Slide 1

Quarterly Status Update (QSU) Q1 FY 2011
October-December, 2010

February 15, 2011

Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array

Slide 2

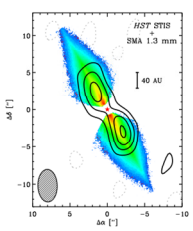
Agenda

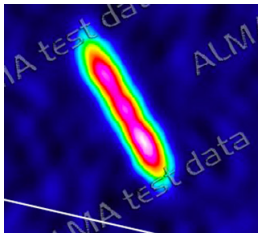
- Science Results
- Observatory Science Operations
- Observatory Development & Programs
- Observatory Telescope Operations
- Observatory Support Services
- Director's Office

Slide 3

Science Results
- *ALMA*

Test data from ALMA CSV





- On the left above is an image of the Beta Pictoris debris disk, observed with the Smithsonian Array at 1.3mm (contours) overlayed on an image of optical scattered light. On the right, an image from the eight antenna ALMA array by the CSV team. The ALMA data is more sensitive, with a higher resolution and provides a more detailed image of the debris disk.

NRAO

3

Title:This is ALMA Test data on the right, from http://www.almaobservatory.org/en/visuals/images/?g2_itemId=2784
Investigators: Data was reduced and imaged by members of the Commissioning and Science Verification Team, including Science IPT members.

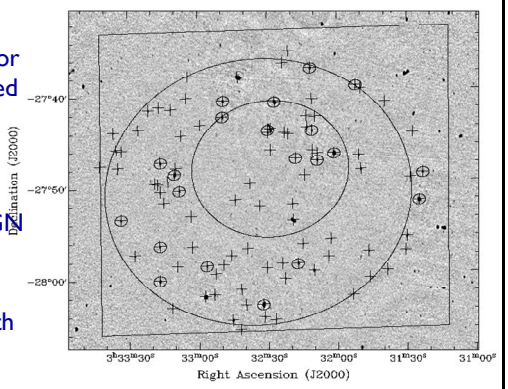
The ALMA data were obtained in November 2010 using 8 antennas in the compact CSV array. The observations were made at a frequency of 340 GHz and imaged with a beamsize of 1".5 x 1".5. Weather was good with a measured column of precipitable water vapor of 0.5mm. The data were corrected for phase variations caused by water vapor passing over the antennas using the installed water vapor radiometers and software (Nikolic). E. Villard, E. Fomalont and W. Dent worked on reduction of the data. Integration time was approximately four hours.

On the left, data from Wilner, D.~J., Andrews, S.~M., \& Hughes, A.~M.\ 2011, \apjl, 727, L42. The data was taken at 1.3mm with a beamsize of 4.3 x 2.6".

Slide 4

Science Results
- *VLBA*
Wide-field VLBA Observations of the Chandra Deep Field South

- VLBI fields of view are notoriously narrow
- A new wide-field technique allows for 10s or 100s of sources to be simultaneously studied with the VLBA
- This technique was used to target extra-galactic sources within the CDS
- Results were used to classify sources as AGN or star bursts
- With this advance VLBI can be used effectively alongside deep surveys made with other instruments



Middleberg et al., 2011, A&A 526, 74

NRAO

Notes: Background image is from ATCA. The large circle corresponds to the VLBA half-power primary beam. Objects marked with a + are ATCA detected sources that were imaged with the VLBA in this experiment. Objects inside a small circle were those detected by the VLBA. The medium sized circle represents the 2 megasecond Chandra Deep Field South (CDS).

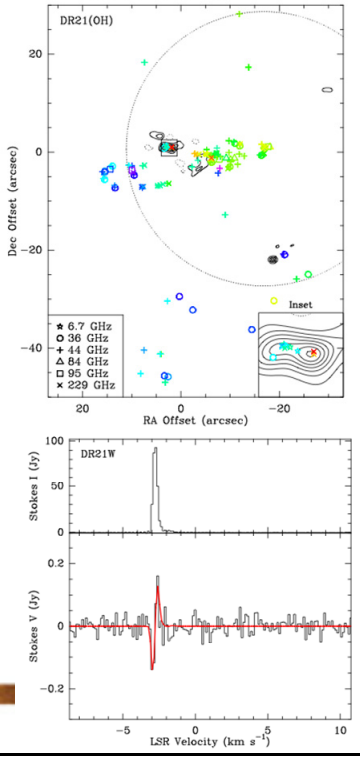
Slide 5

Science Results
- *EVLA*

EVLA images masers in DR21

- The EVLA Ka band has performed the first high resolution imaging of the Class I 36GHz methanol masers in a dense star forming region, DR21.
- Class I masers are likely shock heated, and trace an early, dense stage of star formation
- The pronounced "S-curve" in Stokes V implies a very large magnetic field if interpreted as Zeeman splitting, and hence higher densities than previously believed
- The diverse variety of different maser phenomena in these sources suggests differing physical conditions among them.

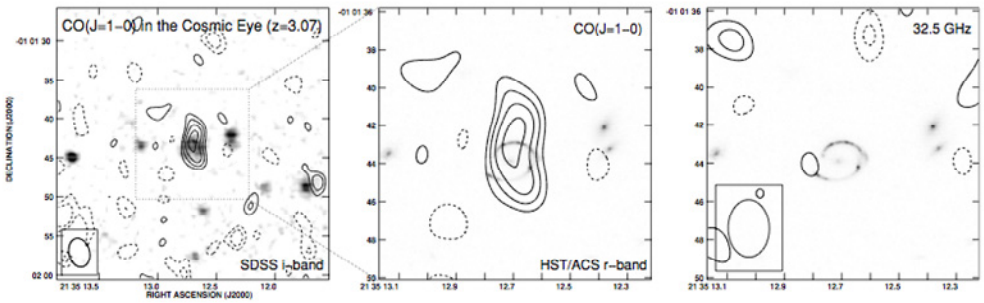
Fish et al., 2011, ApJ, in press



Slide 6

VLA images molecular gas in lensed LBGs

- The Ka band has performed the first imaging of molecular gas in normal star forming galaxies at high redshift (LBGs)
- Two strongly lensed were detected in CO1-0.
- The gas masses, gas fractions, moderate CO excitation, and star formation efficiencies are comparable to low redshift star forming galaxies

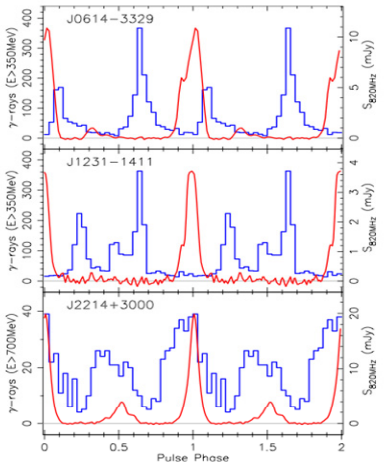


Riechers et al., 2011, ApJ,724, L153

Science Results
- *GBT*

GBT discovers millisecond pulsars through gamma ray selection

- The GBT has discovered 3 millisecond pulsars in a search based on sources selected in gamma rays by Fermi, all in binary systems
- These observations imply that most MSPs are efficient gamma ray sources, and verify a new method for discovering MSPs.
- Figure: Gamma ray (blue) and 820MHz (red) pulse profiles.

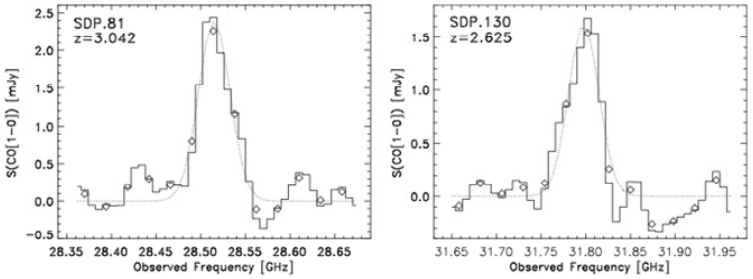


Ransom et al., 2011, ApJ,727, L16

Slide 8

GBT detects CO in strongly lensed, high z galaxies from Herschel

- The GBT has detected CO 1-0 emission from two of strongly lensed z ~ 3 starburst galaxies (SMGs) from the Herschel Atlas survey.
- The redshifts of these galaxies were previously unknown, and these observations demonstrate the power of the GBT Zpectrometer as a redshift machine.
- The molecular gas masses are > 10^{10} Mo.



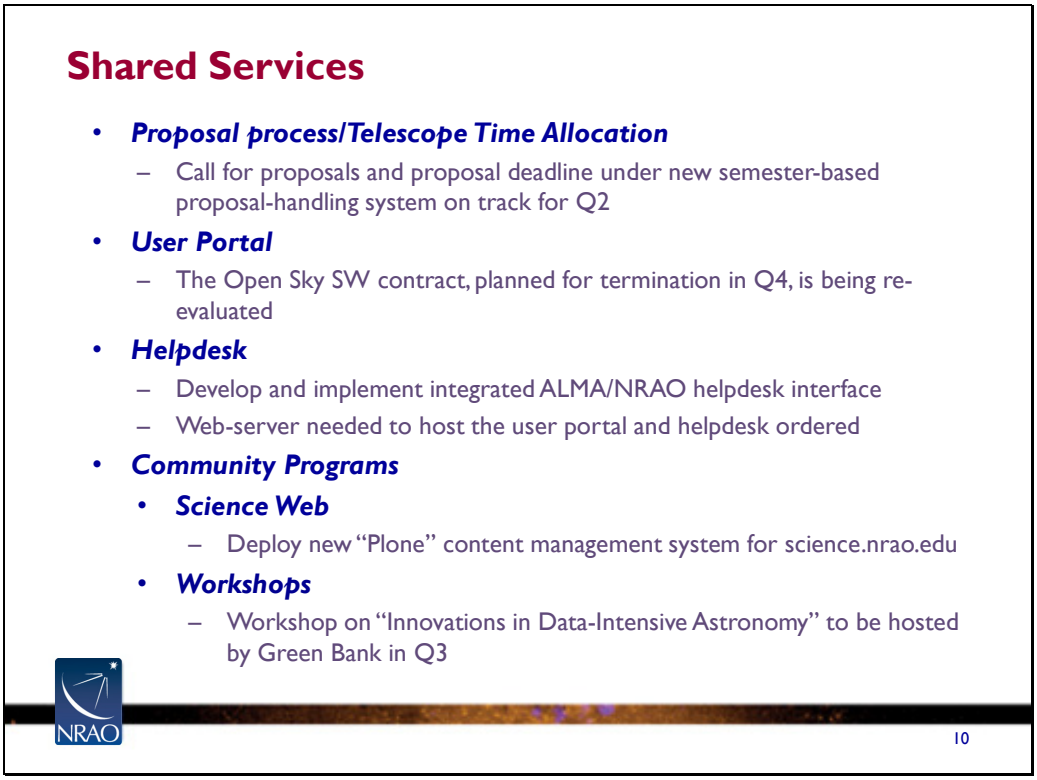
Frayer et al., 2011, ApJ,726, L22

Slide 9

Agenda

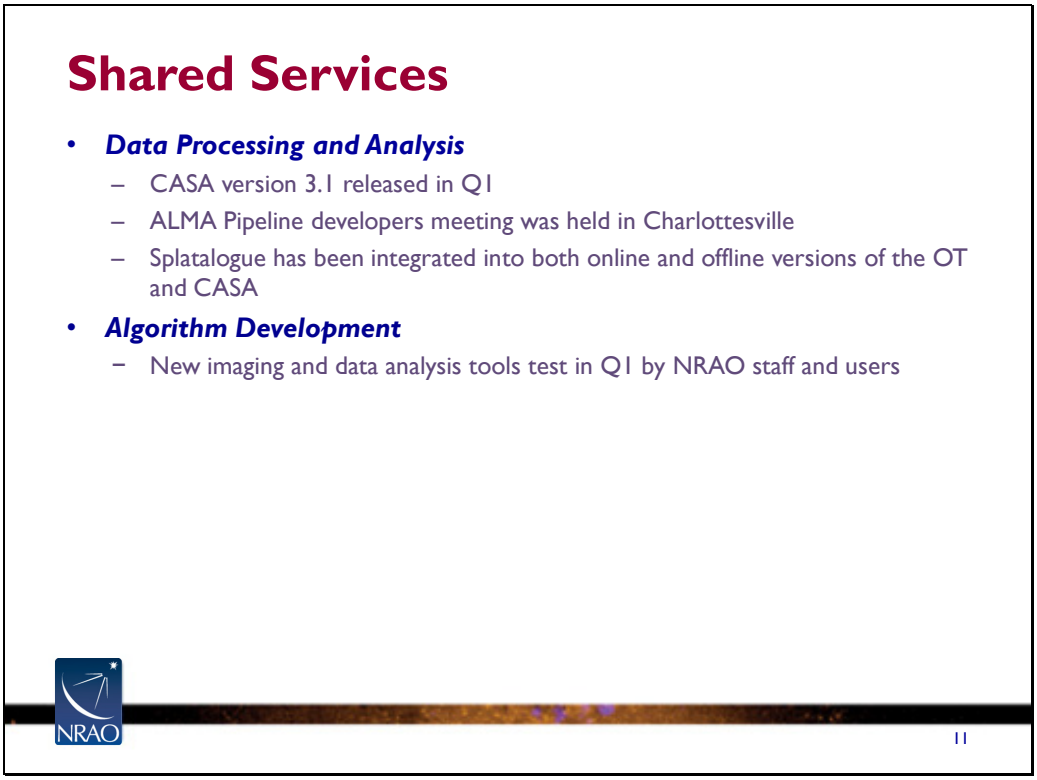
- Science Results
- Observatory Science Operations
  - Shared Services
  - North American ALMA Science Center
  - Array Science Center
  - Green Bank Science Operations
- Observatory Development & Programs
- Observatory Telescope Operations
- Observatory Support Services
- Director's Office

Slide 10



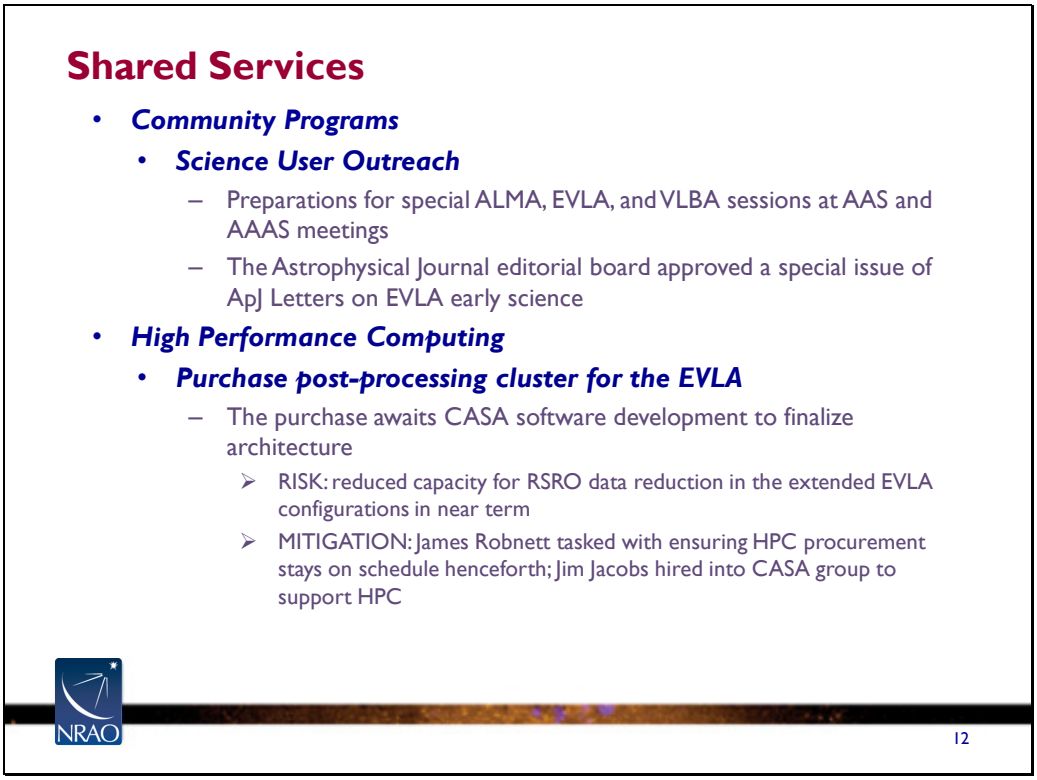
The specifications and development work for the new **proposal processing system** is progressing well. It will be in place for the Feb 1, 2011 proposal deadline. The decision to re-in-source the maintenance and development of the **user portal** and the PST is being re-evaluated – not as a way to save costs, but as a way to ensure support for the new proposal handling process until it has successfully handled at least two proposal cycles. This will allow OSO to efficiently refine and implement new PST requirements in response to user feedback and NRAO experience with the new system. The helpdesk interfaces between **ALMA Helpdesk** and **NRAO Helpdesk** were developed and implemented this quarter. The web-server needed to host the user portal and helpdesk has been ordered and is on track for a Q2 installation. Test installation of plone version of the science.nrao.edu (for the **Science Web**) was completed on plan this quarter. This will be deployed to users in the next quarter. Migration of content to new system for EVLA, VLBA, GBT, and NAASC will follow. Green Bank will host a workshop on "Innovations in Data-Intensive Astronomy" in Q3.

Slide 11



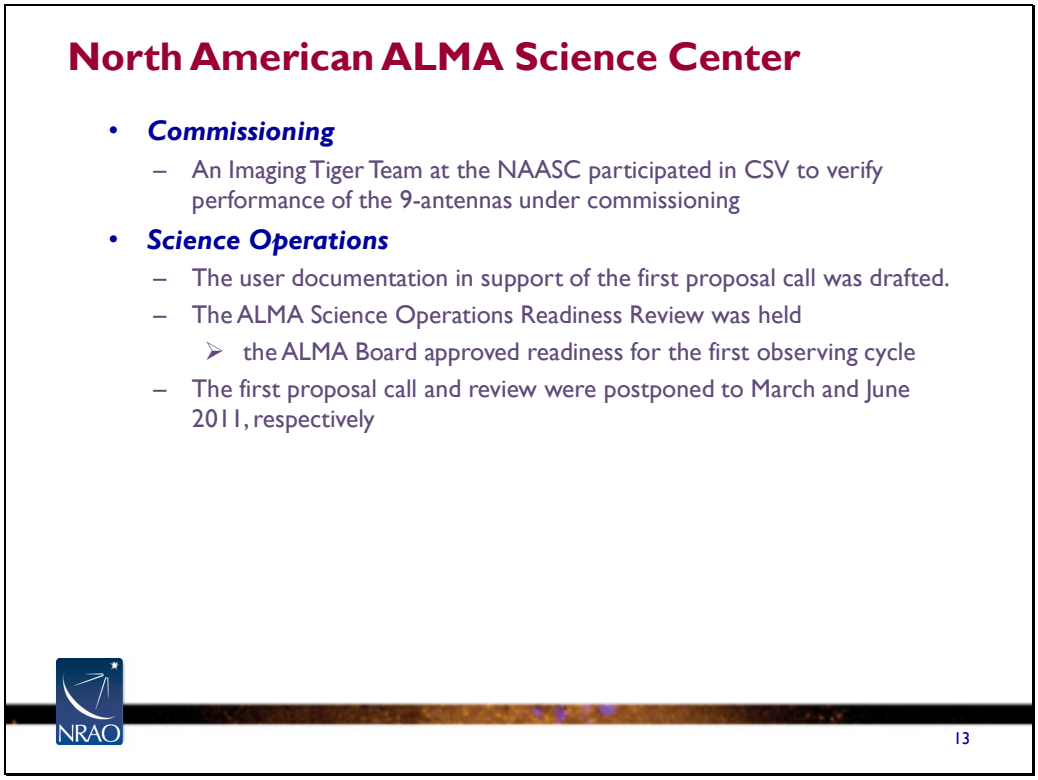
This quarter, the NRAO **Algorithm Research and Development Group** delivered new imaging and data analysis algorithms that will be tested by NRAO staff and users. Multi-scale, multi-frequency synthesis algorithms for wideband EVLA data are being actively tested by NRAO staff and RSRO residents; a Faraday rotation synthesis algorithm was implemented in AIPS and distributed with the 31DEC10 version in Q1.

Slide 12



For **high performance computing**, a proposed EVLA post-processing cluster configuration has been developed in this quarter. Procurement continues to await CASA software development. CASA in its current form can not make use of a cluster. The risk is a reduced capacity to reduce data in the extended EVLA configurations. Note, however, that 1) OSRO observers will not be affected; 2) the upside of the delay is that we get for our money. We will buy it as soon as we have finalized the architecture. Later in Q2 FY11 test code should exist to verify the cluster design at which point procurement can proceed.

Slide 13

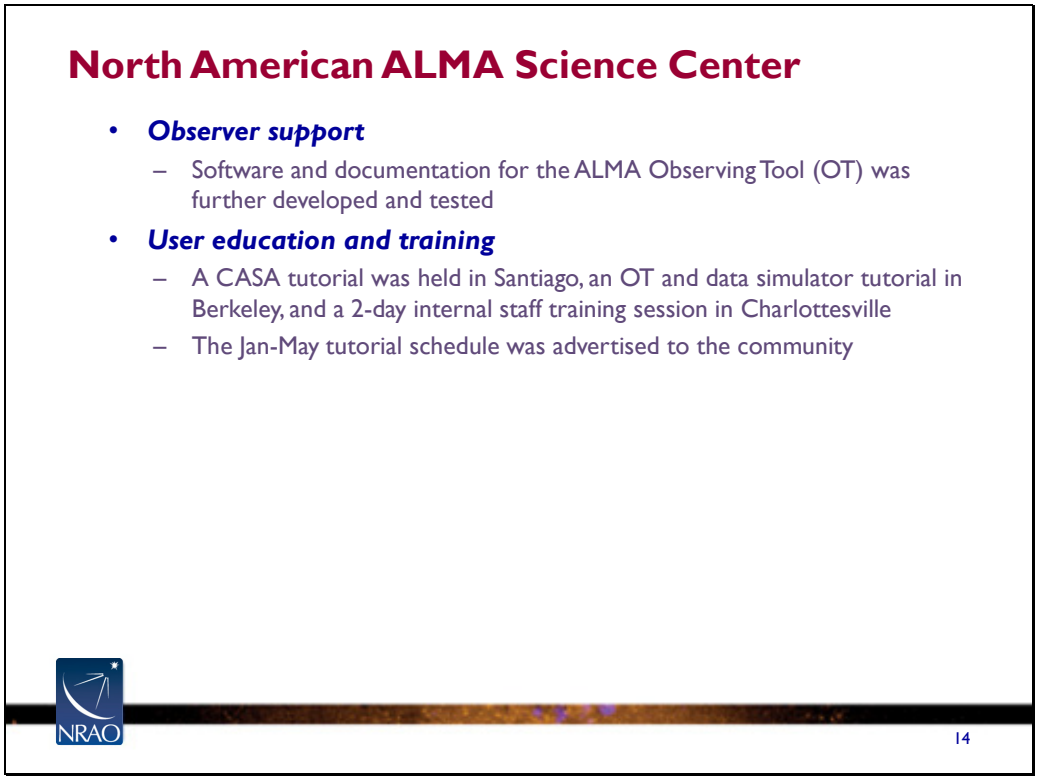


9 antennas were under commissioning by the end of Q1. The **Imaging Tiger Team** at the NAASC participated in CSV through direct involvement and through analysis at NAASC of ALMA data to verify performance of the array. Several test images show that the performance of the array is already impressive, equal in sensitivity and spectral compass to the best millimeter arrays in the world today.

