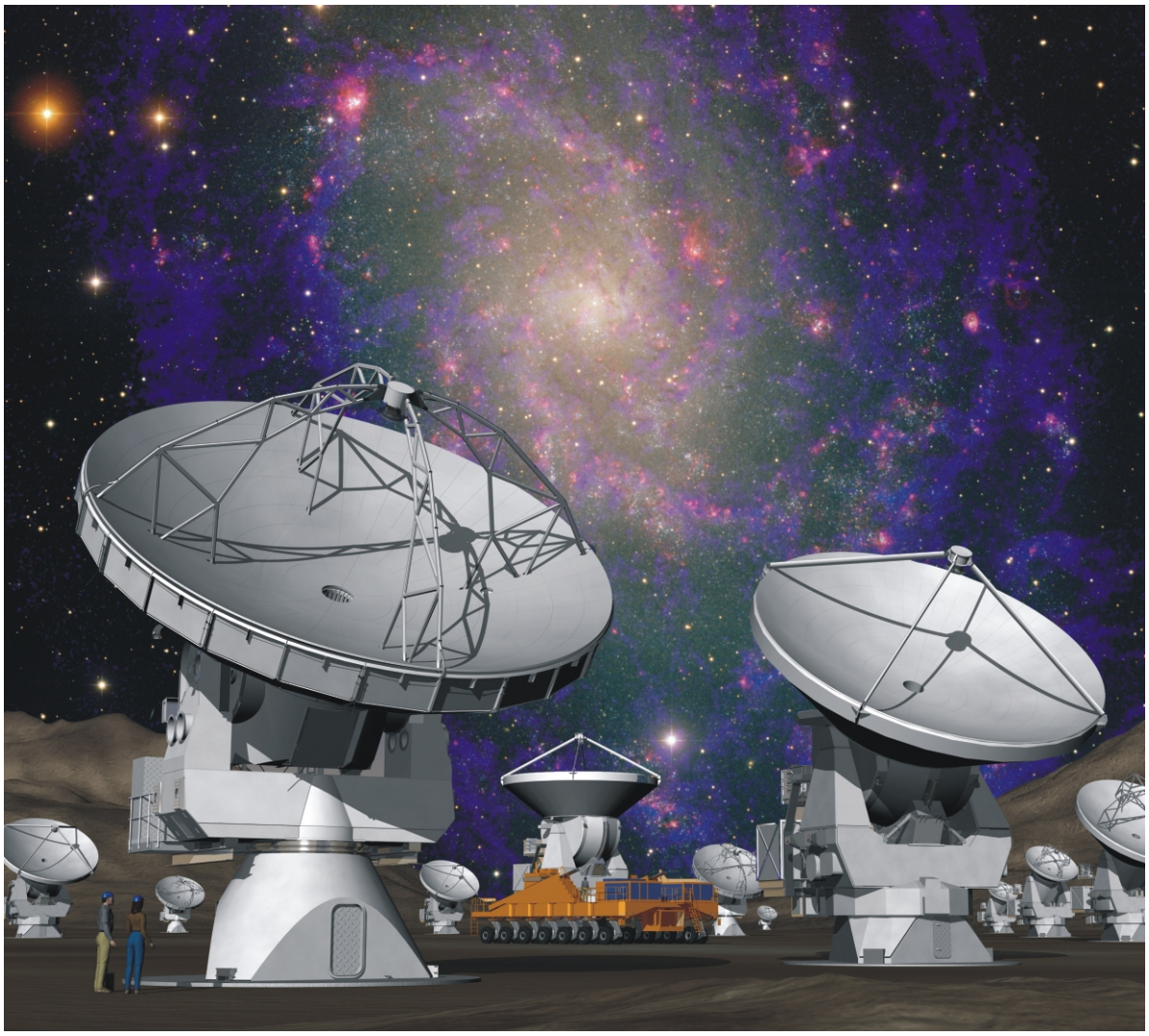
National Radio Astronomy Observatory



Quarterly Report

July – September 2006

NATIONAL RADIO ASTRONOMY OBSERVATORY

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Cover Image: The nearby spiral galaxy M33 is shown in visible light and the 21 cm line of neutral hydrogen as imaged by the VLA (violet) behind a computer image representing the completed ALMA.

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EXECUTIVE SUMMARY

Science and Academic Affairs

During the third quarter, the Scientific and Academic Affairs (SAA) division hosted the internal meeting "Future Directions for NRAO in cm/m Astronomy" and helped to organize the "Chicago II" meeting. The large-proposal policy was extensively revised and a funding policy to support large proposals was developed. The very successful GBT student support program was expanded to cover all NRAO telescopes.

The transfer of scientific staff to functional support areas was completed. Two Jansky appointments ended, and two new appointments (Dan Marrone and Wei-Hao Wang) began. Two scientists in Charlottesville (Barry Turner and Qi Feng Yin) retired.

The SAA division is presently developing a staffing plan that analyzes staff demographics, functional and research roles of the staff, and optional staffing level.

The 2006 NRAO summer-student research assistantships program ended with 23 students completing their appointments: 6 at Green Bank, 7 at Charlottesville, and 10 at Socorro. Twelve travel grants for 2006 REU students to attend the AAS meeting were issued. The recruitment process for the 2007 program was initiated.

Expanded Very Large Array (EVLA)

As of September 30, a total of seven antennas were in various stages of retrofit to the EVLA design. Five of these antennas are used routinely for astronomical observations, one antenna is undergoing tests, and the mechanical outfitting of another antenna was recently completed. A revised funding profile for the project was clarified and agreed upon with the NSF. Cryogenic cooling problems with the new L-band, wideband orthomode transducer (OMT) have been resolved. The mechanical design of the Ka-band receiver is nearing completion. A prototype of the 3-bit, 4Gsps sampler has been fabricated, and performance tests are underway. The problem with dropouts in fringe amplitude caused by the L302 frequency synthesizer has been solved, but other subtle problems persist. Delivery problems with the WIDAR correlator baseline boards appear to be resolved. A significant milestone was achieved for the EVLA monitor-and-control (M&C) transition system with the installation of a new controller that allows the transition system to control the VLA correlator. Internal testing of the Observation Preparation Tool by NRAO scientific staff has begun. Hardware was purchased to support the ESO/ALMA Next-Generation Archive System (NGAS) to evaluate how this data-archive storage and access system might be used with the EVLA.

New Initiatives

The SKA site selection has been narrowed to sites in Western Australia and in South Africa. Work continues to define the SKA system and to evaluate the competing technologies with a goal of an independent engineering review in early 2008. Discussions continue within the NRAO and with the community to define NRAO's role in the U.S. SKA Technology Development Program. First observations with the Long Wavelength Demonstrator Array were made in October. The Japanese VSOP-2 space VLBI mission has now been approved for a 2011 or 2012 launch.

Green Bank Operations

The third quarter of 2006 saw progress on lab work on four high-frequency instruments—the Q-band (40–49 GHz) receiver, the Ka-band (26–40 GHz) receiver, and completion of the lab testing for the Penn Array, and the Zpectrometer. Penn Array commissioning also began during this quarter, while commissioning of the other three instruments will take place in the final quarter of 2006. Additionally, all plans and schedules for the GBT track work were completed in this quarter, with the construction of the new base and wear plates beginning in Q4.

In September the GBT Future Instrumentation Workshop was held, whose purpose was to ask the scientific community to revisit GBT development priorities in light of recent scientific, technical, and software/data-handling advances, and to plan a second generation of GBT instrumentation that would include wide-field imaging arrays. The results from the workshop are being compiled and will be available in Q4.

The FY 2007 Project Plan and Budget were completed during this quarter. Additionally the first NRAO-wide software conference to be held in many years was organized by the Green Bank staff and held in August in Socorro.

New Mexico Operations

A final plan was developed for upgrading the VLA–AOC link from 3 Mbit/s to 155 Mbit/s. Hardware procurements were issued, and the order for the higher-bandwidth link was placed with the local phone company. A Mark 5 VLBI recording system was installed at the VLA, replacing the old tape drive.

Scheduled maintenance visits were made to the Mauna Kea and Hancock VLBA antennas. At Mauna Kea, one of the azimuth wheel assemblies was found to be damaged beyond repair. A spare wheel was shipped from Socorro, and the site visit was extended to replace the assembly. Along with the new Mark 5 recording system at the VLA, three more Mark 5 playback units were procured. This brought the total number of Mark 5 playback drives on the VLBA correlator to 14, enabling the VLBI High Sensitivity Array to be operated entirely on Mark 5 systems and the decommissioning of the last instrumentation tape drives at VLBA stations.

North American ALMA Science Center (NAASC)

Work concentrated this quarter on completing the NAASC NSF proposal and the global ALMA operations plan. These documents are due at the NSF and the ALMA Board, respectively, on October 31, 2006. The North American ALMA Regional Center (ARC) Manager worked with the JAO on modifications to the ALMA Operations Plan to include the ALMA Compact Array, the rebaselined project, and other issues. A series of face-to-face meetings were held involving the Operations working group, including the ARC managers, as well as numerous telecons. Submission of the plan to the Board and presentation of the plan at the November 2006 Board meeting are the primary milestones for the next quarter.

The NAASC operations plan went through two major reviews, one by the ANASAC in September and a second by an internal NRAO committee plus Canadian representatives in October. The plan was then reviewed by the NRAO Director's Office and AUI. The primary milestone in the next quarter is

submission of the proposal to the NSF. Longer-term major milestones (spring 2007) will be participation in the NSF and ALMA Board external review of the ALMA operations and NAASC plans.

ALMA Operations planning was also presented at the AUI management review in October. Planning for the next NAASC workshop "Transformational Science with ALMA: Through Disks to Stars and Planets" is proceeding; this workshop is scheduled for June 2007. Two articles were submitted for the October NRAO Newsletter. A series of lectures on ALMA at universities is being planned for spring 2007.

