Slide 1

Quarterly Status Update (QSU) Q2 FY 2011
January-March, 2011

L. Wingate

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

Slide 2

Agenda

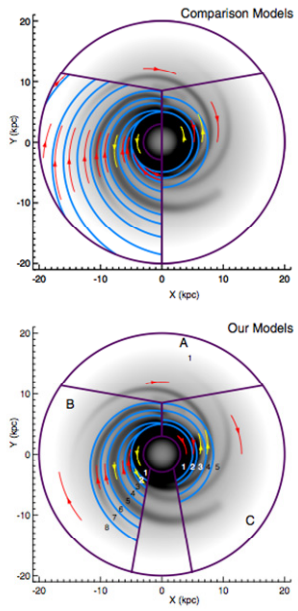
- Science Results
- Observatory Science Operations
- Observatory Development & Programs
- Observatory Telescope Operations
- Observatory Support Service

Slide 3

Science Results
- *EVLA*

MODELING THE MAGNETIC FIELD IN THE GALACTIC DISK USING NEW ROTATION MEASURE OBSERVATIONS FROM THE VERY LARGE ARRAY

- Using VLA polarization measurements of Faraday rotation, van Eck et al. find that, in the inner Galaxy, the magnetic field closely follows the spiral arms, while in the outer Galaxy, the field is consistent with being purely azimuthal. Furthermore, the models contain no reversals in the outer Galaxy, and together seem to suggest the existence of a single reversed region that spirals out from the Galactic center.



Chris Carilli w/input from Chandler/Brisken 3

arXiv: 1012.2938
Cameron Van Eck, et al., Astrophysical Journal, 2011, 728, 97.

Slide 4

Coming soon: ApJ Letters special issue on first year of early science with EVLA

- Submission deadline: April 15, 2011 (coordinator: Carilli)
- 56 proposed letters: pluto to reionization
- Random selection of titles:
  - Radio emission of ultracompact binary HM Cnc (Brunthaler)
  - EVLA observations of the largest trans-neptunian objects (Butler)
  - Star formation and magnetic fields in IC 10 (Heesen)
  - The radio SEDs of nearby ULIRGs (Leroy)
  - EVLA detection of widespread CCS in Taurus molecular cloud (Roy)
  - Molecular gas excitation in z=6 quasar host galaxies (Wang)
  - IRAS 1907+0857: the first water fountain in a planetary nebula (Suarez)

NRAO

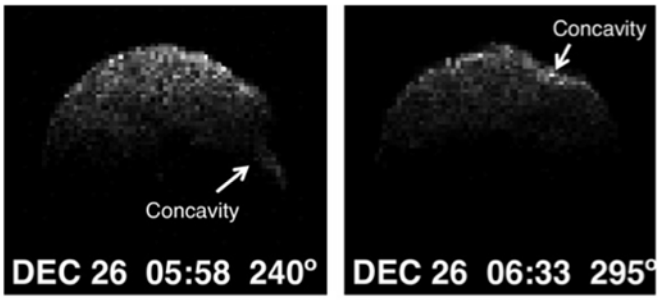
Note that although the topics (and authors) were proposed, not all of these were actually submitted for the special issue.

Slide 5

Science Results
- *VLBA*

RADAR OBSERVATIONS AND THE SHAPE OF NEAR-EARTH ASTEROID 2008 EV5

- EV5 was observed with the Arecibo and Goldstone planetary radars and the Very Long Baseline Array. EV5 rotates retrograde and its overall shape is a 400 ± 50 m oblate spheroid. The most prominent surface feature is a ridge parallel to the asteroid's equator that is broken by a concavity about 150 m in diameter. We interpret the concavity as an impact crater. Shaking during the impact and later regolith redistribution may have erased smaller features, explaining the general lack of decameter-scale surface structure.



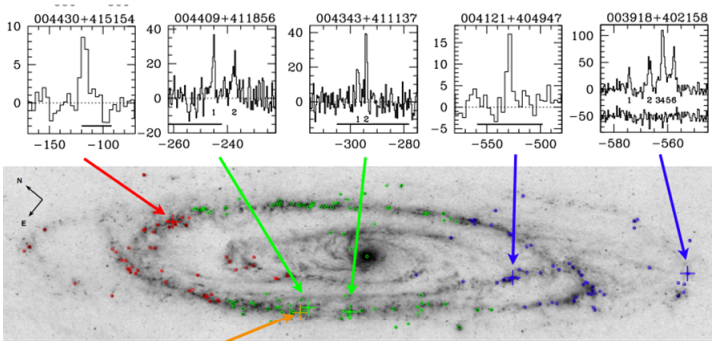
arXiv: 1101.3794v1
Michael W. Bush, et al., Icarus, in press, 2011.

Slide 6

Science Results
- *GBT*

GBT DISCOVERY OF H_2O MASERS IN M31

- The Proper Motion of M31 is the Keystone of Local Group Dynamics
- At the distance of M31 the GBT can detect Galactic analog H_2O masers in 5 minutes
- 206 sources, 5 detections.



J. Darling ApJL, in press

Chris Carilli w/ input from O'Neil/Lockman

6

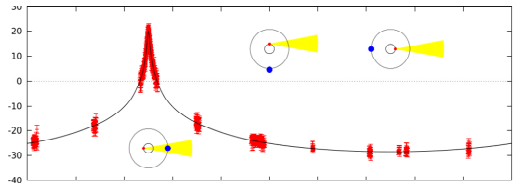
arXiv: 1103.4788
Jeremy Darling, Astrophysical Journal Letters, 2011, in press.

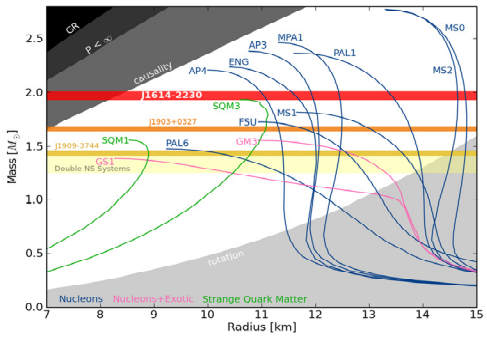
Slide 7

GBT MEASUREMENTS TEST FUNDAMENTAL PHYSICS WITH RADIO PULSAR J1614-2230

- The new mass determination for PSG J1614-2230 makes it the most massive pulsar known, and rules out a number of soft equations of state for nuclear matter including many "exotic" hyperon, kaon models.

  ~1 week of GBT timing observations with coherent GUPPI
- Orbital inclination = 89.17(2) deg!
- Companion mass = 0.500(6) solar!
- Pulsar mass = 1.97(4) solar!



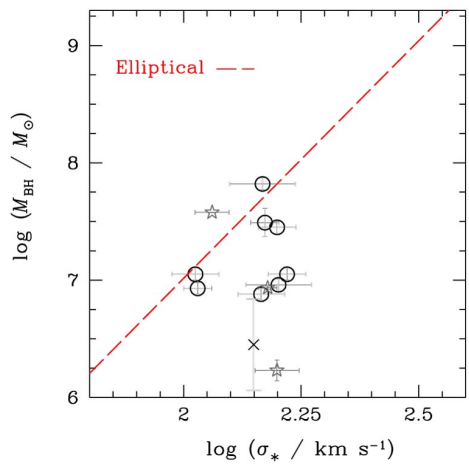


Demorest et al. 2010, 467, 1081

Slide 8

GBT + HSA MEASURE SUPERMASSIVE BLACK HOLE MASSES

- H_2O masers discovered with the GBT
- Nuclear disk mapped with the HSA
- Black Hole masses obtained for Seyfert galaxies
- SMBH masses in Seyfert galaxies lie below the "universal" line defined by SMBH's in elliptical galaxies



Kuo et al. 2011, ApJ, 727, 20
Greene et al. 2010, Nature 470, 54

slide 9

Observatory Science & Academic Affairs (OSAA)

- ***General***
  - Carilli replaced Bastian as OSAA Head in March, 2011
  - Utley assumed position as OSAA Admin in March 2011
  - OSAA Aligned with Director's Office
- ***Recruiting***
  - Selection process for Scientist-track position: offer made (and accepted) to Paul Demorest
  - Search in progress for Astronomer-track position: 6 short-listed candidates are being interviewed
  - NM AD position: 3 excellent candidates are being interviewed
- ***Postdoc programs***
  - 4 Jansky fellowships accepted for 2011: Arielle Moullet (Harvard to Charlottesville; Michael Busch (UCLA to UCLA and Socorro); Brian Lacki (Ohio State to Institute for Advanced); Sui-Ann Mao (Harvard to Wisconsin-Madison)
  - Postdoc symposium held in Charlottesville in April, 2011, including 21 NRAO postdocs (Jansky + project), and 4 Postdocs from UVa

NRAO

Chris Carilli 9

Future QSUs will include an update on postdoc mentoring (including the items identified in the ALMA O&M proposal).

Slide 10

Observatory Science & Academic Affairs (OSAA)

- ***Jansky lecture***
  - Lectures given by Prof. Reinhart Genzel in Cville and Socorro
  - Nominations are being considered for 2011
- ***OSTC is reviewing development proposals for budget cycle***
- ***Scientific Staff***
  - NRAO scistaff were deeply involved in numerous RSRO programs at EVLA
  - NRAO staff organized science meetings on:
    - 'New Horizons' meeting in Santa Fe in March
    - NAASC workshop on ALMA spectral line observing in Victoria in January
    - Future of the VLBA workshop in Cville in January
    - AAS special sessions on the EVLA and HERA
  - NRAO staff are participating in many EVLA early science ApJ letters special issue papers (due date: April 15, 2011)
- ***PEP process has started, including scientific evaluation by OSAA***
- ***Academic promotions***
  - Staff review and promotions: 10 academic promotions advanced in January 2011

NRAO

Chris Carilli 10

NRAO **scientific staff** organized science meetings on: "New Horizons" meeting in Santa Fe in March, NAASC workshop on ALMA spectral line observing in Victoria in January, Future of the VLBA workshop in CV in January, and AAS special sessions on the EVLA and HERA. NRAO scistaff were deeply involved in numerous RSRO programs at EVLA.

Slide 11

Observatory Science Operations

Community Support Programs

- ***Undergraduate Student Programs***
  - Summer students
    - Twenty seven students accepted appointments as 2011 summer students
    - Updates and improvements to the online REU/RET application system made
  - Co-operative Education Students
    - Four Co-Op students continued their appointments
  - Undergraduate Internships
    - Six undergraduates (SO: 5, CV: 1) continued undergraduate internships

Tim Bastian/Tony Remijan w/ input from Chandler/O'Neil/Lonsdale 11

Summer Student Program: Twenty seven undergraduate and graduate students accepted appointments as 2011 **summer students**. Updates and improvements to the online REU/RET application system made following the 2011 review and acceptance process. For more information on the program go to http://science.nrao.edu/opportunities/summerstudents.shtml.

Co-Op: Four **Co-Op students** continued their appointments in the Electronics Division in Socorro: Shaine Baldwin, Edward Menne, New Guy, Cameron Welch (all SO)

Undergraduate Interns: Six undergraduates (SO: 5, CV: 1) continued undergraduate internships working in the Electronics Division in Socorro and SAA in Charlottesville: Dana Sills, Cameron Welch, Aaron Cunningham, Deepak Rai, Loren Good (all SO).

Slide 12

Observatory Science Operations

- ***Graduate Student Programs***
  - Graduate Student Internships
    - Five graduate students began or continued work as graduate interns with NRAO mentors
  - Predoctoral Program
    - University of Virginia student continued appointment working in Charlottesville
    - New Mexico Tech student continued appointment working in Socorro
  - Student Observing Support
    - SOS Selection Committee received 11 proposals for observing support for the 11A observing term, 7 of which were granted observing time by the NRAO TAC
    - SOS Selection Committee awarded a total of $81,200 to 6 SOS proposals
- ***Visiting Astronomers***
  - One sabbatical visitor at the ASC in Socorro
  - One visitor to Charlottesville

Tim Bastian/Tony Remijan w/ input from Chandler/O'Neil/Lonsdale 12

Graduate Interns: Five graduate students began or continued work as **graduate interns** with NRAO mentors. *Paul Ries (UVA)* is working with Todd Hunter on studying the long-wavelength characteristics of TNOs; Srikanth Bussa *(University of Akron)* is working with John Ford on research in digital signal process for the Green Bank telescopes; *Dana Ficut-Vicas (University of Hertfordshire)* is working with Michael Rupen on the Little Things project, *Leon Harding (NUI Galway*) is working with Greg Hallinan on broadband periodic dynamic spectra of ultracool dwarf pulsars; and *Nimish Sane (Umd)* is working with John Ford on a multiple frequency window processor for the GBT.

Pre-Docs: University of Virginia student continued appointment working in Charlottesville. New Mexico Tech student continued appointment working in Socorro. *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.

SOS Awards: The SOS committee recommended funding a total of **$81,200 to 6 of the 11 proposals submitted (only 7 of which were allocated observing time and considered for SOS funding)** this period. They are as follows: GBT11A-009, supervisor, Brian Mason, student Charles Romero, University of Virginia, for **$34,000**; GBT11A-020, supervisor Dan Werthimer, student Andrew Siemion, University of California, Berkeley, for **$6,000**; GBT11A-023, supervisor Maura McLaughlin, student Jason Boyles, West Virginia University, **$12,200**; GBT11A-035, supervisor Dan Werthimer, student Andrew Siemion, University of California, Berkeley, **$5,000**; GBT11A-065, supervisor Farhad Yusef-Zadeh, student Marc Royster, Northwestern University, **$22,000**; VLA11A-236, supervisor Steve Cederbloom, student Alexander Charthand, University of Mount Union, **$2,000.** Information on the SOS Program can be found at *http://science.nrao.edu/opportunities/sos.shtml*.