The ALMA Science **Operations Readiness Review** occurred in October and November, resulting in a statement from the ALMA Board that "ALMA is on track to begin Early Science observations late in 2011, as planned. While many challenges remain, it is already clear that ALMA 'works'."

The first **proposal call** was postponed to March 31 and the deadline to June 30, based on the results of the Readiness Reviews, which found that ALMA requires a little more time to be ready for the first observing cycle. There is no risk mitigation required for Science Operations due to the delayed proposal call, because the net result is an extension of the schedule.

Slide 14

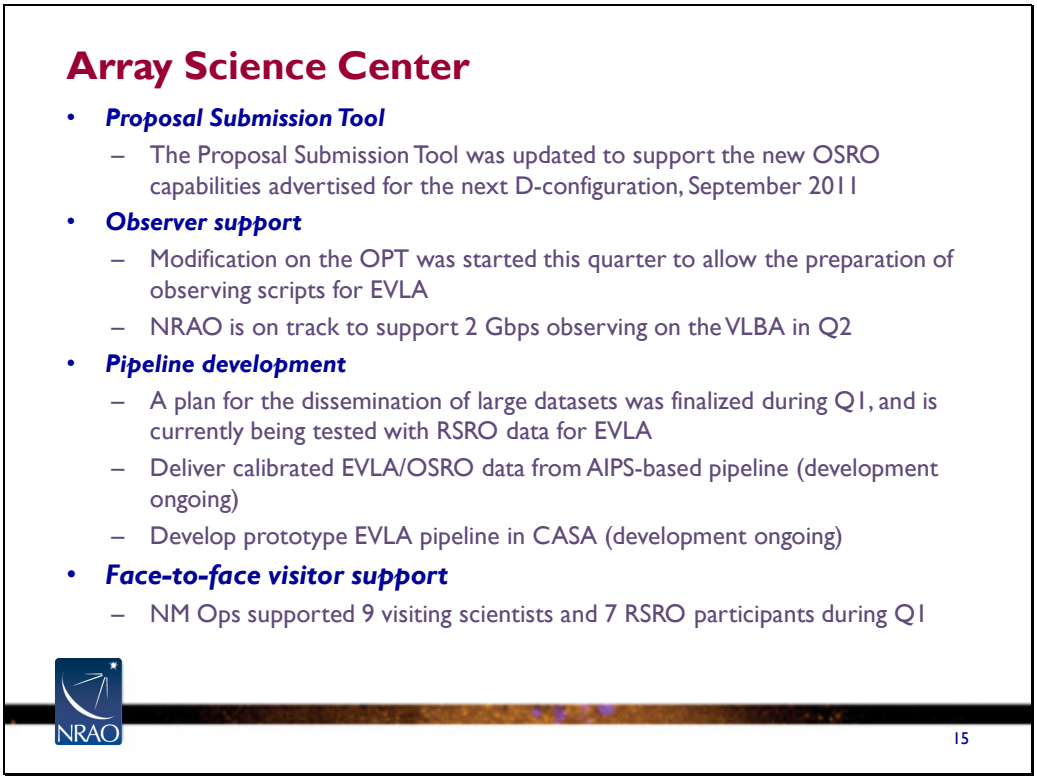


Completion of the software and documentation for the ALMA Observing Tool (OT) was delayed into Q2, as was the completion of the user documentation in support of first proposal call, because of the postponement of the call. No risk mitigation required since this is a schedule extension.

ALMA and CASA tutorials were given in Santiago, Berkeley and Charlottesville. The NAASC developed the tutorial schedule for Q2 and Q3 and advertised it to the community.

CASA version 3.1 was released in Q1 and the ALMA Pipeline developers meeting was held in Charlottesville. Splatalogue has now been integrated into the OT and CASA in both online and offline versions, ahead of the scheduled completion date in Q2.

Slide 15



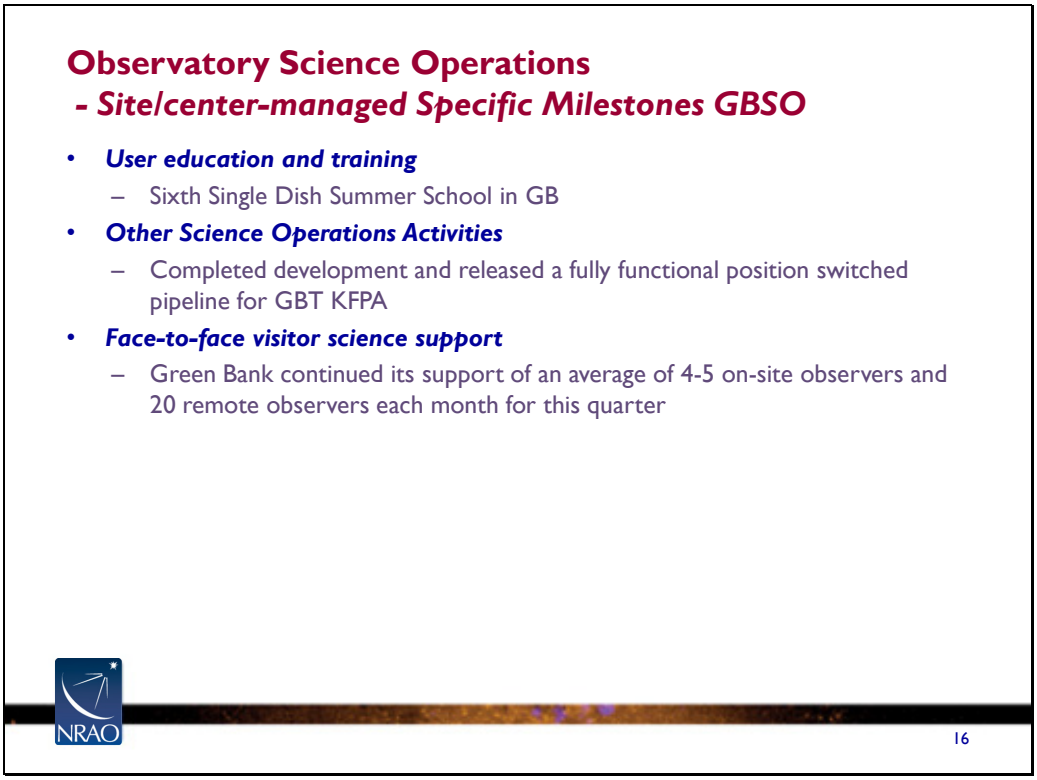
The **Proposal Submission Tool** was updated during FY2011 Q1 to support the new capabilities being offered for the next D-configuration, for which observing will begin in September 2011. The Observation Preparation Tool (OPT) is being modified for the **EVLA** to allow the preparation of **observing scripts** with 16 correlator sub-bands and up to 2 GHz bandwidth for the next D-configuration in Q4. A preliminary version of this capability is being tested and used for RSR observations. In order to support **2 GHz bandwidth observing on the EVLA** the PST needs to be updated, and the Observation Preparation Tool (OPT) needs to support the new hardware set-ups. NRAO is on track to complete the PST updates in Q2 to support the Call for Proposals, and the OPT will be undergoing testing through Q3, ready for deployment in Q4.

In order to support **2 Gbps observing on the VLBA** the Proposal Submission Tool (PST) needs to be updated, the software used to produce observing scripts (SCHED) needs to support the new hardware set-ups, and calibration data need to be made available with a user's dataset. NRAO is on track to complete all these items in Q2.

During FY 2010 we upgraded the connection speed from the ASC to the outside world from 32 Mbps to 1 Gbps. While this should be sufficient for the delivery of EVLA datasets in real-time from our end, many users may not have such a fast connection speed. We have therefore developed alternative **data dissemination** procedures for large datasets, giving users the option of retrieving data via FTP in the usual way, or on a USB disk shipped to their home

institution, to be returned to NRAO within a specified time period. The practicalities of this method are being tested using RSRO data, and will be modified as needed prior to the beginning of D-configuration. **AIPS:** Progess was made on development of a pipeline for EVLA/OSRO data in AIPS, the legacy software that has been responsible for the delivery of more than 100,000 images of VLA data. The AIPS-based pipeline will be used as a baseline for initial quality checks of data products from the prototype CASA pipeline, which is under development in parallel. Started to experiment with the new scheme and tasks for Tsys calibration to find reasonable defaults to apply on general data sets. Final experiments on data quality measures are pending. **CASA:** New scripts for RFI flagging and delay calibration needed in a CASA pipeline were developed. New Mexico Operations supported 9 **visiting scientists** and 7 RSRO participants during Q1.

Slide 16



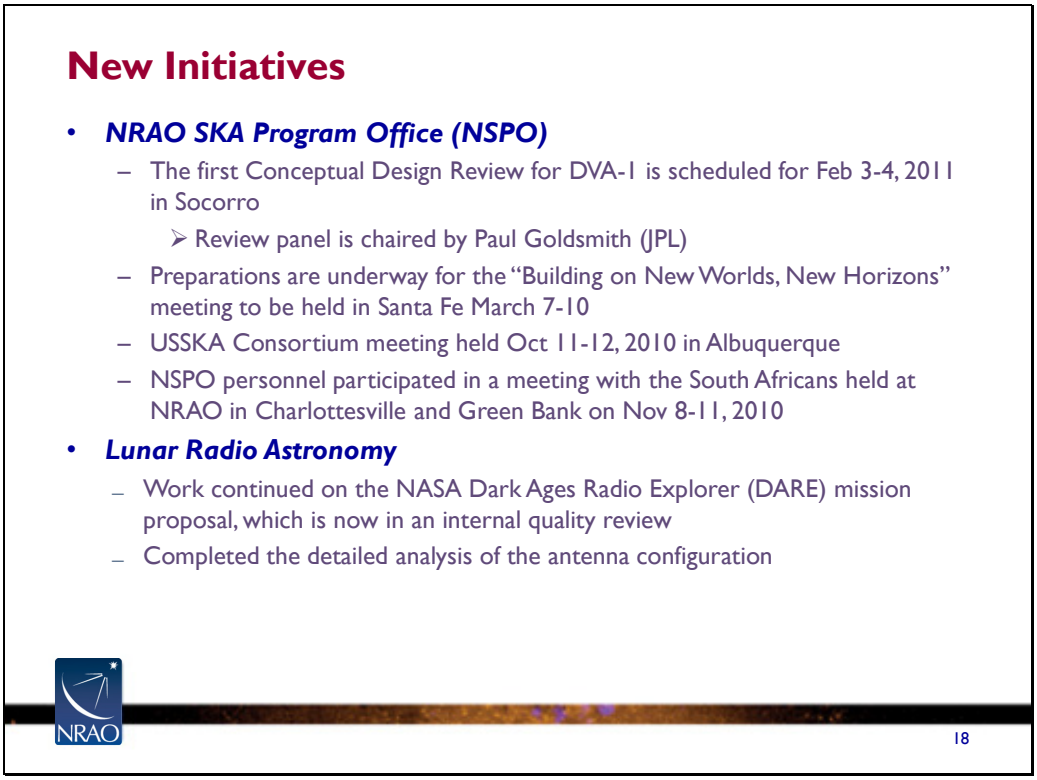
A commitment was received from NAIC to co-host the **Single Dish Summer School** in Green Bank on July 10-16, 2011 (http://www.nrao.edu/meetings/sds6) . In other Green Bank Science Operations, work continues on the **end-to-end data pipeline,** implemented in GBTIDL, for the GBT KFPA receiver with release of a fully functional position switched pipeline being tested during shared risk observing. A frequency switched version is now in development. This quarter, Green Bank continued supporting an average of 4-5 **on-site observers** and 20 remote observers each month.

Slide 17

Agenda

- Science Results
- Observatory Science Operations
- Observatory Development & Programs
  - New Initiatives Office
  - Coordinated Development Laboratory
  - Projects
- Observatory Telescope Operations
- Observatory Support Services
- Director's Office

Slide 18



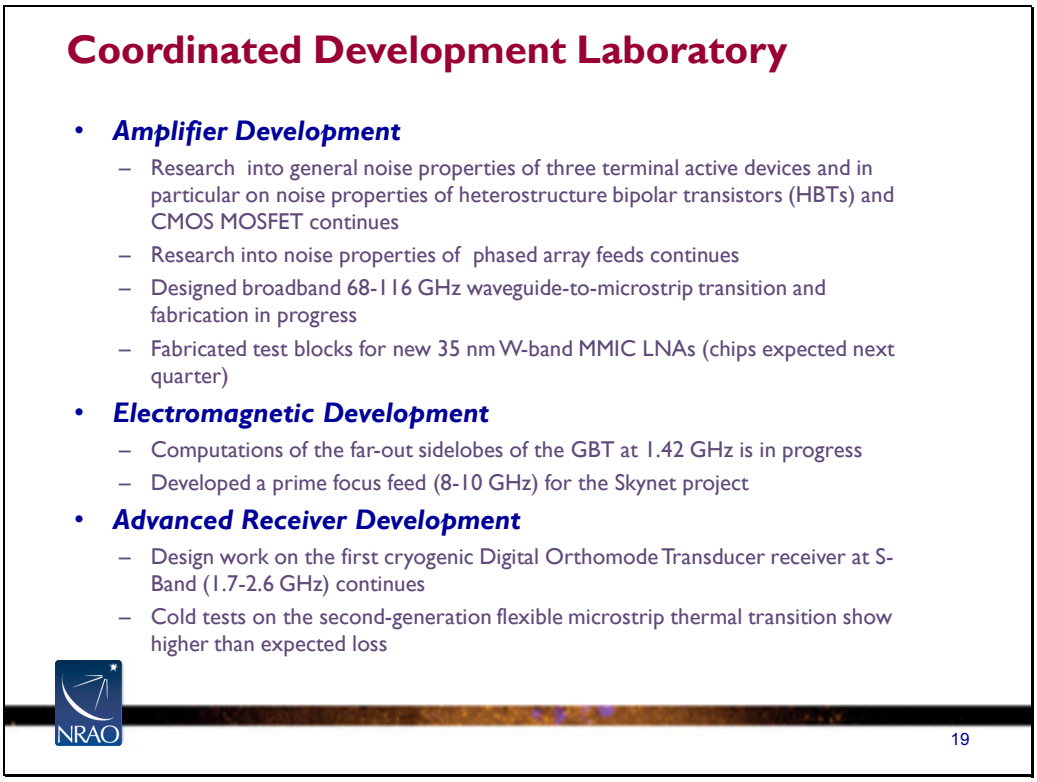
A CoDR for DVA-1 was set up in 2011 Q1 and scheduled for Q2. Most of the preparatory work is being done by the USSKA TDP at Cornell, Berkeley and in Canada. NRAO is hosting the review, and if the review is successful and should a prototype be constructed, we will explore opportunities for significant involvement in further **DVA-1** activities such as hosting the prototype at the VLA site and managing the DVA-1 project. At this point in the process we are still monitoring progress towards the design and project definition.

The post-Astro2010 meeting "**Building on New Worlds, New Horizons:** New Science from Sub-millimeter to Meter Wavlengths" is co-hosted by NRAO/AUI. NSPO (S. Myers) is involved in organization and will participate in the meeting. See conference website: http://science.nrao.edu/newscience/. NSPO and other NRAO personnel attended the USSKA Consortium meeting in Albuquerque, which was focused on the **USSKA** response to Astro2010 and interfacing with the international SKA project (SPDO and SSEC) on possible activities this coming decade. These discussions are ongoing, as is development of a coherent US strategy for future SKA involvement. NRAO is a key participant in these discussions. As part of this meeting, a site visit to the VLA/LWA site was held. Activities continue under **the NRAO-SASPO MoU**. Possible joint activities involving NRAO and SASPO staff and resources were explored. A response to actions items raised at this meeting is under formulation.

The **Lunar** University Node for Astrophysics Research (LUNAR) is a grant from the NASA Lunar Science Institute to develop instrumentation for lunar-based research. Our current

activity is centered around the Explorer-class **DARE** mission proposal with specific attention given to the front-end design concept. Frequency Agile Solar Radiotelescope (FASR): This project was not funded last year, but is on the recommended list of mid-scale ground-based instruments from the ASTRO2010 decadal review. A revival is sought. No work was reported this quarter on the Space Very Long Baseline Interferometry, or the Long-Wavelength Array.

Slide 19



Amplifier Production and Development: Research on general noise properties of three terminal active devices and in particular on noise properties of heterostructure bipolar transistors (HBTs), and CMOS MOSFET continues. A paper covering initial results has been published in IEEE Microwave Magazine (M.W. Pospieszalski, "Interpreting Transistor Noise," IEEE Microwave Magazine, vol. 11, no.6 pp. 61-69 Oct. 2010). The research into the noise properties of phased array feed has commenced. Three Engineering Lunch Forum talks were presented.

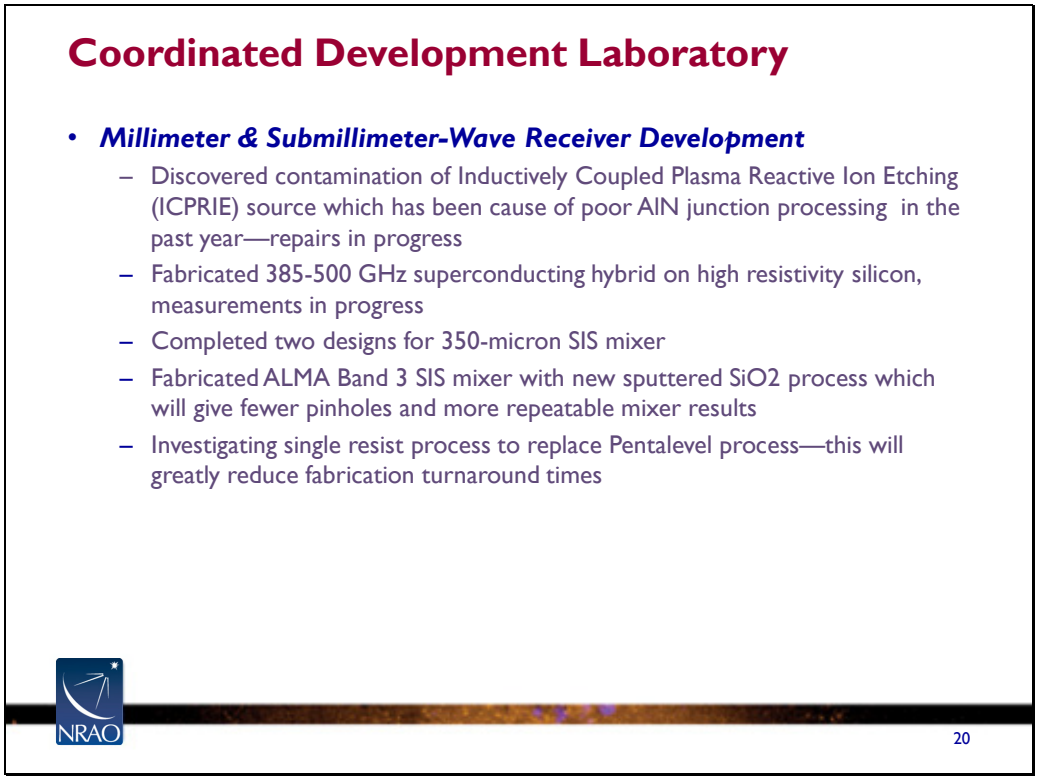
Electromagnetic Support: In order to account for a small difference in the spillover of the GBT calculated using measured and theoretical beam patterns, far-out sidelobes are being calculated taking into account scattering from the feed arm structure. Developed a **prime focus feed** (8-10 GHz) for the Skynet project.

Advanced Receiver Development: Design work on the **first cryogenic Digital Orthomode Transducer at S-band** is in progress. The passive probe structure and the warm downconverter designs are complete and in fabrication. The design of the low-noise amplifiers for this front end, utilizing state-of-art Silicon Germanium transistors, is still in progress, as is the integral signal source for field calibration. By reducing the size of the OMT, eliminating the phase shifter and cal coupler, and minimizing the electrical path between the

feed and the amplifiers, we hope to realize a ~10% improvement in noise temperature over our best S-Band receivers to date.

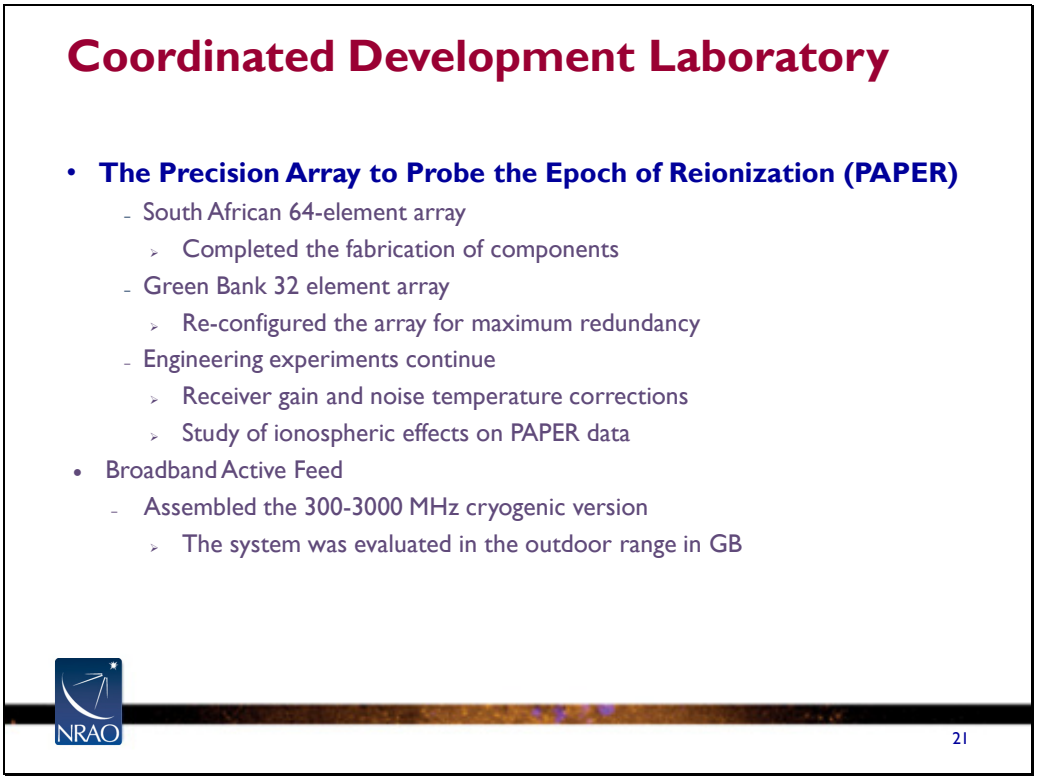
Cold tests on the **second-generation flexible microstrip thermal transition** show improved loss after elimination of the acrylic adhesive layers, but still more loss than expected. The cause of this extra loss, which does not improve upon cooling, has not yet been determined.

