



Radar Status Overview

Mark Lester

With thanks to the SuperDARN
PIs



Jean-Paul Villain



Hokkaido radar report

2007-2008

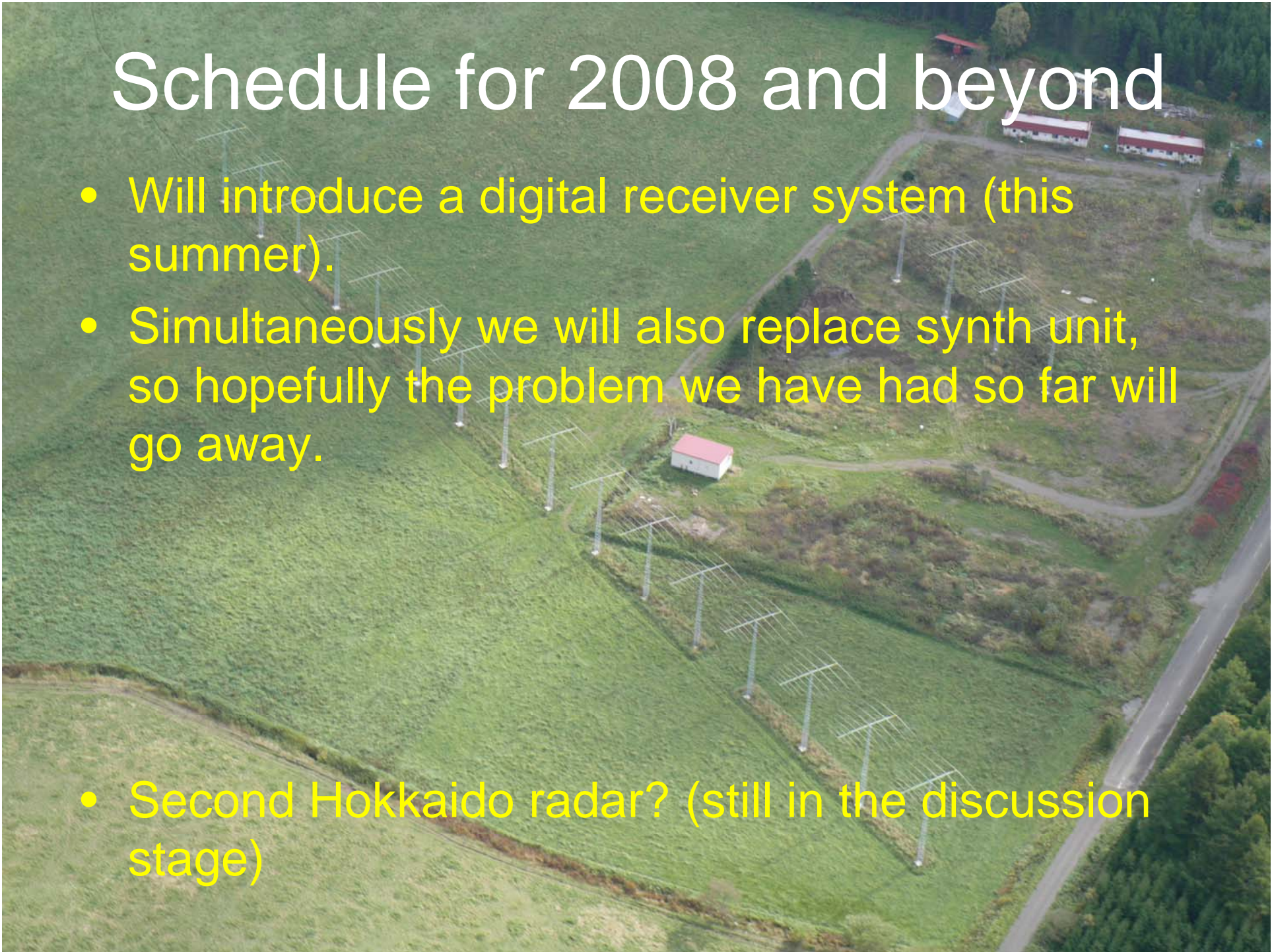


Hokkaido radar status report

- Almost no problem until SD 2007, but...
- Many problems after you guys left!!
 - **High noise level since July to October** so that we had to send the receiver back to Leicester, which led to the data gap (Oct. 12 to Nov. 20). It was also found that the **elevation angle data was useless until October**.
 - **The synthesizer unit began shutting down abruptly** since the end of November. We sent the synth unit to Leicester again (Dec. 13), but Julian Thornhill could not detect any problem.
 - After the unit was back to the site we restarted the radar on Jan. 10 after 1 month of data gap. First 2 months it was ok, but then **we started having same problems again**. We are still tackling the problem.
 - The network link was down twice (August and September) because of lightening. It took two weeks for each event to replace the device and recover the link. They did not affect the radar operation.
 - Power failure occurred on August 26, which did not do harm to the radar system.
- **Data Distribution started on December 11, 2007.**

Schedule for 2008 and beyond

- Will introduce a digital receiver system (this summer).
- Simultaneously we will also replace synth unit, so hopefully the problem we have had so far will go away.
- Second Hokkaido radar? (still in the discussion stage)



Information from SD2007 LOC

- Ms Tomoko Ida (now Tomoko Maezawa), one of the SD 2007 LOC team, got married on March 21!



Tomoko sends her regards to everyone.

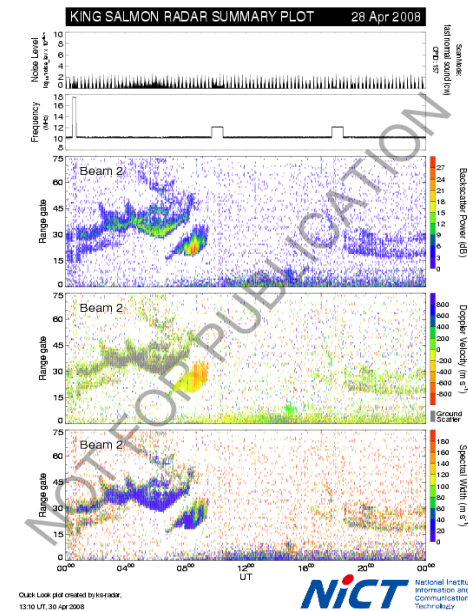
Report on King Salmon Radar

Shinichi Watari
(National Institute of Info. and Com. Tech.)



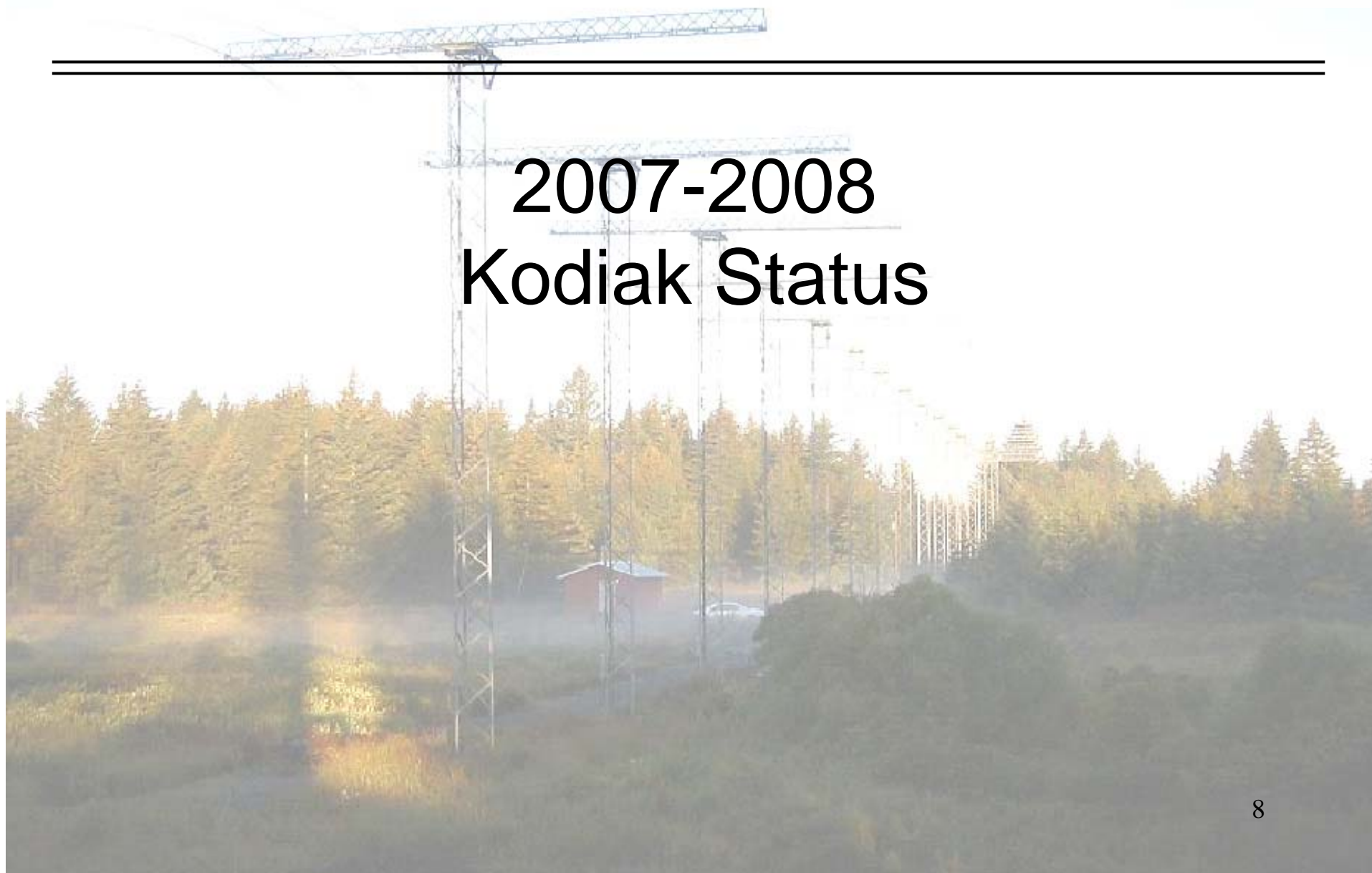
- **Jun. 2007:** Data transfer from the KS radar site to the NICT through the Alaska Univ. started with a help of the Alaska Univ. Group. Quick look plots of the KS radar are produced in collaboration with the Nagoya Univ. Group.
(http://www2.nict.go.jp/y/y223/sept/SuperDARN/HF_radar_e.html)
- **Oct. 2007:** Replacement of a pair of wireless bridges at the KS radar site with a help of the Alaska Univ. Group.
- **Dec. 2007:** Failure of a switch at the KS radar site. No observation between 21 Dec., 2007 and 30 Jan., 2008
- **Jan. 2008:** Replacement of the switch with a help of Alaska Univ. Group.