Visiting Astronomers: There were two visiting astronomers this quarter. John Cannon, of McCallister, is began a 6 mo sabbatical in Socorro. Ue-Li Pen made an extended visit to CV and participated in a workshop on intensity mapping.

Slide 13

Observatory Science Operations

- ***Library***
  - The Springer contract was renegotiated without a price increase, combining eBooks & eJournals.
  - The scanning of NRAO Miscellaneous Internal Reports is now complete
  - Shifting of the physical collection is finally complete
- ***Historical Archives***
  - Processing continued on the Papers on Chilean site planning for the MMA (later ALMA)
  - The family of the late Donald C. Backer donated his professional papers to the NRAO Archives
  - Archivist Ellen Bouton received the 2011 Herbert C. Pollock Award from Dudley Observatory
  - Finding aids for the Archives collection and the Archives online catalog are linked from the NRAO Archives home page http://www.nrao.edu/archives/

Tim Bastian/Tony Remijan w/ input from Chandler/O'Neil/Lonsdale 13

Library: Springer contract allows NRAO to capture complete releases, including the present year. The previous contract was from July – June so NRAO did not get the current copyright year until mid-year. The Springer contract was renegotiated without a price increase, combining eBooks & eJournals. The scanning of NRAO Miscellaneous Internal Reports is now complete (with OCR 'back'), adding to the 3 previously scanned NRAO Memo series. These (as well as the other Memo series) can be accessed via: http://www.nrao.edu/library/nrao_memos.shtml. There are 136 memos in this series which range from Bok's "Toward a National Radio Observatory" in 1956 to Vanden Bout's "Recent Examples of Technology Fostered by Radio Astronomy" in 1999 with lots of interesting reports in between. The shifting of the **physical collection** is finally complete; the Library staff shifted in excess of 35,000 volumes to redistribute the collection and diminish the safety issue in 301A.

Historical Archives: Processing continued on the Papers of Ronald N. Bracewell. Processing began on Mark A. Gordon's files on Chilean site planning for the **MMA (later ALMA**) and on Paul A. Vanden Bout's MMA and ALMA materials. The family of the late **Donald C. Backer** donated his professional papers to the NRAO Archives, and the 32 boxes of materials were received from Berkeley's Radio Astronomy Laboratory. We began work on a preliminary inventory of the box contents. Ellen Bouton received the **2011 Herbert C. Pollock Aw**ard from Dudley Observatory. The $5,000 award will be used to hire a summer student to digitize the collection of 255 audio-taped interviews of 20th century radio astronomers donated to the NRAO Archives by Woodruff T. Sullivan III, to edit the digitized files when necessary, to work on obtaining permissions from interviewees still living and the heirs/estates of those who have died, to assist in preparing finding aids, and, if time allows, to transcribe key interviews for which transcriptions do not already exist. Finding aids for the Archives collection and the Archives online catalog are linked from the NRAO Archives home page, http://www.nrao.edu/archives/.

Slide 14

Observatory Science Operations
- *Shared Services Specific Milestones*

- ***Proposal process***
  - The proposal deadline for GBT, EVLA, and VLBA proposals was Feb 1 under the new, semester-based proposal system.
  - 303 proposals received and peer-reviewed
- ***User Portal***
  - Re-in-source of the OpenSky SW contract, planned for termination in Q4 for cost savings, is being re-evaluated.
- ***Helpdesk***
  - Development of integrated ALMA/NRAO helpdesk interface under discussion

Tim Bastian/Tony Remijan w/ input from Chandler/O'Neil/Lonsdale 14

The **proposal submission** deadline was Feb 1. All proposals were submitted through the Proposal Submission Tool (PST). The PST was also used to manage proposal review. The proposals were released for review on Feb 15 and The Science Review Panels completed their reviews of the proposals using tools available in the PST on Mar 25. The rest of the proposal review and time allocation process is to be completed in Q3.

The re-insource of OpenSky is contingent on factors involving both the PST and the **user portal**. It is expected that the re-insource will not occur until development of the PST in support of the new time allocation process is sufficiently mature. The Q2 milestone was completed: Web-server needed to host the user portal and helpdesk was installed. The https://alma-help.nrao.edu and the https://almascience.nrao.edu/ are now both in production on a High Availability server pair in Charlottesville.

The integration of the ALMA/NRAO **helpdesk** was discussed at the OSO kick-off meeting in Q2. The NAASC department of the NRAO helpdesk was closed with the implementation of the ALMA helpdesk on Mar 31. However, a link to the ALMA helpdesk was put in place to point users to the ALMA user portal where they can register and use the ALMA helpdesk. More seamless options are under consideration.

VAO: hardware, software, and Oracle data base acquired to support mirrored archive to implement and test VAO queries for metadata and raw data.

Metrics/statistics: interim functionality for Observatory-wide metrics/statistics queries to be deployed via Helpdesk in Q3 while OSO assesses optimum strategy for integrating sources.

Algorithm development: at present, wide-field, narrow-band imaging and narrow-band, wide-field imaging algorithms have been implemented and tested in CASA 3.2 and CASA 3.3, respectively. Scientific testing of wide-band, wide-field imaging with A-projection is targeted for Q1 of FY13.

Slide 15

Observatory Science Operations
- *Shared Services Specific Milestones*

- ***Community Programs***
  - ***Science Web***
    - Q2 was used to train staff at the various sites in use of Plone
    - Migrate all content to new system for EVLA, VLBA, GBT, and NAASC to be completed early Q3
  - ***Science user outreach***
    - There were special sessions on ALMA and EVLA at the January AAS meeting, and a special VLBA session at the AAAS meeting in February.
    - The call for interest in submitting papers for the special issue of ApJL on EVLA early science went out this quarter.
- ***High Performance Computing***
  - The architecture for the post-processing cluster for the EVLA is now finalized, but not purchased.
  - Data intensive astronomy workshop will be held in Q3 on May 3-5 in Green Bank.

Tim Bastian/Tony Remijan w/ input from Chandler/O'Neil/Lonsdale 15

The bulk input of existing **Science Web** updates (science.nrao.edu site) will take place in April, 2011, further web content updates will then be taken over by the sites.

Science user outreach: The call for expressions of interest in submitting papers for the EVLA ApJ Letter special issue resulted in 57 papers being proposed. The deadline for submission of articles to the journal was set to April 15.

A number of ALMA events were conducted at the 217th meeting of the American Astronomical Society in Seattle, WA. These included an ALMA update at the NRAO Townhall, an ALMA Special Session highlighting ALMA science, a Splinter Session introducing users to ALMA proposal tools and Early Science capabilities, and hands-on demonstrations of ALMA tools at the NRAO booth.

The NAASC/NRC workshop entitled "ALMA: Extending the Limits of Astrophysical Spectroscopy" was held Jan 15-17 2011 in Victoria, BC. The workshop was attended by 125 scientists from around the world.

High Performance Computing: The cluster architecture is now finalized, with only small details remaining (such as how much RAM per node) pending some timing tests. The next step is for CASA to produce a user-friendly parallelized version of its code that can make use of the cluster. There is no point in purchasing a cluster until this is ready, since no one would be able to use it and the longer we wait the more we get for our money. The high performance computing workshop will be held in Q3 on May 3-5 in Green Bank and it has received funding through the NSF OCI division.

Slide 16

Observatory Science Operations
- Site/center-managed Specific Milestones ASC

- ***Commissioning - EVLA***
  - Observation Preparation Tool modified to allow the preparation of scheduling blocks (observing scripts) with 16 correlator sub-bands and up to 2 GHz bandwidth in time for D configuration
  - Planetary/ephemeris object observing modes enabled; first detection of Pluto/Charon system at wavelengths > 3 mm
  - Correlator recirculation modes enabled and in use

Claire Chandler w/ input from Brisken/Myers/Bastian/Langley/Perley 16

The **Observation Preparation Tool** (OPT) is well on track – it is already being offered to, and exercised by, RSR observers. In February a draft **data distribution plan** was formulated, which includes such targets as adopting a commercial inventory tracking system as used by the ALMA construction project, and modifications to the archive retrieval tool interface to support data transfer on disk in addition to over the internet. We have successfully transferred data to RSRO observers, both domestic and overseas, and are currently sorting out details of disk shipping costs. The plan for disseminating large data sets is on track to support data transfer on disk by the time we offer 2 GHz bandwidth as part of OSRO, in September 2011.

Two major "firsts" were obtained in the area of **EVLA commissioning** during Q2: (1) planetary/ephemeris object observing modes were enabled, and delivered the first detection of the Pluto/Charon system at wavelengths longer than 3mm; (2) modes with increased numbers of spectral channels over a given bandwidth were enabled for RSR observations, both via stacking multiple baseline board pairs in each correlator sub-band, and via recirculation (time multiplexing).

Archive: the EVLA archive is on track to be mirrored in Charlottesville in Q3. The hardware exists in Socorro and a populated archive will be shipped to Charlottesville. There remain minor network tuning issues that need to be resolved to ensure that the mirrored archive keeps up with data transfer needs.

Slide 17

Observatory Science Operations
- *Site/center-managed Specific Milestones ASC*

- ***Observer support***
  - The PST was successfully used in support of proposal submission for 2 Gbps observing on the VLBA
  - The PST was successfully used for 2 GHz bandwidth Open Shared Risk Observing proposals on the EVLA; the OPT fully supports all OSRO observing modes advertised, and the data dissemination procedures are being finalized
- ***Pipeline development***
  - An AIPS-based pipeline is now being used to validate the development of a CASA-based pipeline for EVLA
- – ***Science support software***
  - All EVLA scheduling blocks, including RSRO SBs, can now be scheduled dynamically via the Observation Scheduling Tool (OST)
- ***Face-to-face visitor support***
  - NM Operations supported 15 visiting scientists during Q2, 9 of which were RSRO participants

NRAO

Claire Chandler w/ input from Brisken/Myers/Bastian/Langley/Perley 17

The PST was updated to support proposal submission for **2 Gbps observing on the VLBA**, and was successfully used for the February 2011 proposal deadline. The SCHED software was updated to support the new hardware set-ups, and tested successfully in astronomical observations. The necessary support for **2 GHz bandwidth observing on the EVLA** is almost complete: the PST was updated to support proposal submission for up to 2 GHz bandwidth through the Open Shared Risk Observing program, and the OPT fully supports all OSRO observing modes advertised through the end of 2012. The data dissemination procedures and policies are being finalized.

An **AIPS-based pipeline for EVLA/OSRO data** is now in place, and is being used to validate the development of a **CASA-based pipeline for the EVLA**, which is ongoing.

A key milestone for **Science Support Software** was met for EVLA operations and the construction project during Q2, where all scheduling blocks can now be selected and tracked automatically through the entire observing system without manual intervention.

NM Operations supported 15 visitors during Q2, 9 of which were participating in the EVLA RSRO program.

Slide 18

Observatory Science Operations
- Site/center-managed Specific Milestones NAASC

- ***Commissioning***
  - 14 antennas had started commissioning by end of Q2, all but 3 of them North American
- ***Science Operations***
  - The user documentation in support of first proposal call was completed and posted to the Science Portal
  - International end-to-end test number 3 (IT3) was completed, including portal, helpdesk, and load test
  - The first proposal call was released March 31
  - The new Science Portal deployed
- ***Observer support***
  - Software and documentation for the ALMA Observing Tool (OT) was revised following IT3

Mark McKinnon w/ input from Lonsdale 18

CSV activities in Chile included execution & reduction of Science Verification data and development of observing & data reduction scripts. The NAASC staff participated in commissioning activities and an imaging "Tiger Team" evaluated ALMA ES configuration candidates, and reduced ALMA datasets.

The NAASC participated in the finalization of operations procedures for proposal review, phase2 change requests, technical assessments, archive, **Science Portal**, document templates, and helpdesk. NAASC contributed to the user documentation: ALMA Cycle 0 Proposers Guide, Technical Handbook, Call for Proposals, and Science Portal content. NAASC updated the ALMA Primer based on final configurations & capabilities. **NAASC participated in Integrated Test No. 3**: proposal preparation, the helpdesk, Observing Tool (OT) Load testing, proposal review tools & processes, and phase 2 submission. The Cycle0 **Call for Proposals** was released and the OT and Science Portal were deployed under a User Support configuration which supports the 3 ALMA Regional Centers on March 31 after extensive testing of the local deployments of the Portal, the OT and the Sensitivity Calculator. Per the Program Operating Plan milestones for Q2, the integration of both on-line and off-line versions of Splatalogue into the OT and CASA was completed. The OT has both the online and offline versions of Splatalogue interfaced in through VO standards and protocols. CASA has an extensive subset of the Splatalogue database that has been included as a CASA table and made available to the users through a developed CASA task. In addition, users can access the online version of CASA through the web interface, define their own search criteria, dump the data to file and upload their own catalog into CASA.

Slide 19

Observatory Science Operations
- Site/center-managed Specific Milestones NAASC

- ***User education and training***
  - Numerous "observing with ALMA" tutorials were scheduled through June 2011, and 6 were held in Q2
- ***Data Processing and Analysis***
  - Development for the third public release of CASA (v3.2) was completed
- ***Other Science Operations Activities***
  - The policies & procedures for ALMA science operations were finalized
  - A workshop was held concerning future ALMA development activities

Mark McKinnon w/ input from Lonsdale 19

ALMA Early Science "Community Day" events were held at the Institute for Astronomy, Hawai'i (2/10-11); NAASC in Charlottesville; (2/25) University of Pennsylvania (3/7); Santa Fe, NM (3/11); California Institute of Technology (3/15-16).

Development for the third public release of CASA was completed, with an anticipated release date of early to mid May 2011.

More than 70 scientists and engineers attended an **ALMA development & studies workshop** held in Charlottesville March 21-22, to discuss the astronomical motivation for developing new capabilities for ALMA.

The integration of both on-line and off-line versions of Splatalogue into the Observing Tool and CASA was completed per the plan. The OT has both the online and offline versions of splatalogue interfaced in through VO standards and protocols. CASA has an extensive subset of the splatalogue database that has been included as a CASA table and made available to the users through a developed CASA task. In addition, users can access the online version of CASA through the web interface, define their own search criteria, dump the data to file and upload their own catalog into CASA.