Slide 20



Millimeter & Submillimeter-Wave Receiver Development (R&D only): UVML foundry work: contamination from Coupled Plasma Reactive Ion Etching (ICPRIE) source has been getting into AlN barriers and contaminating them creating pinholes/conductive shorts. The poor SIS characteristics we have been obtaining with this reconfigured (ICPRIE) source the past year have been due to this defective (ICPRIE) source. We are in progress of acquiring a new (ICPRIE) liner and a protective cap so that we can return the (ICPRIE) to its proper operational state. Once this is done, we can move forward to grow high quality AlN barriers once again. Two basic 350-micron SIS mixer designs have been optimized. Both have Nb/Al-AlN/NbTiN junctions, but one has a Nb ground plane with a NbTiN wiring layer, and the other has an Al ground plane and Al wiring layer. Based on typical material properties (loss and London penetration depth), simulation indicates they will have similar performance over 787-950 GHz.

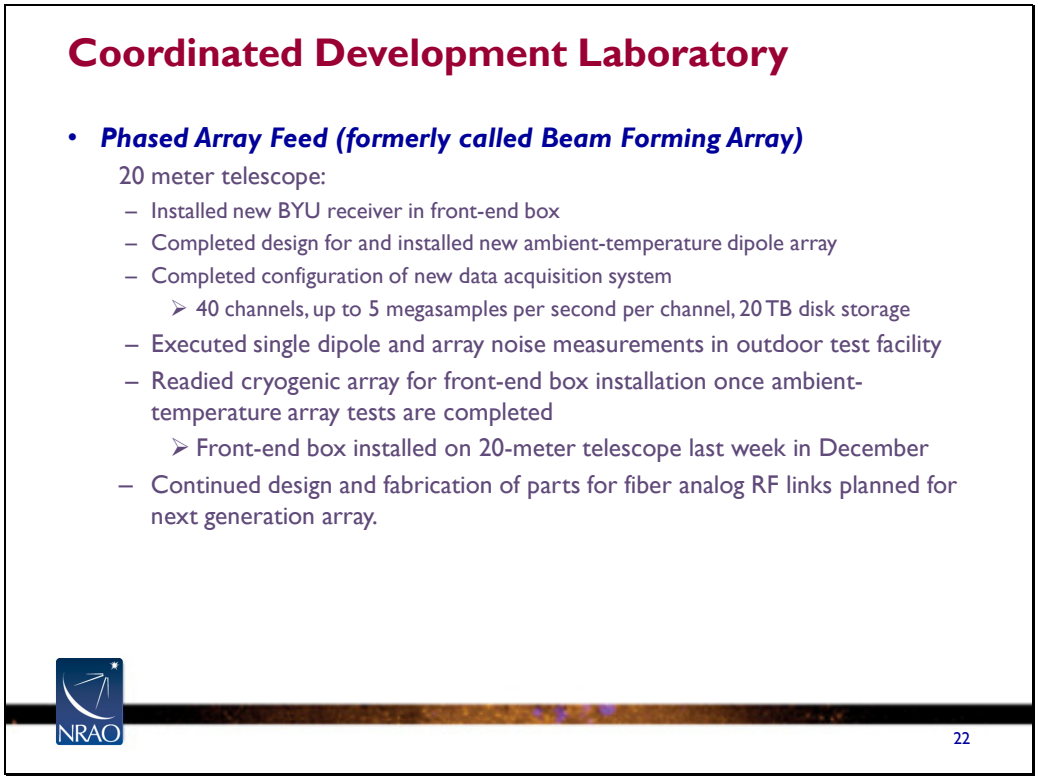
Slide 21



The Precision Array to Probe the Epoch of Reionization (PAPER) (collaboration with UC Berkeley)**:** The components for the **64 element** array in South Africa have been fabricated and will be shipped in the near future. The **Green Bank array** has been reconfigured into three north–south lines. The study of ionospheric effects and the receiver modeling projects conducted by graduate students will continue.

Broadband Active Feed: The **cryogenic version** was cooled to 100K in the receiver test range in GB and the performance was found to be consistent with modeling.

Slide 22

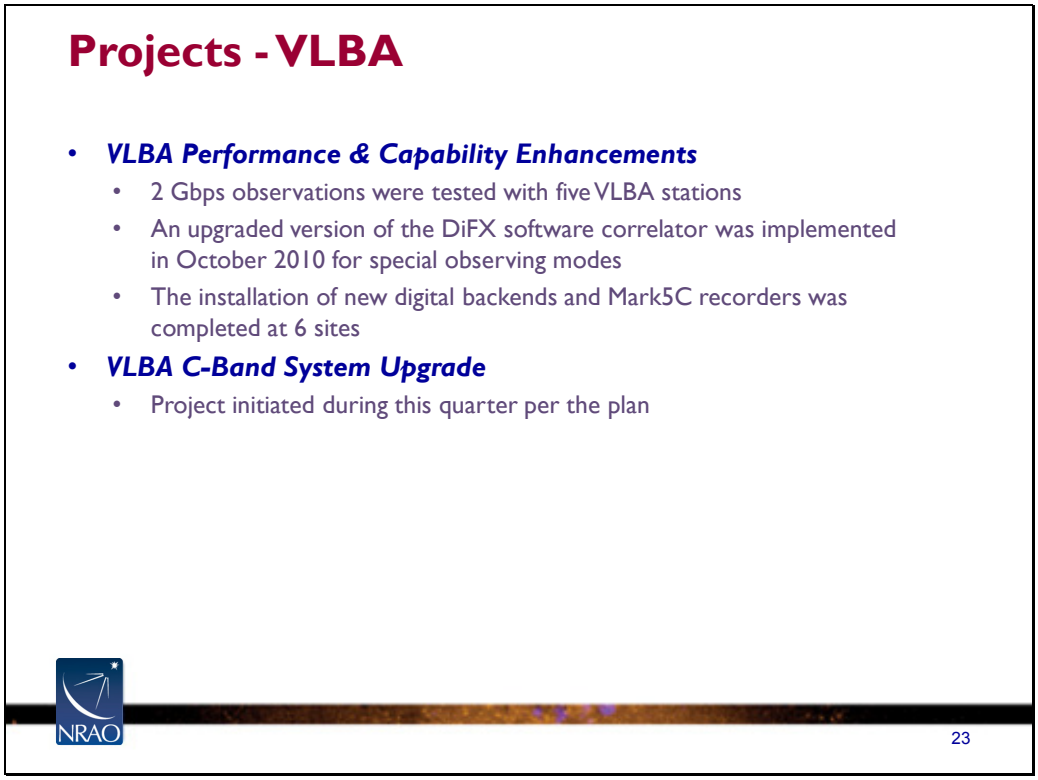


Phased Array Feed (formerly called Beam Forming Array): Work in this quarter focused on preparing the next measurement campaign on the 20 meter telescope. Installed a new **BYU** receiver in the front-end box which provides better stability and isolation and the option for wider instantaneous bandwidth. Completed the design for and installed the new **ambient-temperature** dipole array designed for optimum noise match in the presence of mutual coupling. Completed configuration of **new data acquisition** system: 40 channels, up to 5 megasamples per second per channel, 20 TB disk storage.

Executed **single dipole** and array noise measurements in outdoor test facility. Hot-cold load measurements use sky as cold load and absorber panel for hot load. Readied **cryogenic array** for front-end box installation once ambient-temperature array tests are completed. The front-end box was installed on 20-meter telescope last week in December. Continued design and fabrication of parts for **fiber analog RF** links planned for next generation array.

The primary objective of this ambient-temperature array measurement is to test the design assumptions that the array system noise can be improved with an optimal impedance match between the array-embedded dipoles and the low-noise amplifiers. Wider instantaneous bandwidth will provide greater measurement sensitivity.

Slide 23

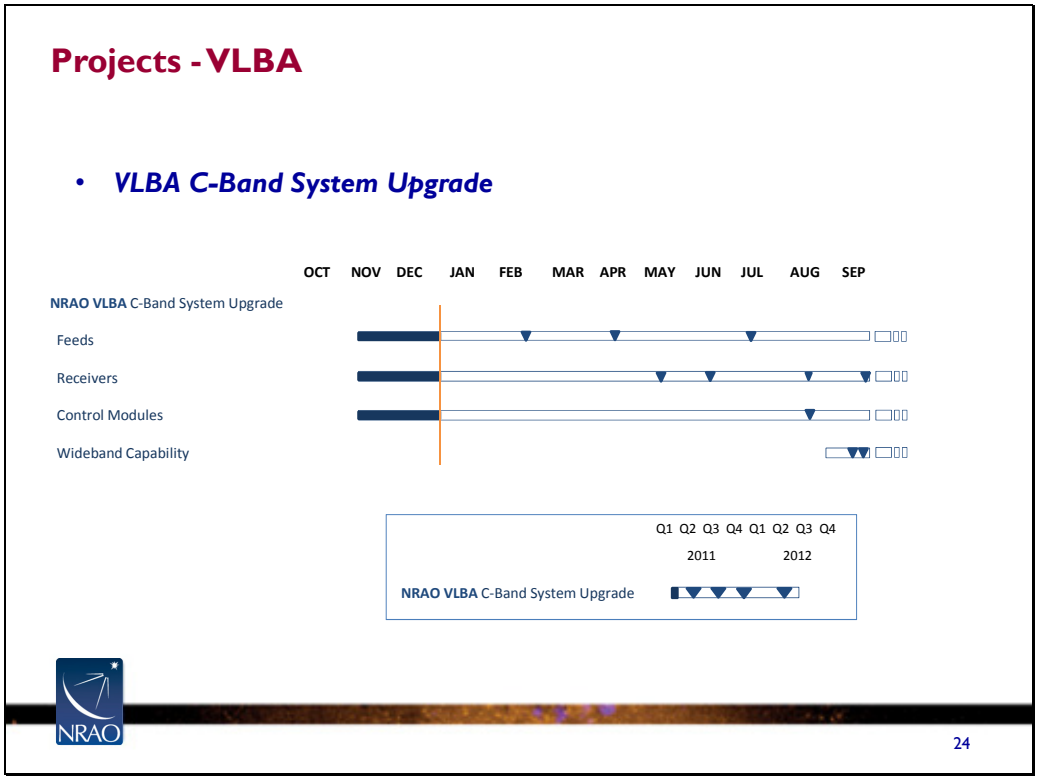


VLBA performance and capability enhancement continue with 2 Gbps observations being tested with five VLBA stations during Q1. Early science observations at **2 Gbps** using at least 6 antennas is on track for Q2. Transition of the full array to 2 Gbps equipment is planned for Q3 with demonstration of 4 Gbps observing on track for Q4. An upgraded version of the **DiFX software correlator** was implemented in October 2010 per the plan for special observing modes. The installation of **new digital backends** and Mark5C recorders was completed at 6 sites in Q1. First successful engineering tests of the digital downconverter personality is now expected in Q2 versus planned in Q1. RISK: delays the delivery of the DDC to users; in particular, limits very high spectral resolution spectroscopy. MITIGATION: extra 0.6 FTEs brought in to work on the DDC; delay offering this capability to users. This work is funded with an MRI grant.

This project for VLBA **C-Band System** will provide frequency coverage of 4.0-7.9 GHz; enables access to the 6.7 GHz methanol maser line for Galactic parallax measurements. Requires new feeds, receivers, IF downconverters, and M&C system. The C-band prototype receiver will be installed at Pie Town in Q3. Parts will be ready for installation at St. Croix and Mauna Kea in Q4. The funding for the C-band implementation comes from ARRA, under the Max Plank agreement for operating funds for this fiscal year. RISK: FTEs applied to this project are shared with EVLA, with EVLA having first priority. The overall project target completion date is end fiscal year 2012. While the **VLBA C-band system upgrade project** is adequately budgeted it is being performed on a best-effort basis using resources partially allocated to the

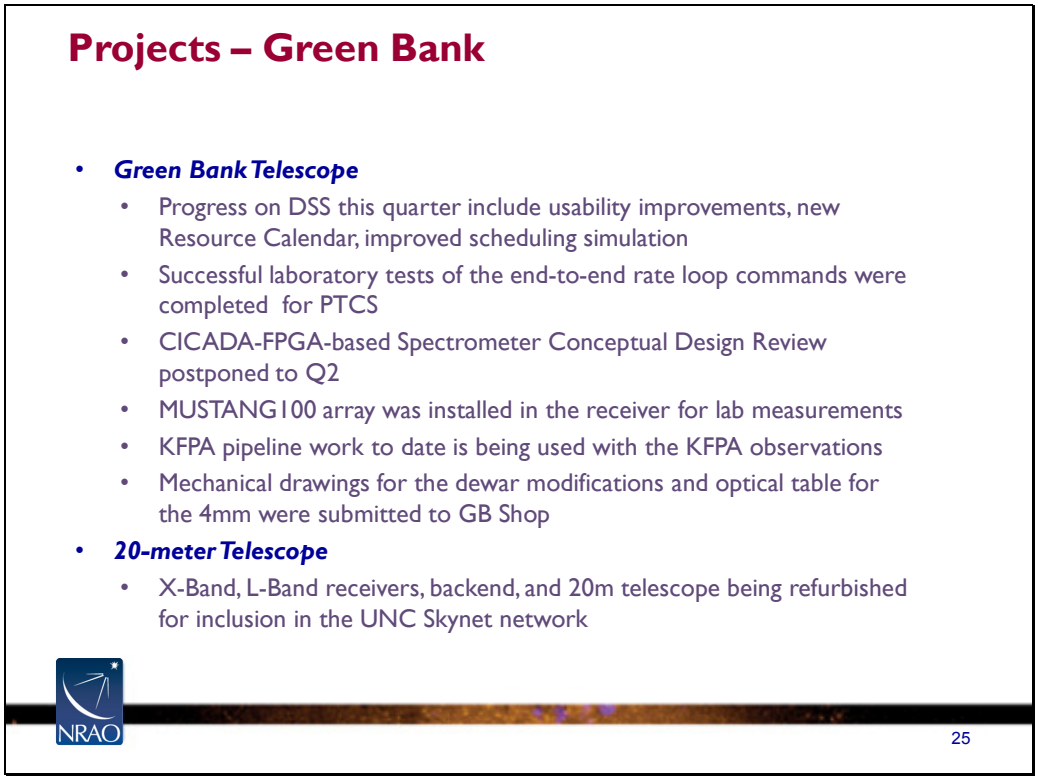
EVLA project. We recognize that the EVLA project must take priority and so are prepared to accept delays in the C-band upgrade as dictated by the EVLA's needs. As soon as individual antennas are upgraded the new receivers will be made immediately available to the user community.

Slide 24



The First graph is this fiscal year view. The vertical line represents where we are today. The Second graph illustrates the full project. NOTE: this schedule is currently being developed and will be modified during the next quarter once FTE commitments are solidified.

Slide 25



Dynamic Scheduling System (DSS): Improvements to the **DSS** for this quarter include: usability improvements to the Schedulers' Tools (including undo/redo functionality), release of a new Resource Calendar, improved scheduling simulations, and continued improvements to the scheduling algorithm inspired by continued simulation as well as scheduler feedback. The sensitivity calculator, scheduled for Q1FY11 will be delivered in early Q2FY11 due to reduced staffing, but in time for use by technical reviewers of 11B GBT proposals. The final release of the DSS is scheduled for Q4.

*Precision Telescope Control Systems (**PTCS**)*: Successful laboratory tests of the end-to-end rate loop commands were completed on schedule in Q1FY11. Detailed hardware installation plans for the GBT summer maintenance period were approved and shared with GBT Operations for their planning. A new GBT memo was released in November entitled "Distortions of the GBT Beam Pattern due to Systematic Deformations of the Surface Panels" summarizing what was learned about the small-scale surface errors of the telescope over the past 2 years.

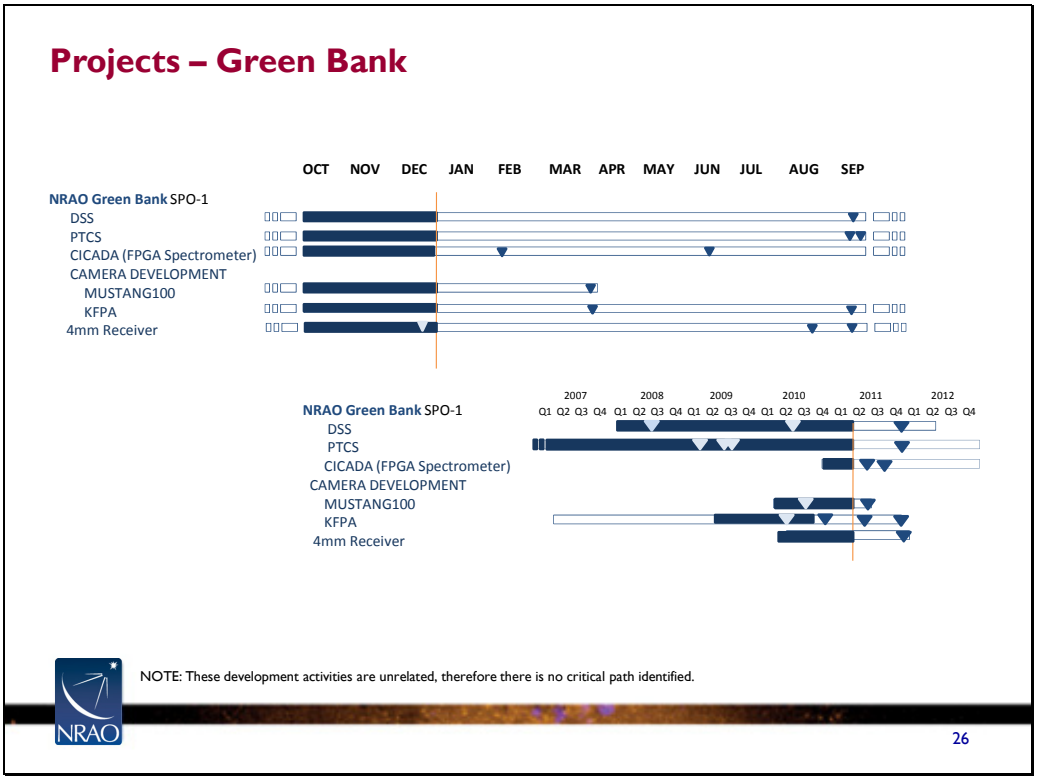
***CICADA-**FPGA-based Spectrometer:* Throughout Q1FY11 multiple design iterations were discussed with UC-Berkeley; materials were assembled in advance of the Conceptual Design Review in Q2FY11. RISK: The POP milestone of Q1 for the CDR was moved back by one month, but that time should be readily be compensated for later in the project, keeping it on eschedule.

MUSTANG100: The **MUSTANG100** array was installed in the receiver for lab measurements of the optical time constant, vibrational susceptibility, and noise of the NIST array detectors. The NIST array shows promising vibrational susceptibility improvements, but not sufficiently lower white noise levels to justify GBT installation.
*K-Band Focal Plane Array (**KFPA**):* Shared-risk observing has gone quite well and general science release is expected in Q2FY11. The **KFPA pipeline** work to date is being used with the KFPA observations; the pipeline is scheduled to be complete in Q4FY11.

***4mm** Receiver:* Mechanical drawings for the dewar modifications and optical table were submitted to GB Shop in Q1FY11. Component selection is now complete pending initial lab hardware tests in Q2FY11.

20-meter Telescope: X-Band, L-Band receivers, backend, and 20m telescope are being refurbished for inclusion in the UNC Skynet network. This work is funded as a subcontract to UNC through an NSF-MRI grant.