Special thanks for Dr. Bill Bristow, Dr. Tomoaki Hori and Dr. Nozomu Nishitani.





2007-2008 Kodiak Status





The radar worked again this year

- Installed Direct Digital Synthesis to create transmit signals in September 2007.
 - Error in phasing resulted in broad transmit beam until March 2008
 - DDS allows adaptive beam forming and phase coding for near arbitrary range resolution. Have tested with 9 km resolution.
- Continued work on multi-receiver system. Deployed May 2008 (Todd will present).

Major Changes at JHU/APL

- Ray Greenwald has retired from APL and accepted part-time research professorship at Virginia Tech.
- Mike Ruohoniemi has moved to Virginia Tech as a tenure track Associate Professor.
- Jo Baker has moved to Virginia Tech as a tenure track Assistant Professor.
- Elsayed Talaat will lead continuing science activities at JHU/APL.
- Rob Barnes will continue his SuperDARN software and data processing responsibilities at JHU/APL.
- Rob finally has his Permanent Residency Status in USA.

Major Changes at JHU/APL

- SuperDARN Upper Atmosphere Facility Grant currently being transferred from JHU/APL to VT.
 - JHU/APL effort to be funded through a subaward from VT to JHU/APL.
- Mike Ruohoniemi will be the P.I. of the SuperDARN facility grant at VT. He will be responsible for the:
 - Goose Bay Radar
 - Kapuskasing Radar
 - Blackstone Radar
- Elsayed Talaat will be the P.I. of the JHU/APL sub-award. He will be responsible for the:
 - Wallops Island Radar

Goose Bay Radar

- Goose Bay radar has been operating well with the exception of a heat problem caused by transmitters inside building.
 - Required replacement of one computer last summer.
 - Radar is or will be shut down until air conditioning installed for summer operation.
 - Will be completed after grant is transferred to VT.

Kapuskasing Radar

- Kapuskasing radar has been operating reasonably well.
 - Sensitivity affected by long cables between Tx units and antennas.
 - Air conditioning has been installed in building.
 - Plan to upgrade to a digital receiver this summer.

Wallops Island Radar

- Funds from THEMIS paid for development of interferometer array.
 - Construction of antenna array complete, electronics needs to be assembled.
 - Antennas need minor modification and calibration.

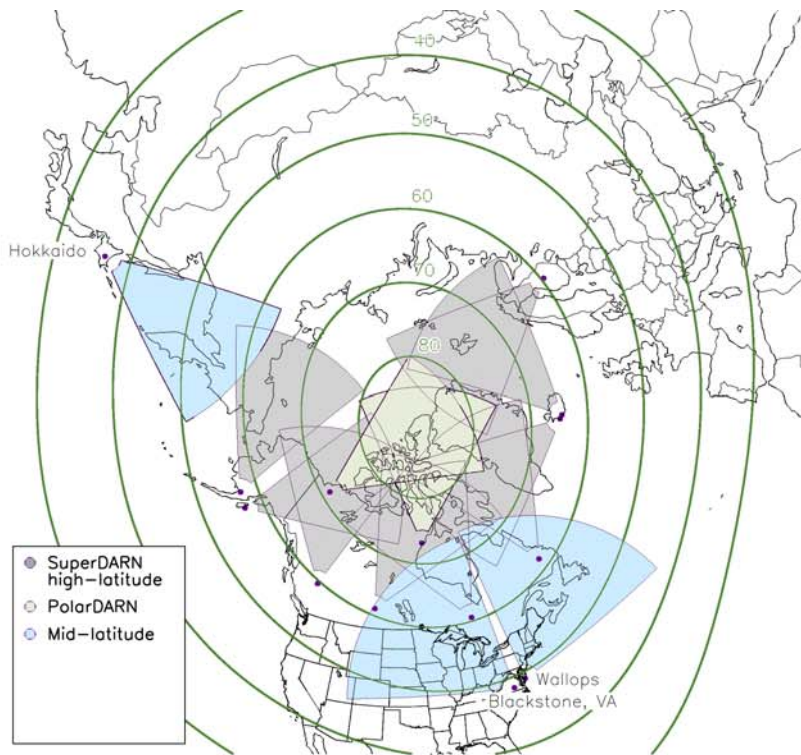
Blackstone Radar

- New radar developed by Virginia Tech, University of Leicester, and APL completed and put into operation. Radar has been operating since early February, 2008.
- More to be presented on this radar later in the meeting.

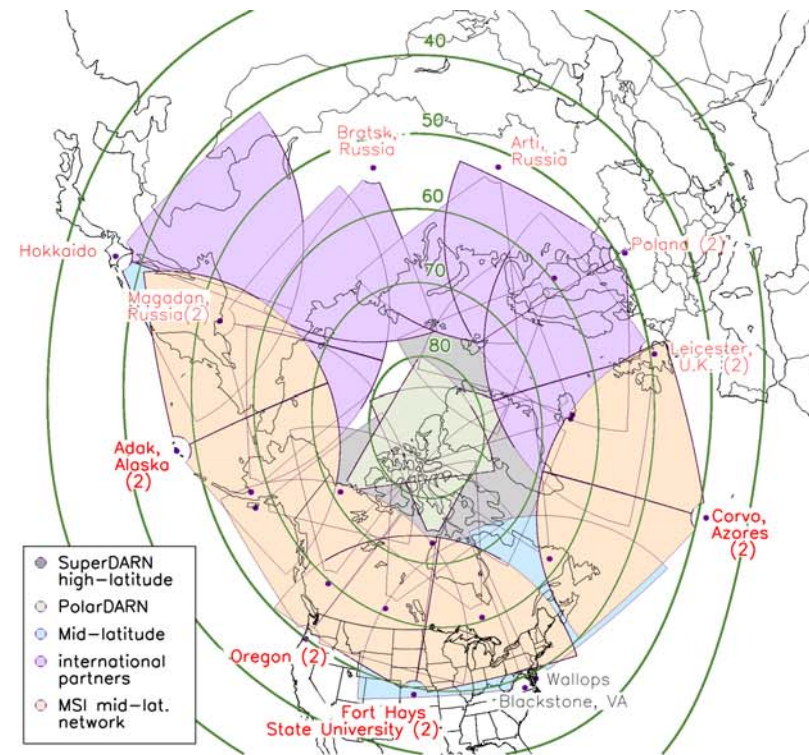
New Mid-Latitude Radars

- NSF has approved a preliminary proposal for an array of 8 additional mid-latitude SuperDARN radars.
 - Proposal submitted by Dartmouth College, Virginia Tech, University of Alaska, and APL.
 - One of eight proposals requested to submit full proposals
 - If approved, construction will begin in Summer, 2009.
 - Full proposal submitted on May 30, 2008