Central Development Laboratory (CDL)

Research continues on noise properties of Heterostructure Bipolar Transistors (HBTs). This effort may lead to the development of low-noise amplifier chains with much smaller $1/f$ gain fluctuations than those currently available, resulting in much improved broadband radiometers. Good progress was made in the designs of 18–26 GHz and 26–40 GHz low-noise amplifiers for the new EVLA receivers. A total of 22 amplifiers were built or upgraded for the EVLA and GBT. The design for a new GaAs power amplifier for ALMA Band 3 (up to 108 GHz) has been completed and is in fabrication. The effort to develop advanced NbTiN/insulator/Nb tunnel junctions for frequencies above 700 GHz continues at the University of Virginia Microfabrication Laboratory, but the subsequent work on NbTiN SIS mixer development will be delayed by the withdrawal of funds promised by the University of Arizona for this work. The design of a 211–275 GHz balanced sideband-separating SIS mixer with a superconducting hybrid was completed. The design of the W-band (84–106 GHz) phase shifter has been completed, and the fabrication of a prototype scaled to K-band (18–26 GHz) is in progress.

A major upgrade to the Green Bank Solar Radio Burst Spectrometer is underway with completion expected in early November. FASR system engineering is on hold pending the outcome of an overall project restructuring effort. Work on the Precision Array to Probe the Epoch of Reionization (PAPER) to measure the predicted step in the cosmic background amplitude from neutral hydrogen at the Epoch of Reionization is in progress. An eight-element array is currently operational at the Green Bank Galford Meadow site. Initial deployment in Western Australia has been rescheduled for April 2007 to take advantage of several evolutionary instrument improvements planned for the next several months.

Chile

Following the decision that AUI/NRAO will act as the sole employer of Chilean Local Staff for ALMA on behalf of the international collaboration, the Head of HR for ALMA, Mr. Alvaro Leiva, was hired and started his work at El Golf on July 19. A basic set of HR-related documents was approved by ALMA and subsequently was approval by the NSF.

Business support for ALMA construction in Chile continues, with a number of work packages completed or under completion, including the Array Operations Site (AOS) Technical Building (TB) Foundation and Shell Packages, the ALMA Recreation Room at the Operations Support Facility (OSF), the grading of the Antenna Vendor erection facilities areas, and construction of their underground utilities. Support for other packages has been started, such as the Completion Package for the AOS TB.

End to End (e2e) Operations

In Q2 2006 End-to-End Operations was established, including identifying roles and responsibilities, identifying startup funding, building channels of communication, and determining strategies for action in the Division's initial year. The focal activities initiated in Q2 that will continue throughout FY 2007 center around establishing an active presence within the emerging National Virtual Observatory (NVO) facility. This includes ensuring that science products are available for most of the existing archived data from NRAO telescopes, making the archived data easier to access and making more extensive use of NVO protocols and services.

The key accomplishments in Q3 2006 were; a) the expansion of the VLA automated data-processing pipeline to all configurations and most frequencies, expanding the coverage of the VLA archive from 25% to 75%, b) the generation of 20 GBytes of VLA images and supporting calibrated data, and c) the establishment of a coordination process whereby software development groups from across the Observatory will synchronize their efforts to eliminate waste and rework in software development.

The proposal submission tool will transition to e2e Operations after the February 2007 proposal deadline.

Computer and Information Services (CIS)

In response to some widely publicized events where personal data was lost or stolen, the security committee has produced the first draft of a data security policy for the NRAO. To ensure that our traffic is properly encrypted, we have deployed secure certificates on our web and mail services. The present data link between the AOC and the VLA site is inadequate to support EVLA development. An upgraded link will be installed in the next quarter. The link between NRAO Charlottesville and the UVa has limited the bandwidth available to transmit GBT data to the community. We now have an agreement to upgrade this link in stages. There were no formal security incidents during this quarter.

Education and Public Outreach (EPO)

An inaugural and productive ALMA EPO Working Group meeting was organized at the Prague IAU General Assembly in August, with representation from the three Executives, the JAO, and the Executives' representatives in Chile. EPO also staffed and managed the NRAO exhibit and assisted with the ALMA exhibit at the IAU. The newly formed ALMA EPO Working Group met twice per month via teleconference after the IAU and will meet face-to-face once per year. The next face-to-face meeting will be in Madrid, Spain in November. A new ALMA brochure is being prepared for distribution at the ALMA Board and science meetings in November. An ALMA EPO Program Plan and Policies & Procedures documents are in preparation for the JAO and Chilean ALMA EPO. Two new NRAO WWW support positions have been defined and approved for hire: an Observatory-wide Webmaster and an EPO Content Specialist. Advertisements for both positions were placed in late September, and selection committees were formed. The design and development of a new Observatory-wide NRAO brochure for the general public made significant progress, and the brochure should be available at the Charlottesville Open House in early November. Six press releases describing a wide range of science accomplished at NRAO facilities were written and distributed (3 VLA, 1 VLBA, 1 GBT, and 1 other). The NRAO conducted a dozen major education programs in Green Bank and Socorro for university faculty, K-12 teachers, students of all ages, and amateur astronomers.

SCIENCE HIGHLIGHTS

Very Large Array

X-Ray Flashes May Represent a New Class of Cosmic Explosions - An X-Ray Flash (XRF) detected by the Swift satellite on 18 February 2006 was subsequently studied with the VLA. The radio observations revealed that the ejecta from this blast are quasi-spherical, as opposed to the beamed ejecta common to Gamma-Ray Bursts (GRBs). This, along with data from other wavelengths, suggests that XRFs represent a type of burst roughly 100 times less energetic than GRBs but up to ten times more common. The observers speculate that a magnetar central engine may distinguish the subenergetic events from cosmological GRBs, which are thought to be powered by black holes.

Investigators: A.M. Soderberg, S.R. Kulkarni. E. Nakar, E. Berger, P.B. Cameron, A. Gal-Yam, R. Sari, M. Kasiwal, E. Ofek, A. Rau, B. Cenko, E. Persson and D-S Moon (Caltech), D.A. Frail (NRAO); D. Fox and D. Burrows (Penn State); R. Chevalier (UVa); T. Piran (Hebrew University); P. Price (Hawaii); B. Schmidt (Mount Stromlo) G. Pooley (Mullard); B. Penprase (Pomona College); and Neil Gehrels (Goddard).

Very Long Baseline Array

VLBA Reveals the Earliest Structure Resolved in a Nova Explosion - VLBA observations of the recurrent nova RS Ophiuchi following its 12 February 2006 outburst revealed the earliest spatially resolved structure in any nova (or indeed supernova) explosion. The observations clearly showed that, contrary to earlier assumptions of spherical explosion symmetry, the ejection is jet-like, collimated by the central binary whose orientation on the sky can be determined. The observers believe the lessons learned from this object can also be applied to supernova explosions.

Investigators: T.J. Obrien, T.W.B. Muxlow, R.J. Beswick, S.T. Garrington, and R.J. Davis (Jodrell Bank); M.F. Bode (Liverpool John Moores University); R.W. Porcas (MPIfR, Bonn); S.P.S. Eyres (U. Central Lancashire); and A. Evans (Keele University).

Green Bank Telescope

Discovery of Water Maser Emission in Five AGN and a Possible Correlation Between Water Maser and Nuclear 2-10 keV Luminosities - The authors discovered water maser emission in five active galactic nuclei (AGN) with GBT. Positions of the newly discovered masers, measured with the VLA, are consistent with the optical positions of the host nuclei to within 1σ (0.3" radio and 1.3" optical) and most likely mark the locations of the embedded central engines. The spectra of three sources, 2MASX J08362280+3327383, NGC 6264, and UGC 09618 NED02, display the characteristic spectral signature of emission from an edge-on accretion disk with maximum orbital velocities of about 700, 800, and 1300 km s^{-1}, respectively. The authors also showed a GBT spectrum of the previously known source MRK 0034 and interpreted the narrow Doppler components reported as indirect evidence that the emission originates in an edge-on accretion disk with orbital velocity of about 500 km s^{-1}. The authors obtained a detection rate of 12% (5 out of 41) among Seyfert 2 and LINER systems having $10000 < v_{sys} < 15000$ km s^{-1}. For the 30 nuclear water masers with available hard X-ray data, they reported a possible relationship

between unabsorbed X-ray luminosity (in the 2–10 keV band) and total isotropic water-maser luminosity, $L_{2\text{-}10}$ proportional to $L_{H2O}^{0.5\pm0.1}$, consistent with the model proposed by Neufeld and Maloney in which X-ray irradiation and heating of molecular accretion disk gas by the central engine excites the maser emission.

Investigators: P.T. Kondratko, L.J. Greenhill, J.M. Moran (Harvard-Smithsonian CfA).

SCIENCE AND ACADEMIC AFFAIRS

Science and Academic Affairs (SAA) is responsible for supporting the scientific community both inside and outside the NRAO. External activities include managing the diverse student and visitor programs, scientific meetings, and the Jansky Fellowship Program, and maintaining the integrity of the telescope proposal process. Internal activities include the annual Performance Evaluation Process (PEP), tenure recommendations and promotions for the scientific staff, supervising library services and the colloquium series, and leading the Observatory Science Council (OSC).

The Assistant Director for Science and Academic Affairs is presently developing a comprehensive staffing plan. This plan will analyze staff demographics, the research and functional roles of the staff, an optimal staffing level, and will develop long term staffing projections and succession planning. A preliminary version of the study will be available in 2007 Q1.