Slide 26



Milestones:

DSS: Q4FY11 - Final release of the DSS with all observing efficiency and ease-of-use components – On Schedule

PTCS: Q4FY11 - Laboratory tests of the new servo system complete – On Schedule; Hardware installation on GBT complete – On Schedule

CICADA (FPGA Spectrometer): Q2FY11 - Conceptual design review –SCHEDULED Q1; Q3FY11 - Proposal call for shared risk observations – On Schedule

Camera Development

•*MUSTANG100* : Q2FY11 - Delivery, testing, and installation complete – On Schedule (Schedule depends on NIST providing 100-pixel array free of charge to NRAO/Upenn)

•*KFPA:* Q2FY11 - Release of KFPA for general science use – On Schedule; Q4FY11 - Completion of KFPA pipeline – On Schedule

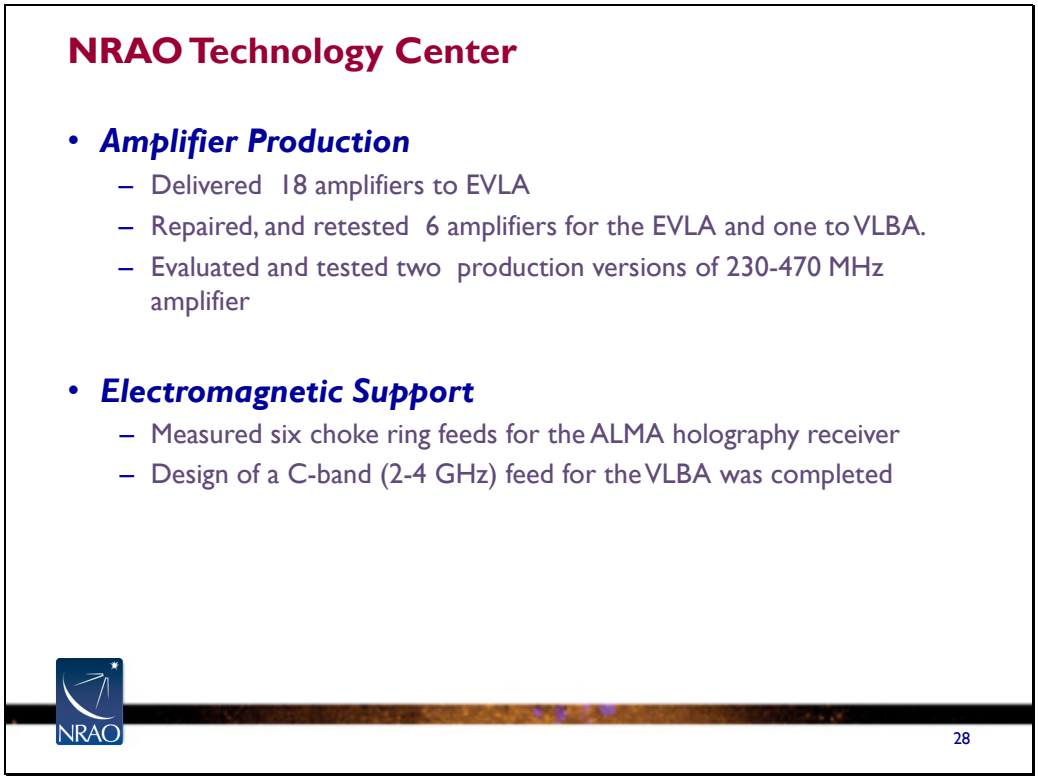
•*WFPA:* Q4FY11 - Conceptual design review – On Schedule

4mm Receiver: Q4FY11 - Amplifier delivery (CDL milestone) – On Schedule; Receiver testing complete – On Schedule

Agenda

- Science Results
- Observatory Science Operations
- Observatory Development & Programs
- Observatory Telescope Operations
  - NRAO Technology Center
  - ALMA Construction
  - ALMA Office of Chilean Affairs
  - EVLA Construction
  - EVLA/VLBA Operations
  - Green Bank Operations
- Observatory Support Services
- Director's Office

Slide 28

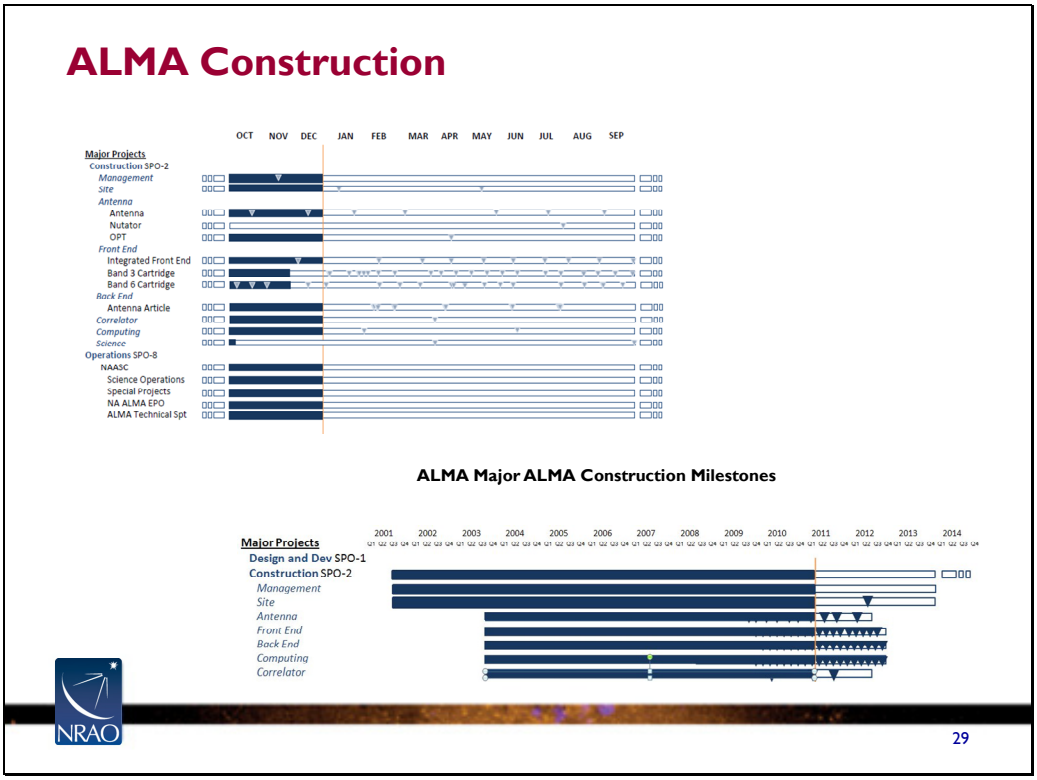


Amplifier Production and Development: Two prototypes of 230-470 MHz amplifier have been evaluated and tested and delivered to EVLA. Experimental evaluation of ALMA band #1 and #2 amplifiers awaits the availability of technician time.

Amplifier Production Milestones: New amplifier production included three 230-470 MHz amplifiers, four 1-2 GHz, six 8-18 GHz, two 26-40 GHz amplifiers and three 26-40 GHz amplifiers. Repair, upgrade, and retesting of amplifiers included one 4-8 GHz, five 26-40 GHz and one 70-95 GHz amplifiers. In total, 25 amplifiers were shipped. The EVLA amplifier production is on schedule. The deliveries of 18-26 GHz and 38-50 GHz amplifiers in support of the MPIfR Receiver Group are on schedule.

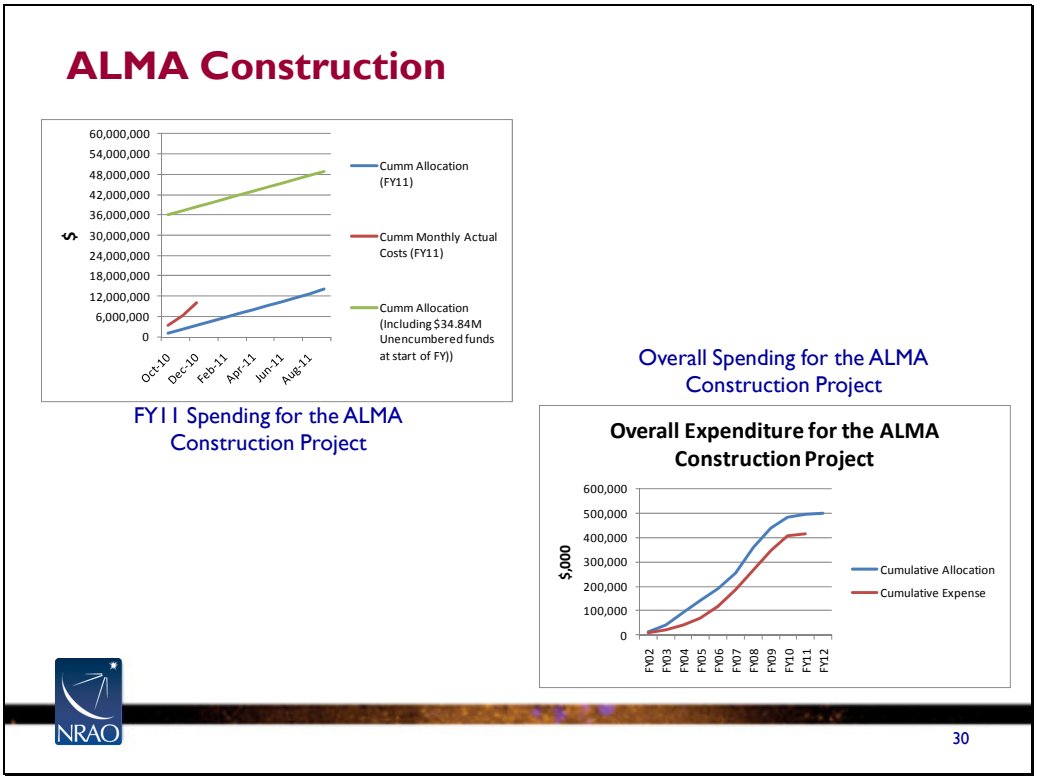
Electromagnetic Support: Far-field patterns of six choke ring feeds for the ALMA holography receiver were measured in the indoor antenna range in Green Bank. Patterns were measured at 104.02 GHz in the E-, H- and the two diagonal planes. The C-band feed is a corrugated horn and has a sinusoidal inside profile from the throat to the aperture. There are 8 ring-loaded corrugations in the mode-matching section of the feed. The feed has a nominal illumination taper of -13.2 dB at the edge of the subreflector.

Slide 29



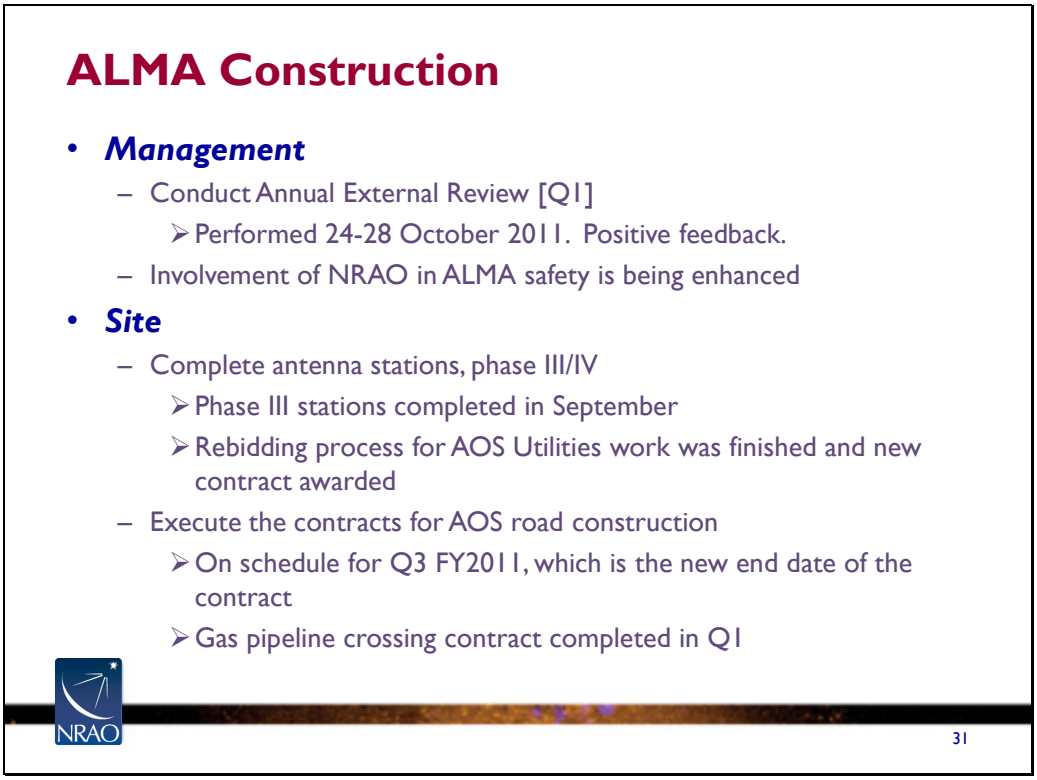
The first graph illustrates the full lifecycle. The second graph is this fiscal year view. The vertical line represents where we are today.

Slide 30



Spending on the construction tapered off in FY10 due to slower delivery of Vertex antennas, postponement of front end (FE) deliveries due to design verification tests, and delayed site work from terminated AOS utilities contract. A new antenna schedule has been developed, FE deliveries have resumed, and a new contract has been awarded for AOS utilities.

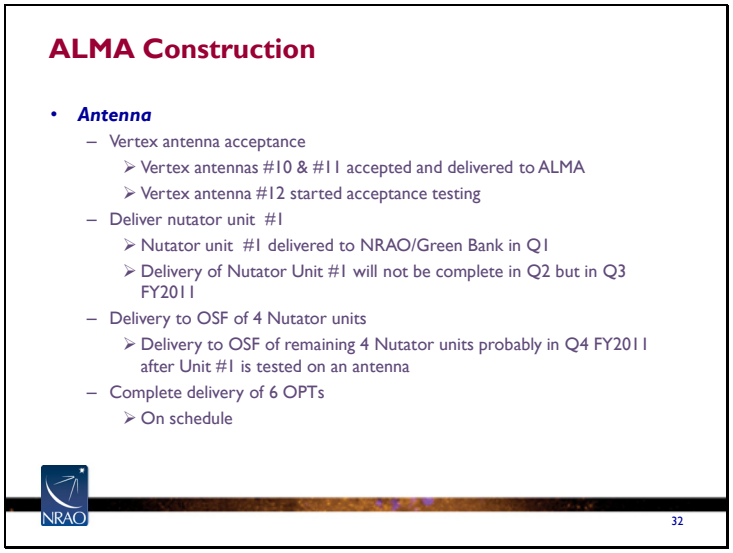
Slide 31



The **ALMA Annual External Review (AAER)** was conducted in Santiago 24-28 October 2011. The report indicates "… dramatic progress since last year" related to the having 8 Antenna at AOS, producing science results; bottle necks have moved up to higher levels; more cohesion in many aspects of the project team; "heroic" efforts by large team towards accelerated delivery; many threats to schedule; budget is OK. It also expressed a concern for safety and to develop the safety policy in a more collaborative way with all involved parties.

The delivery of **switchgears** continued and was completed on schedule during Q1 FY 2011. The **AOS Utilities Contract** execution was delayed due to the former contract termination on June 30, 2010. The new contract start date was December 2010 and work will restart on site on 3 January 2011. The next milestone in the ALMA schedule to deliver phase 4 stations for CSV will be maintained delivering partially in Q2 2011 - early March - and the rest in early April. Legal proceedings with the former contractor, its former employees and the insurance company holding the performance bond have been concluded or are in process. **AOS road construction** work (58% complete) restarted in October 2011 after the winter break. No significant progress to report on this contract. The work will be finished as scheduled in Q3 2011. During Q1 FY2011 a contract was signed for the construction of a **bridge over the GasAtacama natural gas pipeline** to provide a safe crossing for the transporter. The contract was finished during the same period. Due to the diverse nature of responsibilities of the ALMA Project in Chile, NRAO is analyzing how to step up it's safety awareness and presence in the activities for which it is liable. Actions will follow in Q2 FY2011.

Slide 32

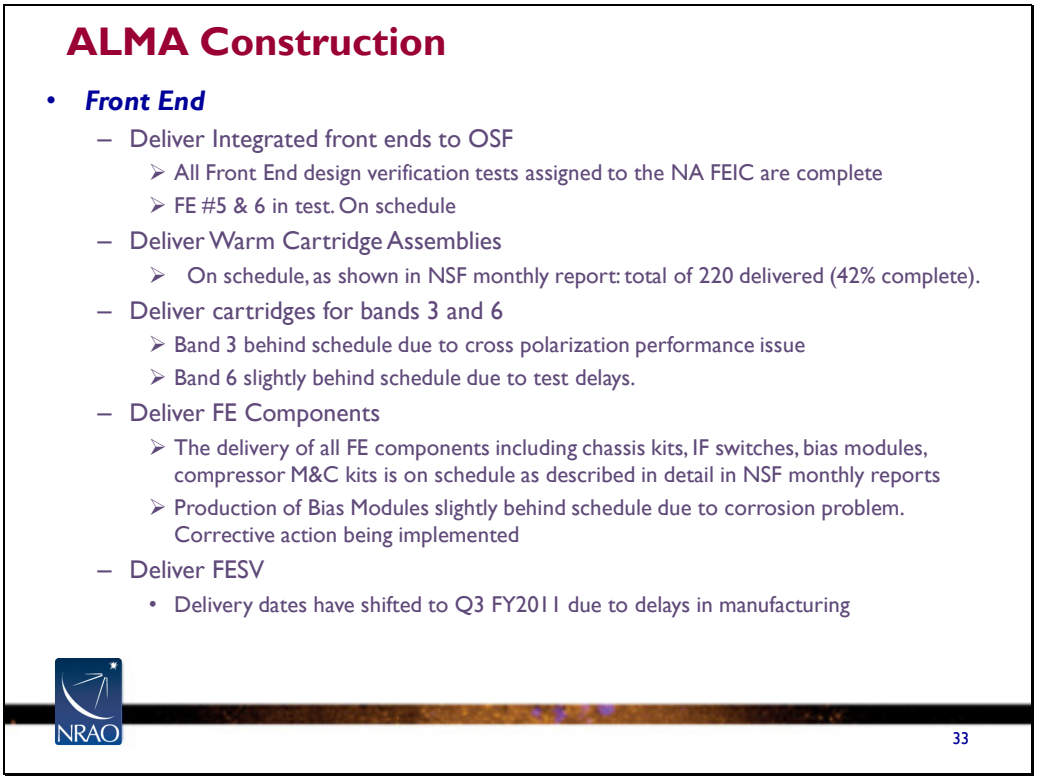


ANTENNA: During Q1 FY2011, the **10th and 11th Vertex antennas were accepted** into ALMA. Acceptance testing of the **12th** Vertex antenna was started but interrupted by the December holiday shutdown. In addition, verification of maintenance requirements which has been an outstanding condition for full antenna acceptance was completed in Q1, FY2011. There were no significant issues raised or resolved during this quarter and the availability of the Vertex antennas operating at the AOS has steadily been improving with software updates which improved the antenna control computer's ability to operate in conditions of poor ALMA provided timing signaling.

Nutator: The first Nutator unit was delivered to NRAO Green Bank in December to allow John Ford to continue to work on optimizing the performance of the Nutator servo control system. The engineers in Taiwan continued to work on refining some of the mechanical functionality such as stow motor cam design. It is expected to return Unit 1 to Taiwan in Q2, FY2011 for refurbishment and then transport on to Chile. **Risk**: Zero spacing data can't be recorded on timescale required by the Commissioning and Science Verification Team. **Mitigation**: The Computing IPT is implementing a fast scanning technique on the antennas to provide similar nutator functionality.

Production OPT (POPT): Units #1 & #2 are being used by AIV and NRAO/Vertex to perform acceptance testing on Vertex Antennas #10, #11 and #12. The all-sky and offset pointing measurements continue to be consistent with earlier testing with prototype OPT. The thermal drift problem remains but is being addressed on an individual test basis. An NRAO Antenna IPT engineer will travel to the contractor's facility in Tucson, AZ for a week of testing in Q2, FY2011.

Slide 33

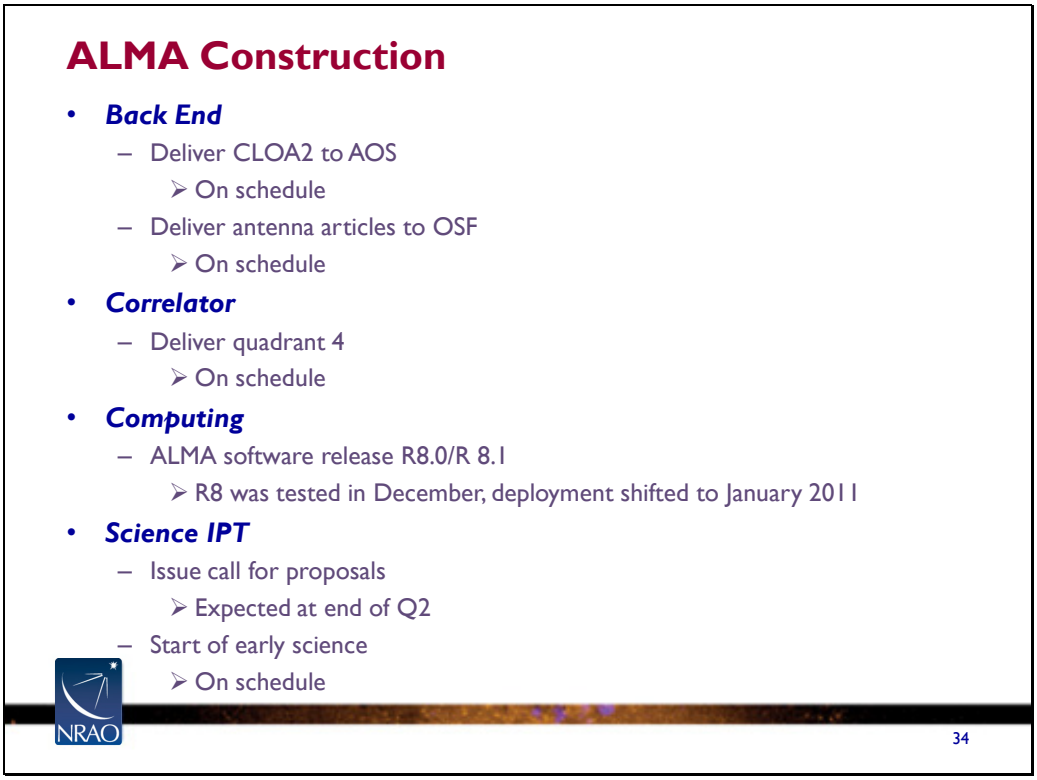


FRONT END: All Front End design verification tests assigned to the NA FEIC are complete. Front End production operations have resumed. North American **FE #5** in final test, PAI and shipment scheduled for January 2011. NA **FE #6** in test. Five additional FEs are completely assembled and another one is in assembly. Additional software to automate test operations is being developed. This will enable off-shift, unattended test operations and accelerate the test process. **Goal is to deliver the fourteenth NA Front End during FY2011**. NA Front Ends are projected to be off of the critial path schedule by Q2 FY2011. Two test operators were re-assigned to the FE Integration Center. All FE assembly operations are conducted in an assembly workcenter apart from the two test chambers. Production of **WCA baseline bands 3, 6, 7, and 9** is on schedule. **Band 3 CCA deliveries** to be resumed in January; production of Band 3 CCA is behind schedule due to a cross-polarization performance issue. **Risk**: B3 CCAs not delivered in time for FE assembly. **Mitigation**: Seek request for waivers and develop recovery plan. Requests For Waivers have been granted for seven cartridges and seven are pending. Schedule recovery plan is in place. Fourteen additional B3 CCAs have been produced; Total delivered: 35 (48% complete). Despite the risk, all three **FEICs have sufficient CCAs** to support production operations through Q2. **Band 6 CCA delivery** is slightly behind schedule due to test delays. **Risk**: B6 CCAs not delivered in time for FE assembly. **Mitigation:** Improve production efficiency. An improved method for matching feedhorns and OMTs has been implemented; total delivered: 39 (53% complete). Despite the risk, all FEICs have sufficient cartridges to support production operations through Q2. The final batch of 6 **FE Chassis Kits** was delivered to the NA FEIC, closing out the Chassis Kit task.

Production of **Bias Modules** is slightly behind schedule due to a corrosion problem discovered at the OSF and implementation of corrective action. **Risk**: modules not available in time for FE assembly. **Mitigation**: Develop schedule recovery plan. This has been done. Total modules delivered: 253 (50% complete). Production of **FE Monitoring & Control Kits** (including IF Switches) is on schedule; total delivered: 39 (56% complete).