Coverage of Proposed Radars

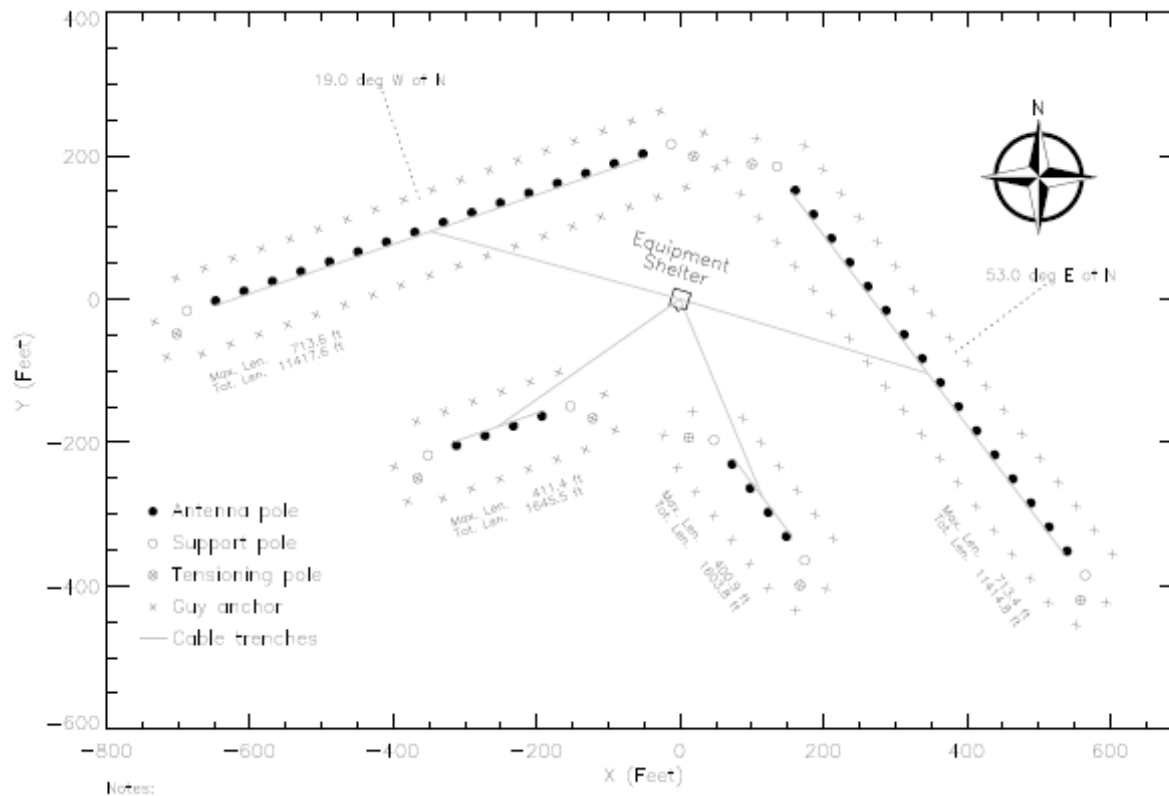


Current



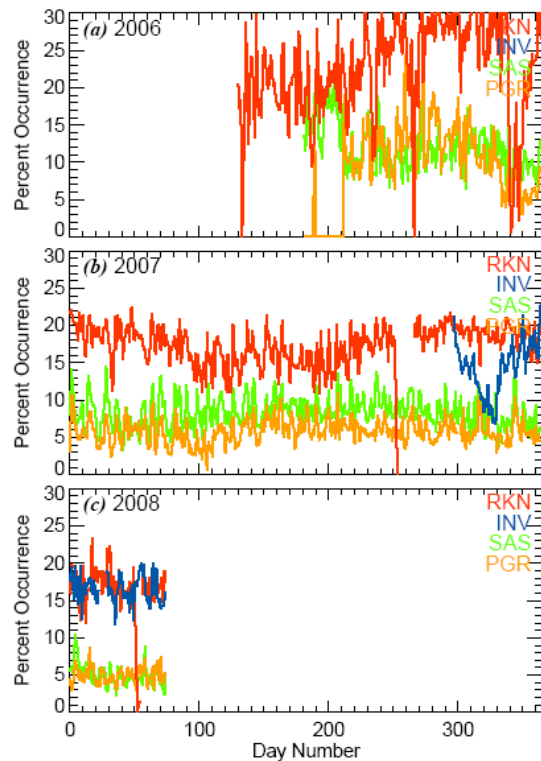
Proposed

Fort Hays, Kansas Site Photo and Layout Plan



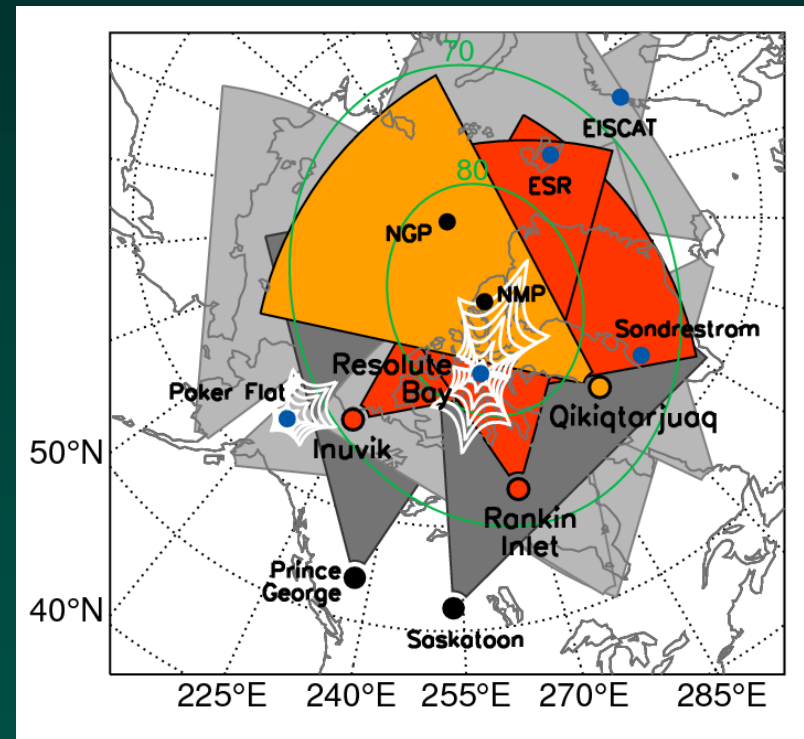
Saskatoon, Prince George and PolarDARN

- Saskatchewan has been successfully funded by NSERC and the CSA for the next 5 years of operations;
- Have a two-year funded IT position from the CANARIE NEP program;
- The PolarDARN radars receive more scatter than the Prince George and Saskatoon radars
- INUVIK was started in late Oct but, after a few modifications by Jan, became truly operational on Dec. 12, and that the results have been very good, considering the solar cycle 23 minimum conditions that both radars have encountered since turn-on.



- Occurrence of backscatter is illustrated in this viewgraph
- PolarDARN radars are the red and blue curves
- Sas and PG are the green and orange curves

- Current success of the PolarDARN radars has led to suggestion of a third radar.
- Radar would be located in Greenland



General

- No major hardware problems with the current radars
- Both radars running well and providing good results
- Plans for major maintenance trips to both sites this summer



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Funding Crisis in the UK

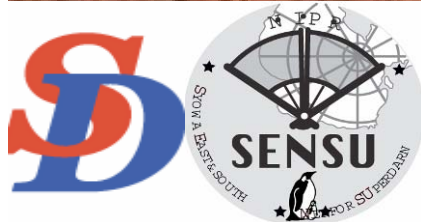
- Major concerns over funding, although the current situation is less than clear
- In December 2007, STFC announced in its delivery plan that it was pulling out of all ground-based STP facilities
- However, I have a grant which runs until March 31 2010
- STFC subsequently engaged in a “consultation exercise” to which many of you contributed
- Reports have been submitted and will be reviewed by STFC Council at start of July
- Future funding for STP in the UK is unclear despite much pressure including in a report by the House of Commons Select Committee for Innovation, Universities and Skills