Slide 20

Observatory Science Operations
- Site/center-managed Specific Milestones GBSO

- ***User education and training***
  - Sixth Single Dish Summer School will take place in Q4 on July 10-16 in Green Bank.
- ***Pipeline development***
  - The final GBT KFPA end-to-end pipeline will be delivered before the end of April (Q3)
- ***Face-to-face visitor science support***
  - 1-2 visitors per week on site

Karen O'Neil w/input from Bloss/Holstine 20

User education and training: We have received over 70 applicants to attend the school. Awaiting confirmation of the NSF grant that will provide financial aid to students.

Pipeline development: The final GBT KFPA end-to-end pipeline will be delivered before the end of April (Q3). The group is reforming to be the GBT pipeline group and will be expanding their scope to include the new spectrometer and 4mm receiver. The plans have always been for the KFPA pipeline to be the first step in creating a more general pipeline for the GBT. Within those plans has also been the statement that no new instrument will go onto the GBT (as a general user instrument) without a pipeline. As a result, with the completion of the GBT KFPA pipeline we are now closing that project and moving forward with the plans to expand the pipeline to now include the next two new instruments - the new spectrometer and the 4mm receiver.

Face-to-Face Visitor Science Support: Green Bank continues to host 1-2 visitors per week on site as well as provide significant help to remote observers.

Other Science Operations Activities: CICADA-FPGA call for shared risk observations remains planned for Q3.

Slide 21

Observatory Development & Programs (ODP) - *VLBA*

- ***VLBA Performance & Capability Enhancements***
  - Early science observations at 2 Gbps using 6 antennas (BR, HN, LA, MK, PT, SC) took place on March 19
  - Transition of the full array to 2 Gbps equipment is on track for Q3
  - First successful engineering tests of the digital downconverter personality delayed

Claire Chandler w/input from Brisken 21

The **VLBA sensitivity upgrade** project is making good progress. A first **"early science"** observation was made using the polyphase filterbank (PFB) personality on March 19. This observation went very smoothly. The goal of a 10 station observation within Q3 is on track to be met. The more flexible digital downconverter (DDC) personality is making good progress as well, with expectations that version 1 of this firmware will be ready by June 1 (originally expected Q1). First on-the-sky tests will happen very soon. RISK: the DDC personality may not be available to users in time for general use. MITIGATION: Funding from the Mexican funding agency CONACyT has allowed purchase of additional recorders that will allow the legacy system to remain intact for a complete parallel install until the DDC is ready. The legacy system can serve as a back-up for most of the science that would require the DDC personality.

Slide 22

Observatory Development & Programs (ODP) - *VLBA*

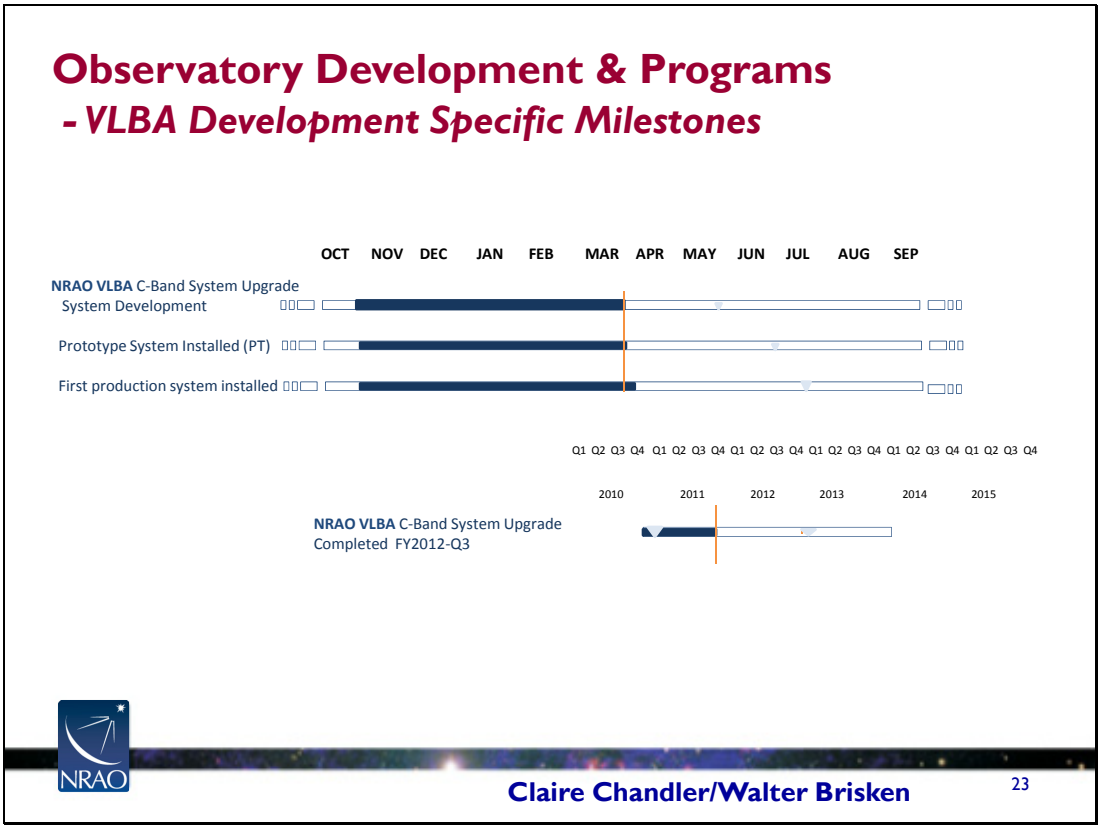
- ***VLBA C-band System Upgrade***
  - Will provide frequency coverage of 4.0-7.9 GHz; enables access to the 6.7 GHz methanol maser line for Galactic parallax measurements
  - Requires new feeds, receivers, IF downconverters, and M&C system
  - Status:
    - Two old style C-band receivers have been removed
    - One has been mostly outfitted with upgraded components
    - Early testing shows encouraging initial performance results
    - Nominal completion date for this project is end of FY2012

Claire Chandler w/input from Brisken 22

The VLBA C-band upgrade project was started after the POP was developed so there are no POP milestones. It is making good progress, with a project completion date at the end of FY2012. RISK: The VLBA C-band upgrade project is adequately funded but is being performed on a best–effort basis using resources partially allocated to the EVLA project which must take priority. We are prepared to accept delays in the final delivery if necessary. RISK: Should the third upgraded receiver not be available in time, the project may not be able to perform major upgrade work during the August *tiger team* visit to St. Croix, causing additional schedule slip and increased installation expense. MITIGATION: The budget was constructed assuming a separate visit to SC so the additional cost can be covered. The project would probably slip an extra month or two in completion.

VLBA C-Band Project Support: GB Machine Shop is fabricating the Prototype Feeds; two delivered during Q2. VLA Machine shop is fabricating the Dewars, OMTs, Modules [Q3,Q4]. CDL is providing the LNAs [FY2011-Q3 to FY2012-Q2].

Slide 23



The Second graph illustrates the full project. The First graph is this fiscal year view. The vertical line represents where we are today. The project is on track to be completed FY2012-Q3. The first VLBA site to be commissioned will be Pietown in September 2011

Slide 24

Observatory Development & Programs
- *Green Bank*

- ***Green Bank Telescope***
  - MUSTANG100-pixel development work suspended in lieu of MUSTANG2 development
  - KFPA released for 153 hours of general science use in Q2FY11
  - Completed Conceptual Design Review for CICADA-FPGA-based Spectrometer
  - Two end-to-end integration iterations completed in lab for Precision Telescope Control Systems (PTCS) new servo system

Karen O'Neil w/ input from Bloss

24

MUSTANG100: Evaluation by collaborators Upenn, NIST, and NRAO supports the finding that the existing 100-pixel array technology will not significantly improve the performance of MUSTANG on the GBT. Resources should instead be focused on the development and funding of a feed-horn coupled bolometer array (MUSTANG2).

K-Band Focal Plane Array (KFPA): The milestone of releasing the **KPFA** for general use was achieved with 153 hours of observing scheduled in Q2FY11. One major activity for this quarter was verifying the performance of each of the beams.

CICADA/FPGA Spectrometer: The rescheduled Conceptual Design Review for the **FPGA Spectrometer** was conducted early in Q2FY11. Due to the uncertainty of the delivery of Roach2 boards and in response to a concern raised by the Design Review Panel, the early science call in Q3FY11 has been canceled. No impact or mitigation - the call was never advertised.

Precision Telescope Control System (PTCS): In Q2FY11, end-to-end capabilities for position command, telescope operator interface. and limits & faults were added into the **servo system** code base running on the system simulator in the servo lab. A journal paper describing the design and operation of the **Quadrant Detector** system was submitted to the PASP, and the paper was accepted one week after the end of this Q2FY11 (April 7).

Slide 25

Observatory Development & Programs
- *Green Bank*

- ***Green Bank Telescope (cont.)***
  - Successful 4mm receiver cool-down and first-light testing in lab
  - Scheduling algorithm and ease of use enhancements for DSS in Q2FY11
  - All telescope infrastructure updates were completed for 20-meter Telescope in preparation for use with UNC Skynet telescope network

Karen O'Neil w/ input from Bloss

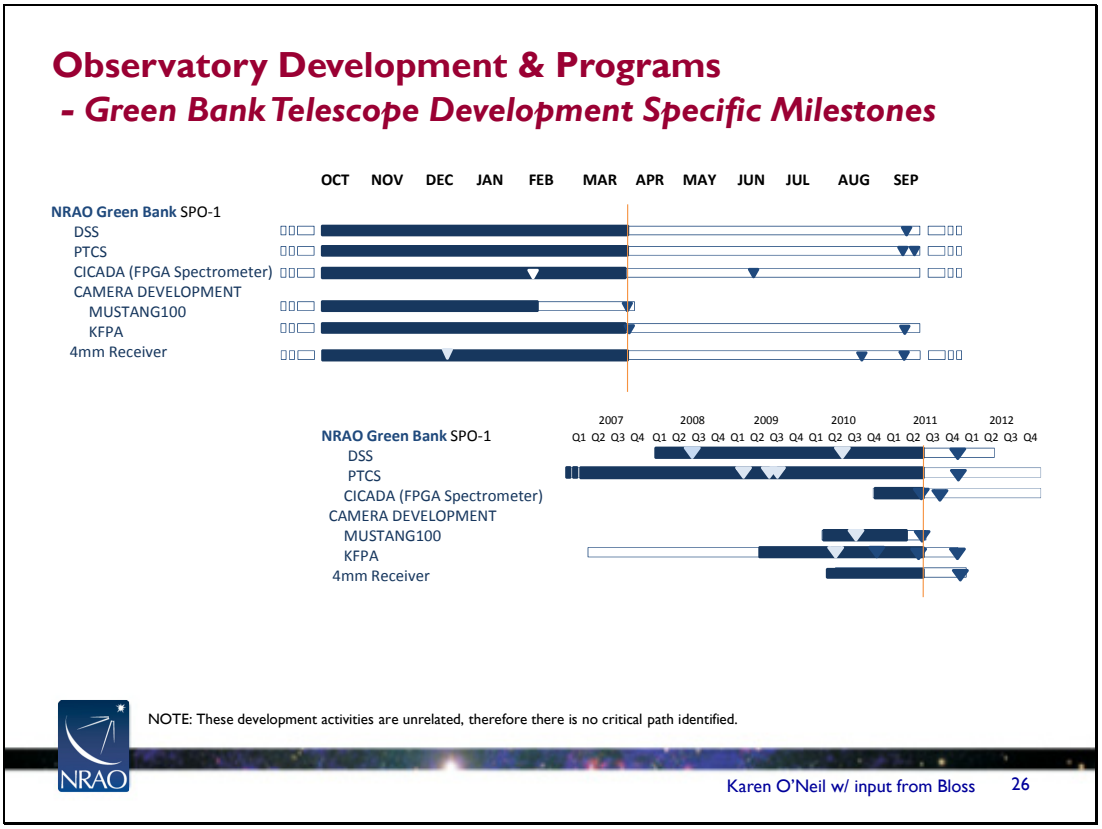
25

4mm Receiver: First cool-down was successful with spare cooling capacity. Initial **RF tests** are encouraging with four channels working, and tests continue. The **optical table mechanism** and control circuitry designs were completed, assembled, and are currently under test. Beta **M&C manager software** was completed and is being tested with the receiver hardware. A first call for shared-risk proposals was issued.

Dynamic Scheduling (DSS): The **Dynamic Scheduling** team continued its improvements to the scheduling algorithm and its ease-of-use this quarter. Improvements included: usability and robustness improvements to the Schedulers' Tools, work on the new Resource Calendar to ease the scheduling of maintenance days and activities, and continued improvements to the scheduling algorithm inspired by continued simulation as well as scheduler feedback. The beta version of the new sensitivity calculator, which will assist astronomers in determining observation durations based upon science objectives, was also tested in this quarter and will be released in Q3.

20-meter Telescope: All mechanical systems, cryogenic rehabilitation, and control system work was completed on the **20m telescope** in Q2FY11 in advance of the first **UNC Skynet** receiver installation in Q3FY11. Receiver designs are completed and parts are being fabricated in the Green Bank shop.

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 – Completed. Q3FY11 - Proposal call for shared risk observations Q3FY11 removed from FY11 schedule. **Risk**: none; **Mitigation**: not required.

