The Future of the USAP Antarctic Internet Data Distribution System

A discussion on LDM Efforts at ASC

with Satellite Ground Stations update

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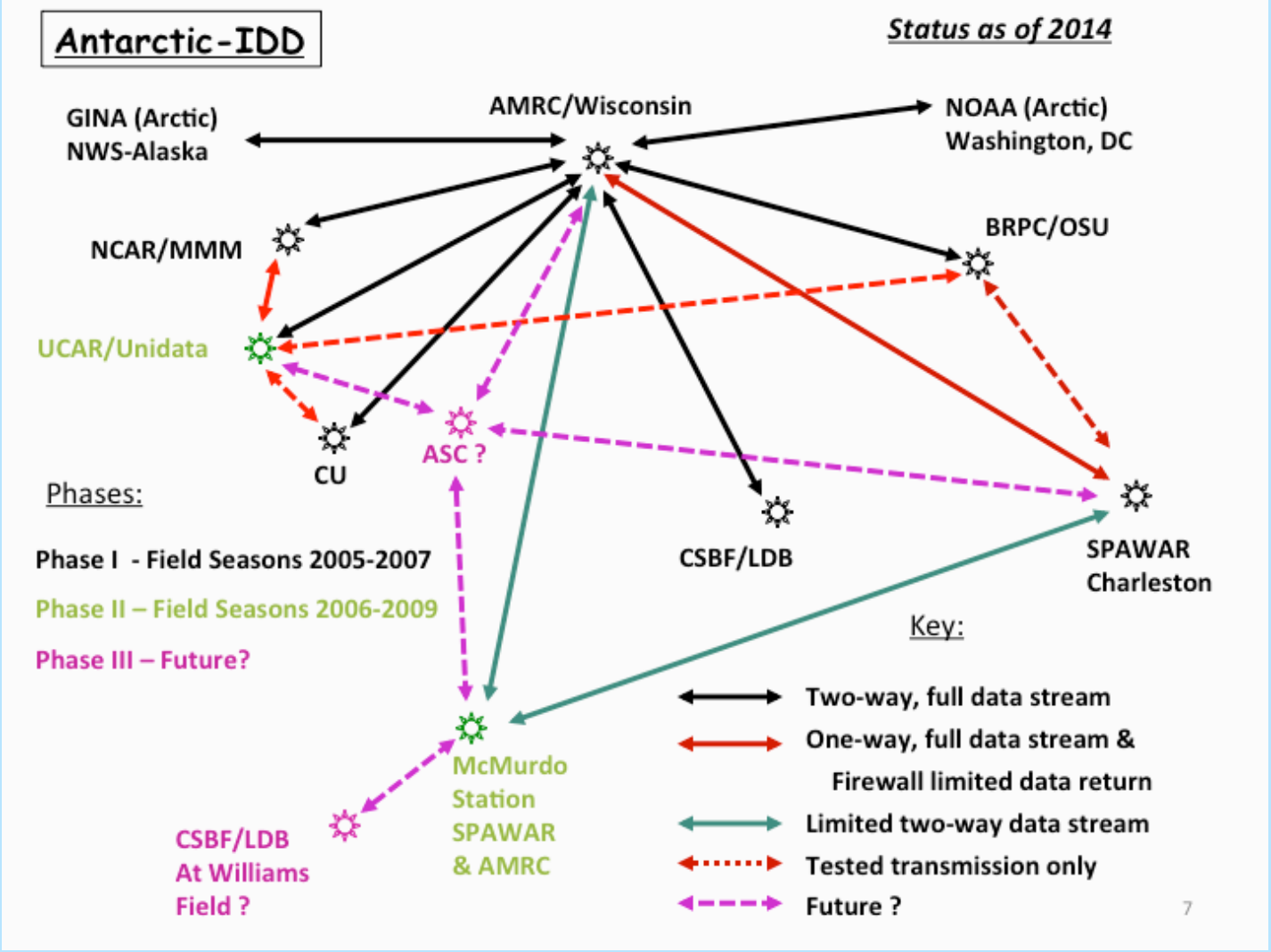
U.S. Antarctic Program

