

Radiation blasts Space Ship Earth

In September 2002 a team of three departed from Cape Town on board the *Kapitan Klebnikov* bound for Mawson. Their task was to install the new components of a neutron monitor, a device that measures the ground effects of the dynamic radiation environment surrounding the earth. This instrument is part of the international Space Ship Earth collaborative network ('Space Ship Earth: monitoring space weather', *Australian Antarctic Magazine*, 1:31)). The neutron monitor sites that make up the network are carefully chosen to view specific directions in space as shown in the graph opposite. Nine installations view in narrow bands around the equator whilst two others view the far north and south giving complete 3-D coverage. The data are recorded with one minute accuracy and transmitted in real time back to the central coordination agency, the Bartol Research Institute of the University of Delaware, from which they are forwarded to industry and governments. The Australian Antarctic Division and the Institute of



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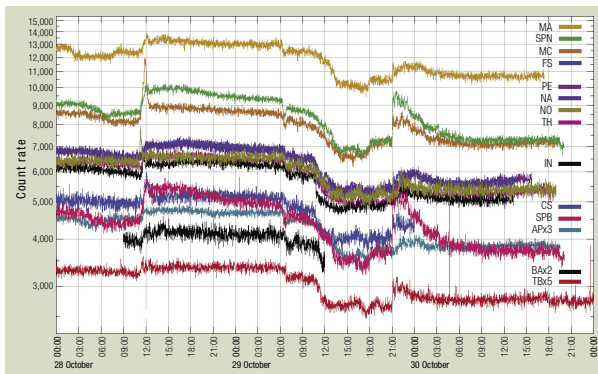
Above left: Upgrading the neutron monitor in the newly extended Cosmic Ray Laboratory at Mawson. Above: An aurora illuminates the cosmic ray laboratory at Mawson station.

The unexpected recent solar activity at the end of October and November resulted in rare radiation blasts hitting the Earth with such energy that they produced increased background radiation at sea level (see the following story). These occurrences are known as Ground Level Enhancements (GLEs) and only 67 have been recorded since reliable records began in the late 1940s. A total of three such events were recorded around 12 Universal Time (UT) on 28th of October, 21

this stage of the solar cycle) and the large but not smooth drop before the second GLE is due to the material blasted off the sun during the first GLE hitting the earth a day later and causing a large geomagnetic storm.

Perhaps even more exciting is the fortuitous recording of flight radiation dose data by Qantas pilot Ian Getley during the second GLE. As well as being a pilot, Ian is undertaking postgraduate studies on radiation dosage in aircraft and was the pilot on a Qantas Boeing 747 flight between Los Angeles and New York at the time of the event. His equipment recorded a greater than 30% increase in the dose rate at the time of the GLE. This is possibly the first time that flight data at high altitude and reasonably high magnetic latitude have been recorded and will prove invaluable in refining both the atmospheric response to such radiation and in assessing the radiation dose hazard in such events. Following European Union legislation requiring airlines to keep track of radiation exposure by aircraft crew a few years ago and similar legislation in other countries it is timely that we learn more about these rare but important events.

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Left: Space Ship Earth data showing Ground Level Enhancements from 28 to 31 October 2003. The top trace is the data from Mawson station. Below right: The location (red circles) and corresponding viewing directions (yellow lines) of the Space Ship Earth network of neutron monitors.

Terrestrial Magnetism, Ionosphere and Radiowave Propagation in Moscow make up the rest of the consortium. The value of these measurements is that they give an immediate picture of the high-energy radiation environment in space near the Earth that affect spacecraft operation and that is responsible for the increased radiation dosage received in aircraft, particularly those travelling at high altitude and high magnetic latitudes.

During the 2002 winter the cosmic ray laboratory at Mawson had been extended from its 'L' shape to a rectangle to house the new monitor. The existing monitor at Mawson was to be upgraded with new electronics and two identical modules added in the building extension to triple the total size and thus almost double the statistical accuracy of the data. The installation of the new modules involved manually placing 20 tonnes of lead rings in rows into which the detection counters were fitted and enclosing the module in a thick plastic housing. This was achieved in under a week due to the assistance of the station staff. Within a short time the new system was fully operational with data flowing back to Kingston and on to Bartol.

UT on 29th of October and 18 UT on 2nd of November. The Space Ship Earth data from the first two GLEs are shown in the figure. Although sequences of GLEs are not unknown the occurrence of a sequence and such an active solar region well into the declining part of the 11 year solar activity cycle is extremely rare. Looking at the figure it is clear that the radiation environment was anything but steady (it usually is almost flat at