A combined Critical Design and Manufacturing Readiness Review for the Compressor M&C module and Power Supply M&C module is scheduled for 15 February 2011 at the OSF. Successful completion of this review with a minimum number of RIDs and engineering changes is key to keeping production operations on schedule. The **Front End Service Vehicle (FESV)** is scheduled for delivery during Q3 FY2011. Manufacturing at supplier is under control. Supply of critical components has delayed delivery. **Risk**: Lack of FESV means FEs must be removed from antennas at the OSF instead of in place at the AOS. **Mitigation**: Expedite delivery. Deputy PM held extensive meeting with vendor (CoTech) in Taiwan to expedite the delivery of truck chassis unit #2, from Volvo in Sweden.

Slide 34



BACK END: The **Central LO Article 2** continues to progress very well through its acceptance testing required prior to shipment release. Shipment is still scheduled for February with the beginning of installation starting in March. **Antenna Articles** are continuing to be assembled and accepted for shipment in Socorro. By end of December 2010, 50 articles had undergone testing. Further shipments are being pushed into 2011 due to space constraints at the OSF and the fact that the articles provide a useful testbed for new methods under investigation. These articles can be shipped at a moment's notice, though. Antenna Articles remain on schedule for completion (66) in Q4.

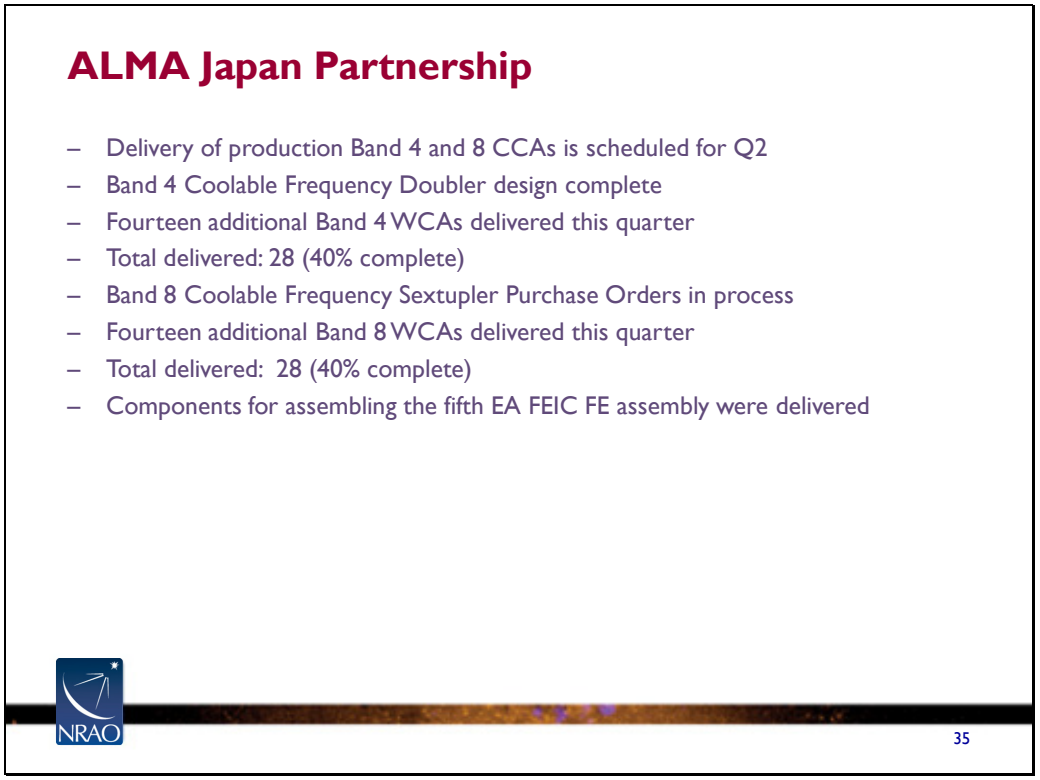
CORRELATOR: **Quadrant 4 has been completed and verified**. On schedule for delivery in Q2 FY2011. Plans were formulated for moving fiber and other connections for 2-quadrant operation (up to 32 antennas) in coordination with Back End CLOA2 installation beginning in March 2011.

COMPUTING: **R8 deployment** was delayed into January because 1) JAO requested that it not be deployed in the holiday season for support reasons, and 2) a bug was discovered which limited total-power (square-law detector) observing at the high site. It is expected that CSV will be able to use R8 in the first half of January. **Risk**: none. **Mitigation:** none. **CASA release 3.1** was delayed to resolve some performance problems which were triggered by ALMA data. Performance improvements (both fixing defects and adding parallel processing features) will also be the single largest focus of the release 3.2 development cycle. **Risk**: None. **Mitigation**:

Important fix. Accept minor delay, although it is inconsequential on the broader scale of the project.

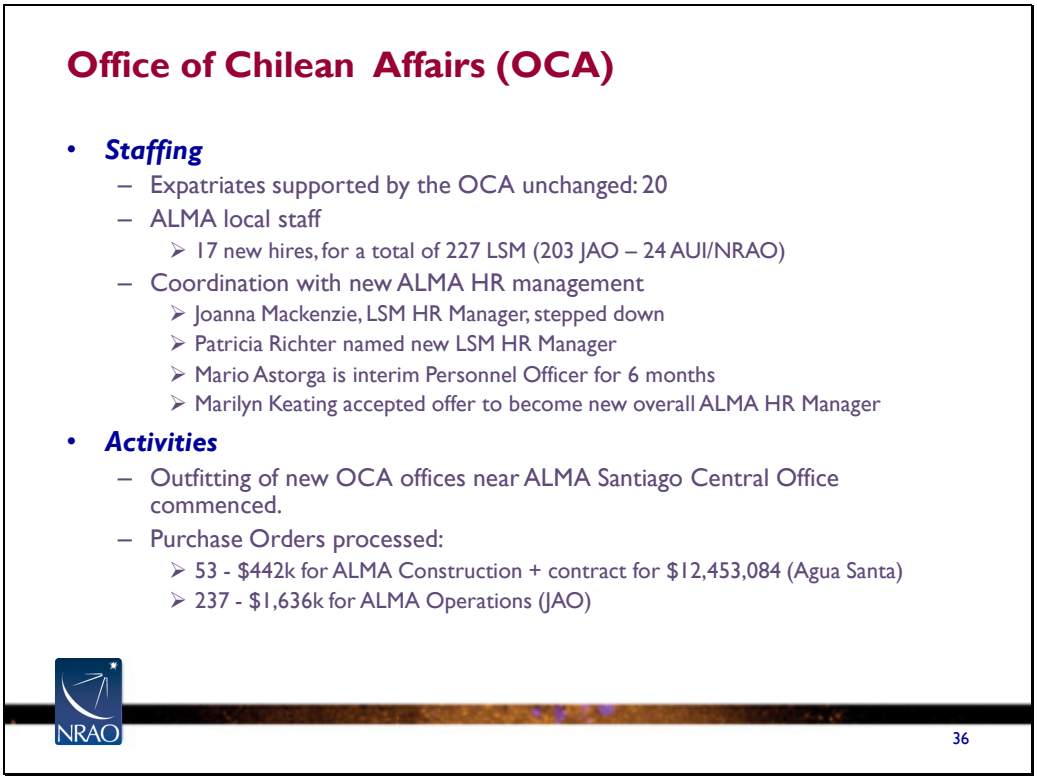
SCIENCE: The IPT participated in development of the Plan for ALMA Early Science Cycle 0 to be announced in early Q2 FY 2011. The Science IPT leads an Imaging Tiger Team at the NAASC which participates in CSV through direct involvement and through offshore analysis of ALMA data to verify performance of the array. Several test images made with ALMA test data and released during Q1 2011 show that the performance of the array is already impressive, equal in sensitivity and spectral compass to the best millimeter arrays in the world today. On the advice of the ALMA Board, the **Call for Proposals** will be made in Q2 FY 2011, with **Early Science** beginning at the end of Q4 FY 2011. The delay in the call and start of Early Science were made to accommodate array readiness. **Risk**: None, beyond providing science capability one quarter later than predicted. **Mitigation**: accept delay.

Slide 35



SPO-7 activities: Delivery of production Band 4 and 8 CCAs is scheduled for Q2. Fourteen additional Band 4 WCAs delivered this quarter; total delivered: 28 (40% complete). Fourteen additional Band 8 WCAs delivered this quarter; total delivered: 28 (40% complete). Components for assembling the fifth EA FEIC FE assembly were delivered. The NA FEIC is prepared to retrofit these cartridges into assembled (and untested) Front Ends. Test operations plans for both bands is approximately 80%complete. The aforementioned test automation initiative is key to absorbing the additional test workload (50% increase; going from test of 4 bands to 6 bands). "On-chip" test data for Band 10 Power Amplifiers for WCAs from BAE Systems is expected during Q1. Band 4 Coolable Frequency Doubler design complete. Band 8 Coolable Frequency Sextupler Purchase Orders in process.

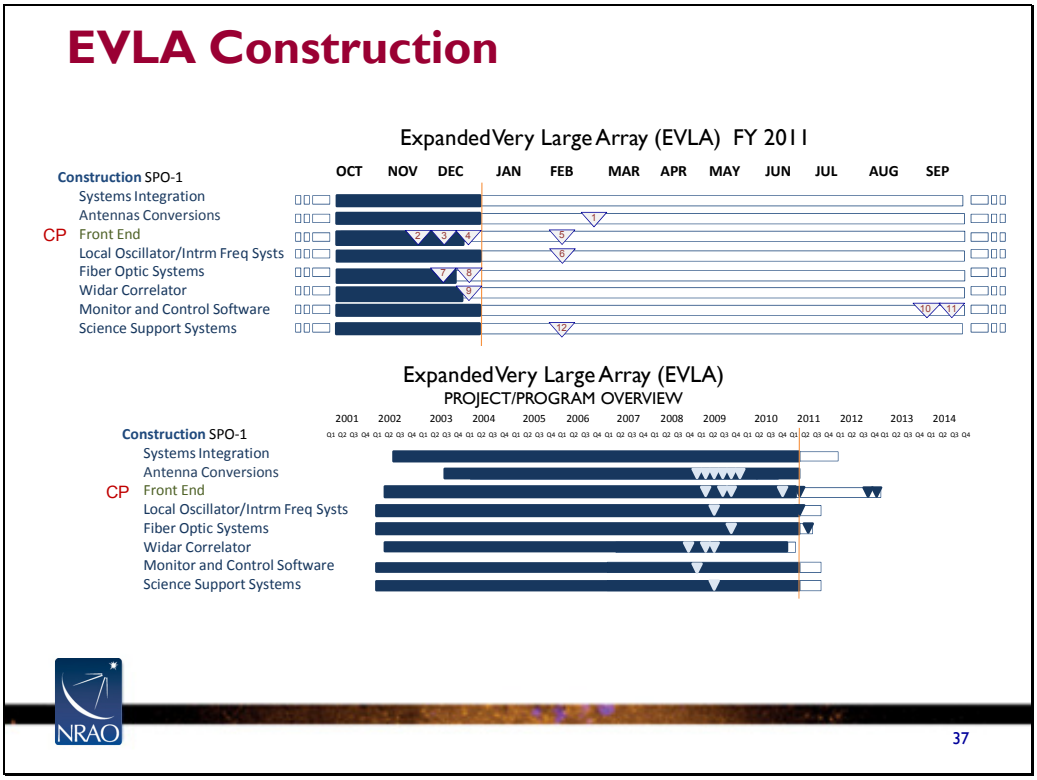
Slide 36



OFFICE OF CHILEAN AFFAIRS (OCA): No changes in number of **expatriates**. OCA has signed a total of **17 new ALMA Local Staff Member contracts in the quarter**, bringing the total number of employees for which OCA provides ALMA with legal, payroll and travel support to **227 local staff** (203 under JAO supervision and 24 under AUI/NRAO's). Changes in ALMA's HR management include: announcement that the current LSM HR Manager, Joanna Mackenzie, has stepped down and plans to leave 31 December 2010. Patricia Richter, former ALMA Personnel Officer, accepted the position as new ALMA LSM HR Manager. Mario Astorga is interim Personnel Officer for 6 months while the position is advertised. Marilyn Keating has accepted the offer to become new overall ALMA HR Manager and will assume in Q2 FY2011. More pronounced involvement of US NRAO HR is planned.

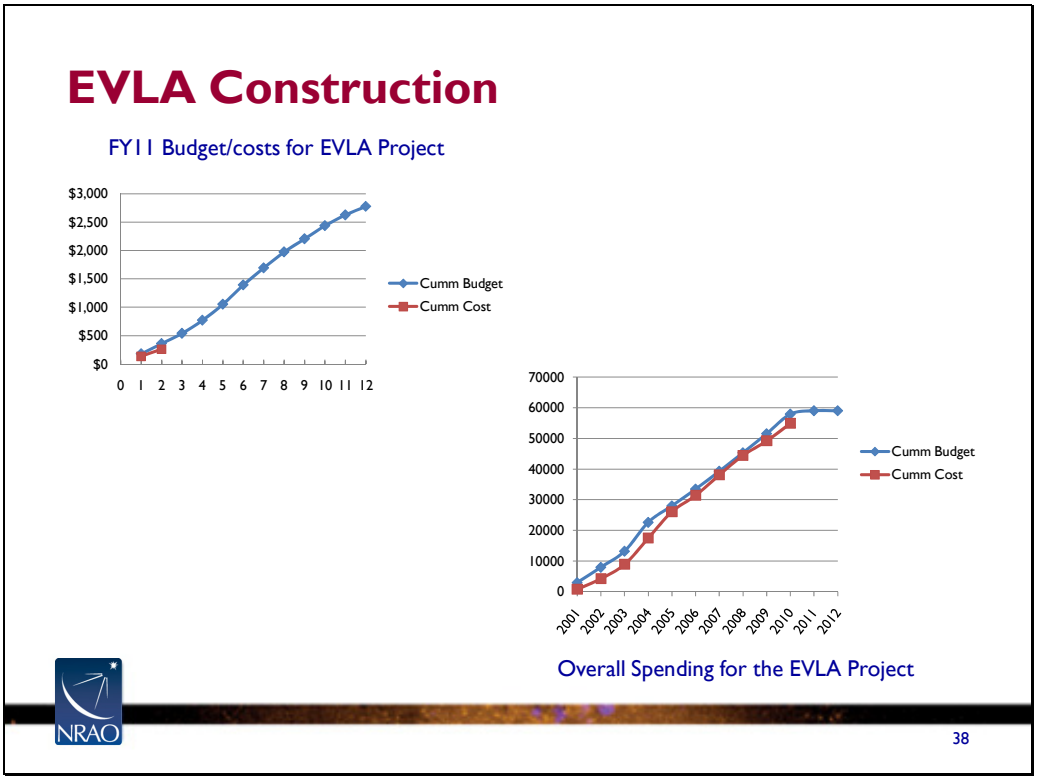
Outifitting construction of the new OCA offices has started. Change to new offices expected at the end of January 2011. OCA has provided the legal and institutional support for contracts and procurements for ALMA as follows: a total of **53 purchase orders were made for ALMA Construction (442 k$)**, plus the signature of the AOS Utilities – Electrical and FO cables installation contract with Agua Santa for $12,453,084, and **237 for ALMA Operations (JAO) (1,636 k$)**. The activities for ALMA Construction involve those described in the Site IPT section, namely AOS Roads Construction Contract, AOS Utilities – Electrical and FO cables installation contract, Fiber Optic Cable supply and Contractors' Camp expansion (JAO activity). Monthly reports were issued to CONAMA (environmental authority) related to flora/fauna and archaeological follow-ups. The **termination of the AOS Utilities – Electrical and FO cables installation contract** with Echeverría & Kelly Ltda. continues to involve additional litigation.

Slide 37



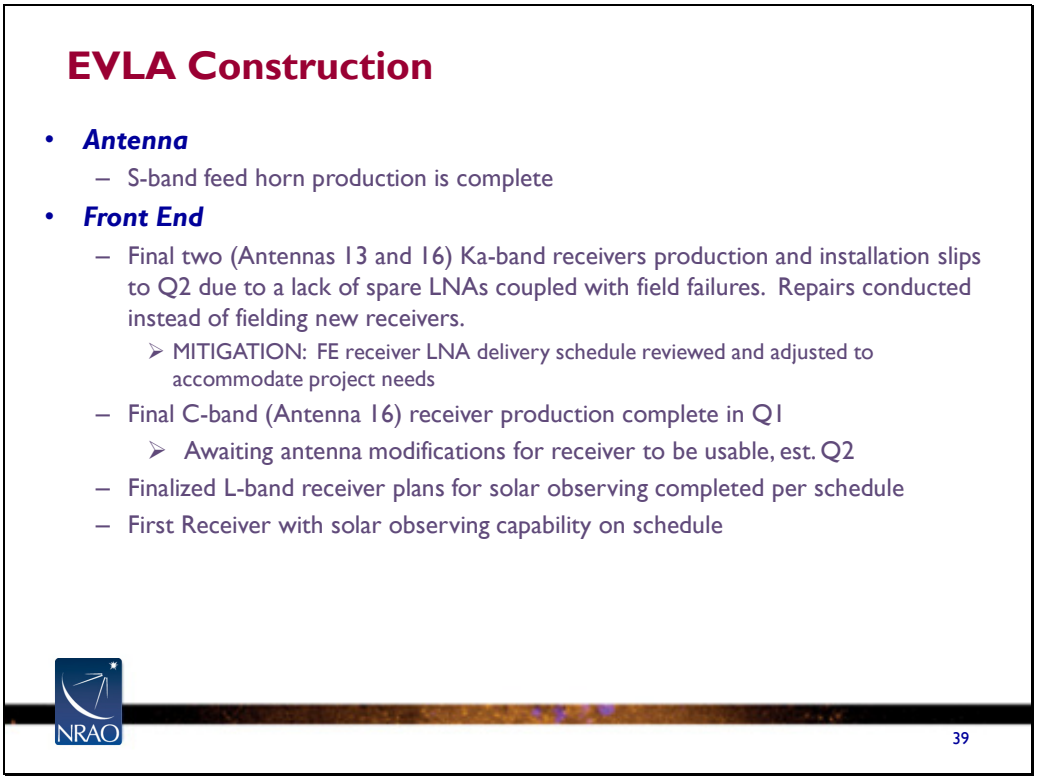
The bottom graph illustrates the full lifecycle. The top graph is this fiscal year view. The vertical line represents where we are today. The CP represents the critical path. Front End remains the critical path product area, as S-, L-, U-, and X-Band receivers are scheduled to be constructed and installed through the end of 2012.

Slide 38



Cumulative cost depicted in lower right hand graph will always be below the budget due to contingency, which is spent as required.

Slide 39



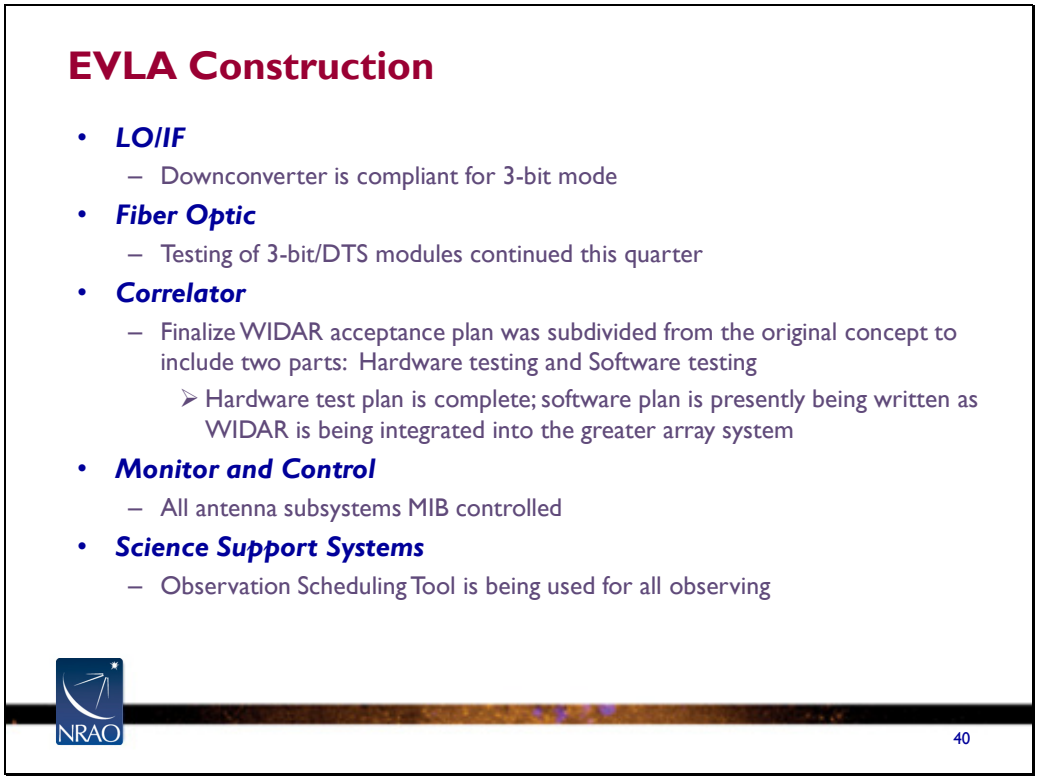
NOTE: [numbers] refer to corresponding numbers on the milestone charts. No specific milestones defined for Systems Integration in FY 2011 Program Operating Plan. Would-be system milestones covered in specific product areas. All **S-Band feed horns** are fabricated and assembled. Five remain to be tested [1]. Testing will re-commence once weather improves at the VLA. A Q2 completion for this item is anticipated.

Milestones 2 and 3 (completion of all Ka- and C-Band receivers) narrowly missed the Q1 milestone. Both bands are in good shape to be completed in January 2011. Milestones 4 and 5, the finalization of plans for solar observing and the installation of the first solar observing receiver, have slipped. Development is ongoing, as key staff have been involved with more pressing EVLA construction issues. The Front End is on the Critical Path. The current EVLA project plan calls for its receiver production to be complete by the end of calendar year 2012. RISK: Due to the prolonged development of receiver designs, the receiver production schedule has been compressed requiring additional resources to assemble and fabricate receiver components. MITIGATION: Contingency is being used to hire additional temporary assemblers/installers. **Ka-band** receivers scheduled to be installed in Antenna 13 on 3/08/11 and in Antenna 16 on 1/21/11. Slippage due to LNA units being used to repair existing receivers. Spare LNAs have not yet been delivered to the FE group. These, along with spare LNAs for all bands are scheduled to arrive after the delivery of those required for actual construction. The delivery schedule for low noise amplifiers (LNAs) for the EVLA project is provided by CDL. An accelerated schedule to ensure the LNA will be delivered in advance of

their need date, and thus remove the potential risk of late LNA deliveries causing delays in receiver production has been implemented. This is achievable by use of mostly contributed effort from CDL and project labor support. The original plan for the project was to fabricate and plate most of the receiver machined components in-house. Both the GB and VLA machine shops contribute to this effort, for which ongoing support is needed to maintain schedule and help keep costs to a minimum.