Science Community Development focuses on those activities that provide services to the wider astronomical community outside the NRAO, with the goal of fostering a strong U.S. radio-astronomy community. The many activities include research programs to employ undergraduates (NSF REU program and engineering co-op students), graduate students (Junior Fellows), and postdocs (Jansky Fellows, NRAO Postdoctoral Fellows, and Research Associates). The SAA also manages the peer-review process for the allocation of telescope time for all current NRAO telescopes. As part of this process, funding is provided for travel to the telescope, student research support, as well as computing and page charge support. In addition to these activities, a healthy and active U.S. radio community is supported though funding University-led hardware and software projects, NRAO staff community service, and organizing science meetings.

The second major activity coordinated by SAA is the support of Science Research at the NRAO. In order to provide the science planning and functional support to on-going NRAO facilities it is necessary to have a vibrant world-class research staff. The hiring of scientific staff, their assignment to functional roles within the Observatory, and the evaluation and career tracking processes are all coordinated by the SAA. Close links among NRAO staff and the University community are encouraged through visitor programs to the NRAO, short-term University sabbatical visits of NRAO staff, and the exchange of staff for scientific colloquia.

During the third quarter, the SAA hosted the internal meeting "Future Directions for NRAO in cm/m Astronomy" and helped to organize the "Chicago II" meeting. The large-proposal policy was extensively revised and a funding policy to support large proposals was developed. The very successful GBT student support program was expanded to cover all NRAO telescopes.

The transfer of scientific staff to functional support areas was completed. Two Jansky appointments ended, and two new appointments (Dan Marrone and Wei-Hao Wang) began. Two scientists in Charlottesville (Barry Turner and Qi Feng Yin) retired.

David Sevilla (University of Texas, El Paso) completed a three-month graduate internship working with Walter Brisken at the Array Operations Center on radio frequency interference and other unwanted features in the EVLA spectrum. Andrew Michael (Rochester Institute of Technology) began working as a pre-doctoral Junior Fellow with Steven Myers at the Array Operations Center for a two-year term. Mr. Michael's Ph.D. thesis will be on multi-scale deconvolution and image reconstruction, co-supervised by Prof. Stefi Baum of the Center for Imaging Science at Rochester Institute of Technology. Esteban Araya

(New Mexico Tech) began working as a pre-doctoral Junior Fellow with Miller Goss at the Array Operations Center. Mr. Araya's Ph.D. thesis will be on formaldehyde maser emission in the Galaxy, co-supervised by Prof. Peter Hofner at New Mexico Tech. Diana Grijalva (New Mexico Tech) completed a semester working as a co-op student with Travis Newton at the Array Operations Center. Ronald DuPlain (University of Cincinnati) completed his term as a co-op student with Nicole Radziwill (Green Bank and Charlottesville). Tanner Oakes (New Mexico Tech) began his second rotation as a co-op student under the supervision of Dan Merteley at the Array Operations Center. Scientific visitors supported by SAA were Drs. Greg Taylor (UNM) and Patrick Palmer (University of Chicago) at the Array Operations Center, and Drs. Anton Zensus (MPIfR), Gerrit Verschuur (Memphis), Matthias Kadler (NASA-GSFC) and Steven Bloom (HSC) in Charlottesville.

Other pre-doctoral students supported by SAA during this period were: Kathryn Devine (University of Wisconsin) working on infrared dark clouds and high mass star formation with Claire Chandler at the Array Operations Center and co-supervised by Prof. Ed Churchwell at the University of Wisconsin; Yurii Pidopryhora (Ohio University) working on HI halo clouds with Jay Lockman at Green Bank and co-supervised by Prof. Joe Shields (Ohio University); Chatalli Parashare (University of Virginia) working on instrumentation for low frequency radio astronomy arrays with Richard Bradley at NRAO Technology Center; Alok Singhal (University of Virginia) working on connections between internal galaxy kinematics, HI line widths, and the cosmic distance scale with Rick Fisher in Charlottesville and co-supervised by Prof. Ed Murphy (University of Virginia) and Karen O'Neil (NRAO Green Bank);

The 2006 NRAO summer-student research assistantships program ended with 23 students completing their appointments: 6 at Green Bank, 7 at Charlottesville, and 10 at Socorro. Twelve travel grants for 2006 REU students to attend the AAS meeting were issued. The recruitment process for the 2007 program was initiated.

TELESCOPE USAGE

The NRAO telescopes were scheduled for research and maintenance during the third quarter of 2006 as described in the table below. Time lost and actual observing for the arrays are computed as fractions of the total antenna arrays. For example, losing 27 VLA antennas for one hour counts as 1.0 hours of array time lost, while losing one out of ten VLBA antennas for one hour counts as 0.1 hours of array time lost.

Beginning in 2005, antennas being modified for the EVLA are counted as lost for observing.

Telescope Usage (hours)			
Activity	**VLA**	**VLBA**	**GBT**
Scheduled Observing	1655.48	943.1	1588.0
Scheduled Maintenance and Equipment Changes	201.50	239.8	425.0
Scheduled Tests and Calibration	351.02	251.9	195.0
Time Lost	484.57	40.2	48.0
Actual Observing	1170.91	902.9	1540.0

GBT OBSERVING PROGRMAS

The following research programs were conducted with the GBT during this quarter.

No	Observer(s)	Programs	Hours Allotted
BF088	Fish, V.L. (NRAO)	Multifrequency hydroxyl maser observations of G11.90 0.14. 2 cm	5
BK127	Knudsen, K.K. (MPIA) Walter, F. (MPIA) Momjian, E. (Arecibo) Carilli, C. L. (NRAO) Yun, M. (Massachusetts)	Resolving the AGN and the starburst in an intensely starforming quasar. 21 cm	8
BU031	Ulvestad, J. (NRAO) Neff, S. G. (NASA/GSFC)	A search for young supernovae in the antennae galaxies. 11 cm	27
GBT02A-053	Heiles, C. E. (UC, Berkeley) Roshi, A.D. (Raman I) Robishaw, T. (UC, Berkeley) Fisher, R. (NRAO)	Magnetic fields in photodissociation regions from Zeeman splitting of carbon recombination lines. 6 cm, 11 cm, 21 cm	67
GBT02A-054	Stairs, I. (UBC) Lyne, A. G. (JBO) Kramer, M. (JBO) Athanasiadis, D. (NRAL)	High-resolution studies of a precessing pulsar. 21 cm	6
GBT04C-031	Kondratko, P.T. (CfA) Greenhill, L. J. (CfA) Moran, J. M. (CfA) Lovell, J.E.J. (CSIRO) Kuiper, T. B. H. (JPL) Jauncey, D. L. (CSIRO)	Monitoring of five NGC4258-like water megamasers discovered with the GBT and the DSN. 1.3 cm	13
GBT05B-011	Minter, A. (NRAO)	Using pulsar HI absorption to determine the distance to the local spiral arm in the second quadrant of the galaxy. 21 cm	12
GBT05B-018	Kanekar, N. (NRAO) Chengalur, J. (TIFR) Ellison, S.E. (Victoria)	Do the fundamental constants change with time? 70 cm	3

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT05B-034	Stairs, I. (UBC) Camilo, F. (Columbia) Kramer, M. (JBO) Faulkner, A. (JBO) McLaughlin, M. (WVU) Lyne, A. G. (JBO) Hobbs, G. (ATNF) Manchester, D.R. N. (ATNF) Possenti, A. (INAF, Italy) D'Amico, N. (INAF, Italy) Burgay, M. (INAF, Italy) Ferdman, R. (UBC) Ramachandran, R. (UC, Berkeley) Backer, D. C. (UC, Berkeley) Demorest, P. (UC, Berkeley) Nice, D. (Princeton)	Timing Binary and Millisecond Pulsars from the Parkes Multibeam Survey. 21 cm	2
GBT05B-042	Kramer, M. (JBO) Stairs, I. (UBC) Camilo, F. (Columbia) McLaughlin, M. (WVU) Lyne, A. G. (JBO) Manchester, D.R. N. (ATNF) Possenti, A. (INAF, Italy) D'Amico, N. (INAF, Italy) Burgay, M. (INAF, Italy) Freire, P. (Arecibo) Joshi, B. (TIFR) Ferdman, R. (UBC)	Timing and General Relativity in the Double Pulsar System. 21 cm, 38 cm	7
GBT05C-001	Campbell, B. (Smithsonian I) Campbell, D. B. (Cornell) Carter, L. (Smithsonian I)	Radar Mapping of the Moon at 70-cm Wavelength Using Arecibo and the GBT. 70 cm	6
GBT05C-023	Camilo, F. (Columbia) Ransom, S. (NRAO) Gaensler, B.M. (CfA) Slane, P.O. (CfA) Lorimer, D. (WVU) Manchester, D.R. N. (ATNF)	PSR J1833-1034, the Very Young Pulsar in the SNR G21.5-0.9. 38 cm	2
GBT05C-037	Kanekar, N. (NRAO) Carilli, C. L. (NRAO) Langston, G. I. (NRAO) Stocke, J. T. (Colorado) Menten, K. M. (MPIfR) Rocha, G. (Cambridge)	Measuring changes in fundamental constants with redshifted OH lines.	63