Camera Development
•*MUSTANG100*: Q2FY11 – Milestone for delivery, testing, and installation complete has been removed from FY11 schedule and project suspended. **Risk**: MUSTANG observations use existing 64-pixel array; **Mitigation**: (Short term) – None required; (Long term) Focus development resources on design and funding of feedhorn-coupled bolometer array
•*KFPA*: Q2FY11 - Release of KFPA for general science use – Complete; Q4FY11 - Completion of KFPA pipeline – Ahead of schedule, Anticipate a Q3FY11 completion
•*WFPA*: Project transferred to ODP Q1FY11

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

Slide 27

Observatory Development & Programs
- *Coordinated Development Laboratory*

- ***Amplifier Production and Development***
  - Delivered 24 new amplifiers to EVLA
  - Repaired and retested 6 amplifiers for the EVLA and one to VLBA.
  - Evaluated and tested two production versions of 230-470 MHz amplifier
  - Broadband 68-118 GHz waveguide-to-microstrip transition delivered and tested
  - New 35 nm 68-118 GHz MMIC LNAs wafer run complete, chips currently being diced
- ***Electromagnetic Development***
  - Measured VLBA C-band (4-8 GHz) feed on the Green Bank Antenna Range
  - Physical optics calculations on W-band cold load optics was completed
  - Measured production version of EVLA X-band phase shifter

NRAO

Richard Prestage w/ input from Webber 27

Amplifier Production: The EVLA amplifier production is on schedule. 24 new and 6 repaired amplifiers were shipped for a total of 36. New amplifier production included six 230-470 MHz amplifiers, five 1-2 GHz, four 2-4 GHz, four 8-12 GHz, two 12-18 GHz, one 18-26 GHz, and two 26-40 GHz amplifiers. Repair, upgrade, and retesting of amplifiers included seven 1-2 GHz, one 2-4 GHz, two 8-12 GHz, and two 12-18 GHz.

Amplifier Development: development of W-band (68-120 GHz) low noise amplifiers is extremely important for the transition from cm – mm wavelengths, including for example the GBT working at W-band, and future upgrades to ALMA band 3. Gill A 75-120 GHz amplifier using NGST cryo3 wafer devices with noise temperature of less than 70 K over the whole band was demonstrated with the minimum noise temperature of 26K of at 80 GHz. This best noise temperature in the band is about the same as the best recent results provided by NGST 35nm gate length technology. The work is now continuing on improving the broad band noise performance. Experimental evaluation of ALMA band #1 amplifier awaits the availability of technician time.

Electromagnetic Support: Submitted a paper titled "A Compact Full Waveguide Band Turnstile Junction Orthomode Transducer" to the XXX URSI General Assembly and Scientific Symposium.

The measurement of the new C-band feedhorn for the VLBA upgrade was completed. The horn meets or exceeds specifications. An accurate value for the cold-load for the GBT w-band receiver is a prerequisite for accurate calibration; the performance of the complex optics for this cold load was calculated. The **C-band** feed has a nominal taper of -13 dB at 13.5° as desired with a good match between the E- and H-plane patterns. Cross polarization was measured to be better than -27 dB. Input return loss is 18 dB at 4 GHz and better than 30 dB above 4.6 GHz. Two paraboloidal mirrors dump the beam of one of the feeds to the cold load on the 4mm receiver for the GBT; calculation of performance was completed. Physical optics calculations on W-band cold load optics was completed. Measured production version of EVLA X-band phase shifter.

Slide 28

Observatory Development & Programs
- *Coordinated Development Laboratory*

- **Advanced Receiver Development**
  - Initiated design study for triple-ridged, 1-3 GHz, DOMT receiver
  - S-Band (1.7-2.6 GHz) cryogenic DOMT receiver in fabrication
- **Millimeter & Submillimeter-Wave Receiver Development**
  - Inductively Coupled Plasma (ICP) source in rework at UVML; fabricating Nb/Al-AlN/Nb trilayer test wafers
  - 385-500 GHz superconducting hybrid on high resistivity silicon shows low loss at 4K and will be used for the 385-500 GHz balanced mixer
  - 1.2-1.5 THz 4-pixel heterodyne array in concept stage for proposal to SOFIA 2nd Generation Instrumentation AO
  - Development of balanced and sideband-separating SIS mixers continues for 780-950 GHz based on prototype development at 385-500 GHz
  - NRAO high precision waveguide flange proposed as part of new IEEE submillimeter waveguide standard

NRAO

Richard Prestage w/ input from Webber 28

Advanced Receiver Development: The goal of the advanced receiver development is to digitize the receiver signal as close as possible to the RF, and integrate the complete signal chain from RF to optical fiber into a compact, low-power package. This will provide performance, operability and reliability improvements to all NRAO receivers. A design study for a novel 1-3 GHz Digital Orthomode Transducer (DOMT), the first stage in the signal chain after the feed-horn, has been initiated. This was motivated by an analysis of dual-mode waveguides having symmetry appropriate to the Digital Orthomode Transducer (DOMT) concept already proven in laboratory experiments. It was found that triple-ridged waveguides support much greater bandwidth than other guides (including quad-ridged) without higher-order spurious modes. This suggests the possibility that compact, very wideband receivers could be developed with excellent sensitivity. To take full advantage of this approach will also require a triple-ridged corrugated feedhorn, which is now being considered. The cryogenic version of the **S-Band (1.7-2.6 GHz) DOMT receiver is in fabrication**. The warm and passive cold modules are complete. Parts are on order for completion of the SiGe low-noise amplifiers and integrated calibration source. When fully assembled, this next generation receiver will be tested in the lab using a cryogenic dewar in Green Bank.

Millimeter & Submillimeter-Wave Receiver Development (R&D only): The ability to manufacture SIS junctions is vital to the maintenance and continued development of ALMA and other sub-mm telescopes. The University of Virginia Microfabrication Laboratory (UVML) is one of the few locations in the world with this capability. Over the last few months, the UVML process was suffering from equipment failure; these problems have now been repaired and some test Niobium/Aluminium-Aluminium Nitride/Niobium trilayer test wafers have been fabricated. Circuit components for operation at 385-500 GHz have been tested. Development of ALMA Band 10 (780-950) Mixers based on 385-500 GHz prototype work continues. A concept has been developed for a heterodyne receiver to fly on SOFIA. This is in anticipation of a NASA Announcement of Opportunity for second generation instrumentation; development of such an instrument would be extremely synergistic with continued ALMA Work.

Slide 29

Observatory Development & Programs
- *Coordinated Development Laboratory*

- ***Phased Array Feed (formerly called Beam Forming Array)***
  - Improved prototype of ambient temperature, single polarization array installed on 20-meter telescope for tests:
    - Improvements to noise match to LNAs taking account of mutual coupling
    - New data acquisition system
    - Ethernet front-end box control added
    - Extensive efficiency, noise, stability and mapping measurements completed
    - Data analysis in progress as quarter ended
  - Cryogenic array completed and ready for testing on 20-meter telescope
    - Dual polarized dipoles active-impedance-matched to SiGe LNAs from Weinreb
    - LNAs at 20K but dipoles ambient, custom low RF loss thermal transition
  - Analog fiber transmission system ready for installation after current telescope tests

NRAO

Richard Prestage w/ input from Webber 29

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.

Phased Array Feed (formerly called Beam Forming Array): The phased array feed is an innovative approach to form seven beams on the sky by combining the signals from 19 dipoles placed in the telescope focal plane. This will have applications for both the GBT and the SKA. The primary objective of the ambient-temperature array measurements was 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. The cryogenic version will be the first cryogenic phased array feed ever tried.

Slide 30

Observatory Development & Programs
- *Coordinated Development Laboratory*

- ***The Precision Array to Probe the Epoch of Reionization (PAPER) (collaboration with UC Berkeley) (see NIO)***
  - South African 64-element array
    - Completed the fabrication of components
    - Components are being prepared for shipment in April 2011
  - Green Bank 32 element array
    - Re-configured the array for maximum redundancy
    - Observations continue
  - Engineering experiments continue
    - Receiver gain and noise temperature corrections completed
    - Chaitali Parashare has successfully defended her Ph.D dissertation.
    - Study of ionospheric effects on PAPER data

Richard Prestage w/ input from Webber 30

The Precision Array to Probe the Epoch of Reionization (PAPER): The components for the 64 element array in South Africa have been fabricated and will be shipped in April. The Green Bank array has been reconfigured into three north–south lines and astronomy observations continue. The study of ionospheric effects will continue. Additional information on PAPER collaboration can be found with New Initiatives section.

Slide 31

Observatory Development & Programs
- *Coordinated Development Laboratory*

- **Broadband Active Feed**
  - Assembled the 300-3000 MHz cryogenic version
    - The system was evaluated in the outdoor range in GB
    - Rohit Gawande has successfully defended his Ph.D. dissertation.
- ***LUNAR***
  - Work continued on the NASA Dark Ages Radio Explorer (DARE) mission proposal, which is now in external review by NASA.
  - Completed the detailed analysis of the antenna configuration.
  - Work on the DARE Instrumentation Verification Plan has begun

NRAO

Richard Prestage w/ input from Webber 31

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.

LUNAR: 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 antenna and front-end design concepts.

Slide 32

Observatory Development & Programs
- *New Initiatives*

- ***NRAO SKA Program Office (NSPO)***
  - CoDR of DVA-1 held in Socorro as scheduled on Feb 3-4, 2011
    - Generally positive review report
    - NRAO continues to have reservations about managing DVA-1 program
- ***Building on New Worlds, new Horizons:*** Post Astro2010 meeting was co-hosted by NRAO /AUI and held in Santa Fe, NM March7-10, 2011
- ***Lunar Radio Astronomy:*** Jack Burns reported on status of Dark Ages Radio Explorer (DARE) at the Santa Fe meeting. A proposal was submitted to NASA in February 2011.
- ***Frequency Agile Solar Radiotelescope (FASR):***
  - Preparations for the FASR construction project have moved into a discussion phase with NSF/AGS.

Bob Dickman w/input from Myers/Bastian/Bradley/Ransom 32

Continue working with TDP and PrepSKA to define and carry the DVA-1 program through its CDR and PDRs. **CoDR of DVA-1** held in Socorro as scheduled on Feb 3-4, 2011. Generally positive review report; however, NRAO continues to have reservations about managing DVA-1 program. Have not yet signed Letter of Intent for DVA-1 construction. Reasons for reservations about DVA-1: the connectivity of DVA-1 to SKA and other future US cm-wave projects is now quite unclear, given NSF's declaration that it will not fund any SKA activities in the upcoming decade. It is unclear that the budgets of the DVA-1 participants are adequate to complete the envisioned program. It is unclear that the participants can meet the project on the planned schedule. NRAO will continue to monitor developments and progress of DVA-1/TDP.

Post Astro2010 meeting titled **"Building on New Worlds, new Horizons"** was co-hosted by NRAO /AUI and held in Santa Fe, NM March7-10, 2011.

Jack Burns reported on status of **Dark Ages Radio Explorer (DARE)** at the Santa Fe meeting. A proposal was submitted to NASA in February 2011. DARE is a radio astronomy spacecraft that will orbit the Moon. Primary scientific mission is to construct an all-sky spectrum of redshifted HI coming from redshift range $11 < z < 35$. This will provide the first quantitative characterization of the evolution of HI during the first billion years of the Universe, from the "dark ages," to period in which the first stars and galaxies were born, to the epoch of reionization.

Preparations for the **FASR construction project** have moved into a discussion phase with NSF/AGS.

Slide 33

Observatory Development & Programs

- *New Initiatives*

- ***Space Very Long Baseline Interferometry***
  - RadioAstron launch currently set for June 2011
- ***Long-Wavelength Array***
  - The first LWA station (at the EVLA site) is now taking data
- ***NANOGrav***
  - Additional post-docs and students being hired, mainly using PIRE grant funds
  - Maura McLaughlin elected to 3-year term as NANOGrav chair
  - GUPPI clone for Arecibo is nearly complete – commissioning this summer
  - The EVLA's prototype cluster correlator backend was used demonstrate software-only coherent de-dispersion of 100 MHz-wide data stream from the original millisecond pulsar

NRAO

Bob Dickman w/input from Myers/Bastian/Bradley/Ransom 33

RadioAstron launch currently set for June 2011. VSOP II has been cancelled by the Japanese government. The first LWA station (at the EVLA site) is now taking data. Build-out/construction of the full array remains unfunded. For NANOGrav, Personnel: Additional post-docs and students being hired, mainly using PIRE grant funds. Maura McLaughlin elected to 3-year term as NANOGrav chair. Science/Technology: GUPPI clone for Arecibo is nearly complete – commissioning this summer. The EVLA's prototype cluster correlator backend was used demonstrate software-only coherent de-dispersion of 100 MHz-wide data stream from the original millisecond pulsar.