C-band receiver has been installed, however the antenna itself (Antenna 16), being an early EVLA version, requires additional work before the receiver can be used. Antenna 16 is presently undergoing overhaul, and will be back in the array by the end of January 2011. Finalized **L-band** receiver plans for solar observing [4] completed per schedule this quarter. First Receiver with **solar observing** capability [5] on schedule.

Slide 40



Local Oscillator/Intermediate Freq Systems, the downconverter is compliant for **3-bit mode** [6] and is on track to meet Q2 milestone.

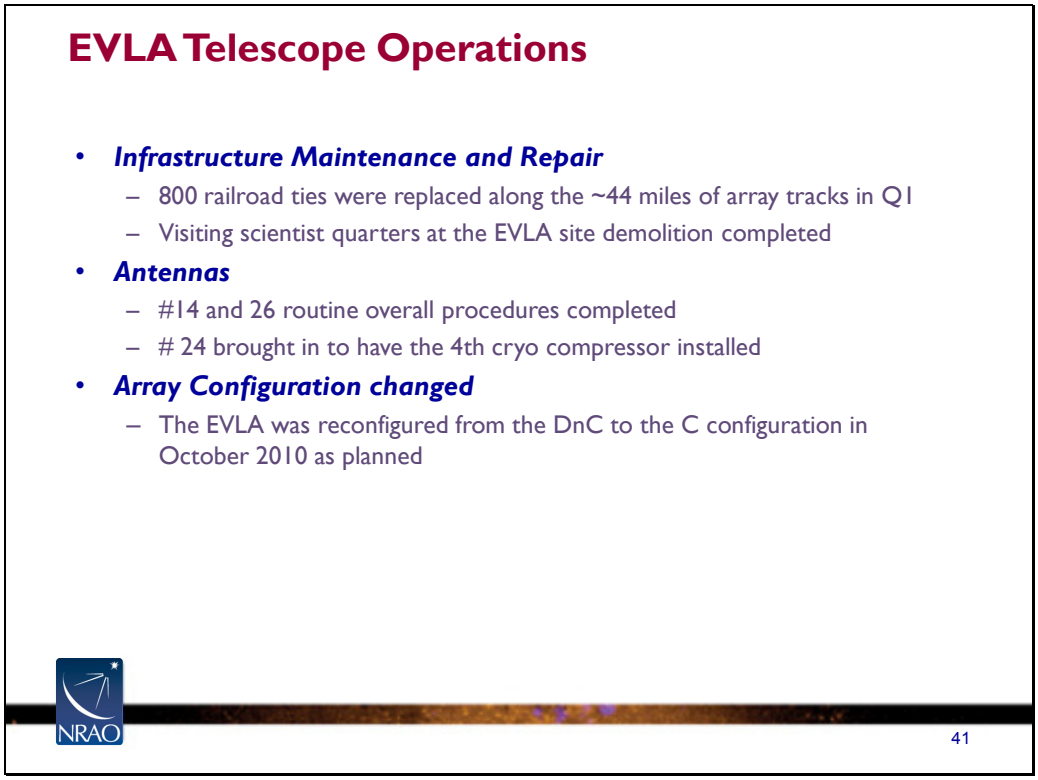
Testing of **3-bit/DTS modules** [7] continued in the first quarter. Testing of the 3-bit sampler prototype (milestone 7) uncovered a flaw in the assembly design. Modifications have been made to the sampler assembly, and new prototype boards will be ordered and tested in Q2. Pending successful tests on the array, production quantities will be procured. Contingency funds will be spent to accelerate assembly and installation of 3-bit samplers into the array if necessary. Begin installation of 3-bit/DTS modules [8] in Q2. RISK: Delay verifying 3-bit assembly will push out installation of modules. MITIGATION: Contingency will be used to hire additional temporary assemblers/installers.

For the correlator, the finalization of the **WIDAR** acceptance plan [9], has slipped due to higher priority testing taxing key resources. To mitigate, the priority of this item has been increased. If necessary, further mitigation will be taken in the form of extra scientific staff help for the document.

Milestone [10] in the Monitor and Control area is complete early. Milestone [11], standard OSRO setup for the next D configuration will allow 16 x 128 MHz subband pairs, for a total of 2 GHz bandwidth per polarization. This is on track for Q4.

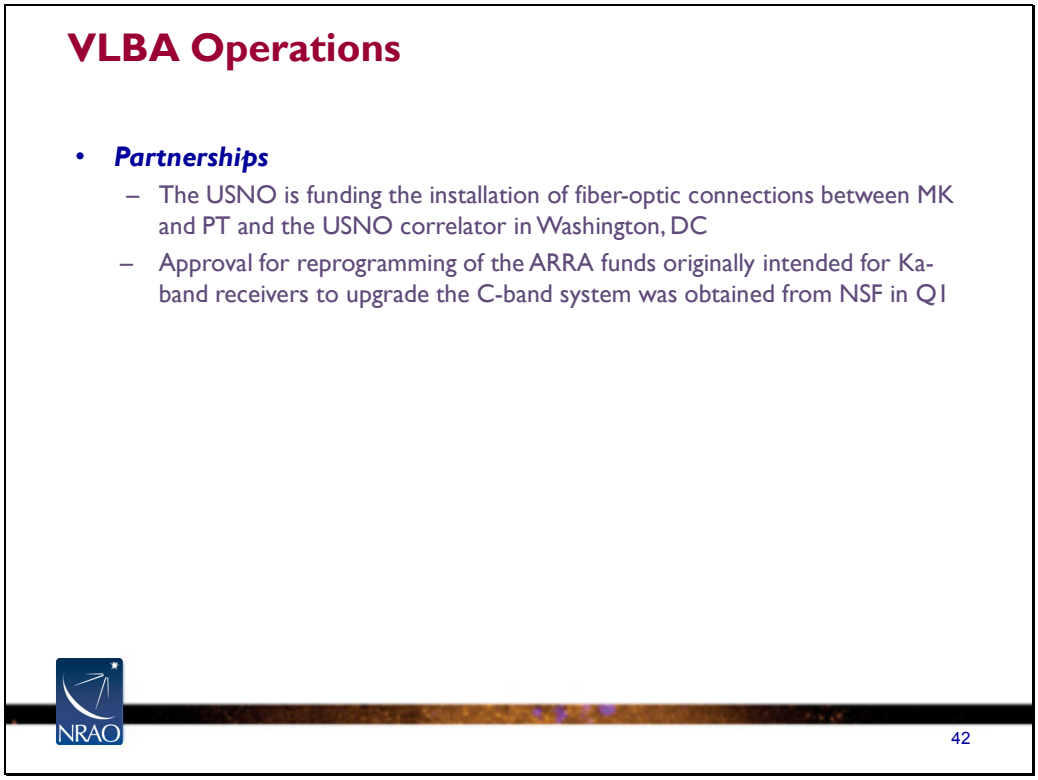
Observation Scheduling Tool [12] now used for all observing (milestone completed early).

Slide 41



Q1 - FY11 of the ~5000 **ties** that we anticipate replacing in FY11, about 800 were replaced in Q1 (this effort slows down in the colder months due to the ground being frozen). **Visitor quarters** at VLA were demolished in Q1, three quarters ahead of schedule. Demolition was due to lack of use, need to replace the fire sprinkler system; expense to do these repairs plus correct the extreme problem with rodent infestation was deemed not worth the effort compared to demolition. NSF approved demolition in FY2010. Replacement of stairs to observation platform will not be complete until end of Q3 FY2011. The normal wear and tear on the stairs was showing in rust weakening the joints, etc. Periodic safety checks highlighted the issues and one set of stairs were closed off for safety reasons. Antennas **14, 26** had routine overhaul procedures completed. Antenna **24** was brought in to have the 4th Cryo compressor installed. The EVLA was reconfigured from the **DnC to the C** configuration in October 2010 as planned; the next reconfiguration is scheduled for January 2011.

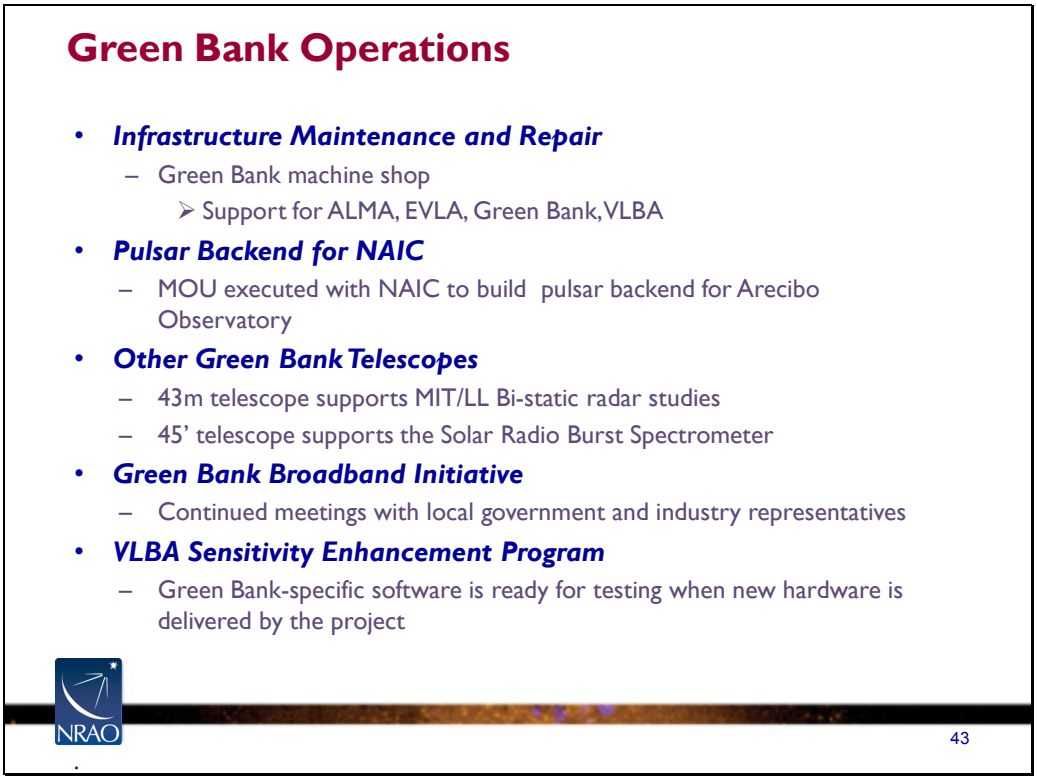
Slide 42



Maintenance Tiger Team visits are scheduled for North Liberty and Owens Valley in Q3, and Saint Croix in Q4, however no maintenance tiger team visit was scheduled or performed in Q1. Other major VLBA maintenance has been deferred until FY 2012.

Key VLBA stakeholders, including PIs of large projects, representatives from other US agencies, and international observatory leaders, will convene to confront the threatened VLBA operations budget in Charlottesville, January 2011. Planning for this meeting began during Q1. The goal is to establish sufficient partnerships to ensure the continued operation of the VLBA for a minimum of 5 years, and to investigate alternative operational models for the VLBA. The USNO is funding the installation of fiber-optic connections between MK and PT and the USNO correlator in Washington, DC. The fast fiber links are expected to be installed during Q2.

Slide 43



Green Bank Shop: the machine shop in Green Bank continues to support a number of projects for Green Bank, NRAO, and other scientific institutions. The activities supported in Q1FY11 were:

- Green Bank: Dewar for MRI Skynet grant for GB 20m telescope, 4mm Receiver dewar modifications and internal parts, 4mm rotating optical table, RFI enclosures for PTCS axle encoders and servo project interface boards
- CDL: Phased Array Feed
- ALMA: M&C enclosure, Bias Boxes
- EVLA: Ku Band Feed horns
- Other (CV): Phase Shifters (10), 45 Deg Twists (7)

Pulsar Backend for NAIC: Initial hardware assembly and software loaded. Ready for scientists to test.

Other Green Bank Telescopes: MIT/LL continues to operate the **43m telescope** under the four-month extension put into place in Q1FY11. The SRBS is opening on the **45'telescope**.
GB Broadband Initiative: Meetings with the key players to provide **Broadband service** to Green Bank and the community continued throughout Q1FY11

VLBA Sensitivity Enhancement Program: Once the recorders are provided by the project, the GB software engineers will test the revised **VLBI software** on the new platform in advanced the published Q3FY11 date.

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- Science Results
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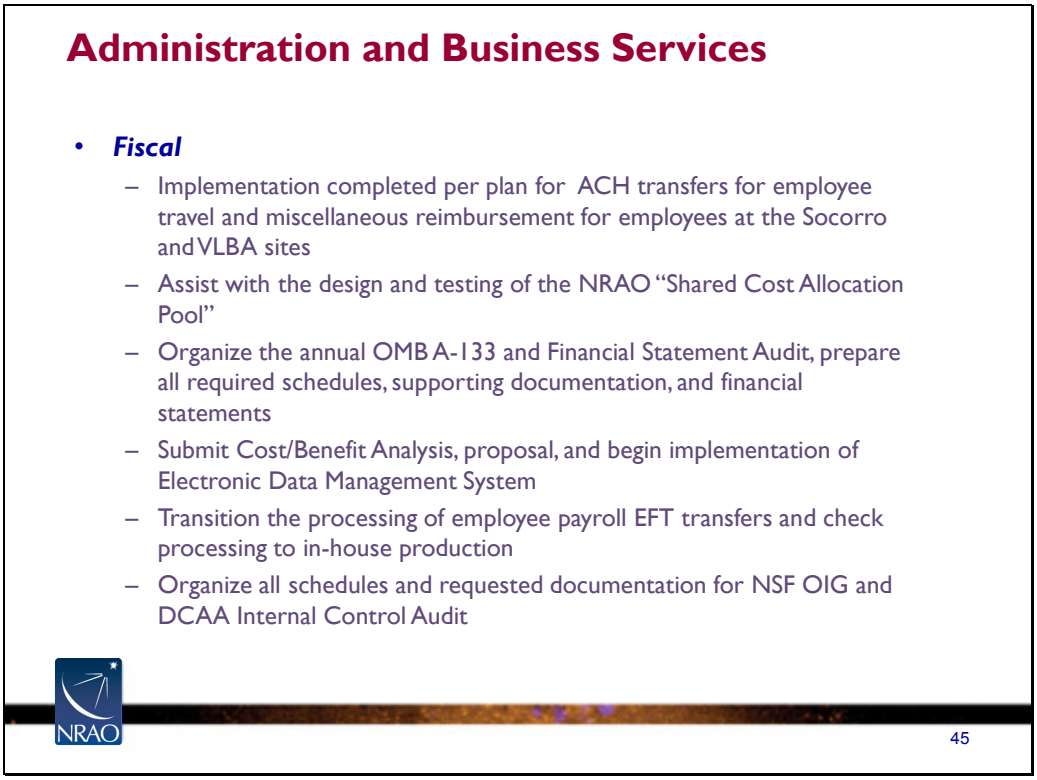
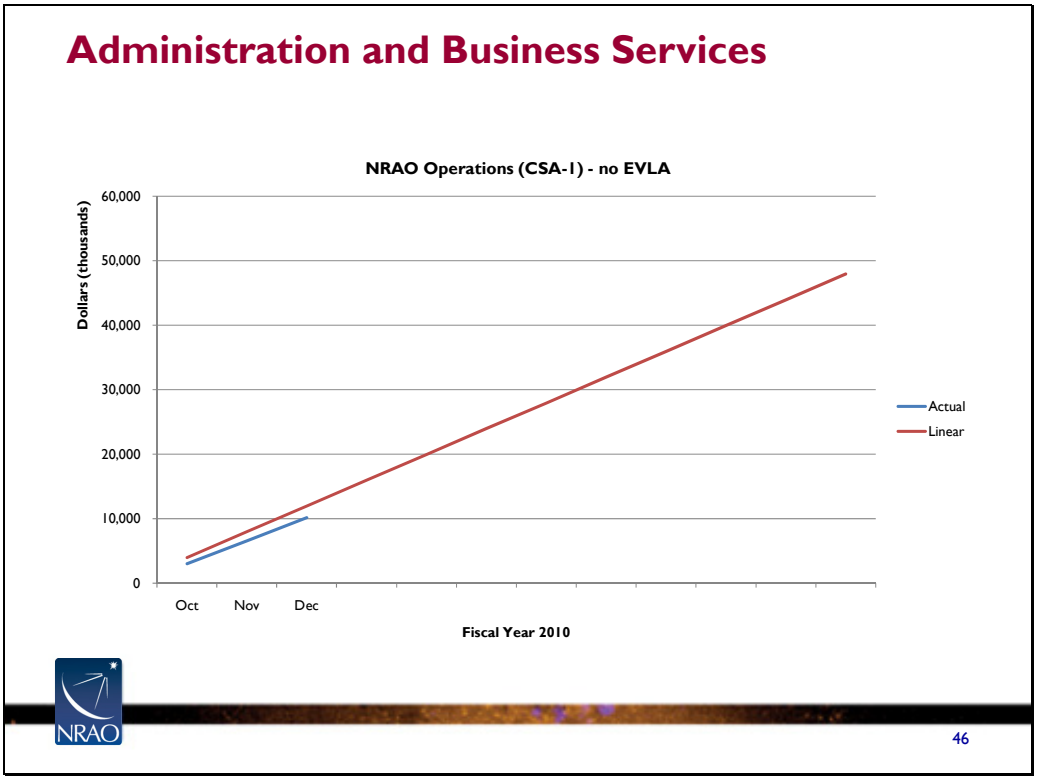
- Observatory Support Services
  - Administration and Business Services
    - Fiscal
    - Contracts and Procurement
    - Management Information Systems
    - Environmental Safety and Security
  - Human Resources
  - Computing and Information Systems
  - Spectrum Management
- Director's Office

Slide 45



There were no specific milestones in this quarter for Observatory Business Services. For Fiscal, completed the implementation per the plan of ACH transfers for employee travel and miscellaneous reimbursement for employees at the Socorro and VLBA sites. Continued during the quarter in the following activities that will close in Q2: design and testing of the NRAO "Shared Cost Allocation Pool" , annual OMB A-133 and Financial Statement Audit, Cost/Benefit Analysis, proposal, and begin implementation of Electronic Data Management System, transition the processing of employee payroll EFT transfers and check processing to in-house production, and support for the NSF OIG and DCAA Internal Control Audit which has no established end date.

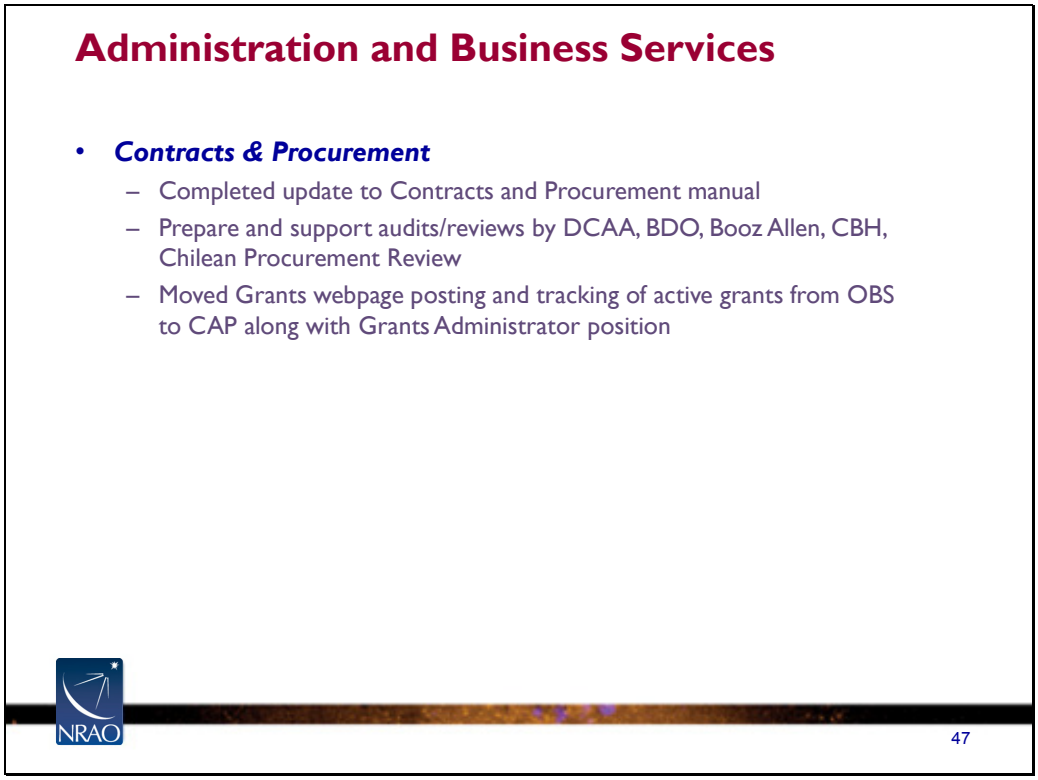
Slide 46



FY 2011 budget based on President's Request and without consideration for the continuing resolution:

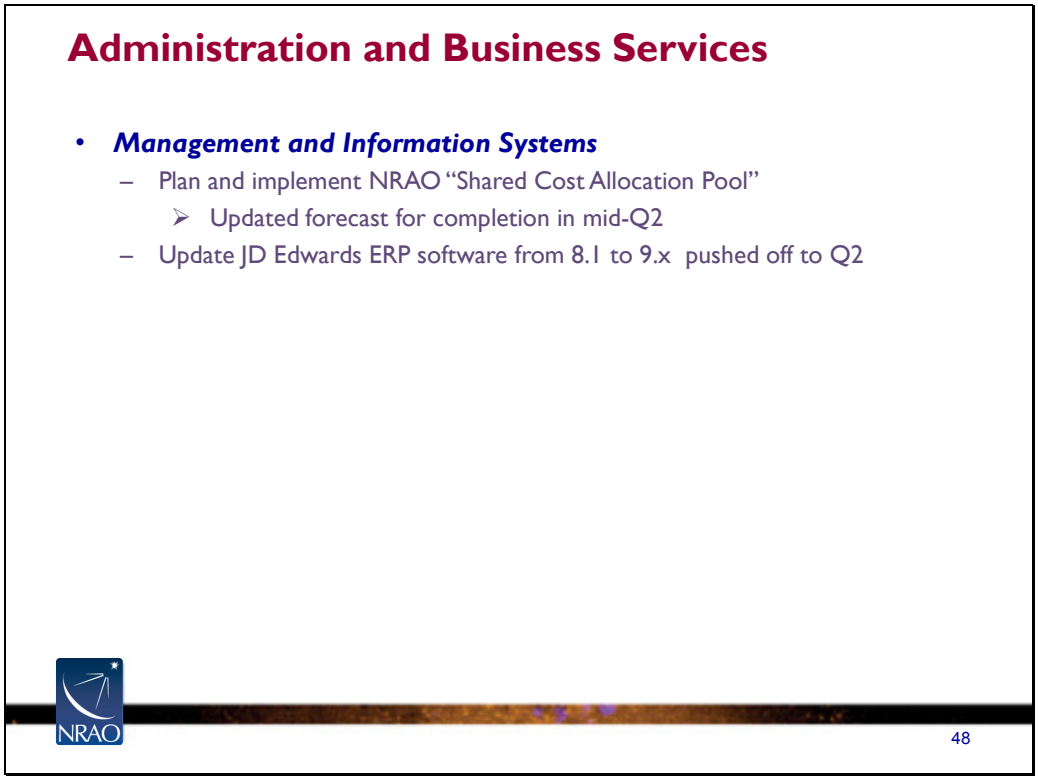
NRAO Operations (less EVLA) FY 2011 new funding allocation is $43,237k. Total available funding including prior year commitments and carryover totals $50,120k. Total expenses and commitments for first quarter FY 2011 is $10,160k or 20.3% of total available funds.