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT05C-042	Ransom, S. (NRAO) Freire, P. (Arecibo) Hessels, J. W. T. (Amsterdam) Begin, S. (UBC) Stairs, I. (UBC) Camilo, F. (Columbia) Kaspi, V. (McGill)	Timing the Binary and Millisecond Pulsars in NGC6440 and NGC6441. 11 cm	31
GBT05C-046	Stairs, I. (UBC) Lorimer, D. (WVU)	Timing of a Relativistic Binary and other Pulsars from the Arecibo PALFA Survey. 21 cm	13
GBT05C-057	Jorgenson, R. (UC, San Diego) Wolfe, A. M. (UC, San Diego) Prochaska, J. (UC, Santa Cruz) Darling, J. (Colorado)	Search for 21cm Absorption toward Radio Loud, Extremely Optically Faint Sources. 90 cm	11
GBT05C-065	Braatz, J. A. (NRAO) Gugliucci, N. (UVA)	Measuring the Extragalactic Distance Scale: A Target of Opportunity. 2 cm	1
GBT06A-004	Reach, W. T. (IPAC) Palla, F. (OAA, Italy) Riccardo, V. (OAA, Italy) Morris, P. (IPAC)	Water Masers from Protostars in IC 1396A. 1.3 cm	7
GBT06A-013	Braatz, J. A. (NRAO) Lo, F.K. Y. (NRAO)	Finding Signatures of a Maser Disk in a Quasar at z = 0.66. 2 cm	3
GBT06A-014	Tarchi, A. (INAF, Italy) Henkel, C. (MPIfR) Brunthaler, A. (MPIfR) Braatz, J. A. (NRAO)	H2O vs Continuum in the Megamaser 3C403: Reverberation Mapping of the Nucleus. 1.3 cm	3
GBT06A-030	Campbell, D. B. (Cornell) Campbell, B. (Smithsonian I) Carter, L. (Smithsonian I) Ghent, R. (Smithsonian I) Margot, J.L. (Cornell) Stacy, N. (DSTO)	Lunar surface studies via S-Band radar imagery and interferometry. 11 cm	8
GBT06A-040	McKinnon, M. (NRAO)	Spectroscopy of Bright, Northern Pulsars at 1.67 and 22.2 GHz. 21 cm	15
GBT06A-046	Langston, G. I. (NRAO) Turner, B. (NRAO)	A search for the Largest Interstellar Molecule, $HC^{13}N$. 2 cm	75
GBT06A-053	Ransom, S. (NRAO) Hessels, J. W. T. (Amsterdam) Stairs, I. (UBC) Freire, P. (Arecibo) Kaspi, V. (McGill) Camilo, F. (Columbia)	Continued Timing of the Binary and Millisecond Pulsars in Terzan 5. 11 cm	8

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT06A-054	Demorest, P. (UC, Berkeley) Backer, D. C. (UC, Berkeley) Ferdman, R. (UBC) Stairs, I. (UBC) Nice, D. (Princeton) Jacoby, B.A. (NRL) Bailes, M. (Swiburne) Ord, S. (Sydney)	Long-term Precision Timing of Millisecond Pulsars. 21 cm	45
GBT06A-068	Shirley, Y.L. (Arizona) Myers, P. C. (CfA)	The Kinematical and Chemical Structure of Pre-protostellar Cores. 1.3 cm	6
GBT06A-070	Camilo, F. (Columbia) Ransom, S. (NRAO) Halpern, J. P. (Columbia) Helfand, D. J. (Columbia)	A new radio transient. 3.5 cm, 2 cm, 6 cm, 11 cm, 38 cm	17
GBT06A-071	Camilo, F. (Columbia) Minter, A. (NRAO) Ransom, S. (NRAO) Zimmerman, N. (Columbia) Helfand, D. J. (Columbia) Halpern, J. P. (Columbia) Reynolds, J. E. (ATNF)	Constraining the distance to the magnetar XTE J1810-197 via HI absorption. 21 cm	31
GBT06A-072	Kaspi, V. (McGill) Champion, (McGill) Hessels, J. W. T. (Amsterdam)	ToO GBT Observations of AXP 4U 0142+61. 11 cm	9
GBT06B-003	McKinnon, M. (NRAO)	A Search for Pulsed Maser Emission in PSR-SNR Associations at 1720 MHz. 21 cm	18
GBT06B-006	Gottlieb, C. A. (CfA) Bruenken, S. (CfA) McCarthy, M. (CfA) Gupta, H. (CfA) Thaddeus, P. (CfA)	Search for Four C_5H_2 Carbene Molecules in Space. 2 cm, 3.5 cm	35
GBT06B-009	Helmboldt, J. (UNM)	The Efficiency of the Star Formation Episodes That Lead to K+A Galaxies. 21 cm	40
GBT06B-011	Champion, (McGill) McLaughlin, M. (WVU) Lorimer, D. (WVU)	High precision timing a double neutron star system. 90 cm	12
GBT06B-012	Magnani, L. (Georgia) Douglas, K.A. (Calgary) Wennerstrom, E. (Georgia) Chastain, (Georgia) Onello, J. (SUNY, Cortland)	OH Observations of the Envelope of MBM 40. 21 cm	30

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT06B-013	Foster, (NRC, Canada) Kerton, C.R. (Iowa State) Arvidsson, (Iowa State)	CTB 102: The Largest HII Region in the Galaxy? 6 cm	33
GBT06B-014	Freire, P. (Arecibo) Ransom, S. (NRAO) Gupta, Y. (NCRA)	Continued timing of the eccentric binary system in the globular cluster NGC 1851. 90 cm	14
GBT06B-015	Morgan, L. (NRAO) Urquhart, J. (Leeds) Thompson, M. (Hertfordshire)	NH_3 and CCS Mapping of Triggered Star Formation Regions. 1.3 cm	13
GBT06B-016	Bruenken, S. (CfA) Brown, R. (Monash) Godfrey, P.D. (Monash) Thaddeus, P. (CfA)	A Search for the Nucleobase Uracil towards Sagittarius B2. 2 cm	17
GBT06B-018	Kramer, M. (JBO) Stairs, I. (UBC) McLaughlin, M. (WVU) Ferdman, R. (UBC) Camilo, F. (Columbia) Lyne, A. G. (JBO) Manchester, D.R. N. (ATNF) Possenti, A. (INAF, Italy) D'Amico, N. (INAF, Italy) Burgay, M. (INAF, Italy) Freire, P. (Arecibo)	Timing and General Relativity in the Double Pulsar System. 90 cm	14
GBT06B-019	Minter, A. (NRAO)	Obtaining A Complete Sample Of Pulsar OH Absorption With The GBT 21 cm	63

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT06B-020	O'Neil, K. (NRAO) Davies, J. (Cardiff) Auld, R. (Cardiff) Martin, B. (ESO) Boselli, A. (MPO, France) Bothun, G. D. (Oregon) Brosch, N. (WO, Israel) Brinks, E. (Hertfordshire) Cantinells, (NAIC) Disney, M. J. (Cardiff) de Blok, E. (Cardiff) Gavazzi, G. (Milano) Giovanelli, R. (Cornell) Haynes, M. P. (Cornell) Henning, T. (UNM) Hoffman, G. L. (Lafayette College) Irwin, J. (Queens) Karachentsev, I.D. (SAO, Russia) Kilborn, V.A. (Swiburne) Koribalski, B. (ATNF) Linder, S.M. (Cardiff) Minchin, R.F. (NAIC) Momjian, E. (Arecibo) Putman, M. (Michigan) Rosenberg, J.L. (CfA) Sabatini, (OAR, Italy) Schneider, S. E. (Massachusetts) Spekkens, K. (Rutgers) van Driel, W. (Paris O, France)	HI in Galaxies and Environments. 21 cm	52
GBT06B-021	Masters, K. (CfA) Huchra, J. (CfA) Crook, A. (MIT) Macri, L. (NOAO) Jarrett, T.H. (IPAC)	Mapping Matter in the Nearby Universe with 2MASS. 21 cm	37
GBT06B-024	Mangum, J. G. (NRAO) Di Francesco, J. (NRC, Canada) Freed, K. (MSCD)	CCS Chronometry of Dense Cores. 1.3 cm	29
GBT06B-025	McLaughlin, M. (WVU) Lorimer, D. (WVU) Kramer, M. (JBO) Stairs, I. (UBC) Lyne, A. G. (JBO)	Low-frequency Observations of RRAT Sources. 90 cm	20

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT06B-026	Deneva, J. (Cornell) Cordes, J. M. (Cornell) Lazio, T. J. (NRL) Bhat, R. (Swiburne) Chatterjee, S. (Sydney) Ransom, S. (NRAO) Bower, G. C. (UC, Berkeley) Vlemmings, W. (JBO) Demorest, P. (UC, Berkeley) Backer, D. C. (UC, Berkeley)	Searching for Pulsars and Transient Sources in the Galactic Center. 3.5 cm	38
GBT06B-027	Bergin, E. A. (Michigan) Ragan, S. (Michigan)	Ammonia in Massive Pre-stellar Cores. 1.3 cm	54
GBT06B-028	Stairs, I. (UBC) Thorsett, S. (UC, Santa Cruz) Arzoumanian, Z. (NASA/GSFC)	Timing the Planet Pulsar in M4. 21 cm	2
GBT06B-030	Martin, P.G. (Toronto) Boothroyd, A. (Toronto) Viero, M. (Toronto) Miville-Deschenes, M. (IAS, France) Lockman, F. J. (NRAO)	Characterizing Dust Evolution in Intermediate Velocity Clouds. 21 cm	82
GBT06B-031	Muno, M. P. (UCLA) Ransom, S. (NRAO) Figer, D. (STScI)	Searching for Pulsars in Massive Young Star Clusters. 38 cm	8
GBT06B-032	Begin, S. (UBC) Freire, P. (Arecibo) Ransom, S. (NRAO) Stairs, I. (UBC) Hessels, J. W. T. (Amsterdam) Kaspi, V. (McGill) Camilo, F. (Columbia)	Timing of the Binary and Millisecond Pulsars in M28. 11 cm	12
GBT06B-033	Hessels, J. W. T. (Amsterdam) Ransom, S. (NRAO) Kaspi, V. (McGill) Champion, (McGill) Roberts, M. (Eureka Sci)	Completing a 350-MHz Survey of the Galactic Plane for Pulsars and Transients. 38 cm	118
GBT06B-034	van Gorkom, J. H. (Columbia) Carollo, C. (ETH Zurich) Lilly, S. J. (ETH Zurich) Norberg, P (Royal Obs)	Galaxy evolution in groups: HI properties of 80 2dfGRS-selected groups. 21 cm	36