Slide 34

Observatory Development & Programs

- *New Initiatives*

- ***PAPER (see CDL)***
  - Expansion of PAPER in South Africa (SA) to 64 antennas will be done by end of June
  - Proposal for $4.5M, to expand SA PAPER to 128 elements and to search for an EOR signature, was submitted to NSF in January

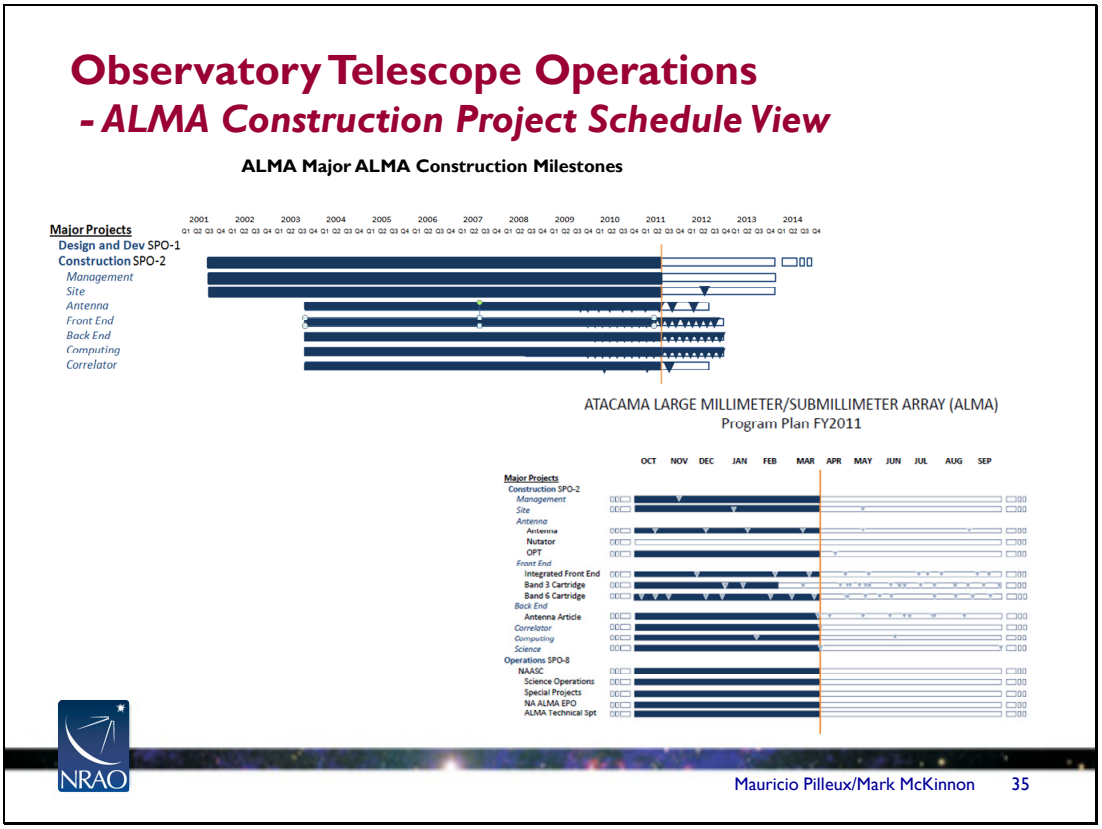
- ***VLBA***
  - A workshop with major US and International VLBI stakeholders, The Future of the VLBA was held in CV January 27-29, 2011
  - Pledges totaling an additional ~$1M per year for VLBA operations were received from 5-6 of the institutions that participated in the workshop

Bob Dickman w/input from Myers/Bastian/Bradley/Ransom 34

Other PAPER accomplishments include a new coherence technique that enhances the sensitivity of arrays for detecting spatial power spectra have been developed by the PAPER group; testing to demonstrate the technique has been carried out at Green Bank, with data under analysis. A catalog of the 500 strongest (> 1 Jy) Southern celestial radio sources at 150 MHz has been complied and submitted for publication by the PAPER group. PAPER data now can be imaged using CASA pipeline. Temperature-induced gain fluctuations in the PAPER front ends was analyzed by a UVA EE grad student for her PhD thesis. Under lab conditions, she showed that the fluctuations can be reduced by nearly a factor of 50 by monitoring temperatures at critical points in the signal path, and by applying thermal compensation.

For VLBA, A workshop with major US and International VLBI stakeholders, *The Future of the VLBA was* held in CV January 27-29, 2011. The workshop emphasized that the scientific promise of VLBA is enormous and would be severely damaged by any reduction in the number of sites. Pledges totaling an additional ~$1M per year for VLBA operations were received from 5-6 of the institutions that participated in the workshop. Intensive efforts are now underway to transform these pledges into working agreements. Pledges from Shanghai Observatory, National Astronomical Observatory of Japan, Academia Sinica Institute for Astronomy and Astrophysics, Max Planck Institut fur Radioastronomie, and others.

Slide 35



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

Slide 36

Observatory Telescope Operations
- *ALMA Construction Specific Milestones*

- ***Management***
  - NRAO/AUI instituted a program to improve safety in the conduct of its work at the ALMA site.
    - Recruitment process for two NRAO Safety Officers at the ALMA site is underway
- ***Site***
  - AOS Utilities work restarted fully in Q2 FY2011 and will continue until Q2 FY12.

Mauricio Pilleux/Mark McKinnon 36

NRAO/AUI instituted a program to improve safety in the conduct of its work at the ALMA site. The program involves placing two safety officers, one per turno, at the site. The primary focus of the safety officers is the work performed by local Chilean companies under contract with AUI. The safety officers will not be involved with the work conducted by the other ALMA Executives. The recruitment process was initiated during March 2011 and is expected to be finished in early Q3.

The AOS Utilities contract was delayed due to the termination of the former contractor on June 30, 2010. The new contract was signed in December 2010 and work restarted on site on January 3, 2011. The milestone in the ALMA schedule to deliver phase 4 stations for CSV was met by a partial delivery in early March and the rest will be ready in early April. The next milestone is the 5 km Array, scheduled for Q4 FY2011. Legal proceedings with the former contractor and the insurance company holding the performance bond are in process.

AOS road construction work is 73% complete. This contract restarted in October 2011 after the winter break. To date, all roads are already cut or filled to subgrade level, and the remaining work is to achieve the final level in the subgrade and install the crushed gravel in the loading area of the antenna station s. Continues on a delayed schedule until Q3 FY11 when it will be finished. Delay does not affect other ALMA milestones.

Slide 37

Observatory Telescope Operations
- ALMA Construction Specific Milestones

- ***Antenna***
  - Vertex antennas #12 & #13 accepted and delivered to ALMA
  - Vertex antenna #14 started acceptance testing
  - Vertex antenna #15 nearing end of integration
  - Delivery of nutator units to OSF slightly delayed
    - Optimization of control software continued on unit #1 in Green Bank
    - Delivery of nutator unit #2 expected to complete in Q3 FY2011
  - Complete delivery of 6 OPTs delayed from Q2
    - To be delivered in late Q4 FY2011 or Q1 FY2012
    - POPT contractor has developed an alternate design configuration

Antenna: During Q2 FY2011 the **12th and 13th** Vertex antennas were accepted into ALMA. System commissioning of the **14th** Vertex antenna was started leading to the initiation of acceptance testing in Q3. The **15th** Vertex antenna is nearing completion of integration in preparation for commissioning and acceptance. DV02 experienced a catastrophic failure of the UPS during Q2; the UPS was subsequently repaired and we are awaiting a full failure assessment report from the Vertex antenna vendor (Jovy-Atlas). NAAIPT continues to work with ALMA (AIV) to provide a high level of antenna availability; efforts continue to concentrate on encoder failure and ALMA provided timing signaling issues.

Nutator: With the first nutator unit in **Green Bank**, we continue to work on optimizing the performance of the servo control system while the rocker arm and stow mechanism redesign was completed in Taiwan. When final optimization of the servo control has incorporated the redesigned rocker arm parameters in early Q3 FY2011, unit #1 will be returned to Taiwan for refurbishment and then transport on to Chile. **Unit #2**, instead of #1, will be delivered to Chile in early Q3 for engineering and interface tests. Risk: The risk inherent in the late delivery of the nutator is a delay in science capability of obtaining short spacing information. Mitigation: A fast scanning technique is being implemented in the antenna software to replicate the nutator function and mitigate the risk.

Production OPT (POPT): Units #1 & #2 were used by AIV and NRAO/Vertex to perform acceptance testing on Vertex Antennas #11, #12 and #13. The all-sky and offset pointing measurements continue to be consistent with earlier testing with the prototype OPT. The thermal drift problem continues to occur but is being addressed on an individual test basis. For unit #3, the **POPT contractor** has developed an alternate design configuration incorporating a new doublet lens, CCD, and focusing mechanism. RISK: Delayed delivery of the production OPT potentially risks prompt delivery of EU and NA antennas. MITIGATION: Mitigations are to conduct a rigorous engineering review of the alternate POPT design prior to allowing the contractor to proceed with fabrication of the alternate design configuration for unit #3. Also, additional expertise in mechanical/optical design will be assigned to the OPT effort. Additional oversight at the vendor's facility is also planned.

Slide 38

Observatory Telescope Operations
- *ALMA Construction Specific Milestones*

- ***Front End***
  - Deliver Integrated front ends to OSF [Q1, Q2, Q3, Q4]
    - FE #5 & 6 delivered to OSF
    - FE #7 & 8 in test; FE #9, 10 & 11 assembled and awaiting test; FE #12 & 13 in assembly
  - Deliver Warm Cartridge Assemblies [Q1, Q2, Q3, Q4]
    - On schedule: total of 292 delivered (56% complete)
  - Deliver Cold Cartridge Assemblies for bands 3 and 6 [Q1, Q2, Q3, Q4]
    - Band 3 still catching up to schedule due to cross polarization issue (64% complete)
    - Band 6 recovered to schedule (66% complete)
  - Deliver FE Components [Q2, Q4]
    - The delivery of Chassis Kits and FESS Plates is 100% complete
    - The delivery of Bias Modules and FE M&C Kits is ahead of schedule and 74% complete
    - Compressor M&C Kits, Power Supply M&C Kits and Thermal Interlock Modules are in design. All component deliveries will be complete by December 2011
  - Deliver FESV [Q2]
    - Delivery dates have shifted to Q3 FY2011 due to delays in manufacturing

NRAO

Mauricio Pilleux/Mark McKinnon 38

FRONT END: Five FEs are completely assembled and two more are in assembly. Additional software to automate test operations is being developed. This will enable off-shift, unattended test operations and accelerate the test process. The goal is to deliver the 14th NA Front End during FY2011. NA Front Ends are off of the critical path (all antennas at the OSF have a "PAS'ed" FE.) Production of WCA bands 3, 6, 7, and 9 is on schedule. Band 3 CCA deliveries resumed in January. As reported previously, Band 3 CCA production was behind schedule due to a cross-polarization performance issue. Risk: Band 3 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 Band 3 CCAs have been produced; total delivered: 35 (48% complete). Despite the risk, all three FEICs have sufficient CCAs to support production operations through Q3. Band 6 CCA delivery has been improved due to improved production efficiency and the implementation of an improved method for matching feedhorns and OMTs; total delivered: 39 (53% complete). 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 Kit and Power Supply M&C Kit was successfully conducted on 15 February 2011, at the OSF. Design verification and manufacturing readiness were established. Purchase orders for production hardware are in process.

The Front End Service Vehicle (FESV) is scheduled for delivery during Q3 FY2011. Manufacturing at the supplier is now 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 Project Manager held extensive meeting with vendor (CoTech) in Taiwan to expedite the delivery of truck chassis unit #2, from Volvo in Sweden.

Slide 39

Observatory Telescope Operations
- ALMA Construction Specific Milestones

- ***Back End***
  - Deliver CLOA2 to AOS [Q2]
    - Installation completed by end of March with acceptance testing ongoing
  - Deliver antenna articles to OSF [Q1, Q2, Q3, Q4]
    - On schedule
- ***Correlator***
  - Deliver quadrant 4 [Q2]
    - Likely to be postponed to Q1 FY12. Waiting for analysis of actual need

BACK END: The Central LO Article 2 was shipped on schedule in early February and arrived in time to begin installation in mid March 2011. This installation was completed at the end of the month and acceptance testing began with a completion goal of mid April 2011. The CLOA2 will be largely complete, supporting the delivery of the LO reference to all 4 subarrays and up to 32 antennas. In Q3 or early Q4, a short final installation campaign will take place to install the remaining cable harnessing and Subarray Switch and Line Length Corrector modules needed to complete distribution to the full 66 antenna array. Antenna Articles are continuing to be assembled and accepted for shipment in Socorro. By end of March 2011, articles 51-55 had undergone testing in preparation for Q3 shipment. Articles 41-50 are crated and ready for shipment to the OSF pending a review and acceptance of new test procedures used during acceptance. These articles can be shipped at a moment's notice, though. Antenna Articles remain on schedule for completion (66) in Q4.

CORRELATOR: Quadrants 1 and 2 were reconfigured and verified for 2-quadrant operation, servicing up to 32 antennas. Quadrants 3, at the AOS, and 4, in Charlottesville are, are in use for firmware and software verification as more functionality is added. Quadrant 4 is ready for disassembly and shipping, but the actual ship date depends on when it will be needed to support 33 or more antennas; at present, it is extremely useful as a test bed as features are activated. The delayed delivery of the quadrant 4 currently poses no risk to budget or schedule.

Slide 40

Observatory Telescope Operations
- *ALMA Construction Specific Milestones*

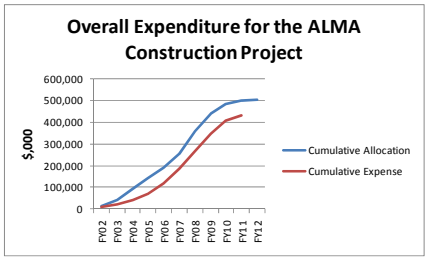
- ***Computing***
  - ALMA software release R8.0/R 8.1 [Q1, Q3]
    - R8 was deployed in January 2011
- ***Science IPT***
  - Issue call for proposals [Q1]
    - Call issued March 30, 2011
  - Start of early science [Q4]
    - On schedule

COMPUTING: Release 8.0 of the ALMA software was deployed in January 2011. More problems were found by CSV than had been anticipated, which resulted in some delay to the CSV schedule (compounded by the poor weather in January/February). Lessons learned include keeping to the release deadlines more strictly (as opposed to allowing late functionality to be inserted into the release after the development freeze date) and allowing keeping fully the allotted time for testing rather than allowing it to be squeezed, and requesting that CSV analyze data thoroughly as part of the release process to ensure previous observing modes continue to produce consistent data across release boundaries. The two-quadrant correlator and CLOA2 software support were introduced as a patch to R8.0 and both are working well.

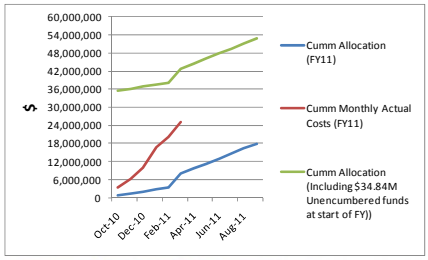
SCIENCE: The IPT participated in development of the Plan for ALMA Early Science Cycle 0 which was announced at the end of Q2 FY 2011. The Science IPT leads an Imaging Tiger Team at the NAASC which participates in CSV through direct involvement and through analysis of ALMA data to verify performance of the array. Several science verification images made with ALMA data during Q2 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 was 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.