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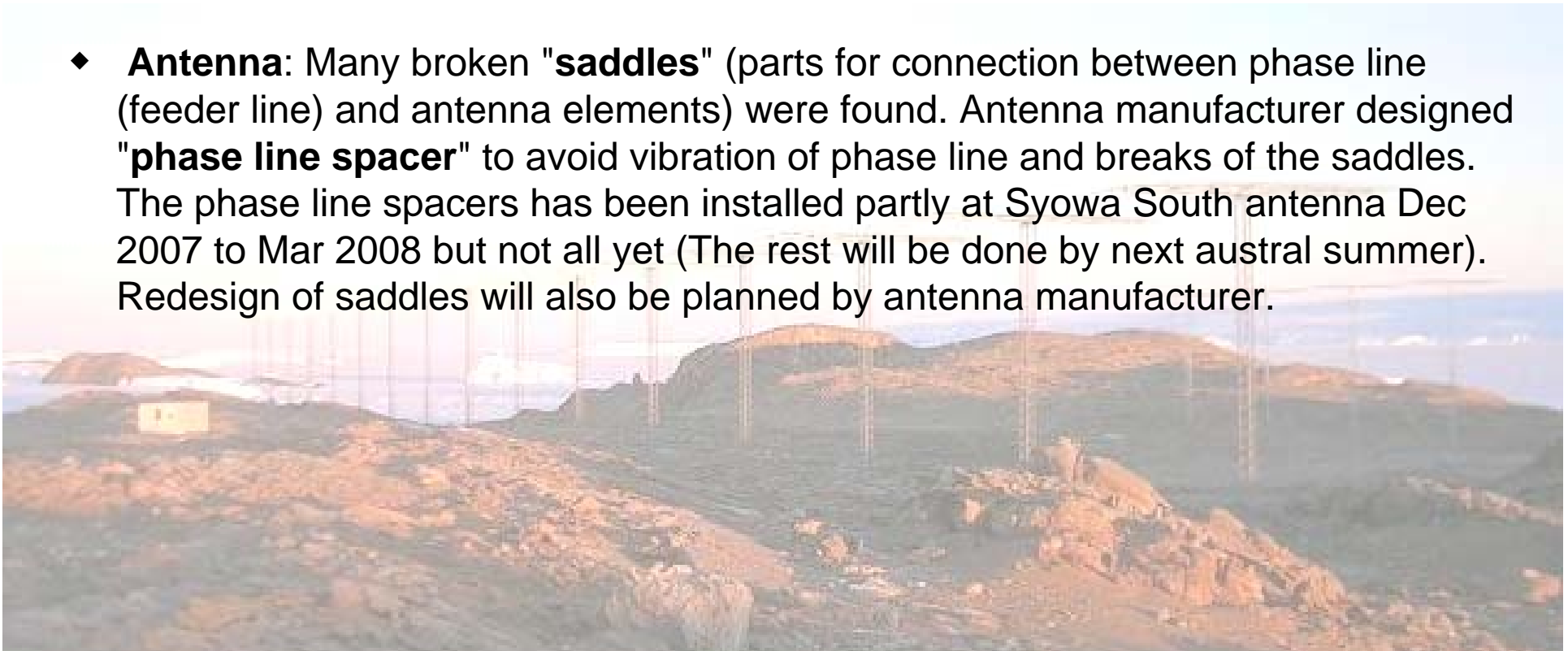
Status Report of SENSU Syowa South and East radars

Natsuo Sato and Akira Sessai Yukimatu @ NIPR



Syowa South Status Report

- ◆ **Rx system:** Upgrade to Stereo digital Rx system (GC214/TS with Leicester front-ends + DDS unit) was done and tested with the newest ROS β in Apr 2008 successfully with helpful support by Leicester people! (i.e., it is now almost the same as Blackstone radar system). The normal operation and data distribution with the new system started in May 2.
- ◆ **Radops:** Raw IQ data are not obtained yet. It'll be started after detail comparison between new ROS and TMS code and some modification if required.
- ◆ **Antenna:** Many broken "**saddles**" (parts for connection between phase line (feeder line) and antenna elements) were found. Antenna manufacturer designed "**phase line spacer**" to avoid vibration of phase line and breaks of the saddles. The phase line spacers has been installed partly at Syowa South antenna Dec 2007 to Mar 2008 but not all yet (The rest will be done by next austral summer). Redesign of saddles will also be planned by antenna manufacturer.

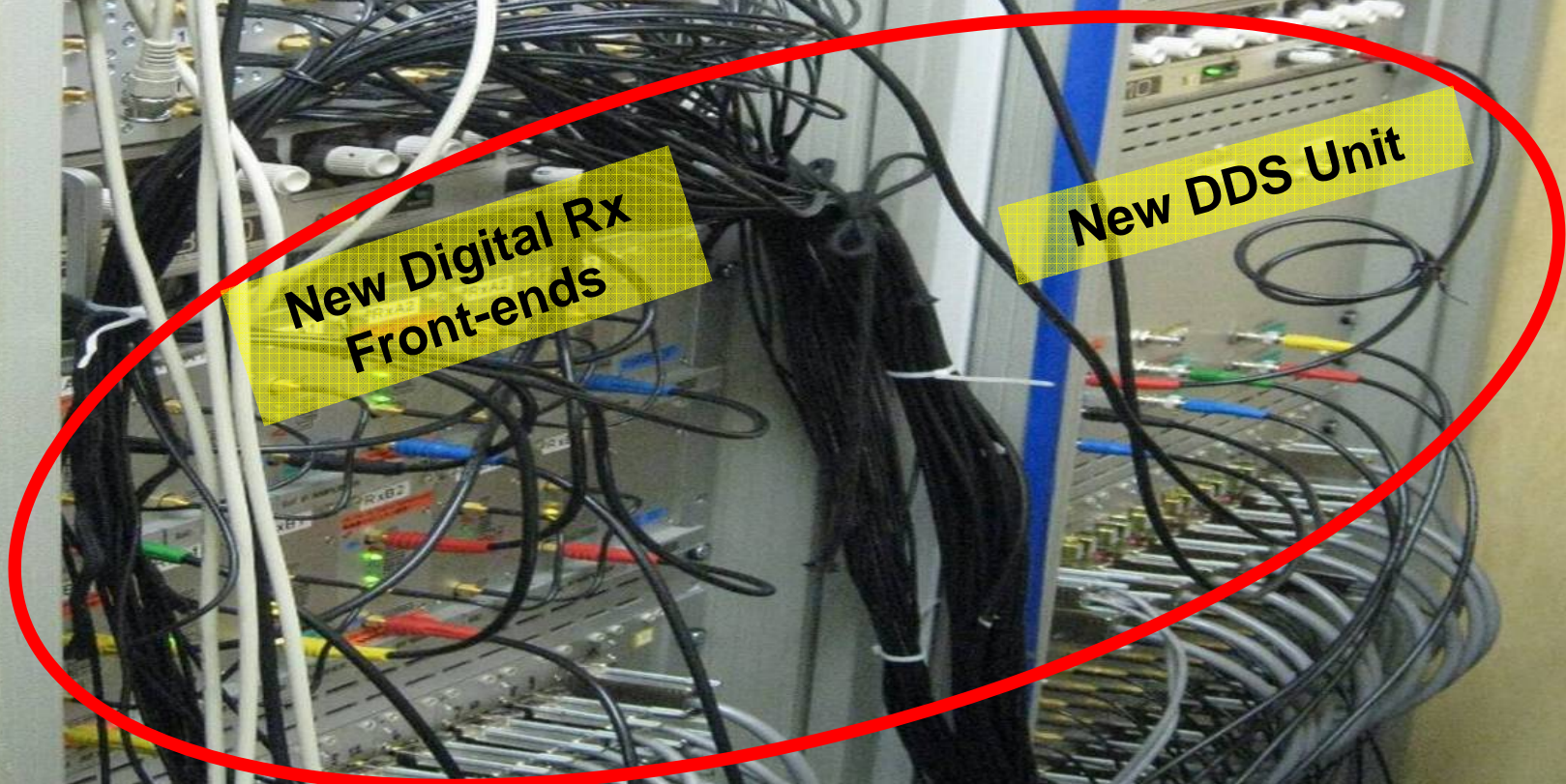


Syowa South New digital Rx system

with 2 GC214TS cards

New Digital Rx
Front-ends

New DDS Unit



Syowa South Status Report

SuperDARN SYOWA SOUTH RANGE-TIME-PARAMETER PLOT

BEAM: 7

Skewed ch.B (-25401)

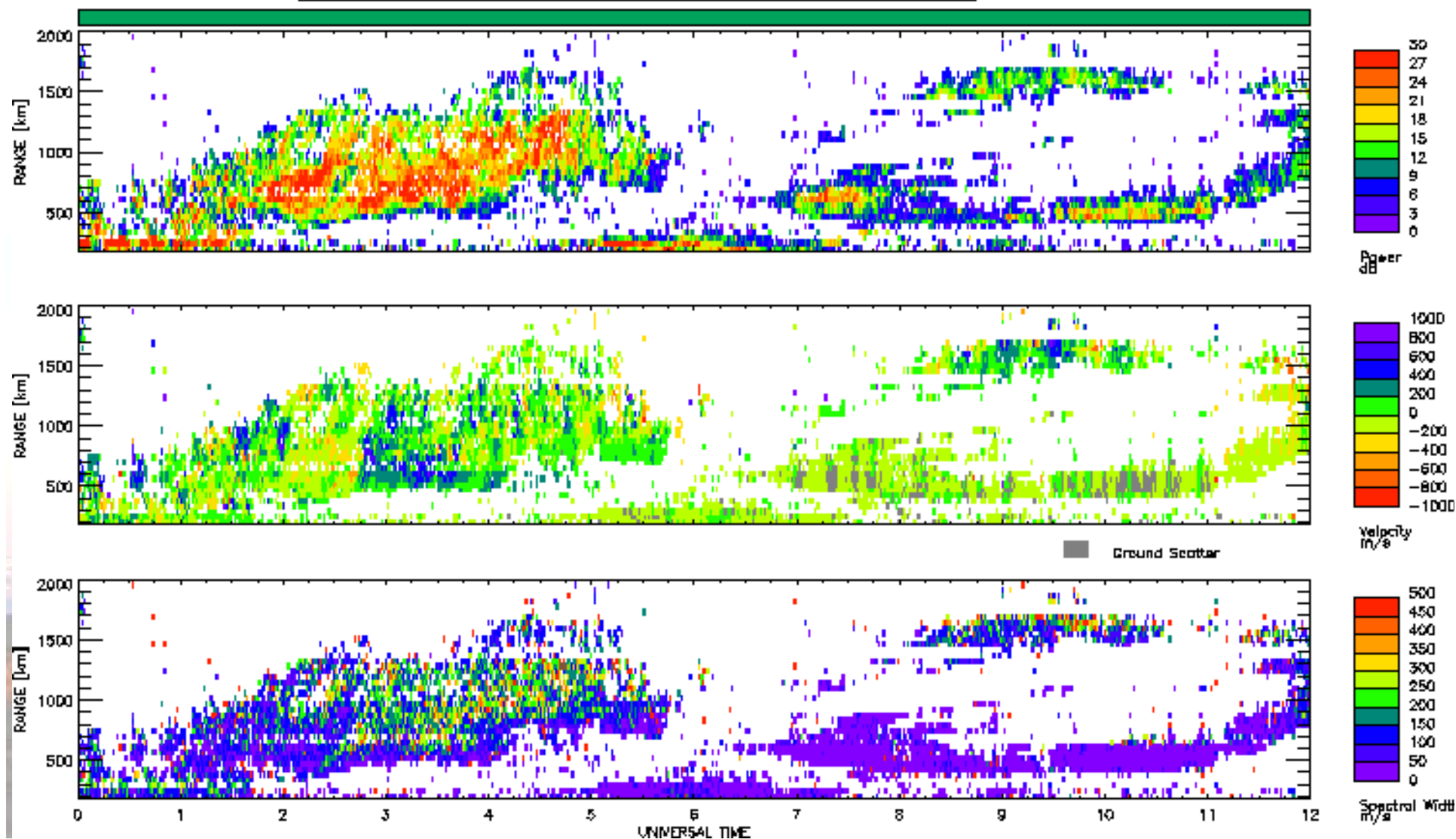
0 10 20 30 40 50 60 70 80 90 100 110 Release /100