Slide 47



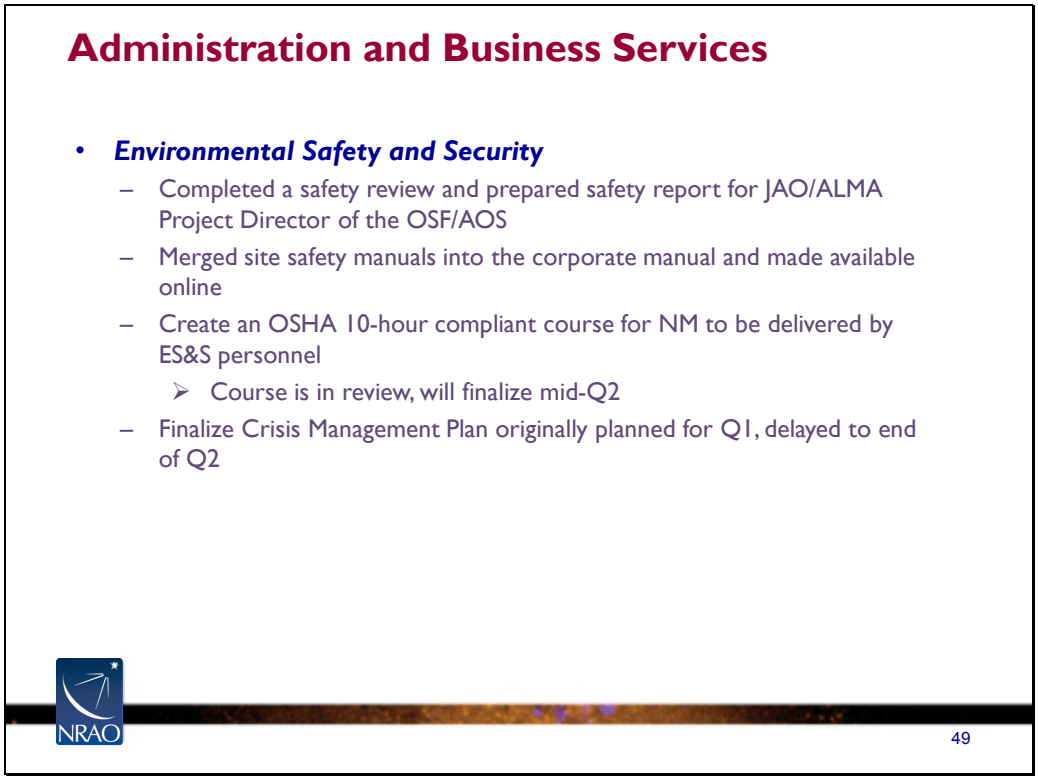
Moved Anthony Turner from Business Services to Contracts and Procurement effective October 1, 2010. Completed update to contracts and procurement manual. Continued working the following initiatives due to close in Q2: Complete the Contracts Change Order Procedures, grants webpage posting and tracking of active grants-moved from OBS to CAP along with Grants Administrator position. Continued to support audits/reviews by DCAA, BDO, Booz Allen, CBH, Chilean Procurement Review-end date is unknown.

Slide 48



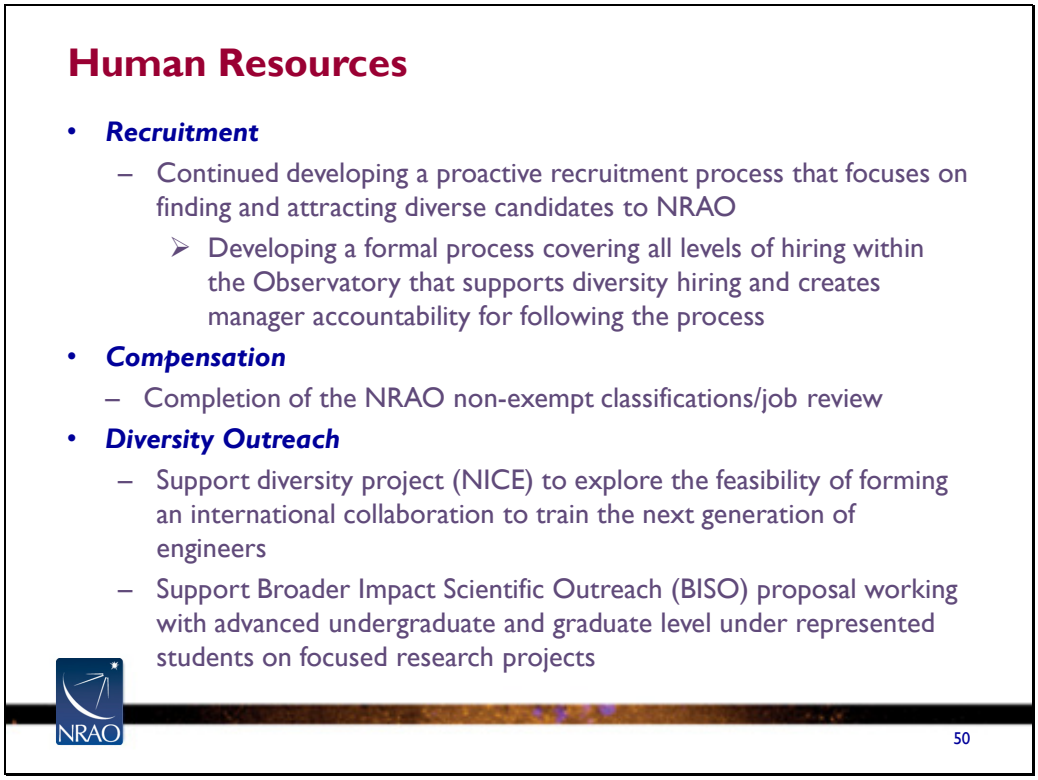
Shared cost allocation pool is taking far more time and resources than initially expected. This is a combined effort with support from Business Services, MIS, and Fiscal. Update **JD Edwards ERP** software from 8.1 to 9.x pushed off to Q2.

Slide 49



ALMA Safety Review has been conducted with recommendations submitted this quarter per the plan. On track to coordinate JAO safety training program with JAO safety office next quarter. Merged **site safety manuals** into the corporate manual and made available online. Slightly delayed in creating an **OSHA 10-hour compliant** course for NM (consistent with the OSHA complaint courses at the other sites) to be delivered by ES&S personnel. Course is in review, will finalize mid-Q2. The finalization of the **Crisis Management Plan**, planned for Q1, has been delayed to end of Q2 due to prioritization conflicts. No risk identified with this slight slip in schedule for either of those items.

Slide 50



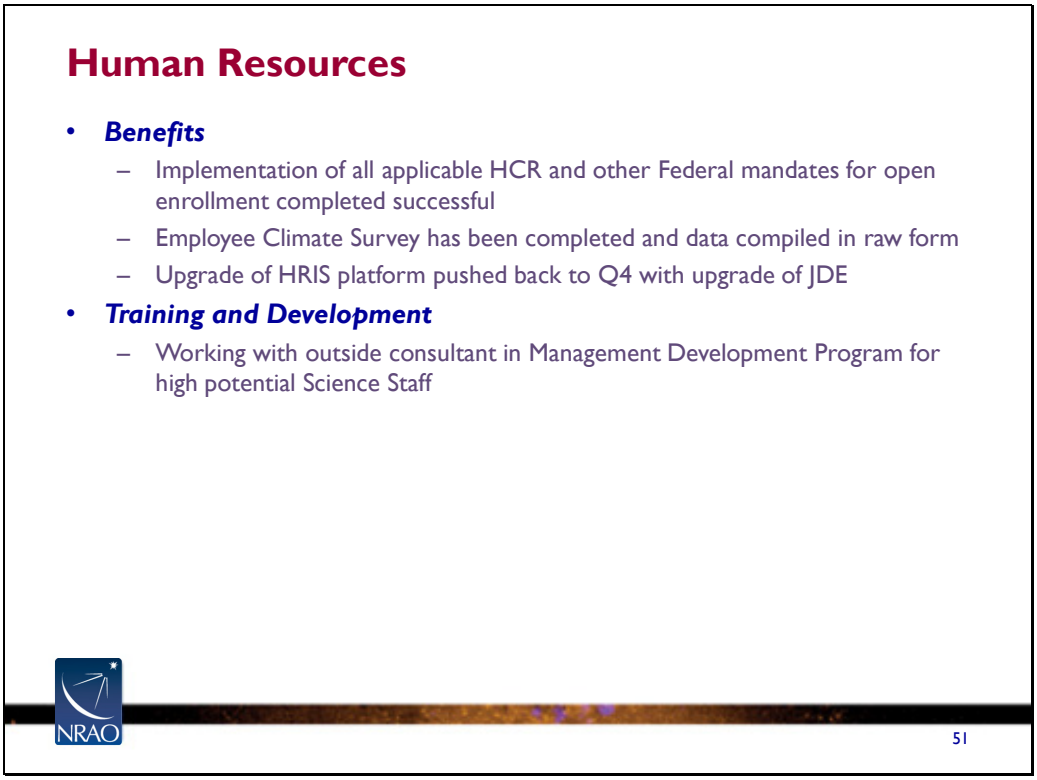
Continued developing a **proactive recruitment process** that focuses on finding and attracting diverse candidates to NRAO. Emphasis on improving diversity within the Scientific Staff and engineering staff, developing a formal process covering all levels of hiring within the Observatory that supports diversity hiring and creates manager accountability for following the process. Will be encompassed in a newly created supervisors guide to recruiting.

The nonexempt classification/job review was complete in Q1 which included market pricing all positions with market matches and slotting those without strong matches onto a new nonexempt pay structure. During Q2 we will implement these changes by notifying all employees/managers, publishing the new structure and job classifications and implementing all changes in the HRIS system. Also during Q2 we will complete the exempt classification/jobs review and finalize the revised exempt salary structure. Following this comprehensive review we will prioritize jobs where equity adjustments may be necessary once funding permits. The wage and salary manual is being revised as these steps reach completion.

This quarter, continued to work with Aaron to collaborate with Howard University Astronomy Department. Supported Richard Prestage's diversity project (NICE) to explore the feasibility of forming an international collaboration to train the next generation of engineers, and increase the diversity of the pool of trained engineers. Richard's student from Italy is due to arrive in February to begin working on the **NICE Proposal**. Support Drs. Aaron Evans and Kartik Sheth with Broader Impact Scientific Outreach (BISO) proposal working with advanced

undergraduate and graduate level under represented students on focused research projects (Q3, Summer 2011). Aaron and Kartik's students will arrive in the summer of 2011 through the **BISO (Broader Impact Scientific Outreach)** proposal to sponsor underrepresented students. New initiative conceived after the new POP was completed. **Diversity support group** members are being identified at each site level. **Diversity Advocates** have been provided training.

Slide 51



Completed Implementation of Heath Care Reform (**HCR**) and other Federal mandates in NRAO benefit plans. Further mandates will be addressed as they are required. This quarter, for the employee **climate survey** covering NRAO employees perception of job satisfaction, management, compensation, benefits and diversity due Q2, survey has been completed and data compiled in raw form. Next steps include identification of major themes, development of report and communication of results. **Upgrade of HRIS** platform pushed back with upgrade of JDE. Upgrade is critical in maintaining the integrity of employee benefit, compensation and employee data. Federal **HIPAA security mandates** require NRAO to secure all sources of HIPAA protected employee information retained or communicated in its IT systems and housed at its facilities. Human Resources is supporting **implementation** through Q4 for the identification of HIPAA protected information locations and sources and the development of HR processes to maintain security. Work on **Total Rewards Strategy** has been slow. Other priorities, including Health Care Reform and electronic open enrollment took majority of benefits resources. **Alternative Medical Plan Options** – planning has begun for development of **HSA** or other medical option. Will continue to develop in coming year(s). AUI Board mandate to reduce or eliminate **AUI FAS 106 liability**. Establishment of an on-going management development program, initially targeting new and future managers who are members of the NRAO Scientific Staff (Q2). Initial program will focus on 15 to 20 current and high-potential future managers from **NRAO's Scientific Staff**.

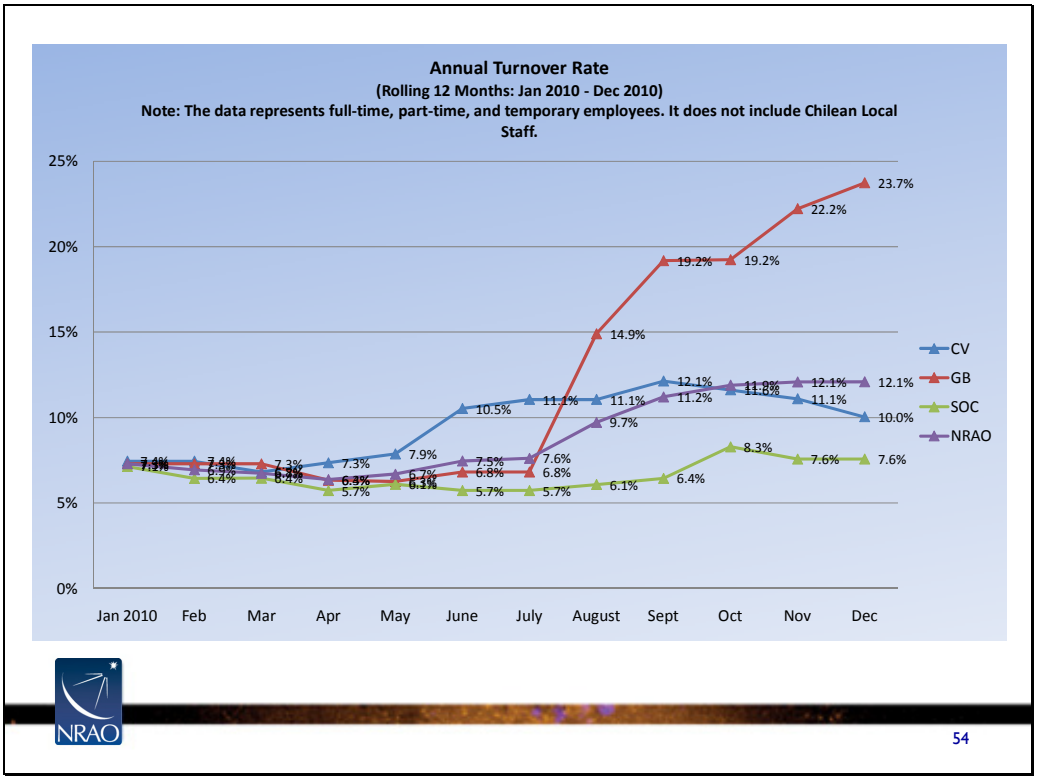
Human Resources

- Human Resources - **New Hires**
  - Diversity Employment Results Q1
    - **SOC**
      - Shipping & Receiving Clerk (PT)– (Minority)
    - **GB –** None
    - **CV**
      - Post Doc – (Female)
      - Admin Asst /NAASC – (Female)
      - Post Doc– (Female)
      - Web Designer– (Minority)

Human Resources

- Human Resources – Promotions
  - Diversity Employment Results Q1
    - **SOC**
      - None
    - **GB**
      - None
    - **CV**
      - None

Slide 54



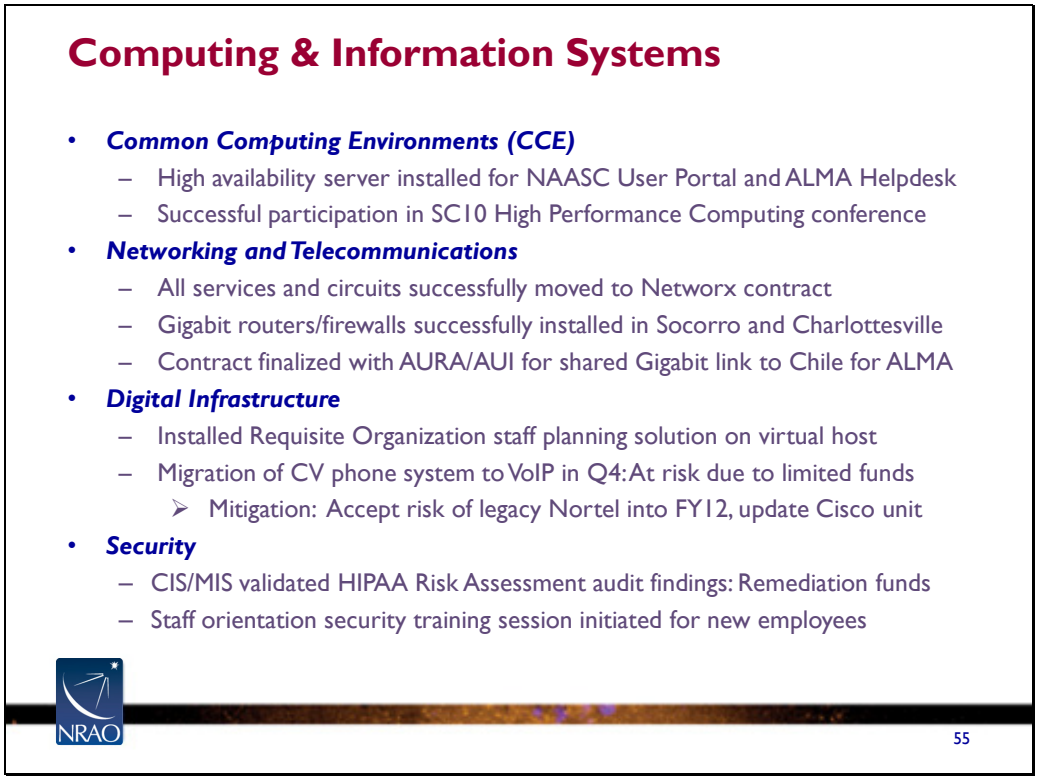
Breakdown of terminations during quarter:

Green Bank (6)
End of Seasonal Appointments - 5 Painters and 1 Tour Guide

Socorro/VLA (8)
ERP – 3 volunteers
End of Appointment – 2 Research Associates
End of Appointment – 1 Co-Op Student
EVLA Roll Off – 2 Employees

Charlottesville (4)
ERP – 1 volunteer
Voluntary Resignations – 2 Employees
Involuntary Term – 1 Employee

Slide 55



High availability server installed for ALMA-wide Observer supporting helpdesk and NAASC User Portal. Due for go-live after Integration Test 3 in Q2 FY11. Successful participation in **SC10** High Performance Computing conference with exhibit, tutorial and technical session representation.

All circuits and services successfully moved to **GSA Networx contract** (from FTS2001) with bandwidth enhancements for ~50% of sites. Billing reconciliation from circuit termination to be completed in Q2. **Gigabit Perimeter router/firewalls** installed for both CV and AOC bandwidth improved from 200Mbit/sec to ~700Mbit/sec but more work needed to optimize archive synchronization throughput. Contract finalized for shared **Gigabit link to Chile**. Final acceptance pending Santiago Metropolitan Link and archive replication testing in Q3.

Successful installation of **Requisite Organization tool** to facilitate JDEdwards HR staffing planning and reconciliation. AD audit underway. Additional capacity installed for CV computer room backup power systems in preparation for ALMA and EVLA archive growth. **Migration of CV phone system to VoIP in Q4 at high risk** due to funding constraints: Rescale to available Q4 funds to support both phone systems at best effort, with plan for full replacement in FY12. CV Visitor support system ready for go-live in Q2 pending local reservationist training.

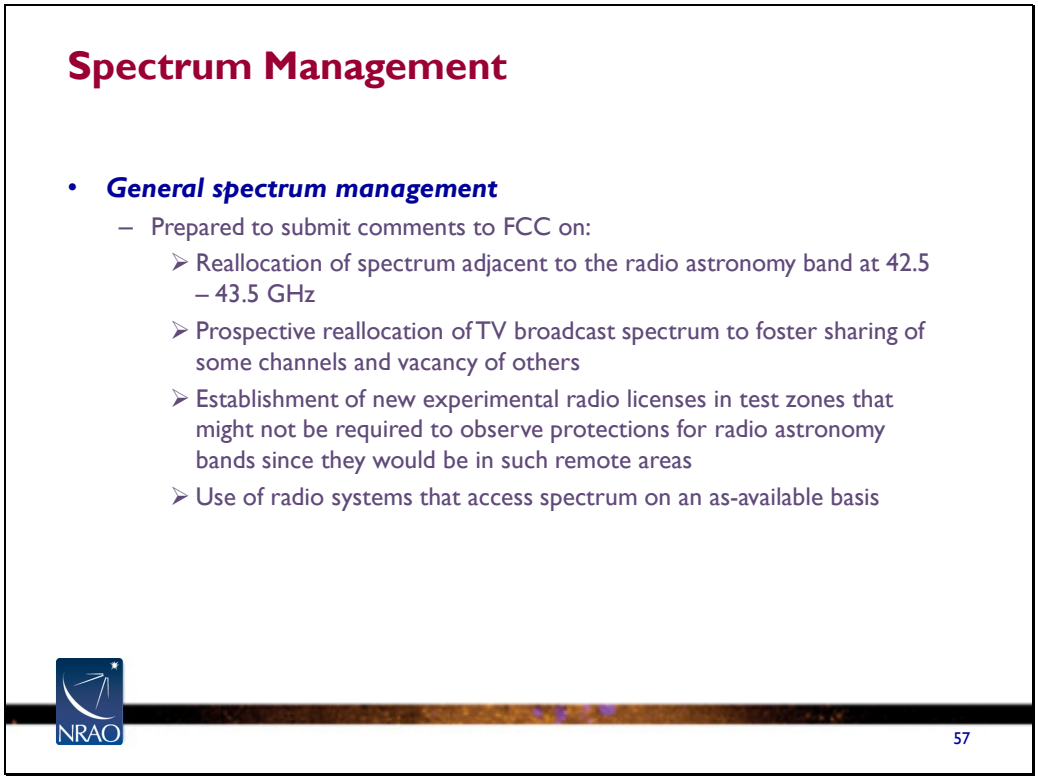
HIPAA audit identified physical access to HR space and server room to be a risk. Installation of swipe card door has been recommended, but requires $20k+ of funds currently outside of plan. Remediation funds being considered. New Employee **security training** program initiated. No production impacting security incidents occurred this quarter.