Slide 41

Observatory Telescope Operations
- *ALMA Construction Financial Performance Graphs – overall & Q2 FY2011*



Overall Spending for the ALMA Construction Project



FY11 Spending for the ALMA Construction Project

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 42

Observatory Telescope Operations
- *ALMA Construction Significant Events-Japan Partnership*

- Delivery of production Band 4 and 8 CCAs is scheduled for Q3
- Band 4 coolable frequency doubler design complete; purchase orders in process.
- Nine additional Band 4 WCAs delivered this quarter.
  - Total delivered: 37 (53% complete)
- Band 8 coolable frequency sextupler purchase orders in process.
- Nine additional Band 8 WCAs delivered this quarter.
  - Total delivered: 37 (53% complete)
- Components for thirteenth EA FEIC FE delivered and assembled

SPO-7 activities: Delivery of production Band 4 and 8 CCAs is scheduled for Q3. Nine additional Band 4 WCAs were delivered this quarter; total delivered: 37 (53% complete). Nine additional Band 8 WCAs were delivered this quarter; total delivered: 37 (53% complete). 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). Components for assembling the thirteenth EA FEIC FE assembly were delivered. "On-wafer" test data (for Band 10 WCA Power Amplifiers) is positive. "On-chip" data is expected from BAE Systems during Q3. Band 4 Coolable Frequency Doubler design complete; POs in process. Band 8 Coolable Frequency Sextupler Purchase Orders in process. EA FEIC has two FEs in PAI; two assembled FEs awaiting test.

Slide 43

Observatory Telescope Operations
- *Office of Chilean Affairs (OCA) Significant Events*

- ***Staffing***
  - Expatriates supported by the OCA: 23
  - ALMA local staff
    - 17 new hires, for a total of 242 LSM (217 JAO, 25 AUI/NRAO)
  - Coordination with new ALMA HR management
    - More pronounced involvement of US NRAO HR is underway.
    - Marilyn Keating moved in as new overall ALMA Head of HR and Internal Communications
- ***Activities***
  - Outfitting of new OCA offices near ALMA Santiago Central Office completed.
  - Aerial and in-situ filming of ALMA construction completed
  - Purchase Orders processed:
    - 65 ($687k) for ALMA Construction
    - 270 ($1,124k) for JAO Operations

NRAO

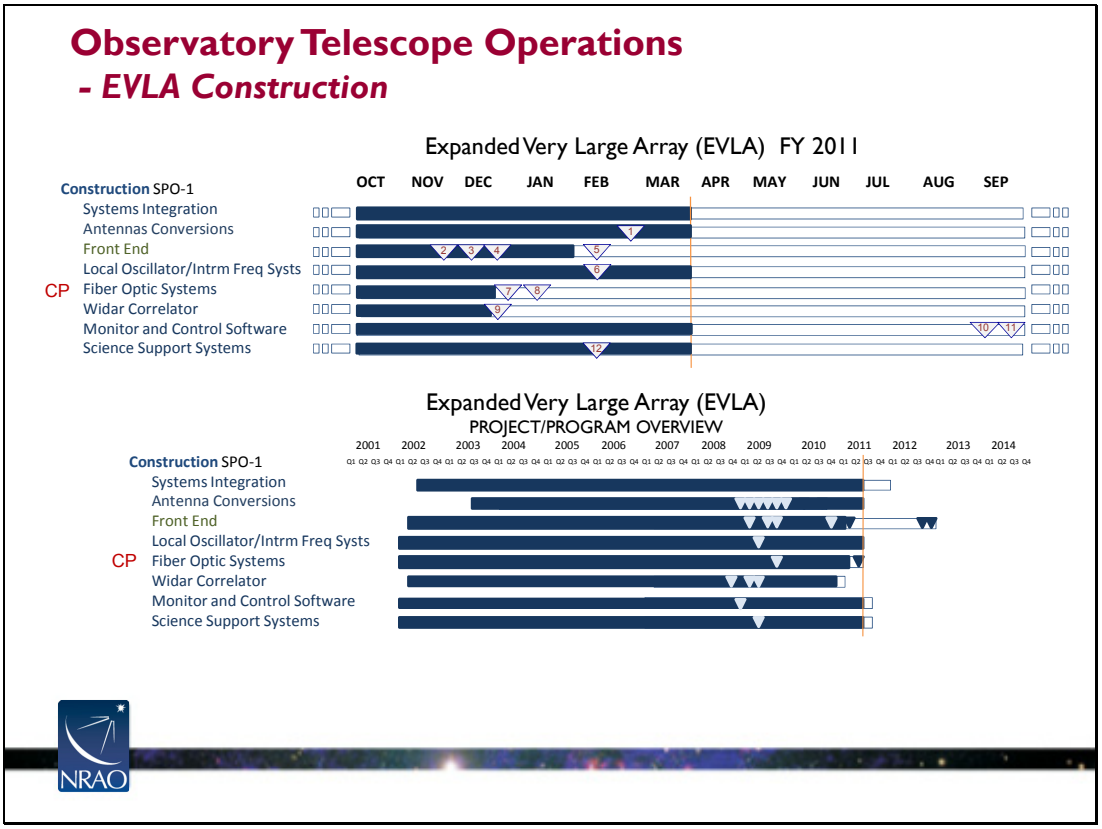
Mauricio Pilleux/Mark McKinnon 43

OFFICE OF CHILEAN AFFAIRS (OCA): The number of expatriates increased by one. OCA has increased the total number of 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 242 local staff (217 under JAO supervision and 25 under AUI/NRAO's). Changes in ALMA's HR management includes Marylin Keating, who moved in as new overall ALMA Head of HR and Internal Communications. She assumes her role in Q2 FY2011. More pronounced involvement of US NRAO HR is underway.

The outfitting construction of the new OCA offices has been completed and the move from the El Golf offices has taken place.

OCA has provided the legal and institutional support for contracts and procurements for ALMA as follows: a total of 65 purchase orders were made for ALMA Construction (687 k$) and 270 for ALMA Operations (JAO) (1,124 k$). 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 44



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.

The Fiber Optic System has replaced the Front End on the critical path due to a delay in the successful qualification and installation of the 3-bit samplers (milestones 5 & 6). L-, S-, X- and Ku- FE receiver bands are scheduled to be installed on antennas up until the end of EVLA construction (12/2012). These have been holding schedule.

Slide 45

Observatory Telescope Operations
- *EVLA Construction*

- ***Front End***
  - Final two Ka-band receiver production and installation is complete
  - First receiver with solar observing capability delayed until Q4
- ***Fiber Optic***
  - Four 3-bit/DTS modules of new design presently being tested on the array
- ***Correlator***
  - WIDAR acceptance hardware test plan is being implemented
  - WIDAR acceptance software test plan is presently being revised

NRAO

45

Front End, Fiber Optic and Correlator are currently running behind schedule. Risks and Mitigations are defined below. For the Front End, Engineering development work continues on the **first receiver with solar observing capability** [5]. The original date for delivering this capability Q1. Defining and characterizing the attenuation paths within the L-Band receiver has proven to be a very involved task, requiring a considerable amount of engineering time and resources. A complete prototype is anticipated by Q3 (April - June). In addition to the engineering challenges, the priority of this activity has been reduced by more critical EVLA FE production requirements. Remaining work includes the software algorithm necessary to compensate for the wide variation in solar power through the system. Testing hardware on the array is now anticipated for Q4 (July- Sept). Risk: Minimal risk because task will be completed prior to established program conclusion. Mitigation: No action required. Accept the risk. **Pre-production testing of the 3-bit/DTS module** [7] continued in the second quarter with the re-designed prototype, and will stretch into Q3. The original milestone was Q1. Four new modules have been built and were deployed for array testing in early April. Pending successful tests, production quantities will be procured. The production contract for the 3-bit sampler assemblies has been awarded pending successful tests, saving two months of procurement cycle time. The milestone **Begin installation of 3-bit/DTS modules** [8] in Q2 is delayed as a result of the redesign and delay in sampler assembly testing. The installation of the first production 3-bit/DTS modules will be pushed until Q4. RISK: Project completion on time. MITIGATION: Contingency funds will be spent if necessary to accelerate assembly and installation, as required. The correlator milestone, **Finalization of the WIDAR acceptance plan** [9], has not been completed. During Q1 it was decided to break this milestone into two parts: Hardware acceptance and Software acceptance. The hardware acceptance, which is concerned only with the physical health of the WIDAR components and connections, is being carried out. A draft of the software acceptance plan is written, however it includes a specific test for

every conceivable requirement, and therefore would take very long to execute. Because many of the identified tests can be consolidated, the plan is presently being pared down to a more manageable document. The WIDAR software acceptance plan is now expected to be finalized in Q3. RISK: Supplier will roll off personnel before correlator accepted; they can no longer assist in troubleshooting and modifications. MITIGATION: The formal WIDAR software acceptance document and tests need to be finalized, but since the correlator is in successful use every day, the official acceptance is considered "low risk." The staff is busy performing commissioning (which involves many checkouts) and has been delayed in completing the formal document and acceptance tests.

Slide 46

Observatory Telescope Operations
- *EVLA Construction*

- ***Monitor and Control***
  - OSRO observing w/ 2 GHz bandwidth on track for Q4
- ***Science Support System***
  - Observation Scheduling Tool used for all observing successfully implemented Q2

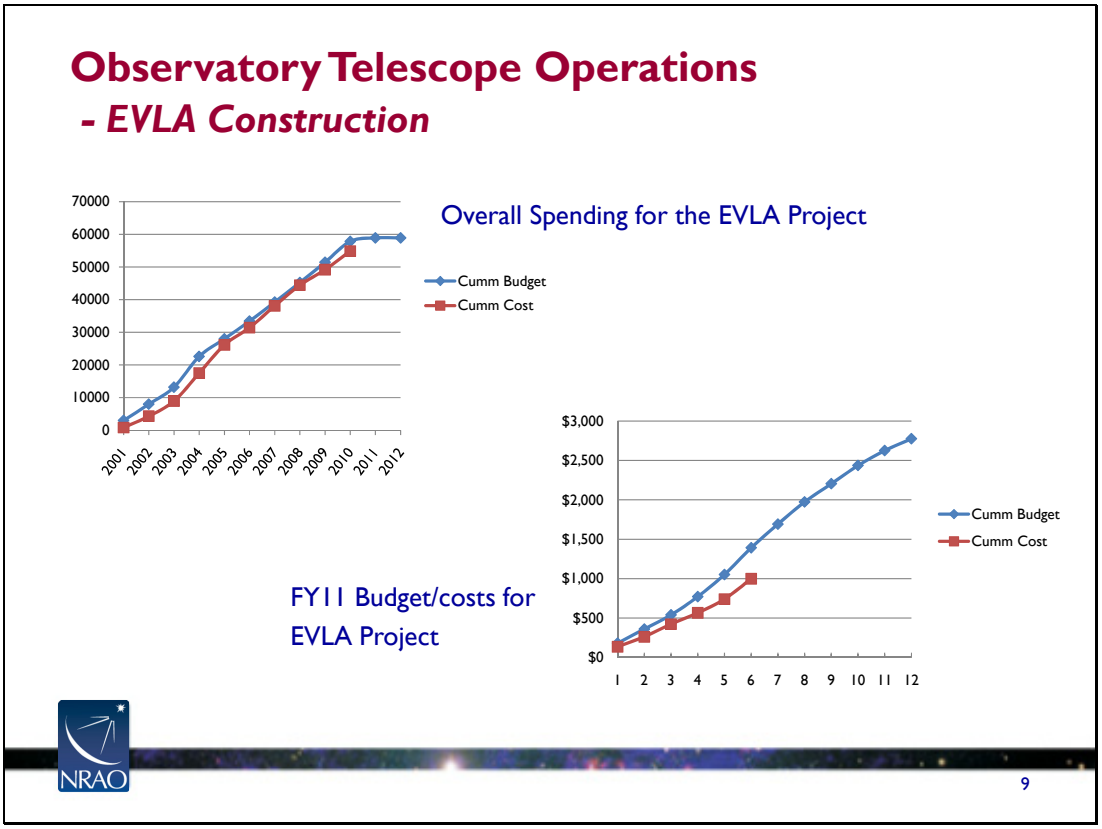
NOTE: [numbers] refer to corresponding numbers on the EVLA milestone chart in the FY2011 POP.

Milestone [11], OSRO observing with **2 GHz bandwidth**, will allow 16 x 128 MHz sub-band pairs, for a total of 2 GHz bandwidth per polarization. This is on track for Q4, when the array moves into the D configuration.

All EVLA scheduling blocks, including RSRO SBs, can now be scheduled dynamically via the **Observation Scheduling Tool** (OST).

Remaining deliveries from Green Bank machine shop include: Ku-Band feed horns and miscellaneous precision machined components. Remaining deliveries from NRAO Technology Center include Low Noise Amplifiers (LNA) to complete L-, S-, X-, and Ku-Bands, and spare LNAs for most bands.

Slide 47



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

Front End spending is lower than planned due to L-band solar observing capability not yet having a complete design, and the relatively early stage of X-band construction. Also, other components, such as the LNAs, are scheduled to be delivered throughout the fiscal year, and are paid for on an ongoing basis, which is not reflected here. Computing is under-spent due to a conscience effort not to purchase archive hardware until it is needed. By delaying this, we anticipate receiving more value for the dollar.

The project contingency was spent down this quarter ~9% to cover items such as RF switches and components, downconverter upgrades, and costs associated with extension/retention of critical skills for antenna mechanic, technician for LOIF, and for a drafting supplier. The project contingency is still at a healthy level, is actively managed, and is expected to be expended by the project closure date. There are several very large contingency hits that are pending, including items like the 3-bit sampler, and two critical skills retention contracts.