History and Background

- Antarctic-Internet Data Distribution based on LDM (Local Data Manager)*
  - Born at an AWS-AMRC-AMPS meeting in Charleston, SC 2004.
- Adopted as a weather data transport mechanism from collection points in the Antarctic to be shared with the research community.
  - This was implemented by O-202-M/P/S University of Wisconsin in 2005. Through time and exposure it became a useful and necessary tool for operational weather forecasting and remains effective in delivering real time weather information to USAP forecasters.
- LDM works by moving weather data via a dedicated UNIX port #388.
  - Port 388 is a reserved service port with IANA (Internet Assigned Numbers Authority) and runs on an LDM UNIX protocol. In order for the USAP to provide weather data to the research community, port 388 must be open to outside known hosts.
- LDM in the USAP:
  - Automatic Weather Station data from researcher systems attached to the TeraScan ground station network to CONUS based researcher systems for analysis and display.
  - SOPP (SPAWAR Office of Polar Programs {Aviation forecasting}) taps into the LDM network to quickly receive AWS updates and review for ongoing forecasts.

* LDM is a product of UNIDATA, an NSF funded project http://www.unidata.ucar.edu/software/ldm/

Antarctic-IDD as of the end of 2014



Why We Need the LDM Capability

- AWS (Automatic Weather Station) information is valuable to weather forecasting. AWS data is moved through LDM to SOPP (SPAWAR Forecasting)

- Providing real time weather data in our operational area is critical to making aviation and field support decisions, this includes our two research vessels.

- Satellite data information can also be relayed through the LDM facility, read; we can look at moving NRT imagery out of the reception points to be used elsewhere if required.

- LDM is the ***only*** means to acquire monthly climatological and routine archive quality weather observations from McMurdo Station/Mac Weather.

Management Perspective

Who manages it? It's a federated system! (by design!)

Presently O-202-M/P/S AMRC and SOPP provide management of their own instances within the USAP LDM connection structure. NSF has requested that the primary contractor provide a managed operational solution with an LDM hub at Denver CONUS data center.

Security concerns: In order for USAP.gov to adhere to DHS Trusted internet connection, the NSF primary contractor should take over comprehensive oversight on the LDM architecture within USAP.gov.

LDM data will need to be evaluated on an ongoing basis to determine whether data flows should be configured for single directional distribution or bi-directional distribution.

Further Arguments For LDM

- LDM has proven very effective and robust for weather data delivery. There are no other industry standards that can match this service. Other methods require significant and unique programming.

- LDM in the USAP is already established with multiple customers dependent upon its continued functionality.

- LDM in the USAP can in the future provide further data distribution solutions if requested. For example the Blue Ribbon Report's request for an Antarctic observatory page 67, section 4.

Proposed Solution

- Install and configure LDM on the primary Denver TeraScan* system Teocali.usap.gov. Use Teocali as the LDM hub on the inside of the USAP firewall. We are currently upgrading this system to a server class computer.

- Create a virtual LDM Linux server on the outside of the DMZ firewall and relay all pertinent and requested weather data to the outer server.

