

Inmarsat / Hughes IP modem trial

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Background

For the past few years BoM (Bureau of Meteorology) have been encouraging Western Australia's Department of Water (DoW) to add back-up telemetry into existing flood warning sites. Recent flood events on the east coast will no doubt resurrect this issue. BoM have already installed their own Alert system alongside a few of our existing sites. To enable this, the DoW's Hydrologic Technology Centre (HTC) supplied special instruments with 4/20 mA output compatible with the Alert system. There are many issues associated with the Alert system that do not fit well with DoW directions and hence the need to find alternate solutions. BoM's biggest concern with DoW's existing telemetry is that the communications carrier will fail in times of heavy use such as during floods or fires. This is a fair concern with the 3G network especially prone. Satellite systems have fewer users and are not as prone but can still potentially fail for a host of reasons. No system is 100% guaranteed. As there is little point in installing a second backup system using the same carrier as the primary, and 3G systems are not preferred, investigations are focused on alternate satellite systems. Fortunately a new satellite IP system has just become available. This satellite is a newer Inmarsat geostationary one located over PNG (the older dialup Inmarsat satellite is located over Fiji and has an elevation of 15 degrees) and for most of WA can be accessed provided there is a clear view at 40 degrees elevation to the north east. A big advantage with this new system is that similar to existing 3G systems there is continual access with no delays waiting for a satellite to come into view.

The Trial

The new Hughes modem and Unidata Neon terminal were pre-configured by Unidata and delivered to DoW. Initial tests in December at the HTC investigated its ease of use and compatibility with existing instruments. The HTC test area is clear to the NE and is in a heavy industrial area. Signal strength was around 50 (60 is good, 40 is marginal) which was lower than most remote areas. It is thought that nearby power lines may have caused some signal loss. The system was connected to a DoW standard SDI-12 pressure instrument with a solar powered 12V battery and data was transmitted to the existing DoW Neon server. Power consumption was low and within DoW requirements.



Test rig with Hughes modem, Neon terminal and SDI-12 level instrument.

No faults were observed during this period with all data being successfully transmitted. The trial was then moved further afield and the system tested alongside existing LEO satellite sites (Walyunga and Yalliwirra) located in the Avon valley just north of Perth. The system performed very well at both locations and was able to connect to the satellite even from the base of a steep river valley as low as water's edge. The river valley lies in a north/south direction with the antenna dish facing towards the valley hill crest. Signal strength 55-57.

Previous experiences with the dialup Inmarsat system using the Thrane and Thrane modems proved to be unreliable from sites located along the south coast of the State. This locality was therefore chosen to further test the Hughes modem. The map shows the location of each test site. Test sites were chosen where either steep slopes or heavy scrub would most likely cause system failure.



Location of test sites in the SW of Western Australia.



Approximate test area on the south coast.



Site 1 Stirling Ranges.

In valley floor with medium density forest to NE and peak 600m.

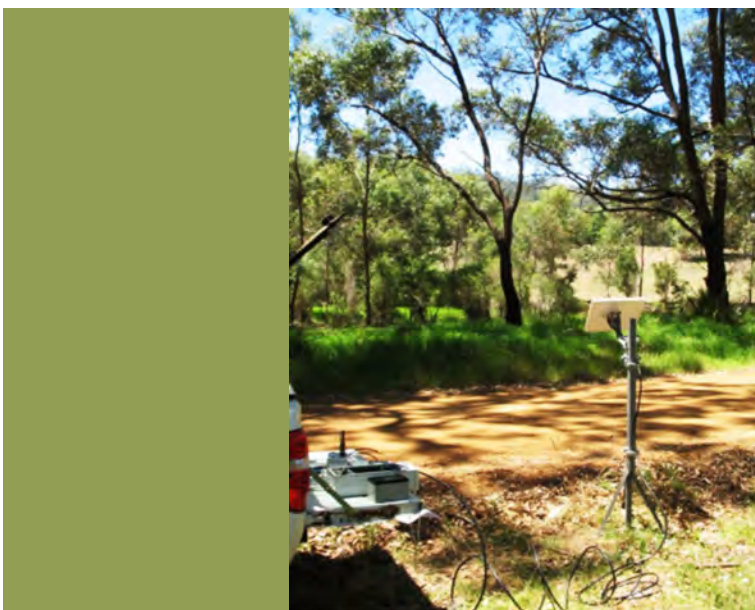
System failed to connect.
Signal strength 30-40.



Site 2 Stirling Ranges.

Half way up valley slope, clear exposure to NE and peak 500m.

System connected immediately.
Good signal strength 56.



Site 3 South side of Porongurups.

Some trees in path to NE with peak at 400m.

System connected immediately.
Signal strength 56.



Site 4 Denmark, Scotsdale River Valley with heavy scrub, hills to NE 150m.
System failed to connect when close to scrub.
Scrub height around 5m.
Signal strength 43.

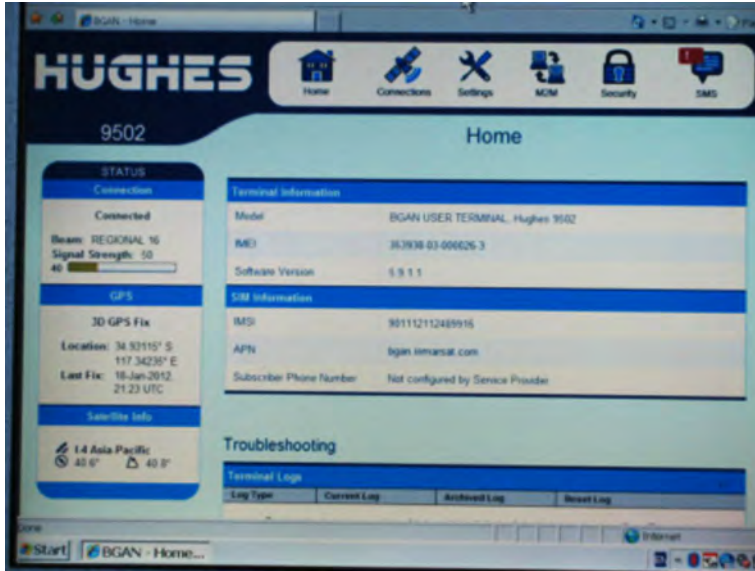
However, after relocating 5m SW from scrub, the system connected immediately.
Signal strength 50



Site 5 Nornalup Forest Tall Trees (40m) with Low Understory.
System connected immediately with signal strength "Narrow" and 51 and also "Region 16" and 65. Not sure why the changeover in signal strengths.



Site 6 Shannon Forest Medium Trees with Heavy Understory to 6m.
System failed to connect.



Hughes software appearance showing signal strength.

Trial Outcomes

- Overall the Hughes modem with Neon terminal performed surprisingly well and it was hard to get the system to fail.
- Provided there is a clear view from the antenna dish to the satellite, connection appears to be guaranteed.
- The antenna dish includes a 15 m low-loss coaxial cable and is a directional type. Unfortunately the antenna dish is highly visible and therefore may not be suitable in vandal-prone sites.
- Topography in the SW of Western Australia is typically low with the peaks in the Stirling Ranges (some of the steepest in WA) located at around 20 degrees elevation from base. Therefore the 40 degree elevation and NE bearing to the GEO satellite will most likely allow clear view from many WA hydrometric sites.
- Thick scrub appears to stop all transmissions and this is to be expected with any radio system.
- Medium tree canopy appears to be OK.
- Indicative costs are about the same as the Globalstar system.

HTC is liaising with Unidata on suitable housings that will maintain compatibility with existing systems and has ordered two systems to conduct long term trials.