Slide 48

Observatory Telescope Operations
- *EVLA Operations*

- ***Infrastructure Maintenance and Repair***
  - 8 of 13 railroad switches were refurbished
- ***Antennas***
  - Antennas 16 and 13 were overhauled
- ***Array Configuration changed***
  - Re-configuration to CnB and to B configurations were completed
- ***Other Operations Activities***
  - Weather Station construction continued
  - Utility meter power monitoring devices installed
  - Control Building East exterior staircase repair initiated

NRAO

Claire Chandler w/ input from P. Perley 48

No railroad track ties replaced in Q2 since this is a spring/summer time activity. 8 of 13 railroad switches were refurbished. Antennas 16 and 13 were overhauled. The array was re-configured to CnB and to B configurations. Electrical, fiber, power and foundation work for the new Weather station was completed. Utility meter power monitoring devices installed to utility meter to improve power quality and usage monitoring. Work began on the Control Building East exterior staircase.

Slide 49

Observatory Telescope Operations
- *VLBA Operations*

- ***Partnerships***
  - On track for installation of fiber-optic connections between MK and PT and the USNO correlator in Washington, DC.

No maintenance tiger team visits occurred in Q2. The next scheduled Tiger Team visits are scheduled in Q3 for North Liberty, Fort Davis (elevation bearing only), and Owens Valley. Saint Croix is scheduled for Q4.

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 in Q3.

Slide 50

Observatory Telescope Operations
- *Green Bank Operations*

- ***Infrastructure Maintenance and Repair***
  - Parts and assemblies for the Skynet X-Band receiver, Phased Array Feed, and 4mm receiver fabricated GB machine shop
  - Skynet X-Band feed horn design and post amplifiers for the 4mm receiver designed and fabricated at NTC
  - Remodeled the Green Bank Science Center Café

Karen O'Neil w/ input from Holstine 50

The GB Machine Shop fabricated parts and assemblies for the Skynet X-Band receiver, Phased Array Feed, and 4mm receiver. The Skynet X-Band feed horn design and characterization were completed in Q2FY11 by the NTC. Post amplifiers for the 4mm receiver based on ALMA LO amplifiers were modified by CDL engineers and will be fabricated at NTC in Q3FY11.

In support of the cost reduction re-organization of the Green Bank Cafeteria and **Science Center Café,** the GB plant staff remodeled the Café to provide additional food preparation capacity for cover evening meals for visiting observers, allowing the Cafeteria to close after the lunch hour.

Slide 51

Observatory Support Services
- *Administration and Business Services*

- ***Observatory Business Services***
  - Relocation status WIKI page delayed to Q4
  - Visitor coordination software implementation system is undergoing testing
  - In process of identifying alternative vendors for installation of electronic passkey doors at CIS server area, communications room, and OBS/Human Resources hallway
- ***Contracts & Procurement***
  - Completed the Contracts Change Order Procedures
  - Implementation of P-Card delayed as liability risk assessed

NRAO

Ted Miller 51

Relocation status **WIKI page**, planned for Q2, has been delayed to Q4 while new Administrative Assistant is trained. RISK: Low; only impact is to employee ease of use. MITIGATION: Accept risk. System is undergoing testing for the **visitor coordination software** implementation-WebEvent replacement as planned for Q2. Based on HIPPA review and NSF security reviews additional security is being added to the CIS area, Communications Room, and the Business Services/Human Resources hallway. The CIS area and OBS/HR hallway will have double panel doors installed that include electronic **passkey** protection. The communications room will have an electronic passkey system installed on the existing door. Preferred vendor went out of business so in Q2 started process to identify alternative vendors for installation. Total cost of the project is estimated at $26k. The replacement of the Edgemont Road phone and voicemail system, and the installation of a cell phone booster, planned for Q4 will be deferred into FY12 and possibly into FY13 due to the continued less than positive financial outlook.

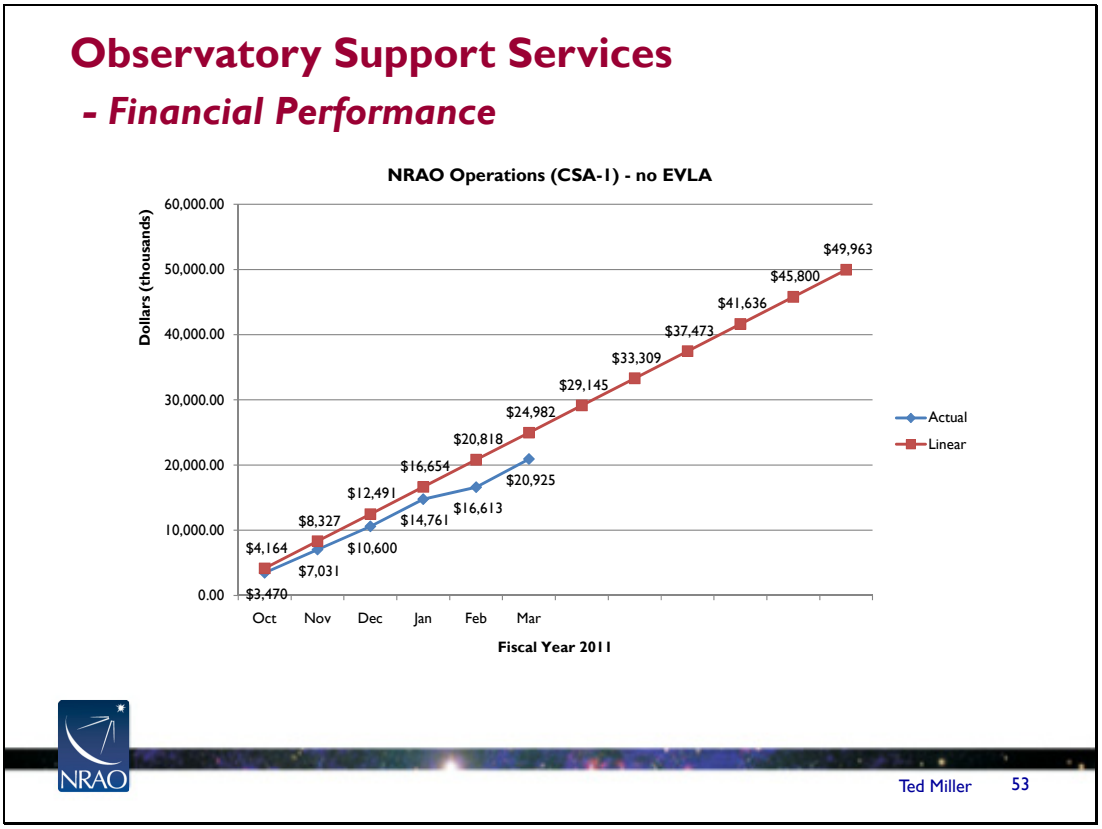
Completed the **Contracts Change Order** Procedures. The Q3 milestone for implementing the **P-Card** Program will not be met. RISK: low risk. This is a process enhancement. Fiscal has taken the implementation lead on this project and is working with AUI to clarify liability. MITIGATION: Accept risk.

Slide 52

Observatory Management Services

Grant NPF #	Grant Contract #	Name of Grant	Funding Institution	Grant Value	PI	Period of Performance	
2938	No Contract	Cornell-Pulsar Backend for Arecibo	Cornell University	$9,100	Scott Ransom	07/01/10	03/31/11
2523	RSA #1428043	Dust-Based Molecualar Gas Maps of Nearby Low Metalicity Galaxies	JPL/Spitzer	$55,000	Adam Leroy	02/01/11	06/30/12
2939	ATI-0384235	The Management and Operation of Virtual Astronomical Observatory	VAO	$457,891	Ethan Schreier	05/15/10	04/30/12
2940	no contract	Pollock Award	Dudley Observatory	$5,000	Ellen Bouton	not applicable	not applicable
2602	NNG11PY64I	Constraining Pulsar Emission Physics through Radio/Gamma Correlation of Crab Giant Pulses	NASA	$14,000	Scott Ransom	12/22/2010	11/15/2011
2941	00007521	ATI - GBT Multibeam Spectrometer	UC Berkeley	$118,149	John Ford	9/15/2010	8/31/2012

Slide 53



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 $49,963k. Total expenses and commitments for first quarter FY 2011 is $20,925k or 41.9% of total available funds.

Slide 54

Observatory Support Services
- *Administration and Business Services*

- ***Fiscal***
  - The annual OMB A-133 and Financial Statement Audit was finalized in Q2
  - Employee payroll EFT transfers and check processing was successfully transitioned to in-house production in Q2

Connie Williams 54

All audit fieldwork and report review was completed on schedule with the final annual **OMB A-133** audit report issued on February 4, 2011. The external audit firm issued an unqualified opinion with no reported material weaknesses or audit adjustments. The Fiscal Division devotes approximately 5 months of the Fiscal Year to the planning, preparation, execution and finalization of the audit.

The transitioning of the processing of payroll **EFT transfers and checks** to in-house production resulted in a cost savings to the Observatory in outsourcing fees and software charges. Additionally, the Observatory realized an extension in the deadline for ACH file submission. To increase efficiency, all payroll remittance advices were transitioned from paper to electronic format.

The Fiscal Division continues to organize/provide all required schedules and respond to questions posed by the DCAA review team. The review has been delayed and completion date is uncertain due to DCAA scheduling conflicts. The delay presents a potential risk to the Observatory of scheduling conflicts and reduced resources with the year end close and FY 11 OMB A-133 audit, which will be mitigated through a reallocation of work effort.

The Fiscal Division assisted with the implementation and design of the cost pool scheduled for completion in Q3. The electronic data management system (EDMS), planned for Q2, was set at a very low priority- as the risk of not implementing is very low- basically a reduction in the efficiency of data storage and retrieval. Due to the budgetary limitations and time constraints on the Fiscal and MIS staff- this project will be suspended until Q4 2012. Risk: Lost efficiency in electronic filing and document retrieval. Mitigation: Retention- Implementation of EDMS will be postponed until Q4 FY 2012.

Slide 55

Observatory Support Services
- *Administration and Business Services*

- ***Management and Information Systems***
  - Implementation of NRAO "Shared Cost Allocation Pool"
  - Commenced JD Edwards ERP software upgrade planning and resource allocation
- ***Environmental Safety and Security***
  - OSHA 10-hour compliant course for NM is in review

Chuck Beverage, Jim Firmani 55

The plan to implement the NRAO "Shared Cost Allocation Pool", planned for Q1, is now expected to be completed mid-Q3. Three of four pools automated. Continue to work software coding for Business Services – Management (BSM) pool. Initial comparisons between automated and manual calculations are very favorable. This is a combined effort with support from Business Services, MIS, and Fiscal. RISK: Low risk. Shared cost allocation pool is taking more time and resources than initially expected, marginally impacting the implementation of the ERP software upgrade. MITIGATION: monitoring risk. JD Edwards ERP software from 8.1 to 9.x upgrade planning and resource allocation commenced in preparation for a Q3 start. Still on plan to complete implementation after the close of the fiscal year, in December 2011.

The finalization of the **Crisis Management Plan**, planned for Q1, has been delayed to end of Q3 due to prioritization conflicts. No risk identified with this slight slip in schedule for either of those items. Delay related to the requirement to recruit & hire replacement personnel within ES&S. Slightly delayed in creating an **OSHA 10-hour compliant** course for NM (consistent with the OSHA compliant courses at the other sites) to be delivered by ES&S personnel. Course is in review, will finalize end of FY 2011. **JAO Safety Training Program** delayed to end of 3rd quarter. No risk identified with this delay. All three of the above have slipped due to the need to replace ES&S personnel in the NM office as well as our drive to revamp the JAO Contractor Safety Program.

Slide 56

Observatory Support Services
- *Human Resources*

- ***Human Resources***
  - Transitioned to "internal posting" methodology to address employees affected by ALMA ramp down
  - Continuing to work with Diversity Advocates to formalize the Diversity Support Groups
  - Collaboration with Center for Diversity in Engineering at the UVA
- ***Diversity New Hires***
  - None this quarter
- ***Promotions***
  - Diversity Employment Results Q2
    - SOC
      - 2 Scientist/CS – Asians (2)
    - GB
      - None
    - CV
      - Scientist/RE – Asian (1)
      - Administrative Asst – Female (1)
      - Technical Specialist II – African American

Jim Firmani w/input from Giles/Franks 56

For HR/Recruitment, transitioned to **"internal posting"** methodology to address employees affected by ALMA ramp down. Developed additional internal communication strategies. For Diversity Outreach: continuing to work with **Diversity Advocates** to formalize the Diversity Support Group. Working with Carolyn Vallas, the Director of the **Center for Diversity** Engineering. We are also working with Dr. Marcus Martin, Chief Diversity and Equity Officer at UVA on future collaborations. The Q2 milestone "Completion of Plan for Training and Development" was reduced in scope to include only new and future leadership on the Science Staff due to budget considerations.