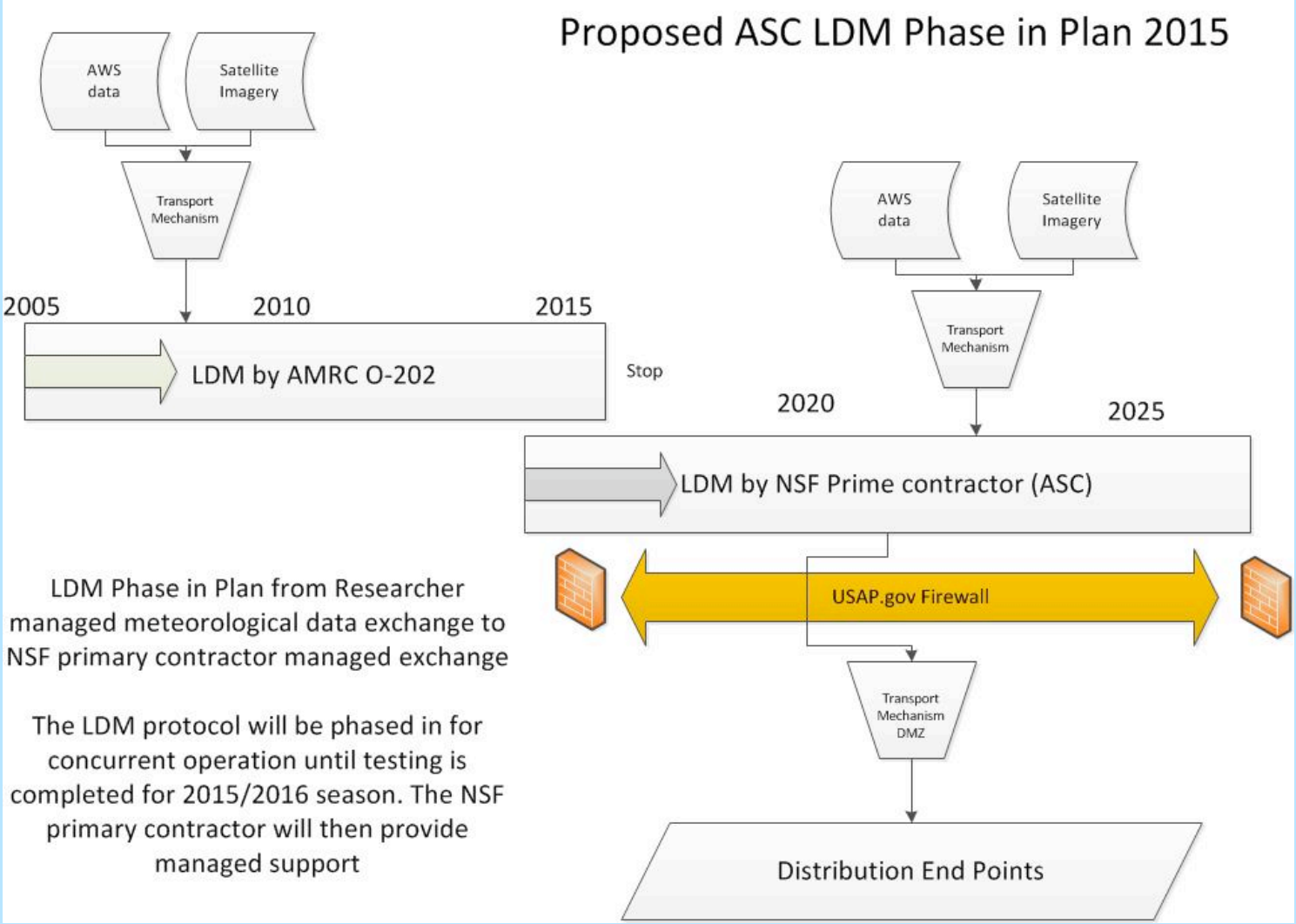
- Internal customers such as SOPP and funded researchers can pull LDM weather data directly from the Denver primary LDM server or through direct interconnections within the usap.gov intranet.

- Configure the two post processing TeraScan servers at McMurdo to provide LDM services to replace grantee systems or provide alternative data flow mechanisms.