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT06B-035	Kent, B. (Cornell) Giovanelli, R. (Cornell) Haynes, M. P. (Cornell) Lockman, F. J. (NRAO)	ALFALFA HI Clouds: Milky Way HVCs or Virgo Cluster Harassment Remnants? 21 cm	22
GBT06B-037	Weisberg, J. M. (Carleton Collge) Johnston, S. (ATNF) Koribalski, B. (ATNF) Minter, A. (NRAO) Stanimirovic, S. (Wisconsin)	Probing the Small-Scale Structure of Molecular Gas with Pulsar B1641-45. 21 cm	8
GBT06B-038	Crutcher, R. M. (Illinois) Churchwell, E. B. (Wisconsin) Troland, T. H. (Kentucky) Watson, D. (Wisconsin) Zweibel, E. (Wisconsin)	Magnetic Fields in GLIMPSE Dark Filaments. 21 cm	21
GBT06B-040	Kanekar, N. (NRAO) Frail, D. A. (NRAO) Macquart, J.P. (NRAO) van Straten, W. (Texas)	A Targeted High Frequency Search for Pulsars at the Galactic Center. 2 cm	10
GBT06B-042	Kanekar, N. (NRAO) Ellison, S.E. (Victoria) York, B (Victoria)	The nature of damped Lyman-alpha systems, as traced by their spin temperature. 70 cm	1
GBT06B-044	Ferdman, R. (UBC) Stairs, I. (UBC) Backer, D. C. (UC, Berkeley) Burgay, M. (INAF, Italy) Camilo, F. (Columbia) D'Amico, N. (INAF, Italy) Demorest, P. (UC, Berkeley) Faulkner, A. (JBO) Hobbs, G. (ATNF) Kramer, M. (JBO) Lorimer, D. (WVU) Lyne, A. G. (JBO) Manchester, D.R. N. (ATNF) McLaughlin, M. (WVU) Nice, D. (Princeton) Possenti, A. (INAF, Italy)	Timing Binary and Millisecond Pulsars from the Parkes Multibeam Survey. 21 cm	27
GBT06B-045	Hewitt, J. (Northwestern) Yusef-Zadeh, F. (Northwestern)	A Continued Search for Supernova Remnant Masers. 21 cm	5

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT06B-047	Schiminovich, D. (Columbia) Johnson, B. (Columbia) Basu-Zych, A. (Columbia) Hoopes, C. (Johns Hopkins) Heckman, T. M. (Johns Hopkins) Treyer, M. (Caltech)	HI Observations of Local analogs of Lyman Break Galaxies. 21 cm	40
GBT06B-049	Margot, J.L. (Cornell) Peale, S. (UC, Santa Barbara) Jurgens, R. (JPL) Slade, M. (JPL)	High-precision measurements of the spin of Mercury. 3.5 cm	4
GBT06B-050	Heroux, A.J. (NRAO) Martin, E. (NRAO) Minter, A. (NRAO) Thomas, (NRAO) Metha, K. (NRAO)	Green Bank REU Student GBT Exploratory Time. 21 cm, 1.3 cm	9
GBT06B-052	Yun, M. (Massachusetts) Tripp, T. (Massachusetts) York, D. (Chicago) Bowen, D. V. (Princeton)	21cm HI Absorption and Emission in a Nearby Galaxy. 21 cm	4
GBT06B-053	Yun, M. (Massachusetts) Borthakur, S. (Massachusetts) Verdes-Montenegro, L. (IAA)	Completing the GBT Survey of Cold Diffuse Intragroup Medium in HCGs. 21 cm	5
GBT06B-054	Darling, J. (Colorado) Hearty, (Colorado) Stocke, J. T. (Colorado)	HI Absorption in a Radio-Loud Spiral Galaxy. 21 cm	3
GBT06C-004	Remijan, A. (NRAO) McMahon, R. J. (Wisconsin) Widicus Weaver, S. (Illinois) McCall, B. (Illinois)	A Search for o-Benzyne (o-C_6H_4) and Phenyl (C_6H_5) toward CRL 618 2 cm	15
GBT06C-010	Schulte-Ladbeck, R. (Pittsburgh) Rosenberg, J.L. (CfA) Koenig, B. (Pittsburgh) Cherinka, B. (Pittsburgh)	The connection between galaxies and Damped Lyman Alpha systems. 21 cm	8
GBT06C-016	Camilo, F. (Columbia) Ransom, S. (NRAO) Halpern, J. P. (Columbia) Reynolds, J. E. (ATNF) Helfand, D. J. (Columbia)	Studying the magnetar XTE J1810-197. 11 cm	1
GBT06C-048	Kanekar, N. (NRAO) Ellison, S.E. (Victoria) Prochaska, J. (UC, Santa Cruz) York, B (Victoria)	HI 21cm absorption in strong MgII and CI absorbers in the redshift desert. 38 cm	23

4. GBT Observing Programs

No	Observer(s)	Programs	Hours Allotted
GBT06C-049	Masters, K. (CfA) Huchra, J. (CfA) Crook, A. (MIT) Macri, L. (NOAO) Jarrett, T.H. (IPAC)	Mapping Matter in the Nearby Universe with 2MASS. 21 cm	31
GBT06C-051	Greenhill, L. J. (CfA) Braatz, J. A. (NRAO) Henkel, C. (MPIfR) Kuiper, T. B. H. (JPL) Jauncey, D. L. (CSIRO) Lovell, J.E.J. (CSIRO) Madejski, G. M. (KIPAC) Moran, J. M. (CfA) Peck, A.B. (CfA) Wilson, A. S. (Maryland)	Monitoring 2 NGC4258-like Masers: Measurement of Distances / Constraint of LCDM. 1.3 cm	9
GBT06C-053	Zwaan, M.A. (ESO) Peroux, C. (ESO) Liske, J. (ESO) Murphy, M. T. (Cambridge) Zych, B. (Cambridge) Bouche, N. (MPIfEP) Curran, S. (UNSW)	A search for molecules in CaII absorbers.	11

VLA OBSERING PROGRAMS

The following research programs were conducted with the VLA during this quarter:

Note: "Hours observed" refers to effective hours with 27 antennas. All VLA programs during the quarter had fewer than 27 antennas because of EVLA retrofits. For example, a 27-hour program with 23 antennas observing successfully is counted as 23.0 hours of observing.

No.	Observer(s)	Programs	Hours Observed
AA301	Argo, M. (Manchester) Muxlow, T. (Manchester) Beswick, R. (Manchester) Pedlar, A. (Manchester) Wills, K. (Sheffield) Fenech, D. (Manchester)	Monitoring of radio SNe and SNR in nearby starbursts. 2, 3.6, 6 cm	6.90
AA307	Araya, E. (NMIMT) Hofner, P. (NMIMT) Goss, W.M. (NRAO) Kurtz, S.(MEXICO/UNAM) Linz, H. (MPIA) Olmi, L. (CNR)	Comprehensive study of H_2CO 6cm maser in G23.71-0.20:II. 2 cm	7.21
AB1190	Birzan, L. (Ohio State) McNamara, B. (Ohio State) Carilli, C. (NRAO) Rafferty, D. (Ohio State) Nulsen, P. (CfA) Wise, M. (MIT)	Radio source in clusters and a group with X-ray cavities. 3.6, 20, 90 cm	12.82
AB1205	Bietenholz, M.F. (York) Bartel, N. (York)	Newly identified plerion G21.5-0.9. 6 cm	1.84
AB1213	Bignall, H. (JIVE) Jauncey, D. (CSIRO) Kedziora-Chudczer, L. (CSIRO) Lovell, J. (CSIRO) Tzioumis, T. (CSIRO)	Coordinated VLA/ATCA monitoring of IDV quasar PKS 1257-326. 3.6, 6 cm	19.57
AB1218	Brunthaler, A. (MPIfR) Reid, M. (CfA) Henkel, C. (MPIfR) Menten, K. (MPIfR) Bower, G. (UC, Berkeley) Falcke, H. (ASTRON)	Measuring the orbits of M81 and M82. 1.3 cm	1.41
AB1223	Brown, A. (Colorado/JILA) Brown, J. (Caltech)	Simultaneous cm, mm, and X-ray observations of the active binary Sigma 2 CrB. 0.7, 1.3, 2, 3.6, 6, 20 cm	10.96

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AC818	Cheung, C.C. (Stanford) Landt, H. (CfA)	Structure of X-shaped FIRST sources. 3.6, 20 cm	20.52
AC819	Claussen, M. (NRAO) Bond, H. (STScI) Evans, A. (Keele) Gehrz, R. (Minnesota) Healy, K. (Arizona State) Rushton, M. (Keele) Starrfield, S. (Arizona State) Woodward, C. (Minnesota)	Monitoring the SiO masers in Monocerotis. 0.7, 1.3 cm	3.47
AC822	Cohen, A. (NRL) Clarke, T. (Virginia)	Ultra steep spectrum emission in galaxy cluster Abell 2443. 20, 90 cm	6.13
AC823	Carilli, C. (NRAO) Wang, R. (NRAO) Walter, F. (MPIA) Bertoldi, F. (MPIfR) Menten, K. (MPIfR) Fan, X. (Princeton) Jiang, L. (Arizona) Strauss, M. (Princeton) Cox, P. (IAP, Paris)	Optically fainter $z = 6.1$ SDSS QSOs. 20 cm	7.60
AC825	Chomiuk, L. (Wisconsin) Wilcots, E. (Wisconsin) Doane, N. (Wisconsin) Sanders, W. (Wisconsin) Zweibel, E. (Wisconsin)	Imaging X-ray super bubbles in nearby spiral galaxies. 20 cm	11.91
AC826	Curiel, S. (MEXICO/UNAM) Ho, P.T.P. (CfA) Patel, N. (CfA) Hiriart, D. (MEXICO/UNAM)	Imaging high-velocity SiO emission in YSO Cep A/HW2. 0.7 cm	7.58
AC827	Curiel, S. (MEXICO/UNAM) Girart, J. (Barcelona)	Structure of protostellar systems in L1448N IRS 3. 0.7, 1.3 cm	5.69
AC845	Clarke, T. (NRL) Schmitt, H. (NRL)	Exploring NGC507's Southern Tail. 90 cm	3.23
AC848	Carlin, J. (Virginia) Clarke, T. (NRL) Sarazin, C. (Virginia) Sivakoff, G. (Virginia)	Exploring radio outburst in NGC 533. 6 cm	3.23
AC849	Carlin, J. (Virginia) Sarazin, C. (Virginia) Sivakoff, G. (Virginia) Clarke, T. (NRL)	Exploring the outburst history of NGC 533. 20 cm	5.30

