Proposed TIGER-3 Radar Architecture

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La Trobe University, the University of Newcastle and the University of Adelaide are planning to build a new digital SuperDARN HF radar at Buckland Park, near Adelaide in South Australia. The new radar (TIGER-3) is the subject of a current grant application and, if funded, is expected to commence operations in 2011. TIGER-3 will have an extended azimuthal footprint east to New Zealand and South to just reach Antarctica. It will provide overlap with the existing TIGER radars, Bruny Island and Unwin as well as significant coverage north of their Field of View.

TIGER-3 will be a stereo radar with antennas chosen so that extended azimuthal sweeps can be accommodated. By placing fully digital transceivers at each antenna the operation of each channel can be completely de-coupled in all operating parameters, e.g. beam width and sweep rate, apart from the transmit pulse pattern. This will enable each channel to operate in completely different modes, for example, the hardware will be capable of supporting one channel operating in a mode giving high-resolution Doppler spectra of low velocity echoes, while the other provides un-aliased spectra of high-speed echoes. Further more, by placing transceivers at each antenna we will have the option to record separately the signals received by each antenna, enabling significant post-processing of radar parameters. This has tremendous potential for the study of highly variable space weather systems, as it is not always possible to specify in advance what precise mode of operation would be ideal for each event.

In designing the architecture for the TIGER-3 radar our focus is on greatly simplifying construction and pushing down as much as possible data reception and generation onto PCs. We will achieve this by implementing a fully digital transceiver front-end in high performance Field Programmable Gate Array (FPGA), with 1Gbit Ethernet connection to a PC on which the back-end transceiver processing will be performed. We envisage that this will produce the best mix of cost vs performance vs flexibility. Once completed we expect this architecture will provide significant cost reductions for future radars.