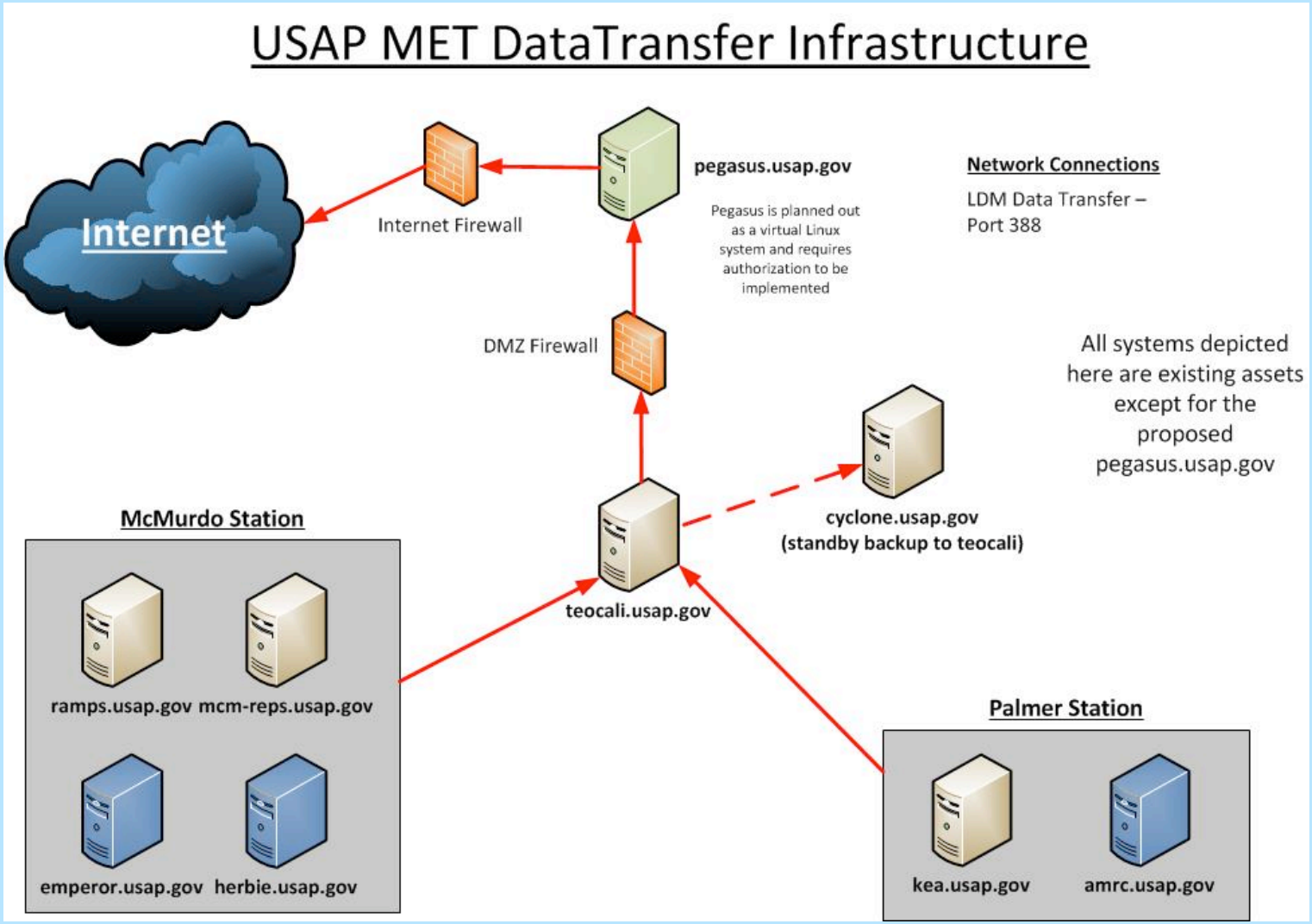
- The Palmer Station satellite system will also be configured for LDM support. We are discussing further data inclusions at Palmer.

* TeraScan is the satellite tracking, reception and data processing system now being used in the USAP, it is a product of SeaSpace Corp..

LDM Timeline



Basic Design Proposal



TeraScan Ground Station Update

- The Terascan systems at McMurdo Station are working very well at this time. We have redundant systems that schedule maximum complement of polar orbiting Met satellites to capture. 2005 first install, 2011 second install. We are capturing between 30 and 40 passes per 24 hour period. We are in a unique place at high latitude so there are almost too many options for the number of satellites we can capture. At least for now. N-18, N19, F-17, F-18, F-19, MetOp-B, AQUA, TERRA, NPP.

- FY-3B was tested, but unsuccessful – OS & TS upgrades required, scheduled for NOV 2015