DATE: 16/May/2008

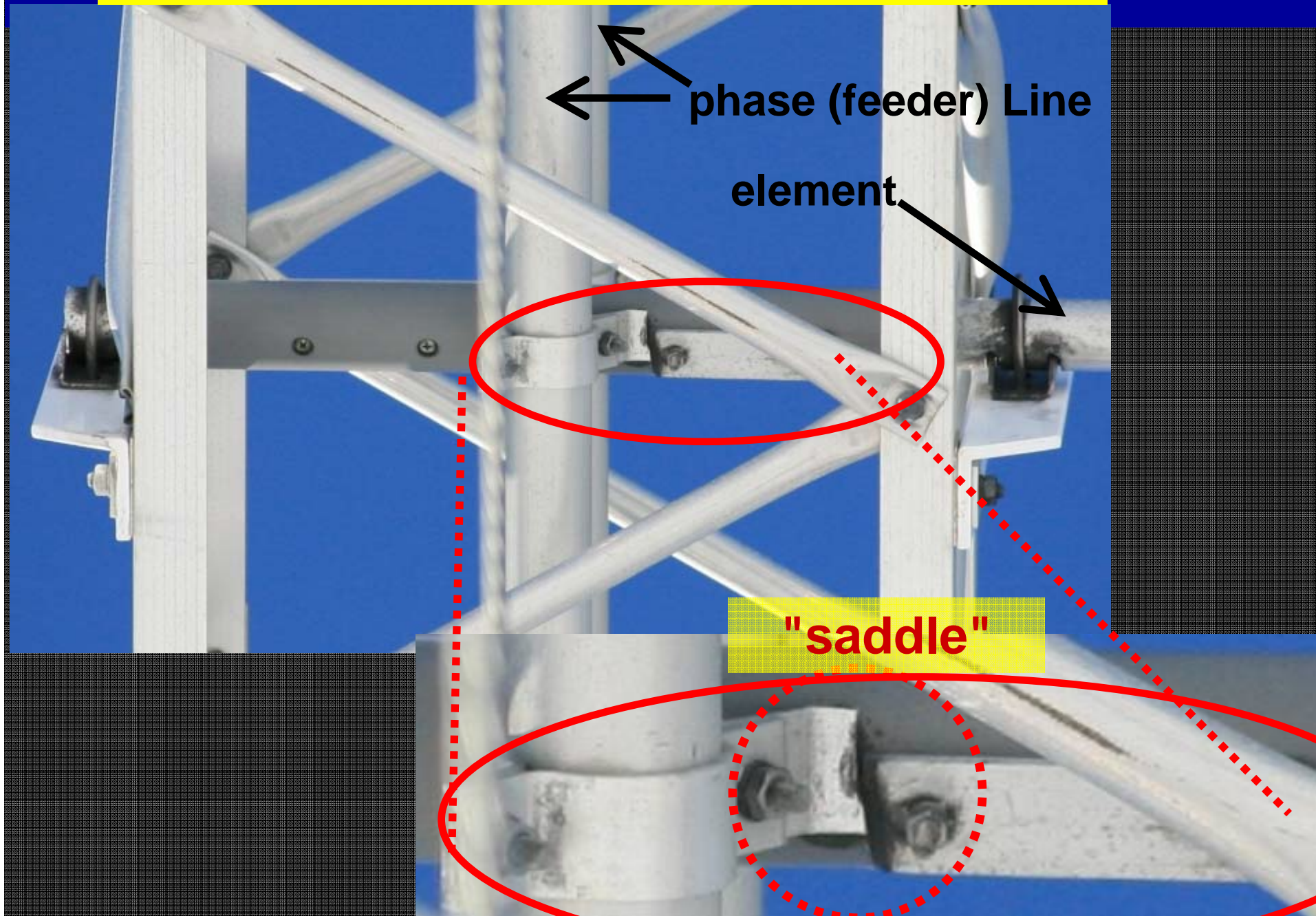
Created by SENSU group

8 9 10 11 12 13 14 15 16 17 18 19 20 Frequency MHz

UAP@NIPR



unexpected broken "saddles"



Syowa East Status Report

Basically no problem

- * But interference is still sometimes/often affecting to data quality
- * TMS mode data (tms/nre) files are always obtained
- * Not upgraded to new ROS β yet. The upgrade will be done after TMS fully migrated to the new ROS β at Syowa South,
- * an optical link between radar site and Syowa main base (~1km) have been used. A spare link with DSL is planned for unexpected shutdown of optical link due to e.g., cut-off of the optical cable in future.
- * Synchronization of Tx pulse timing between Syowa South and East will be planned and tested with helpful support by Leicester people.

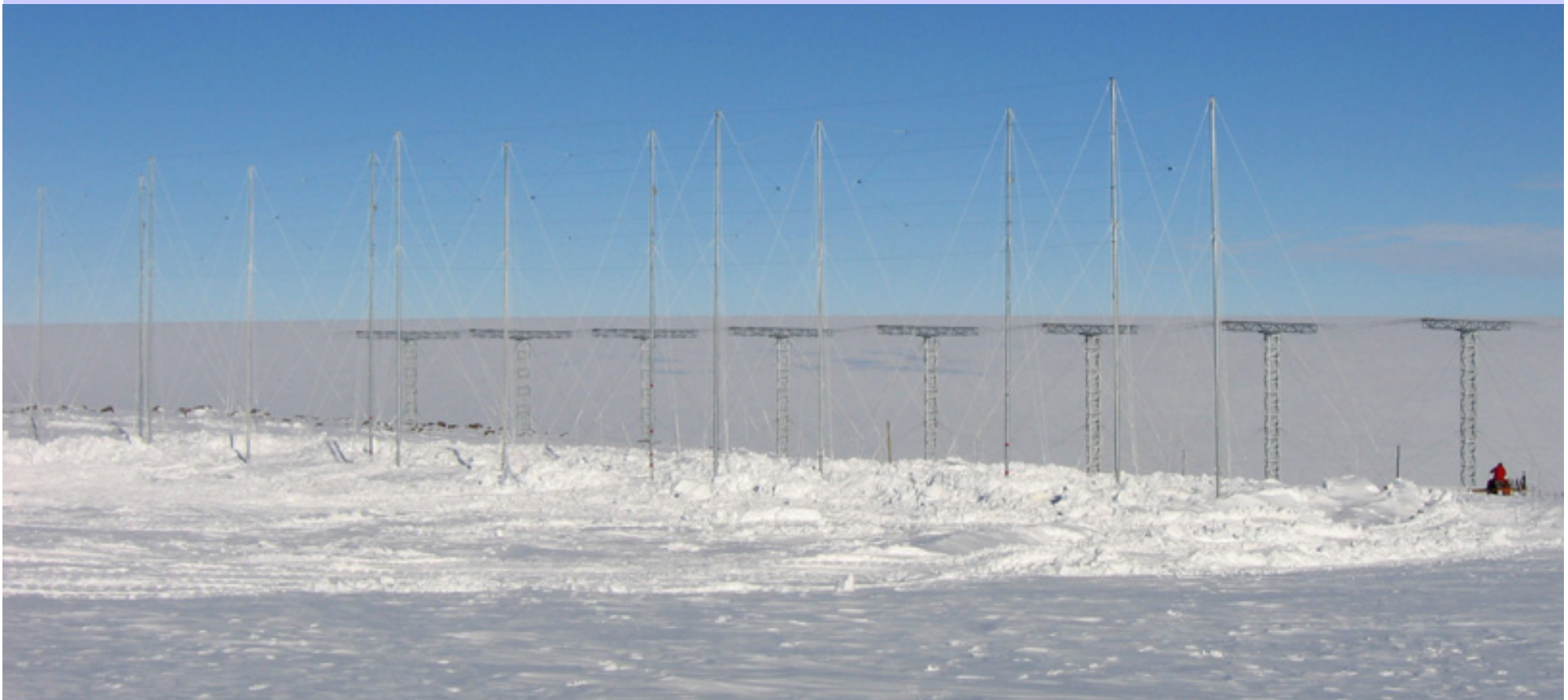




SHARE: Sanae Radar



- Interferometer antenna ('Wallops Island style', installed February 2006) standing tall after two Antarctic winters
- Elevation angle calibration using helicopter problematic – 'drone' being developed for better calibration early 2009