Slide 56

Green Bank: NRAO and **Verizon** are collaborating to find locations where cell phones might operate with low output power to shield the GBT. Coordinating with **HughesNet** regarding satellite internet service. Designing **Faraday cages** to shield microwave ovens to be used by visitors in lieu of maintaining the dinner shift in the dining hall.

VLBA and 12m telescope sites on Kitt Peak- **KPNO** had agreed with Pima County to move mountain top transmitters to the South side of the summit, adding new commercial microwave facilities and PHS systems in such a way as to broadcast over the VLBA site the 12m. NRAO negotiated with KPNO to require additional shielding of harmonics of communications systems and to shift upward in frequency a prospective 6.4 GHz system that would have interfered with VLBA observations of the 6.7 GHz methanol line and with the 12m's LO system generally. Co-op student is assisting with RFI monitoring and mitigation.

Slide 57

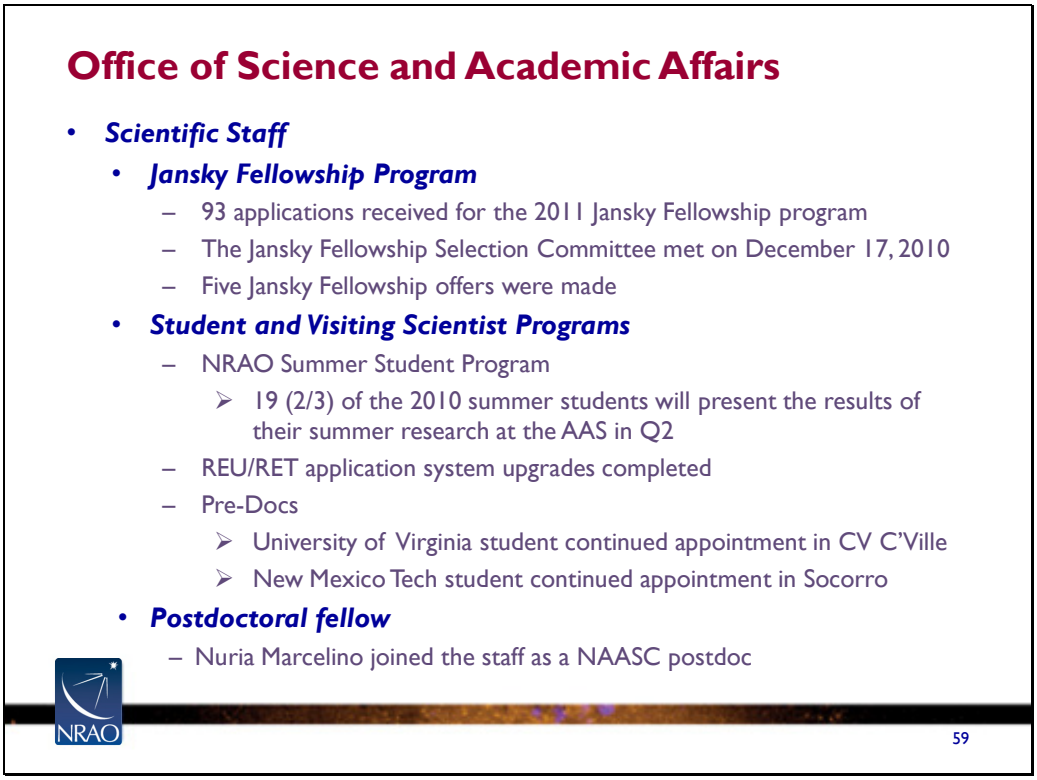


The FCC was more active in one month at the end of 2010 than in the preceding three years, concerning issues affecting radio astronomy. Some of the issues in the experimental radio license proceeding are potentially troubling. Prepared to submit comments to FCC on: reallocation of spectrum adjacent to the radio astronomy band at 42.5 – 43.5 GHz; prospective reallocation of TV broadcast spectrum to foster sharing of some channels and vacancy of others; establishment of new experimental radio licenses in test zones that might not be required to observe protections for radio astronomy bands since they would be in such remote areas; and on the use of radio systems that access spectrum on an as-available basis.

Agenda

- Science Results
- Observatory Science Operations
- Observatory Development & Programs
- Observatory Telescope Operations
- Observatory Support Services
- Director's Office
  - Office of Science and Academic Affairs
  - Communications
  - Education and Public Outreach

Slide 59



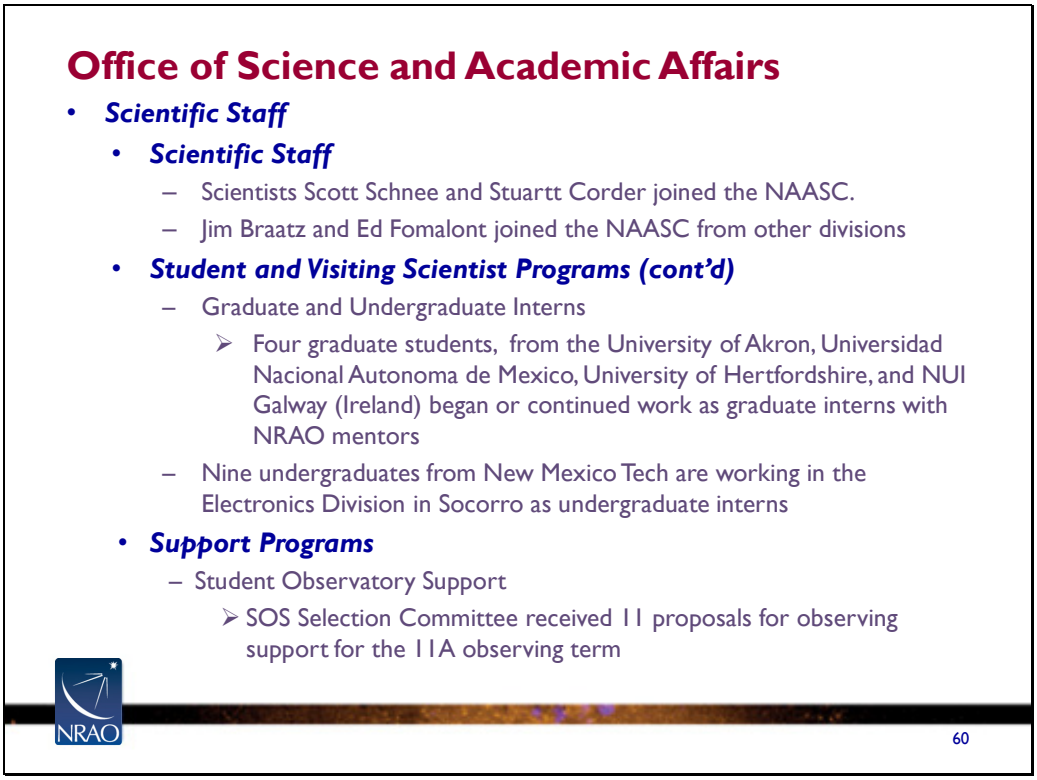
93 applications received for the 2011 Jansky Fellowship program. The number of applications has increased ~10% / yr for several years. The Jansky Fellowship Selection Committee met on December 17, 2010. Five **2011 Jansky** offers were made to *Michael Busch* from UCLA, *Brian Lacki* from Ohio State University, *Sui Ann Mao* from Harvard, *Arielle Moullet* from CfA. *Daniel Perley* from UC-Berkeley. Michael Busch has already accepted the offer.

Summer Student Program: Nineteen of the 2010 summer students presented the results of their summer research at the 217th meeting of the American Astronomical Society in Seattle, Washington 9-13 January 2011. For more information on the program go to http://science.nrao.edu/opportunities/summerstudents.shtml.

Updates and improvements to the online **REU/RET** application system made for 2011 program.

Pre-Docs: *Cheng-Yu Kuo* (Univ of Virginia) continued working w/ Jim Braatz in Charlottesville on reducing and analyzing VLBI observations of water maser emission from galactic nuclei as part of the Megamaser Cosmology Project; and *Josh Marvil* continued his appointment as a PreDoc this quarter working with Fraser Owen.

Slide 60



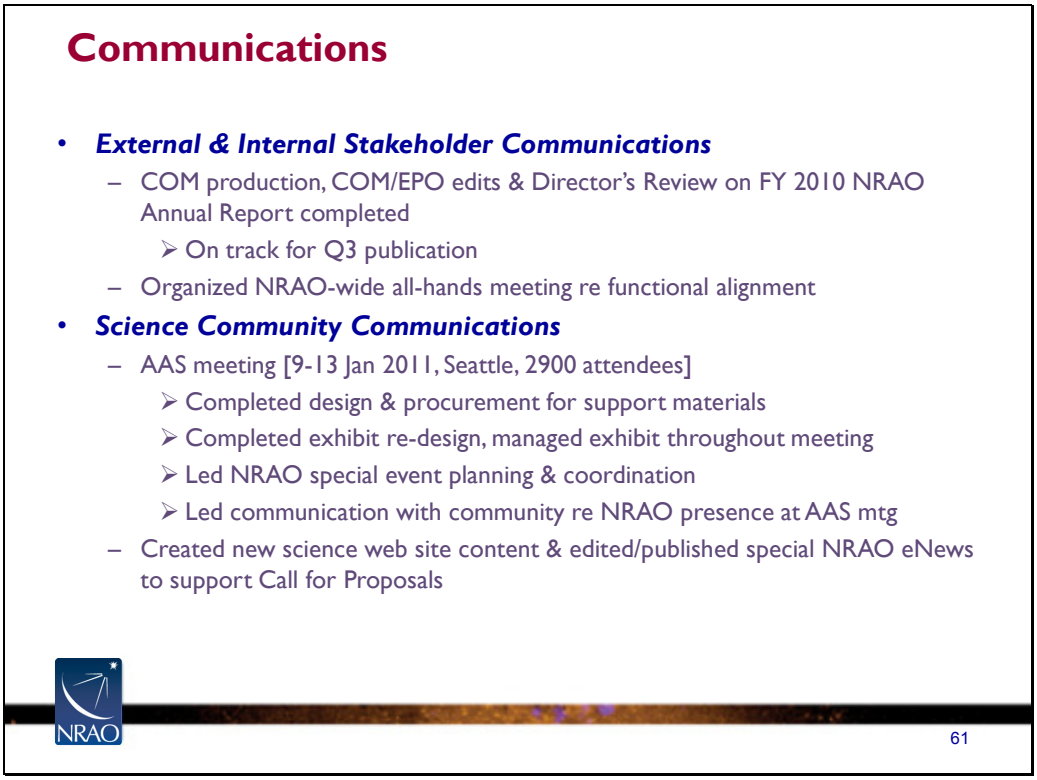
Graduate Interns: *Charles Romero (UVA)* is working with Brian Mason on quantifying the observational signatures uniquely accessible through high resolution SZE data (e.g., shocks and cold fronts, helium sedimentation), and applying them to MUSTANG data and if available data from GISMO on the IRAM 30m at 150 GHz; *Timothy Pennucci (UVA)* is working with Scott Ransom on the NANOGRav project; *Sergio Dzib (UNAM)* is working with Amy Mioduszewski on research projects related to the distance of young stars which will be part of his Ph.D. thesis, and *Leon Harding (NUI Galway*) is working with Greg Hallinan on broadband periodic dynamic spectra of ultracool dwarf pulsars. **Undergrad interns:** these individuals are working under the supervision of Steve Durand.

SOS Awards: The SOS committee recommended funding a total of **$106,500 to 4 of the 8 proposals submitted (only 7 of which were allocated observing time and considered for SOS funding)** this period. They are as follows: GBT10C-063, supervisor, Jim Jackson, student Susanna Finn, Boston University, for **$20,000**; GBT10C-064, supervisor Mark Morris, student Elisabeth Mills, University of California, Los Angeles, for **$35,000**; VLA10C-173, supervisor Lisa Young, student Kristina Nyland, New Mexico Tech, **$19,500**; VLA10C-225, supervisor Min Yun, student Hansung Gim, University of Massachusetts, **$32,000.** Information on the SOS Program can be found at *http://science.nrao.edu/opportunities/sos.shtml*.

Postdoctoral fellow Nuria Marcelino, and scientists Scott Schnee and Stuartt Corder joined the NAASC. Jim Braatz and Ed Fomalont joined the NAASC from other divisions.

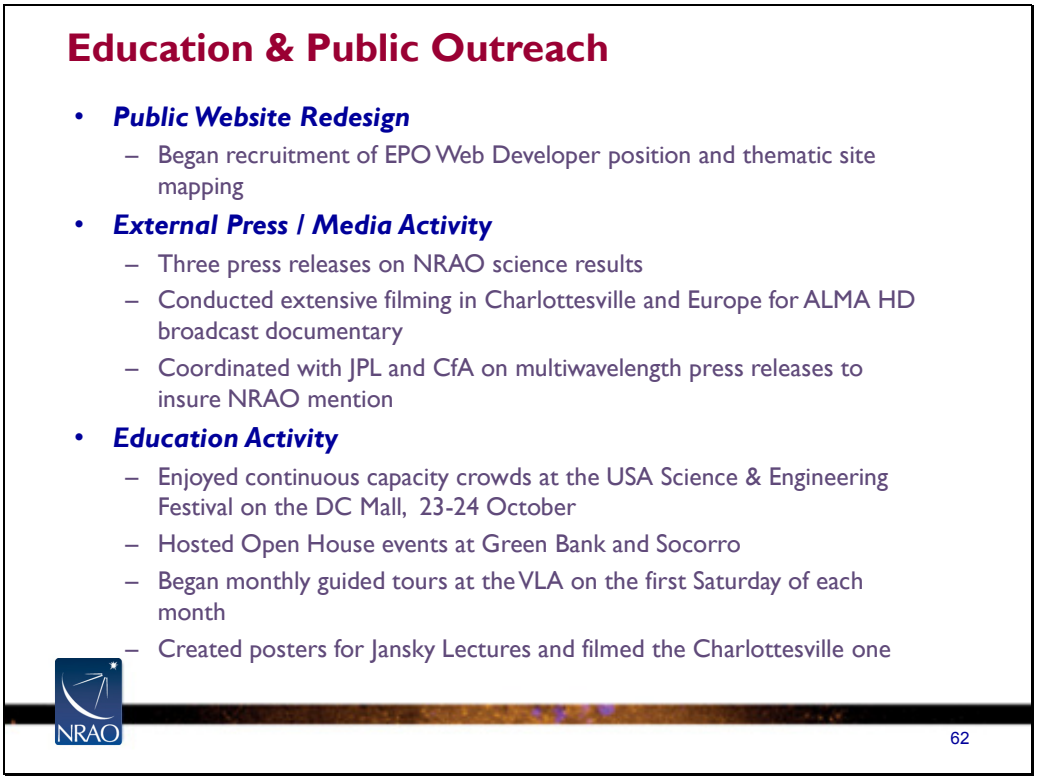
Observatory Library: The **theses link** for the Library Catalogue is *http://69.63.217.22/N10017Staff/OPAC/Index.asp?database=4663326*.
To search with **Blacklight** go to *http://search.space-thz.org/*.

Slide 61



AD review beginning mid-Jan on the **FY 2010 Annual Report**; deliver to printer, publish Feb-Mar. **AAS meeting special events:** 9-13 Jan 2011, 2900 attendees, Seattle, Wa included: NRAO Town Hall: 290 attendees, reception & 3 speakers (Fred Lo, Crystal Brogan [ALMA], Rick Perley [EVLA]); ALMA Special Session: "Observing with ALMA". 150 attendees, 6 speakers [C. Brogan, J. Di Francesco, K. Sheth, A. Wootten, J. Turner, A. Remijan]; EVLA Special Session: "Early Science with the Expanded Very Large Array", 120 attendees, 8 speakers [R. Perley, B. Butler, D. Wilner (CfA), C. Brogan, M. Krauss, L. Chomiuk (CfA), K. Kellermann, C. Carilli]; ALMA Splinter Session: "Early Science Proposal Preparation Tutorial", 50 attendees, led by K. Sheth and S. Schnee. **AAS/NAASC meeting support materials:** Designed and edited 2011 NRAO Research Facilities brochure; procured, designed and pre-loaded drives for AAS meeting Town Hall (drives branded NRAO), and for NAASC science conference in Victoria (drives branded NRAO/NRC); designed ALMA mousepads; NRAO luggage tags; future meeting announcements. **Call for Proposals:** Worked with Tim Bastian (OSO/OSAA) et al to create new science web site structure and content for the science community in support of new NRAO Call for Proposals policies and procedures. **New Web Designer,** Purav Patel has been hired. Top candidate for position. Significant relevant experience from industry and academia (Univ of Houston). Replaces Taylor Johnson.

Slide 62



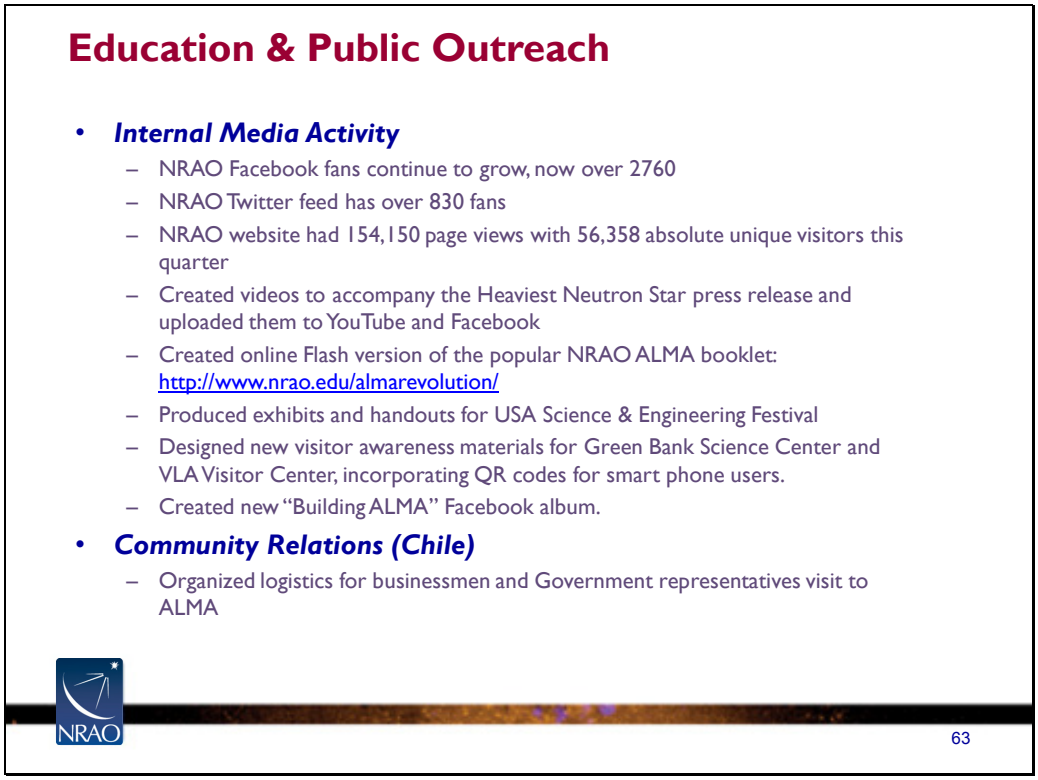
Science result press releases were: Most massive neutron star known - http://www.nrao.edu/pr/2010/bigns/; Magnetism common to all cosmic jets - http://www.nrao.edu/pr/2010/magjet/; Using the Moon to detect neutrinos - http://www.nrao.edu/pr/2010/moonneutrinos/.

ALMA HD Broadcast Documentary filming was conducted in Charlottesville during October at the NRAO Technology Center, the University of Virginia's Center for Chemistry in the Universe (CCU), and the University of Virginia's Microfabrication Lab. ALMA HD Broadcast Documentary filming was conducted in Europe during December at Zrinski Fabrication at Airborne Composites, and at Vertex Antennentechnik.

Education Activity include USA Science and Engineering Festival, held on the National Mall on 23-24 October. NRAO had a prime-location booth opposite the National Air and Space Museum and enjoyed capacity crowds both days. Annual Green Bank Open House (est. 400 in attendance) was promoted as an official Satellite Event of the USA Science and Engineering Festival in DC. The Fall VLA Open House was held the first Saturday in October with 427 people attending. Thirteen tours were given and 14 people volunteered to help. Green Bank Overnight Educational Events, conducting research with the 40 Foot telescope, welcomed groups from 15 schools. Other Green Bank EPO events: Pulsar Search Collaboratory Teacher Institute at Yerkes Observatory in Wisconsin. 8 teachers from WI and IL. NRAO EPO Staff traveled to Yerkes to implement a 3-day workshop for local teachers there, enabling them and

their students to join the PSC. WV Governor's School for Math and Science (60 rising high school freshmen from WV). EPO meeting with South African Meerkat staff on establishing student exchange and developing a SA Science Center similar to the Green Bank Center. Green Bank School Science Fair was held at the Science Center with 34 middle school students participating. Other Socorro Educational Events: Conducted a ham-radio-focused tour of the VLA for the Socorro Hamfest; NRAO Press Officer Gave a lecture to NM Tech's Technical Communication 101 class on the functions of a Public Information Officer.

Slide 63



Businessmen & Government Representatives visit to ALMA: NRAO Chile and High Management Net from Universidad del Desarrollo, organized a visit to ALMA for decision makers (businessmen and Government representatives). More than 30 people visited the radio observatory to learn about its technology and the role of ALMA as a relevant initiative of managing a science project in Chile.