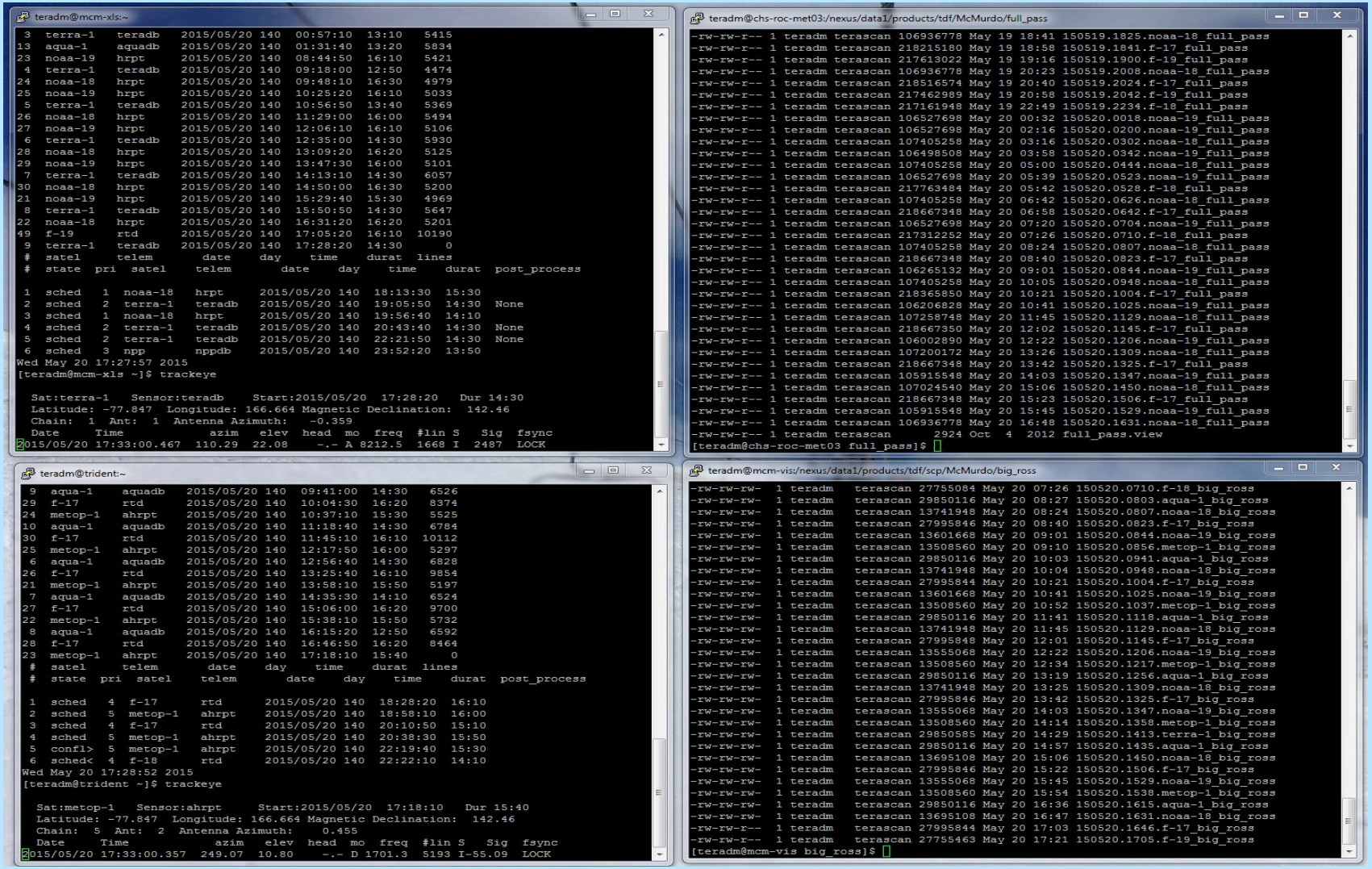
- JPSS-1 primary good, secondary requires antenna parts in order to capture NPP/JPSS-1, there may be some EMI interference at building 165

- Suomi-NPP has been demonstrated, with UW-Madison/CIMSS/AMRC CSPP…see:
  - http://amrc.ssec.wisc.edu/data/view-data.php?action=list&product=satellite/S-NPP

