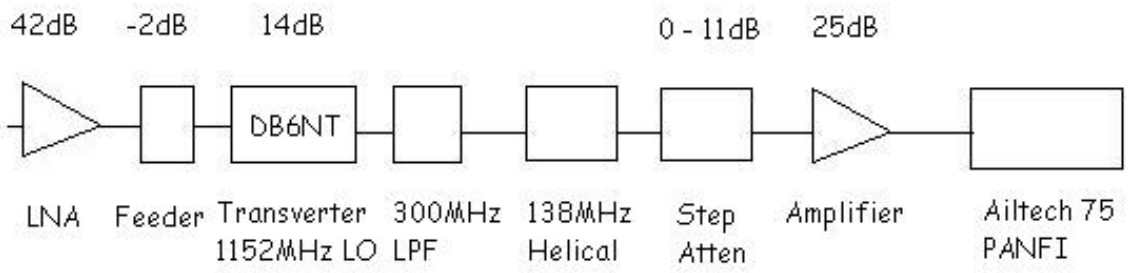
Progress update 30 July 06

Another one of those weeks with not so much visible progress! Have now found the 7/16 connectors to complete the Tx side of the system, and have also cracked an annoying problem I've been battling with for some time - getting audio out of the TS2000 via the packet interface (ACC2) socket. Solved it by building an interface box from scratch and ditching the one I was given! I have also picked up a couple of switching PSU's, one of which will replace both supplies currently in the control box - freeing up space and a mains socket outlet! I did make a preliminary sun noise measurement this week - approx 5dB, which is not bad for no adjustments. I

need to do a bit of work to get to a state where I can make a more accurate measurement and then start adjustments to optimise the system. This will involve using the old DB6NT 1296 - 144Mhz transverter as part of a measurement system, but running with the LO at 1155MHz to bring 1292MHz out at 137MHz. The change is necessary to avoid the strong signal from GB3MHL beacon on 1296.830 MHz - it's 40dB over 9 on the dish, almost anywhere I point!

Progress update 6 Aug 06

More progress this week - the moon is too low for any more listening attempts, due to tree blockage. Audio interface is now working and set up for transmit, and a makeshift radiometer has been assembled from filters and amplifiers, using my Ailtech 75 PANFI as the indicator device. The diagram below shows the system - slightly modified from last weeks thoughts, and now using an 1152MHz LO with a 138MHz IF filter, which means I am measuring broadband noise (approx 4MHz wide), centered around 1290MHz. This is sufficiently away from 1296 to reduce the feedthrough from the GB3MHL beacon to a low level signal outside the main passband of the noise receiver. The step attenuator has 1dB and 0.1dB steps allowing a fairly precise measurement to be made. Unfortunately, just as I was about to start making measurements, the PANFI developed a PSU fault and is tripping out the mains supply to the shack! However, adding a further 30dB amplifier in the system enabled me to use the HP435A Power Meter to measure the system noise. An initial measurement late today indicated 6.3dB Sun/cold sky after optimising the feed. Interestingly, the position for maximum sun noise is approx 1.5cm forward (ie closer to the dish) than the calculated position. Further measurements need to be made with the sun higher in the sky. Later in the week the moon does get sufficiently high for me to start using it again.



Progress update 17 Aug 06

OK - well it's been a bit more than a week since the last update, and a lot has happened! As the moon has got more usable I've had my first JT65C QSO with G4CCH for #1, followed by a CW QSO the next morning. On 16 Aug during the morning I worked K2UYH, WA6PY, G3LTF, F2TU, SM6CKU, W5LUA and OK1DFC bringing me up to initial#8 - all on CW! The DB6NT PA is now remotely mounted in a plastic cabinet at the base of the dish, but I am not getting the full power out of it - only seeing about 150W for 0.5W in. No update next week as I'm off to EME 2006 - but hoping to get a few more initials in first!

10GHz EME

Although not strictly from my own QTH, I got involved in the autumn of 2006 with a project to bring a 7.2m dish back into use for 10GHz EME from the Voice of America Park, Bethany OH. The station is WC8VOA, and you can see a lot of the story from their site. While working with Jim and Mike, I plotted the tracking errors in the dish drives, built a G4NNS Noise Meter for tracking the moon on noise and did some work on frequency stability. This led directly to my F-DFS work over the past year - the first DFS unit is now at WC8VOA to replace the DEMI xvtr LO and lock the signal to GPS.

When I left the site on Nov 13 2006, we heard our first EME signals that same morning - from W5LUA. Since then, Jim and Mike have worked to get the Tx side running, using a DEMI 8W PA, and whilst back there in the summer of 2007, I was able to have a few full QSO's via the moon!

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144 MHz EME

The 2m low power station antenna has been removed, pending re-mounting on the dish at some later stage.

G4HUP 2m Initials.

DL4MUP 23cm Initials.

Click here for G4HUP and DL4MUP EME history.

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