SHARE: Sanae Radar



Radar Operations:

- Implementation of individual digital receivers for each antenna (16 + 4) being tested by 2008 Sanae Radar Engineer Llewellyn Kriedemann
- New operating system installed, but problems with running it – working on resolving issues with configuration files...
- 2009 Radar Engineer Keith Brown at HMO developing drone for interferometer calibration



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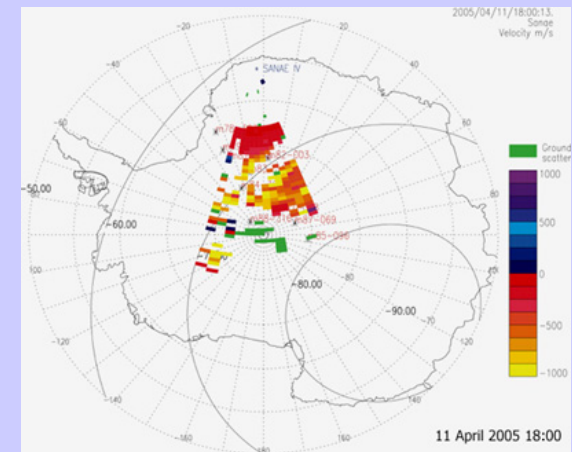


SHARE: Sanae Radar



Radar Data:

- 2007 data returned from Antarctica to Durban in April 2008. Appear to be some data gaps in February and April 2007, but checking... Otherwise, radar operated normally throughout the year.
- Installation of broadband comms with Sanae (for real time data) February 2008 – at last!



And in other news...

- Progress on construction of South African low latitude radar.....



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Halley Status Report



- Radar ceased operation on 15 December 2007
 - radar cabooses returned to Cambridge
 - antennae scrapped
 - new foundations laid
 - new caboose design being drawn up (single caboose rather than two)
- Re-build of Halley 6 station has been delayed due to subcontractor problems
- Radar now likely to resume operation in Jan 2012 (delayed from Jan 2010)
 - options for earlier start under consideration
 - autonomous operation – any advice?
 - other location (e.g., Falklands site selected) – funding source uncertain



**British
Antarctic Survey**

NATURAL ENVIRONMENT RESEARCH COUNCIL

Future



- Difficult times for solar-terrestrial physics in UK
 - identified as low priority by main funding body (STFC) and BAS's funding body (NERC)
 - thanks to all who offered support during recent STFC consultation
 - outcome pending
 - some continuing support for STP at BAS from NERC to maintain national capability
 - low level
 - Halley radar, key staff



**British
Antarctic Survey**

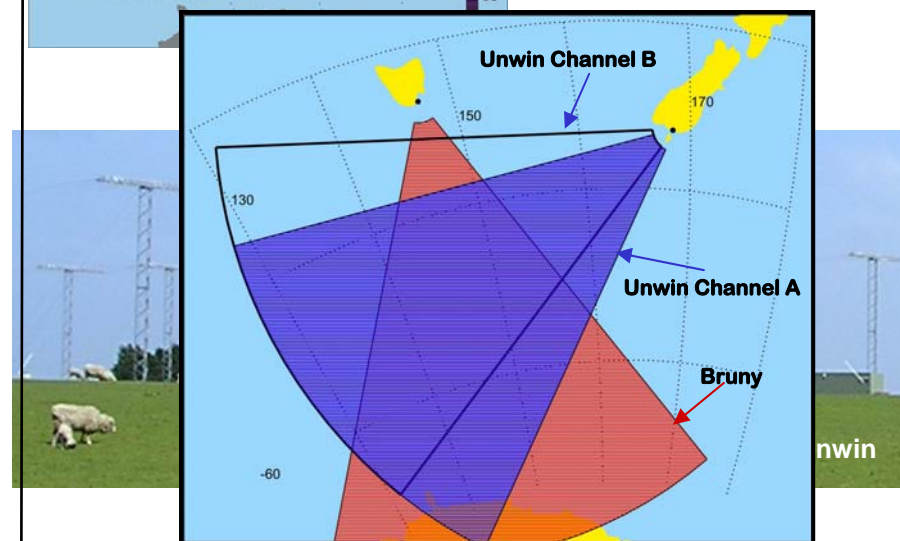
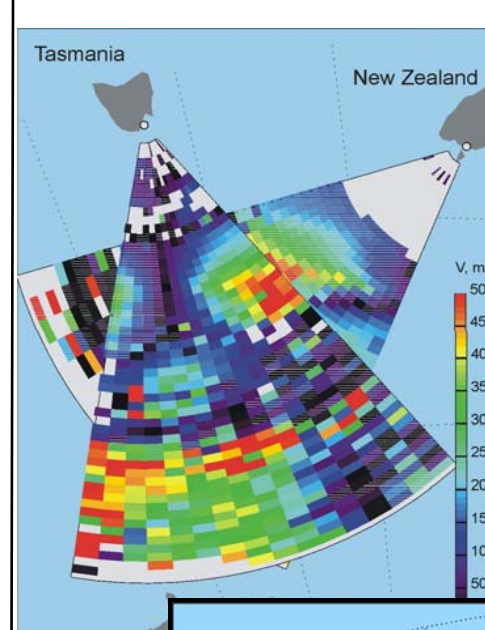
NATURAL ENVIRONMENT RESEARCH COUNCIL

TIGER Bruny

- Operational since November 1999
- Single channel radar

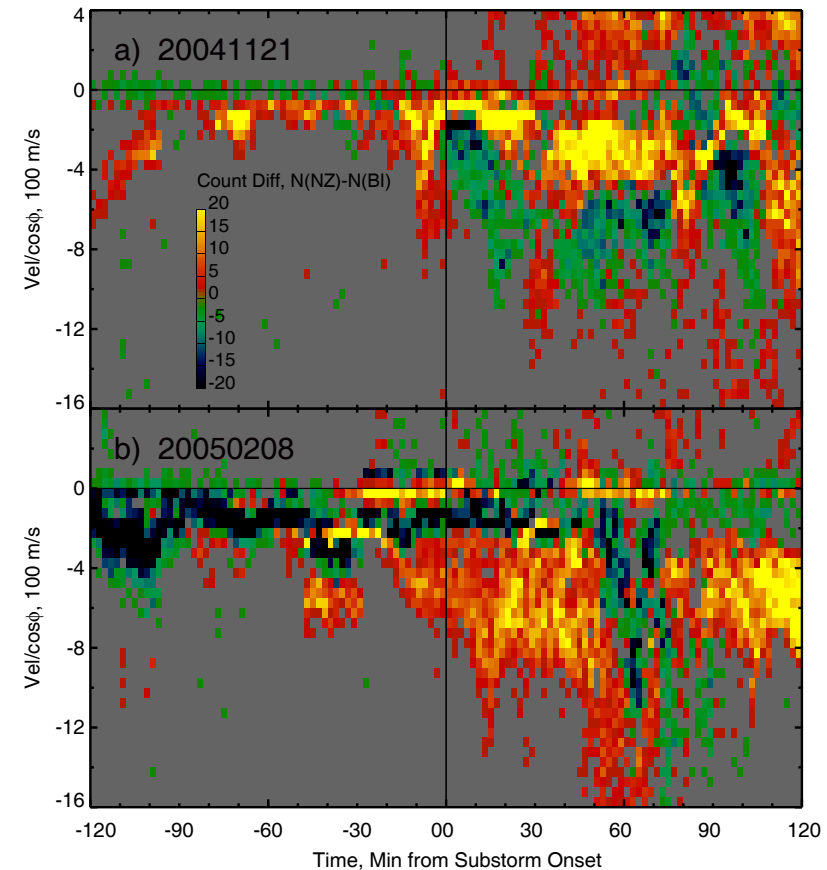
TIGER Unwin

- Operational since November 2004
- Stereo radar
- Channel A – “boresite” footprint
- Channel B – footprint moved 4(?) beams northwest so that same field line can be viewed in F-region by Unwin and in E region by Bruny



Operations 2007-08

- Radars reliable, relatively few crashes although some major
- Use of Discretionary Time
 - E and F irregularities
 - ULF Waves
 - Sea State
 - Various special modes used including shifting Bruny footprint 4 beams east so that it covers AGAD station on Macquarie Island
- Unwin detects fewer echoes than Bruny
 - Improvements made to transmitters but problem not completely solved
- Currently much less ionospheric scatter due to sunspot minimum conditions



2-D colour histogram of the difference in occurrence between the TIGER NZ and BI plasma drift speeds (l-o-s velocity divided by the cosine component of the L-shell angle) versus time from substorm onset (vertical line) for two events. Each 2-min-wide and 50-m/s-high plot cell shows the difference between the counts observed by the TIGER NZ and BI by the colour of the cell according to the colour scheme in panel (a). The BI velocities were reversed and measurements in beams 7-15 were counted. Makarevich and Dyson, *Annales Geophys.*, **25**, 2579-2591, 2007.