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AC850	Curiel, S. (MEXICO/UNAM)	New outburst by the classical T Tauri binary system XZ Tau? 0.7 cm	1.70
AC853	Creel, B. (UNM) Claussen, M. (NRAO) Pihlstrom, Y. (UNM)	OH and H_20 maser emission survey of young planetary nebulae. 1.3 cm	3.80
AD534	Darling, J. (Colorado) Baker, A. (Maryland)	Formaldehyde silhouettes of two EMGs against the CMB. 1.3, 3.6 cm	20.23
AD539	Donovan, J. (Columbia) vanGorkom, J. (Columbia) Schiminovich, D. (Columbia) Oosterloo, T. (ASTRON) Serra, P. (Groningen) Hibbard, J. (NRAO)	HI Kinematics in star-forming rings. 20 cm	5.57
AE153	Eilek, J. (NMIMT) Owen, F. (NRAO)	Imaging of cooling-core radio sources. 20, 90 cm	8.06
AE157	Eyres, S. (Lancashire) Bode, M. (Liverpool, JMU) O'Brien, T. (Manchester) Evans, N. (Texas) Davis, R. (Manchester) Worters, H. (Central Lancashire) Porcas, R. (MPIfR) Rushton, M. (Keele)	Observations of RS Oph. 1.3, 3.6, 6, 20 cm	10.67
AF418	Feretti, L. (Bologna) Dallacasa, D. (Bologna) Giovannini, G. (Bologna) Govoni, F. (Bologna) Murgia, M. (Bologna) Taylor, G. (UNM)	Polarimetric study of the Coma cluster. 3.6, 6 cm	34.22
AF434	Franco-Hernandez, R. (CfA) Rodríguez, L.F. (MEXICO/UNAM) Moran, J. (CfA)	Time variability in ultracompact HII region NGC 7538 IRS1. 0.7, 2 cm	3.12
AF444	Frail, D. (NRAO) Cameron, P. (Caltech) Lane, W. (NRL)	Triggered search for coherent emission from gamma-ray bursts. 400 cm	0.79

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AG715	Gaensler, B. (CfA) Gelfand, J. (CfA) Taylor, G. (UNM) Kouveliotou, C. (NASA) Eichler, D. (Ben Gurion) Lyubarsky, Y. (Ben Gurion) Granot, J. (KIPAC) Ramirez-Ruiz, E. (IAS) Wijers, R. (Amsterdam) Fender, R. (Ámsterdam) Garrett, M. (NFRA)	Imaging and monitoring of afterglow of SGR 1806-20. 3.6, 6, 20 cm	4.43
AG722	Galvan-Madrid, R. (MEXICO/UNAM) Ramirez-Alonso, E. (MEXICO/UNAM) Montes, G. (MEXICO/UNAM) Kurtz, S. (MEXICO/UNAM)	Survey for methanol masers toward formaldehyde masers. 1. 3 cm	10.61
AG723	Giovannini, G. (Bologna) Feretti, L. (Bologna) Govoni, F. (Bologna) Murgia, M. (Bologna) Orru, E. (Cagliari)	Symmetric double relics in Abell 1240 and Abell 2345. 90 cm	9.31
AG724	Gitti, M. (Ohio State) Feretti, L. (Bologna) McNamara, B. (Ohio State)	Structure of diffuse emission from cooling-flow clusters. 20, 90 cm	9.46

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AH884	Hoare, M. (Leeds) Lumsden, S. (Leeds) Marti, J. (U. Jaen) Oudmaijer, R. (Leeds) Urquhart, J. (Leeds) Diamond, P. (Manchester) Garrington, S. (Manchester) Muxlow, T. (Manchester) Smethurst, S. (Manchester) Gunn, A. (Manchester) Spencer, R. (Manchester) Zijlstra, A. (Manchester) Richards, A. (Manchester) Cotton, W.D. (NRAO) Chandler, C. (NRAO) Shepherd, D. (NRAO) Churchwell, E. (Wisconsin) Kurtz, S. (MEXICO/UNAM) Mundy, L. (Maryland) Goldsmith, P. (Cornell) Pandian, J. (Cornell) Jackson, J. (Boston) Shah, R. (Virginia) Moore, T. (Liverpool JMU) Dougherty, S. (DRAO) Gledhill, T. (Hertfordshire) Fender, R. (Amsterdam) Paredes, J. (Barcelona)	CORNISH Survey. 6 cm	159.60
AH885	Harris, D. (CfA) Cheung, C. (Brandeis) Junor, W. (LANL)	Monitoring know HST-1 in M87 jet. 0.7, 1.3, 2 cm	5.88
AH894	Hyman, S. (Sweet Briar) Lazio, T. (NRL) Ray, P. (NRL) Kassim, N. (NRL) Wijnands, R. (MIT) Muno, M. (MIT)	Monitoring GCRT J1745-3009 and other radio transients in the Galactic Center. 90 cm	15.86
AH902	Hofstadter, M. (JPL) Butler, B. (NRAO) Gurwell, M. (Caltech) Orton, G. (JPL) Hammel, H. (SSI)	Imaging atmospheres of Uranus and Neptune. 1.3 cm	6.48

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AH907	Hunter, D. (Lowell Obs.) Simpson, C. (Florida Inst.) Nordgren, T. (Redlands) Elmegreen, B. (IBM) Brinks, E. (Hertfordshire) Westpfahl, d. (NMIMT) Wilcots, E. (Wisconsin) McIntyre, V. (Sydney) Ostlin, G. (Stockholm)	HI structure of blue compact dwarf VIIZw403. 20 cm	8.53
AH912	Haan, S. (MPIA) Schinnerer, E. (MPIA) Mundell, C. (JMU) Garcia-Burillo, S. (Obs. National) Combes, F. (Paris Obs.)	HI imaging of selected NUGA galaxies. 20 cm	30.02
AH913	Helfand, D. (Columbia) Becker, R. (UC, Davis) White, R. (STScI)	MAGPIS: Multi-array galactic plane imaging survey. 20 cm	35.70
AH915	Hunter, T. (CfA) Brogan, C. (Hawaii)	Search for water masers toward massive protostars in NGC6334 I(N). 1.3 cm	2.27
AH917	Helfand, D. (Columbia) Camilo, F. (Columbia) Halpern, J. (Columbia) Zimmerman, N. (Columbia) Ransom, S. (CfA) Reynolds, J. (CSIRO)	AXP XTE J1810-197. 3.6, 6, 20 cm	2.41
AH919	Hankins, T. (NMIMT) Shearer, A. (Irish Center) Sheckard, J. (NMIMT) Eilek, J. (NMIMT)	Joint VLA and integral observations of the Crab nebula pulsar. 20 cm	1.49
AH920	Hallinan, G. (NUI, Galway) Zavala, R. (USNO) Lane, C. (Galway) Golden, A. (Galway) Antonova, A. (Armagh) Doyle, J. (Armagh) Brisken, W. (NRAO) Bourke, S. (NUI) Boyle, R. (Arizona)	Simultaneous VLA and photometric monitoring observations of late-type dwarfs. 3.6 cm, 6 cm	27.00
AJ324	Johnson, K. (Virginia) Biswas, I. (Virginia) O'Connell, R. (Virginia)	Survey for super star clusters in starburst galaxies. 1.3 cm	49.61

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AJ325	Johnson, K. (Virginia) Hunt, L. (CNR/IRA) Hibbard, J. (NRAO) Thuan, T. (Virginia)	Survey for super star clusters in low-metallicity galaxies. 1.3 cm	1.59
AJ328	Johnson, K. (Virginia) Hunt, L. (Virginia) Ulvestad, J.S. (NRAO)	Supernova candidate in ultra-low metallicity galaxy SBS0335-052. 3.6, 6, 20 cm	1.22
AJ329	Johnson, K. (Virginia) Bandiera, R. (Arcetri) Hunt, L. (Arcetri) Ulvestad, J.S. (NRAO)	Radio SN in ultra-low metallicity galaxy SBS0335-52. 3.6 cm	6.70
AK624	Miller, N. (GSFC) Fomalont, E. (NRAO) Kellermann, K. (NRAO) Mainieri, V. (MPE, Garching) Normal, C. (STScI) Padovani, P. (ESO) Rosati, P. (ESO) Shaver, P. (ESO) Tozzi, P. (INAF)	Star formation, mergers, AGN, SMBH, and evolution. 20 cm	0.93
AK631	Klaassen, P. (McMaster) Keto, E. (CfA) Wilson, C. (McMaster)	Gas kinematics in star forming region of K3-50A. 1.3 cm	13.90
AK632	Knapik, J. (Jagiellonian) Chyzy, K. (Jagellonian) Soida, M. (Jagellonian) Vollmer, B. (MPIfR) Beck, R. (MPIfR) Kronberg, P. (Toronto) Urbanik, M. (Jagellonian)	Faraday rotation of sources behind the Virgo Cluster. 3.6, 6 cm	9.67
AK633	Kneissl, R. (UC, Berkeley) Basu, K. (MPIfR) Bertoldi, F. (Bonn) Boehringer, H. (Garching) Menten, K. (MPIfR) Nord, M. (Bonn)	SEDs of radio sources in distant SZ galaxy clusters. 1.3, 20 cm	2.66
AK634	Kulkarni, S. (Caltech) Fox, D. (Penn State) Frail, D. (NRAO)	Long and short of radio afterglows in Swift Era. 0.7, 20 cm	19.27