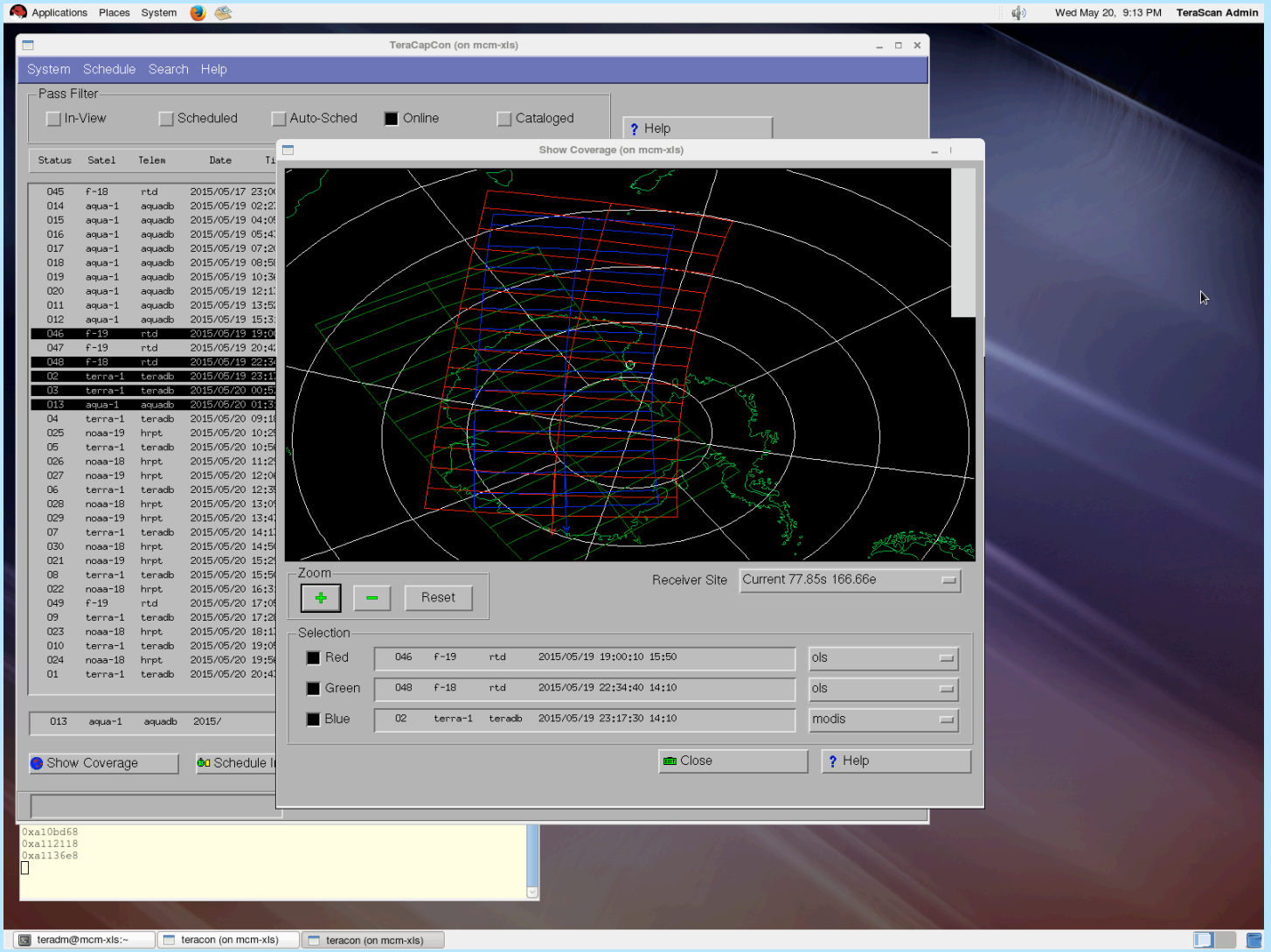
- Metop-B is good on both systems – scheduling priorities have kept the majority of Metop-B collecting on the secondary system.

- Palmer Station is now operating 14 years past life cycle, limited reception, first installed 1994, site visit updates occurred in 1999, 2001 and 2014 – no significant upgrades. NOAA and DMSP only. All satellite imagery ends up at SPAWAR forecaster sites.

Satellite Data Capture Example



Satellite Data Capture



Future directions

- System upgrades are in the works – We are looking at short range and long range improvements. We are looking at all available designs that suit out needs on the Polar environment and seeking solutions for long standing issues.
- Gap coverage – Radar? Fog or low cloud tracking for incoming aircraft.
- Integrative approach to weather data gathering and distribution.
- Subscription based satellite imagery for Polar MET support – Latent data – all possibilities so far are at least 90 minutes to a hour and a half old. Is that too much delay for aviation support? MetOp-B from EUMETCAST is delayed by 6 hours. Until we can solve the latency problem of store-forward/relay imagery data, then we still need to pursue direct readout or direct capture of polar orbiting meteorological satellites in order to properly support aviation and weather tracking. “Now-casting” is necessary for heavy flight support.
- For the Palmer Peninsula side of operations, it may be feasible to go with a subscription based satellite imagery solution since the majority of forecasting is for vessel support, in other words, latency may not have a negative effect in this area of interest. Analysis software will need to be acquired for forecasting.

Final thoughts

- USAP Aviation movement all year requires solid data feeds and comprehensive allocation of all possible resources.

- Operations and research efforts are not necessarily common goals, however, they are not mutually exclusive in our meteorological data gathering and handling of data.

- We wish to be more proactive with regard to international collaboration – and – how do we go about that?

- Please communicate your needs.

Questions?

McMurdo Gap with Estimated Radar Footprint