Future:

Plans for Digital Radar

- In-principle agreement with BAE Australia to supply digital receivers for Bruny
- Proposal submitted to Australian Research Council to develop a Digital Radar located at University of Adelaide's Buckland Park field station.

Partners:

La Trobe University
University of Newcastle
University of Adelaide

Outcome known November 2008

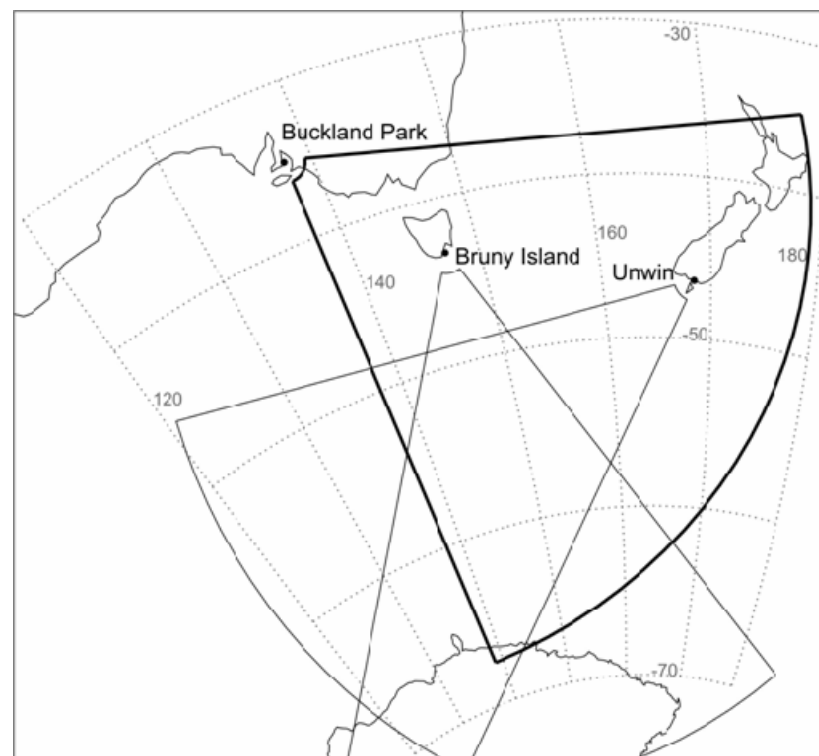


Fig 1. Footprints of the proposed radar, Digi-TIGER, and the existing TIGER radars, BI and Unwin.

Funding

Current Grants:

- Australian Research Council
- Australian Antarctic Program

Past Equipment Grants:

- Australian Research Council
- US Air Force Office of Scientific Research
- British Antarctic Survey

Current Research Funding:

- Current funding for research is tight.
- Major ARC grant (Dyson, Waters, Menk) ends at end of 2008, one grant (Makarevich) continues to the end of 2009.
- Several ARC proposals from La Trobe and Newcastle for 2009 – 2011 funding are currently under review
- Results will be known in November

Consortium Partners:

- La Trobe University – Peter Dyson
- Monash University – John Bennett
- University of Newcastle – Colin Waters
- Australian Antarctic Division – Ray Morris
- DSTO – Trevor Harris
- IPS Radio & Space Services – Phil Wilkinson

Current Operational Funding

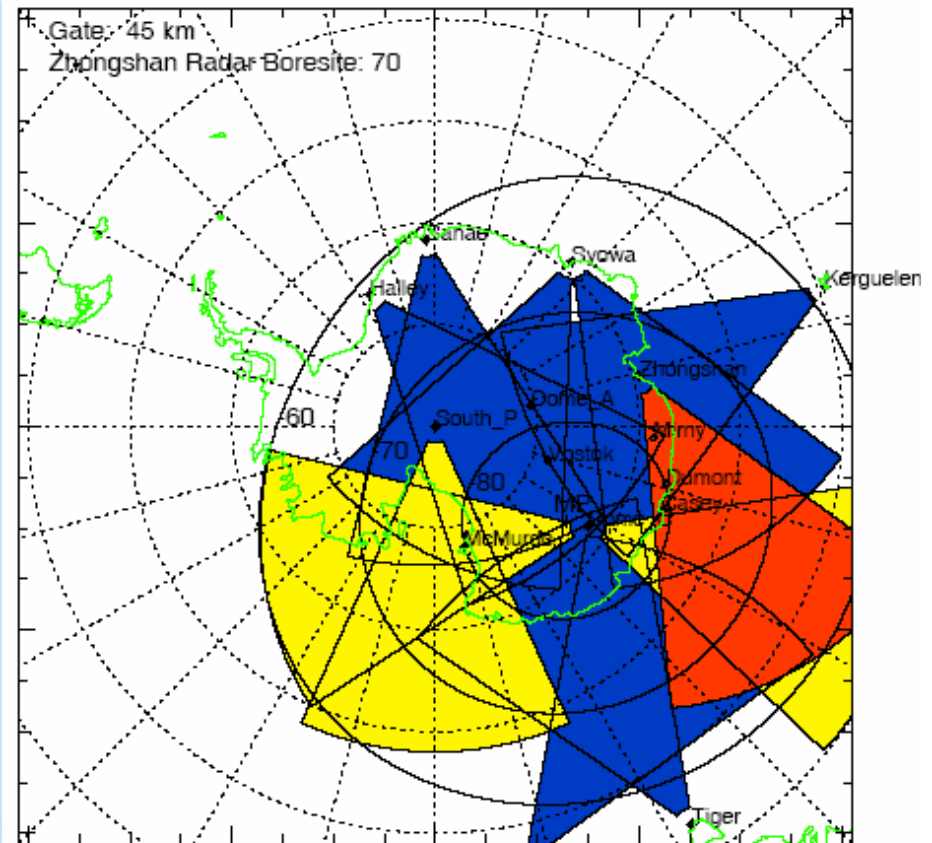
- TIGER Partners
- Funding from DSTO and IPS to help fund radar operations will continue

Chinese Zhongshan Radar

H Hu, H Yang, R Liu & B Zhang @PRIC

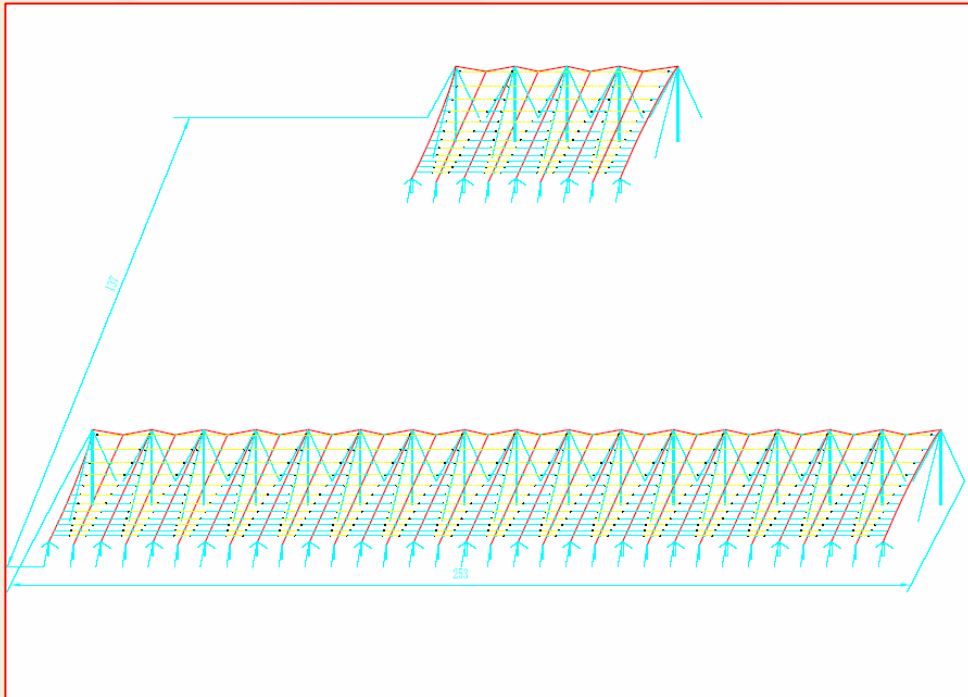
- ❖ Radar site investigation and preparation have been completed.
- ❖ The funding for a stereo radar is ready.
- ❖ In this year
 - ❧ To sign contracts and begin construction in this July.
 - ❧ To build up the antenna basement in 2008/2009 season.
- ❖ In 2009/2010 season
 - ❧ To set up the array and radar system in site and start to operate.