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AK635	Kedziora-Chudczer, L. (CSIRO) Bignall, H. (JIVE) Jauncey, D. (CSIRO) Macquart, J.-P. Lovell, J. (CSIRO) Tzioumis, A. (CSIRO) Rickett, B. (UC, San Diego) Ojha, R. (CSIRO)	Extreme scintillator PKS 0405-385. 3.6, 6 cm	3.15
AL665	Leipski, C. (Bochum) Bennert, N. (UC, Riverside) Falcke, H. (ASTRON)	Extended jet emission from radio-quiet quasars. 20 cm	25.19
AM861	Morganti, R. (NFRA) Tadhunter, C. (Sheffield) Dicken, D. (NFRA) Oosterloo, T. (NFRA)	Spectra indices of cores of 2 Jy sources surveyed with Spitzer. 1.3, 2 cm	17.19
AM862	Monnier, J. (CfA) Tuthill, P. (Sydney) Danchi, W. (NASA) Greenhill, L. (CfA)	Monitoring the colliding wind WR112. 3.6 cm	2.32
AM865	McNamara, B. (NMSU) Rupen, M. (NRAO) Harrison, T. (NMSU)	Coordinated VLA/RXTE/APO/Keck look at LMXB GX 17+2. 0.7, 1.3, 2, 3.6, 6 cm	3.81
AM869	Montes, J. (IAA, SPAIN) Bergond, G. (IAA, SPAIN) Leon, S. (IRAM) Lim, J. (IAA, SPAIN) Lisenfeld, U. (Granada) Ramrez, D. (Jaen) Verdes-Montenegro, L. (IAA, SPAIN) Verley, S. (IAA, SPAIN)	Census and morphology of radio cores of a simple of isolated galaxies. 3.6 cm	0.82
AM870	McMullin, J. (NRAO) Claussen, M. (NRAO)	Continuum survey of Serpens molecular cloud core. 3.6 cm	7.06
AO205	Osten, R. (Maryland) Bastian, T. (NRAO) Hawley, S. (Washington) Reid, I. (STScI)	Spectra of radio emission from brown dwarfs. 3.6, 6, 20 cm	3.38
AP500	Pihlstrom, Y. (UNM) Sjouwerman, L. (NRAO)	Monitoring galactic center 1720 MHz OH masers. 20 cm	4.43

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AP506	Pisano, D. (CSIRO) Garland, C. (Castleton) Guzman, R. (Florida) Gallego, J. (Madrid) Castander, F. (Catalunya)	HI Imaging of local luminous compact blue galaxies. 20 cm	40.16
AP513	Pihlstrom, Y. (UNM) Mioduszewski, A. (NRAO) Loinard, L. (MEXICO/UNAM)	Accurate maser positions and velocities for VLBA astrometry. 1.3 cm	0.33
AR591	Rodriguez, L. F. (MEXICO/UNAM) Loinard, L. (MEXICO/UNAM) D'Alessio, P. (MEXICO/UNAM)	Structure of proto-planetary disk around HH24MMS. 0.7 cm	7.91
AR596	Robberto, M. (STScI) Keto, E. (CfA) Kamp, I. (STScI)	HI absorption against Orion Proplyds. 20 cm	5.38
AR598	Reipurth, B. (Hawaii) Rodriguez, L. (MEXICO/UNAM)	Structure of HH34 protostellar outflow source. 0.7 cm	8.88
AR599	Rodriguez, L.F. (MEXICO/UNAM) Trejo-Cruz, A. (MEXICO/UNAM)	Nonthermal jet toward a galactic star-formation region. 3.6 cm	5.25
AR603	Rupen, M. (NRAO) Mioduszewski, A. (NRAO) Dhawan, V. (NRAO)	X-ray transients. 0.7, 1.3, 2, 3.6, 6 cm	80.17
AR604	Riechers, D. (MPIA) Walter, F. (MPIA) Carilli, C. (NRAO) Bertoldi, F. (MPIfR) Weiss, A. (Bonn)	Imaging molecular Einstein ring at z = 4.12. 0.7 cm	6.72
AR614	Richards, G. (Drexel) Oguri, M. (Stanford) Inada, N. (Tokyo) Becker, R. (UC, Davis) Kochanek, C. (Ohio State)	Largest-separation lensed quasar; SDSS J1029+2623. 6 cm	1.70
AS846	Soderberg, A. (Caltech) Chevalier, R. (Virginia) Frail, D. (NRAO) Kulkarni, S. (Caltech)	Enigmatic type Ibc SNe and their mysterious engines. 0.7,1.3, 2, 6, 20 cm	13.68

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AS860	Schmitt, H. (NRL) Rosa Gonzales, D. (INAOE) Terlevich, R. (RGO) Terlevich, E. (INAOE)	Young star clusters in nearby starbursts. 3.6, 6, 20 cm	18.74
AS871	Stelzer, B. (MPIE, Garching) Testi, L. (Arcetri)	Emission in Herbig AeBe binary systems. 1.3, 2, 3.6, 6 cm	6.69
AS873	Stocke, J. (Colorado) Hart, Q. (Astro and Space Ast.)	Structure of AGN I ten clusters of galaxies. 20 cm	.20
AS874	Schiminovich, D. (Caltech) Basu-Zych, A. (Columbia) Johnson, B. (Columbia) Treyer, M. (Marseille Obs.) Hoopes, C. (Johns Hopkins) Heckman, T. (STScI)	Continuum imaging of ultraviolet luminous galaxies. 20 cm	24.61
AT318	Taylor, G. (UNM) Fabian, A. (Cambridge) Allen, S. (Stanford) Gentile, G. (SISSA-Trieste)	Search for emission in high-luminosity clusters. 20 cm	3.52
AT319	Tarchi, A. (Cagliari) Brunthaler, A. (MPIfR) Henkel, C. (MPIfR) Braatz, J. (NRAO)	H_20 versus continuum in megamaser galaxy 3C 403: Reverberation mapping of the nuclear region. 1.3 cm	0.79
AT327	Testi, L. (Arcetri)	Continuum imaging of the CQ Tau disk. 1.3, 3.6 cm	5.52
AT328	Tsai, C-W. (UC, Los Angeles) Beck, S. (Tel Aviv) Meier, D. (NRAO) Turner, J. (UC, Los Angeles)	Deep radio continuum maps of Maffei II. 1.3, 3.6 cm	2.83
AT329	Tsai, C-W. (UC, Los Angeles) Turner, J. (UC, Los Angeles) Meier, D. (NRAO)	Continuum survey for HII regions in NGC 2403. 3.6, 6 cm	8.02
AT330	Tripp, T. (UMASS) Yun, M. (UMASS)	Rare opportunity to study 21 cm absorption and emission in a nearby galaxy. 20 cm	1.61
AT331	Testi, L. (Arcetri) Stelzer, B. (Palermo)	Centimeter continuum emission in Herbig Ae/Be stars. 1.3, 3.6, 6 cm	3.18
AV288	VirLal, D. (NCRA-TIFR) Ho, L. (DTM/Carnegie)	Properties of Type II quasars. 3.6 cm	19.42

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
AW679	Weiler, K. (NRL) Stockdale, C. (NRL) Sramek, R. (NRAO) VanDyk, S. (UCLA) Panagia, N. (STScI) Marcaide, J. (Valencia) Lewin, W. (MIT) Immler, S. (Massachusetts) Pooley, D. (MIT)	Long-term monitoring of radio supernovae. 1.3, 2, 3.6, 6, 20 cm	17.40
AW695	Wang, R. (NRAO) Carilli, C. (NRAO) Walter, F. (MPIfR) Bertoldi, F. (Bonn) Fan, X (Arizona) Strauss, M. (Princeton) Cox, P. (IRAM) Menten, K. (MPIfR)	VLA obs. of an optically fainter $z = 5.85$ QSO. 20 cm	1.74
AY164	Yun, M. (UMASS) Scott, K. (UMASS) Wilson, G. (UMASS) Yan, L. (Caltech) Choi, P. (Caltech) Frayer, D. (Caltech)	Imaging the FLS Verification Strip. 20 cm	6.43
AY167	Yusef-Zadeh, F. (Northwestern) Roberts, D. (Northwestern) Heinke, C. (Northwestern) Dowell, C. (JPL)	Time delay of Sgr A* flare emission in radio and submm wavelengths. 0.7, 1.3 cm	9.32
BB232	Boboltz, D. (USNO) Ohnaka, K. (MPIfR) Driebe, T. (MPIfR) Murakawa, K. (MPIfR) Wittkowski, M. (ESO) Johnston, K. (USNO) Izumiura, H. (Okayama)	Mapping the water masers associated with the silicate carbon star. 1.3 cm	0.70
BD114	Dougherty, S. (DRAO), et al. *See VLBA Observing Programs*	Structural monitoring of colliding-wind binary WR140. 2, 3.6 cm	13.44
BD116	Dougherty, S. (DRAO), et al. *See VLBA Observing Programs*	Structure of O-star triple system HD 167971. 6, 18 cm	2.47
BK127	Knudsen, K. (MPIA), et al. *See VLBA Observing Programs*	Imaging two submm-bright quasars at redshift 2.8. 20 cm	5.62