Scientific promotions:

Kumar Golap and Sanjay Bhatnagar – SOC

CV Promotions:
Kamaljeet Saini
Jessica Utley
Erik Gaines

Slide 57

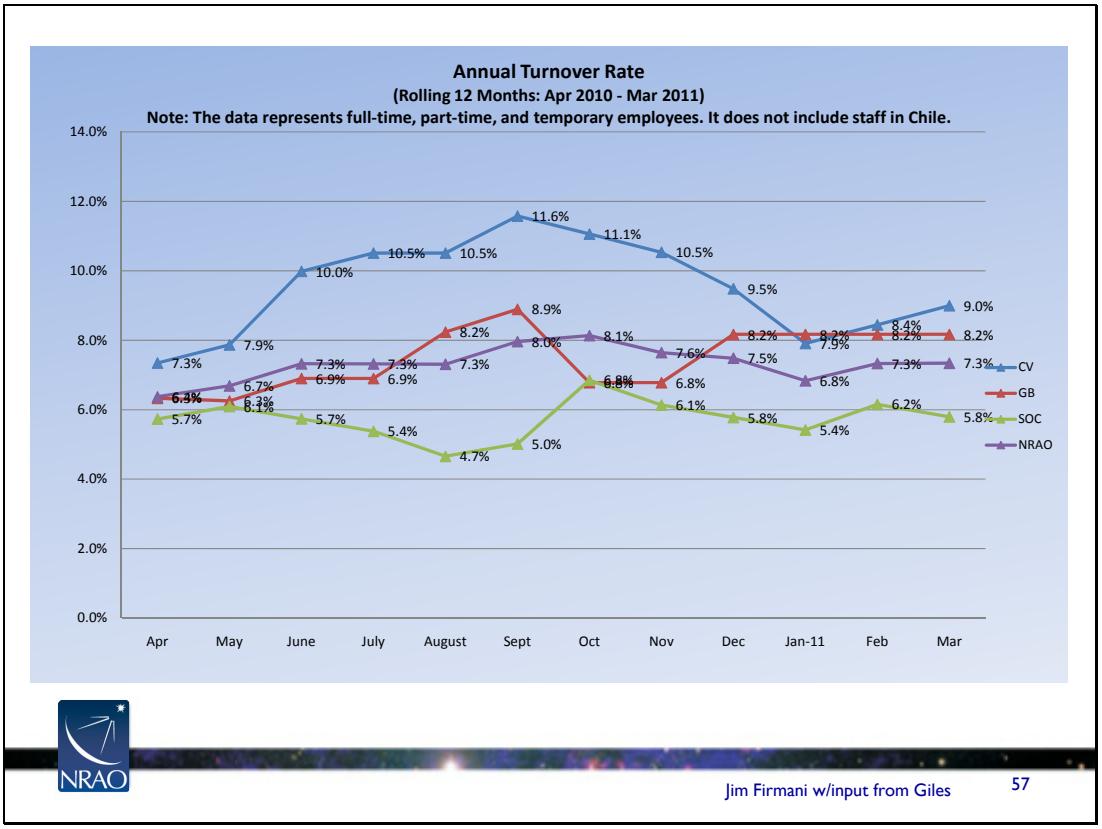


Chart now excludes seasonal hires.

During the period reported:
2010 ERP resulted in 5 (1 CV/1 GB/3 NM) retirements in September and one (CV) in December
One was lost to non-work related death
Three senior managers left for other opportunities
Of the 40 total terminations: 12 were minorities (30% of departures); 15 females (37.5%); and 5 Female-Minorities (12.5%)

NRAO expects to experience higher than historical turnover averages over the next two years due to financial and career limitations resulting from flat or decreasing budgets and increasing pressure on an already lean staff to increase productivity.

Slide 58

Observatory Support Services
- Communications

- ***External & Internal Stakeholder Communications***
  - FY 2010 NRAO Annual Report completed, print bids received
  - Organized all-hands meetings across Observatory 30 March
- ***Science Community Communications***
  - Organized NRAO presence at Seattle AAS meeting; led NRAO special event planning & coordination
  - Organized and chaired VLBA-themed science symposium at the 2011 AAAS Annual Meeting in Washington DC
  - Significant progress achieved re Plone content management system implementation for the NRAO science web site
  - Assisted Director's Office with 2011 Users Committee meeting planning and preparation
  - Prepared for NRAO exhibition and events at May 2011 AAS meeting

NRAO

Mark Adams 58

FY 2010 Annual Report: awaiting final Director approval for printing. Will also publish to the NRAO web site via a well-designed flash application. **Seattle AAS meeting special events (9-13 January, 2900 attendees):** NRAO Town Hall: 290 attendees, reception & 3 speakers (Lo, Brogan [ALMA], R.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. **Plone content management system implementation:** Plone training was conducted across the Observatory March-April 2010. The bulk import of the NRAO science web site into Plone will occur in late April, and Plone will be live in May. **AAAS Annual Meeting:** Organized and chaired a 90-minute science symposium featuring VLBA science for the February 2011 Annual Meeting of the American Association for the Advancement of Science (AAAS) meeting in Washington DC. Speakers included M. Reid (CfA), J. Braatz (NRAO), and G. Bower (UC-Berkeley). The session drew significant media attention. **AAS Meeting (May 2011, Boston):** In addition to the exhibition, the principal NRAO events will be 2 ALMA Early Science Proposal Preparation workshops, which will be held Mon-Tue, 23-24 May, 3 hours each day. NAASC staff will lead the workshop. **2011 Users Committee:** A mid-year telecon was held with the Users Committee on 31 January. Users Committee meeting is scheduled for 11-12 May in Green Bank.

Slide 59

Observatory Support Services
- *Computing & Information Systems*

- ***Common Computing Environments (CCE)***
  - NAASC User Portal and Observing Tool went live for Early Science call
  - ALMA-Wide Helpdesk (hosted at NAASC) moved into production
  - Finalized Content Management System for Science Web transition
  - Successful initial evaluation of integration of CASA into Torque job Scheduler
- ***Networking and Telecommunications***
  - Gigabit routers/firewalls upgrade complete in Socorro and Charlottesville
  - Contract approved for AURA/AUI for shared Gigabit link to Chile for ALMA
- ***Security***
  - CIS/MIS validated HIPAA Risk Assessment audit findings

NRAO

David Halstead 59

NAASC User Portal and Observing Tool went live for Early Science call. ALMA-Wide Helpdesk (hosted at NAASC) moved into production. High availability server for ALMA-wide Observer supporting helpdesk and NAASC User Portal successfully went live March 30th. Finalized Content Management System for Science Web transition. Installation of Plone Content Management System and training material preparation complete. Cutover of Science.nrao.edu planned for Q3. Successful initial evaluation of integration of CASA into Torque job Scheduler. Initial Job Scheduler testing completed to enable batch queue management of user and parallel aware pipeline jobs for CASA completed successfully in Socorro.

Gigabit Perimeter router/firewalls installed for both CV and AOC bandwidth improved from 200Mbit/sec to ~700Mbit/sec: proceeding with implementation of archive synchronization for EVLA and ALMA to C'ville site. Contract between NRAO/NOAO signed for shared Gigabit link to Chile. Final acceptance pending Santiago Metropolitan Link and archive replication testing in Q3.

Migration of CV phone system to VoIP in Q4 at high risk due to funding constraints. MITIGATION: Rescale to available Q4 funds to support both phone systems at best effort, with plan for full replacement in FY12. Full implementation of Networx contract, a Q2 milestone, was completed. We have moved the data network from FTS2001 to Networx MPLS, as well as the long distance service, the 800 number phone cards and the voice/web conference services.

HIPAA audit identified physical access to HR space and server room to be a risk. Installation of swipe card door has been recommended. See Observatory Business Services for plan. No production impacting security incidents occurred this quarter.

Slide 60

Observatory Support Services
- Education & Public Outreach

- Public Website
  - Developing vision and content outline for new public site
  - Web programmer (D. Nagaraj) hired from ALMA construction
- External Press/Media Activity
  - Dwarf galaxy with the big black hole (http://www.nrao.edu/pr/2011/bhdwarf/); http://www.nrao.edu/pr/2011/ransomwarner/
  - Documentary filming in Chile at ALMA site is completed
  - NRAO received mention in 146 articles in U.S. publications
  - NRAO received mention in 80 articles in international publications from 25 countries
  - Numerous mentions of the Pulsar Search Collaboratory

NRAO

John Stoke 60

NRAO EPO staff from all centers, along with several guests, met in Charlottesville 24-26 January to brainstorm a vision and content outline for new public site. Web programmer (D. Nagaraj) hired from ALMA construction. Two press releases issued, one with a press conference, at January Seattle AAS. Additional regional releases on student pulsar discoveries received wide note. Dwarf galaxy with the big black hole (http://www.nrao.edu/pr/2011/bhdwarf/), with associated press conference featuring Amy Reines (UVa). NRAO's Scott Ransom wins Warner Prize(http://www.nrao.edu/pr/2011/ransomwarner/). AAAS Press session on VLBA generated good coverage, including Time magazine. Filming of astronomer interviews for ALMA HD broadcast documentary project conducted at AAS meeting. Filming in Chile at ALMA site, including 20+ trips to the high site and a day of helicopter aerials, conducted in March. General Dynamics underwrote half the cost of the aerials. Monthly guided tours and family activities begun at VLA in January. Visitation and gift shop sales tripled compared to previous years.

NRAO received mention in 146 articles in U.S. publications having a total audience in excess of 190 million persons. NRAO received mention in 80 articles in international publications from 25 countries. Multiple venues carried stories on the **pulsar search collaboratory** student discovery story, including television, educational organization communications, newspapers, science media, etc. For a full listing, contact NRAO EPO. Additional noteworthy media activities: Video footage of VLA antenna transporters provided to Discovery Channel for their "Monster Moves" series. A laptop commercial was filmed at the VLA, bringing in $10K to benefit the VLA Visitor Center. Produced VLBA Fact Sheet for AAAS Press event, worked with reporter on VLA article for El Paso Times, a couple of local articles placed on the new VLA "First Saturday" (of the month) tours, worked with reporter from New Hampshire on article about the VLBA, probably triggered by AAAS materials. Numerous image usage permission requests received and approved. Specialized VLA tour to faculty and staff of the U.S. Air Force Academy physics department given by press officer.

Slide 61

Observatory Support Services
- *Education & Public Outreach (continued)*

- Education Activity
  - Monthly guided tours and family activities begun at VLA in January
  - Numerous educational events, held in Green Bank, including conducting research with the 40-foot telescope
- Internet Media Activity & Media Production
  - NRAO Twitter followers now exceed 1,000
  - Facebook fans have topped 3,000
  - New (interim) VLBA portal page and VLBA tour flash interactive produced
  - Aerial photographs of ALMA site taken and posted to public gallery
  - New 2011 GBT tours pamphlet produced
  - New 2011 VLA First Saturday pamphlet designed for printing in summer
  - Produced interview videos of Scott Ransom to accompany Warner Prize press release

NRAO

John Stoke 61

Numerous overnight educational events, conducting research with the 40-foot telescope, held in Green Bank. Pulsar Search Collaboratory now has 230 students from 32 schools actively participating. Three new pulsars discovered by students during Q2. Confirmed and scheduled Chautauqua course on radio astronomy for teachers at the AOC, having gathered enough registrations to do it after a 2-year hiatus.

Green Bank **overnight educational event** participants:
• Boy Scout troops (on four occasions)
• Providence Day School (NC)
• Eden Christian School (PA)
• Broadway High School (VA)
• Linwood Holton Governor's School (VA)
• Penn State
• Fort Hill High School (MD)
• Central VA Governor's School
• Einstein Fellows
• Radford University

Students discovering pulsars via Pulsar Search Collaboratory
Alec Snider (VA), Casey Thompson (VA), Hannah Mabry (KY), David Dunkum (WV), Susan Chen(VA) , and Matt Moniot (VA)

VLBA Portal and Flash Tour pages:
http://www.nrao.edu/index.php/about/facilities/vlba | http://www.nrao.edu/VLBATour/

Slide 62

Observatory Support Services
- *Spectrum Management*

- Green Bank and National Radio Quiet Zone
  - During 2010 the Quiet Zone processed 562 applications for transmitters at 1874 sites involving 1325 frequency assignments.
  - The Interference Protection Group was assimilated back into the Electronics Division to broaden participation in RFI mitigation
  - An internal discussion is underway about how to protect the site in the face of wider intrusion by cell phones and unlicensed devices and the national initiative to extend broadband to rural areas
- VLA and VLBA
  - Negotiations with KPNO over placement of new transmitters on the south side of the summit concluded with agreement to change some transmitter frequencies and details of installation. Plan is on hold pending evaluation of effects on optical instrumentation on summit.

NRAO

Harvey Liszt w/ input from Chandler/O'Neil/McKinnon 62

Green Bank:
State and Federal regulations regarding use of unlicensed radio communications devices in the vicinity of the GBT are unclear but certainly not strong enough to protect the GB site at all frequencies in the face of increasing use of unlicensed wireless devices and new initiatives for wireless broadband communications. The Interference Protection Group was reorganized in Q2FY11 aligning the various functions of the group with the parts of the observatory which they support. One of the graduate interns in Green Bank was extended through the end of FY11 to support this transition.

VLA and VLBA:
Southwestern sites are under somewhat less pressure following cancellation of the Secure Border Initiative (the electronic border fence) but some ongoing SBI construction will be completed. Development of wind turbine sites delayed during the fiscal crisis are resuming with consequent needs for transmission lines.

Slide 63

Observatory Support Services
- *Spectrum Management*

- General spectrum management
  - Finalized and submitted four FCC filings
  - Attended final preparatory meeting for 2012 World Radio Conference
  - In process of negotiating agreement with space agency operators of high-power orbiting earth- and cloud-sensing radars to provide timely information to radio astronomy
  - Initial contact with equipment manufacturer proposing FCC rules for full market deployment of high-power 77-81 GHz vehicular radars
  - Regions of the spectrum vacated by TV stations 52 – 69 (698 – 804 MHz) in the US will never again be this empty!

FCC filings concerned: rebanding of Q-band spectrum adjacent to the 43 GHz radio astronomy allocation; protection of astronomy allocation at 610 MHz in the face of possible new uses of TV broadcast spectrum; new experimental radio licenses possibly using protected bands; use of cognitive radio systems accessing spectrum opportunistically. Agenda items for WRC-12 include possible allocations adjacent to several protected radio astronomy bands. NRAO maintains a comprehensive White Paper discussing options for WRC-12 Agenda Items on behalf of IUCAF. The Space Frequency Coordination Group has tentatively agreed to aggregate and host information on their web site. Final negotiations between SFCG and IUCAF will probably take place in San Francisco in 2011 June . German car radar manufacturer Bosch is about to propose FCC rules that would allow widespread deployment of 77-81 GHz radar, with protections for radio astronomy TBD.