Radar site and FOV of Zhongshan Radar



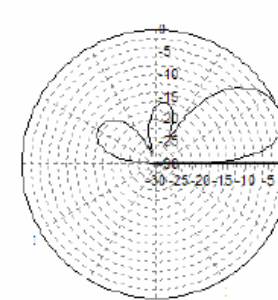
Boresite: 72.5. Combining with France/Italy proposed Dome C west radar to form bi-static radars and to cover an gap of existing SuperDARN radars at Southern auroral oval, which is also a SuperDARN gap in Northern Hemisphere.

Antenna array



- ❖ Soft antenna
- ❖ Antenna separation is 14.5m
- ❖ Be built in China

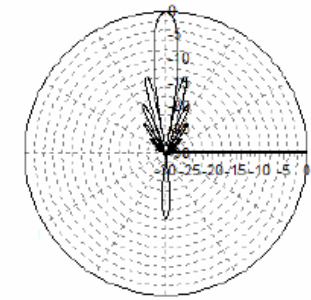
F=8MHz



俯仰方向性

Azim=0°

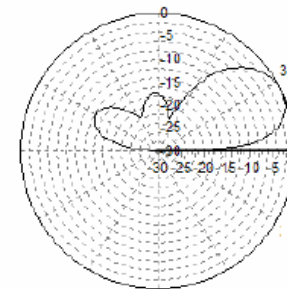
wid=8.8°



方位方向性

G=19.10dBi

F=14MHz

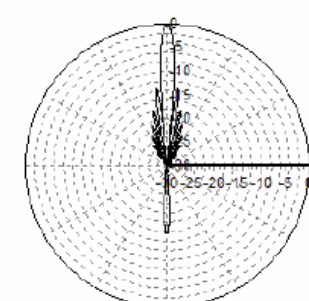


俯仰方向性

Azim=0°

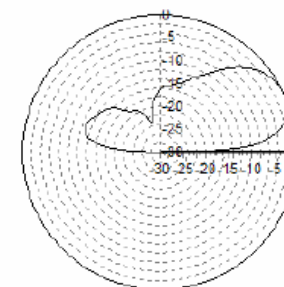
wid=5.0°

G=21.58dBi



方位方向性

F=20MHz

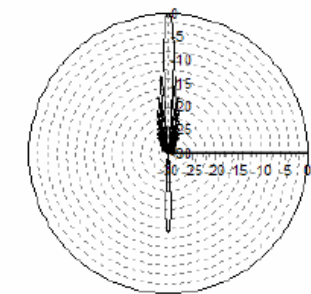


俯仰方向性

Azim=0°

wid=3.6°

G=22.12dBi



方位方向性



2007-2008 South Pole Plans





GEOPHYSICAL INSTITUTE



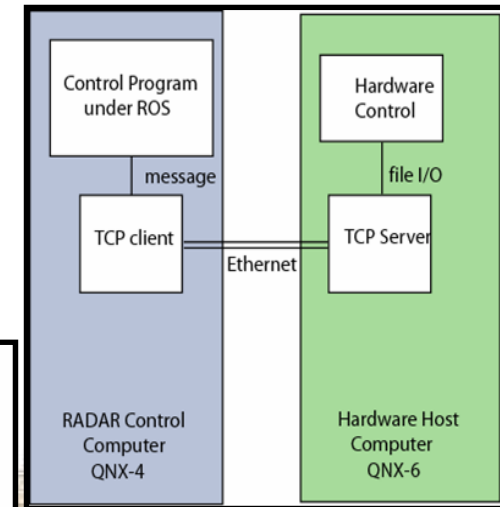
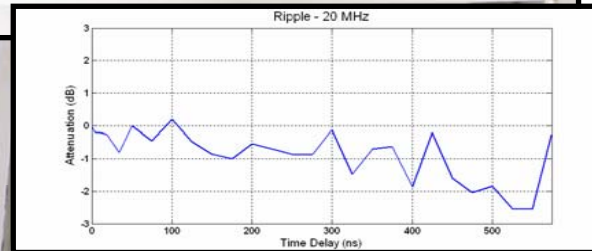
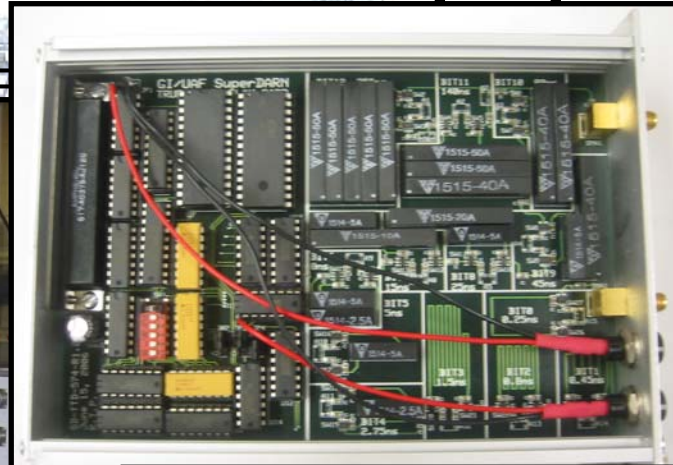
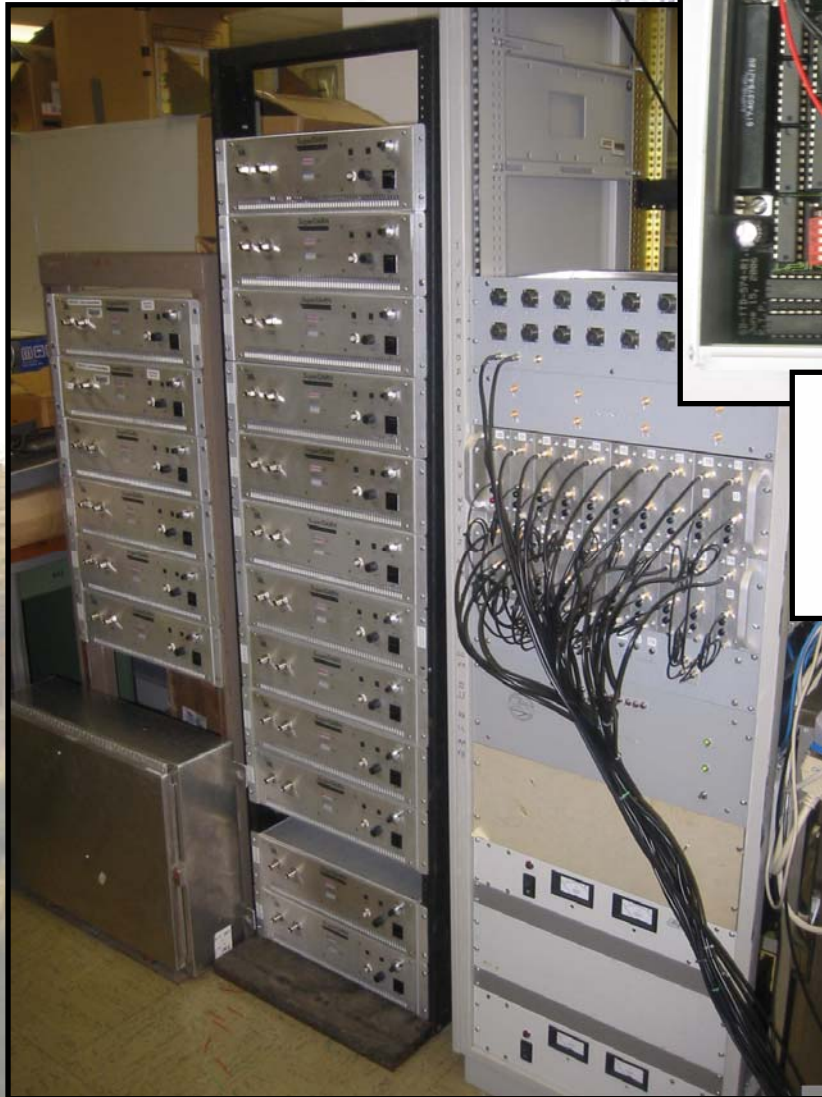
The US Antarctic Radar

At McMurdo





McMurdo ~~South Pole~~ Equipment



The radar consists of the transmitters, the phasing matrix, and five PCI cards (timing, DIO, GPS, synthesizer, receiver)

See poster for details.



Deployment

Deployment schedule is (still) uncertain.

Probably 2008/2009 season

Possibly 2009/2010 season.



Summary

- The last year has been difficult for many reasons
- Yet we have continued to maintain the number of radars despite Halley being pulled out
- New Blackstone radar is operating well and producing good and interesting results
- A new group in the US at Virginia Tech as a result of the move by Ray, Mike and Jo
- Technical developments to hardware and software continue
- New ideas for new radars, for example at mid latitudes in US, in Siberia and on Baffin Is, possibly Japan, South Africa, Australia and the Falkland Islands
- Promotions for Tim Yeoman to a Personal Chair and Steve Milan to Reader partly due to their research with SuperDARN
- Promotion for Gary Abel for his work on complexity at BAS
- Award of a Research Fellowship to Kathryn McWilliams