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
BM239	Moscadelli, L. (Cagliari) Furuya, R. (Caltech) Claussen, M. (NRAO) Kitamura, Y. (ISAS) Testi, L. (Arcetri) Wootten, A. (NRAO) Goddi, C. (Cagliari)	Absolute proper motions of H_20 masers in Serpens SMM1. 1.3	0.81
S70218	Lubin, L. (STScI) Gal, R. (UC, Davis) Mulchaey, J. (Mt. Wilson) McKean, J. (Manchester) Fassnacht, C. (UC, Davis)	Chandra/VLA obs. of super cluster at z = 0.9. 20 cm	31.23
S70601	Forman, W. (CfA) Jones, C. (CfA) Charasov, E. (NPA) Eilek, J. (NMIMT) Owen, F. (NRAO)	Chandra/VLA obs. of galaxy IC 1262. 20 cm	9.61
S70810	Miller, J. (Trieste Obs.) Grindlay, J. (CfA) vanderKlis, M. (Amsterdam) Wijnands, R. (MIT) Mendez, M. (Utrecht-SRON) Raymond, J. (CfA) Rupen, M. (NRAO) Steeghs, D. (CfA) Homan, J. (Milano Obs.) Lewin, W. (MIT)	Chandra/VLA obs. of neutron-star binaries. 3.6, 6 cm	12.73
S70874	Wolk, S. (SUNY) Osten, R. (Maryland) Bourke, T. (CfA) Megeath, T. (CfA) Allen, L. (CfA) Myers, P. (CfA)	Chandra/VLA obs. of star cluster NGC 1333. 3.6, 6 cm	20.45
S70998	Miller, J. (Trieste) Markoff, S. (MIT) Nowak, M. (Yale) Rupen, M. (NRAO) Steeghs, D. (CfA)	Chandra/VLA obs. of LLAGN M81*. 3.6 cm	4.10

5. VLA Observing Programs

No.	Observer(s)	Programs	Hours Observed
S71062	Harris, D. (CfA) Birkinshaw, M. (Bristol) Cheung, C. (Brandeis) Gelbord, J. (Brandeis) Landt, H. (STScI) Jorstand, S. (Boston) Marshall, H. (MIT) Perlman, E. (Maryland) Schwartz, D. (CfA) Stawarz, L. (CfA) Worrall, D. (Bristol, UK)	Chandra/VLA obs. of quasar 4C 19.44. 2, 6 cm	8.13
S80394	Sanders, J. (Cambridge) Fabian, A. (Cambridge) Taylor, G. (UNM)	Cluster and AGN interaction in 2A 0355+096. 3.6, 6 cm	3.41
S80576	Forman, W. (CfA) Sun, M. (CfA) Baum, S. (Rochester) O'Dea, C. (Rochester) Jones, C. (CfA)	Interactions of AGN outbursts with their environments. 6, 20 cm	8.75

VLBA OBSERING PROGRAMS

The following research programs were conducted with the VLBA during this quarter:

Note: "Hours observed" is scaled by the fractional number of operational antennas. For example, a 10 hour run with 9 of 10 VLBA antennas operational counts as 9.0 hours observed.

No.	Observer(s)	Programs	Hours Observed
BA080	Asada, K. (NAOJ) Inoue, M. (NAOJ)	Tri-monthly monitoring obs. of the helical magnetic field in 3C 273 jet. 2, 4, 6 cm	8.0
BA082	Agudo, I. (MPIfR) Gomez, J.L. (IAA,Spain) Jorstad, S. (Boston) Lobanov, A. (MPIfR) Marscher, A. Boston) Marti, J. (Valencia, Spain) Perucho, M. (MPIfR) Roca-Sogorb, M. (IAA, Spain) Roy, A. (MPIfR)	Astrometry of wobbling jets in blazars. 1.3 cm	16.0
BB200	Brunthaler, A. (JIVE) Falcke, H. (Dwingeloo) Greenhill, L. (CfA) Henkel, C. (MPIfR) Reid, M. (CfA)	Geometric distance to M33. 1 cm	24.0
BB213	Brisken, W. (NRAO) Romani, R. (Stanford)	Pulsar J0538+2817: four more epochs. 20 cm	2.0
BB225	Bartkiewicz, A. (Torun) Brunthaler, A. (MPIfR) Szymczak, M. (Torun) van Langevelde, H. (JIVE)	Nature of the methanol maser ring around a young massive star. 2 cm	10.0
BB226	Boboltz, D. (USNO) Diamond, P. (Manchester) Driebe, T. (MPIfR) Johnston, K. (USNO) Ohnaka, K. (MPIfR) Wittkowski, M. (ESO)	Polychromatic interferometry of evolved star RR Aql. 0.7 cm	5.0
BB235	Bennett, W. (NRAO) Willett, K. (Colorado)	Q-band pseudo-continuum observations. 4 cm	2.0

6. VLBA Observing Programs

No.	Observer(s)	Programs	Hours Observed
BC157	Claussen, M. (NRAO) Bond, H. (STScI) Evans, A. (Keele) Gehrz, R. (Minnesota) Healy, K. (ASU) Rushton, M. (Keele) Starrfield, S. (ASU) Woodward, C. (Minnesota)	SiO masers in V838 Monocerotis. 0.7 cm	16.0
BC161	Cotton, W.D. (NRAO) Danchi, W. (NASA) Lacasse, M. (CfA) Ragland, S. (CfA) Schloerb, F. (UMASS) Townes, C. (UC, Berkeley) Traub, W. (CfA)	Miras w/photospheric asymmetries II. 0.7 cm	10.0
BD114	Dougherty, S. (DRAO) Pittard, J. (Leeds) O'Connor, E. (UPEI) Beasley, A. J. (NRAO) Claussen, M. (NRAO)	Structural monitoring of colliding-wind binary WR140. 0.7, 1.3, 2, 3.6, 6, 18 cm	11.9
BD116	Dougherty, S. (DRAO) Blomme, R. (Royal Obs.) Runacres, M. (Vrije) Rauw, G. (Leige) VanLoo, S. (Leeds) Pittard, J. (Leeds)	Structure of O-star triple system HD 167971. 0.7, 1.3, 2, 3.6, 6, 18 cm	11.0
BD117	Dhawan, V. (NRAO) Mioduszewski, A. (NRAO) Rupen, M. (NRAO)	Sitting, spitting, and spinning? 2, 3.6 cm	49.5
BE048	Bennett, W. (NRAO)	X-band continuum of gravitational-lens candidate. 20 cm	4.0
BE049	Edmonds, R. (UNM) Honma, M. (NAOJ) Sjouwerman, L. (NRAO)	Positions for SiO-13 and SiO-23. 0.7 cm	1.0
BF088	Fish, V. (NRAO)	Multi-frequency OH maser observations of G11,90-0.14. 2, 6, 18 cm	4.5
BF091	Frey, S. (FOMISGO) Gurvits, L. (JIVE) Paragi, Z. (JIVE)	Structure of extremely high redshift quasar J1430+4204 after a long range flare. 2 cm	8.0
BG165	Goddi, C. (Arcetri) Imai, H. (Kagoshima) Moscadelli, L. (Cagliari)	Full polarization of H_20 masers towards high-mass SFR W3 (OH). 1 cm	12.0

6. VLBA Observing Programs

No.	Observer(s)	Programs	Hours Observed
BG167	Gabuzda, D. (Cork) Bezrukovs, V. (Cork) O'Sullivan, S. (Cork)	Investigating the 3D B-field structures of AGN using Faraday rotation measurements. 0.7, 1, 2, 4, 6 cm	24.0
BH135	Harris, D. (CfA) Cheung, C. (MIT) Junor, W. (LANL)	Flare decay of Knot HST-1 in M87 Jet. 20 cm	20.9
BH136	Hachisuka, K. (MPIfR) Brunthaler, A. (JIVE) Hagiwara, Y. (NAOJ) Menten, K. (MPIfR) Mochizuki, N. (ISAS) Reid, M. (CfA)	Astrometry of H_20 masers in outer part of the galaxy. 1 cm	6.0
BH145	Helfand, D. (Columbia) Brisken, W. (NRAO) Camilo, F. (Columbia) Chatterjee, S. (CfA) Halpern, J. (Columbia) Ransom, S. (NRAO) Zimmerman, N. (Columbia)	First Magnetar proper motion from the transient AXP XTE J1810-197. 4, 6 cm	4.0
BI033	Imai, H. (Kagoshima) Deguchi, S. (Nobeyama) Kwok, S. (Hong Kong) Nakashima, J. (ASIAA)	Mapping two newly found water fountains. 1 cm	8.0
BJ045	Junor, W. (LANL)	Deep 3 mm observations of Virgo A Core. 0.3, 0.7 cm	37.95
BJ050	Jun, C. (NAOC) Garrett, M. (JIVE) Nair, S. (RRI) Nan, R. (NAOC) Porcas, R. (MPIfR)	3mm obs. of gravitational lens system PKS 1830-211. 0.3, 0.7 cm	7.25
BK127	Knudsen, K. (MPIA) Walter, F. (MPIA) Momjian, E. (Kentucky) Carilli, C. (NRAO) Yun, M. (Massachusetts)	Imaging two submm-bright quasars at redshift 2.8. 18 cm	7.0

6. VLBA Observing Programs

No.	Observer(s)	Programs	Hours Observed
BL122	Lanyi, G. (JPL) Boboltz, D. (USNO) Charlot, P. (Bordeaux) Fey, A. (USNO) Fomalont, E. (NRAO) Gordon, D. (NASA) Ma, C. (NASA) Romney, J. (NRAO) Sovers, O. (Remote Sensing) Taylor, G. (UNM) Ulvestad, J. S. (NRAO)	High precision K/Q-band astrometry. 1 cm	24.0
BL128	Loinard, L. (MEXICO/UNAM) Mioduszewski, A. (NRAO) Rodriguez, L. (MEXICOUNAM) Torres, R. (MEXICO/UNAM)	Distance to Taurus and Ophiuchus. 4 cm	20.0
BL137	Lister, M. (Purdue) Aller, H. (Michigan) Aller, M. (Michigan) Arshakian, T. (MPIfR) Homan, D. (Denison) Kadler, M. (MPIfR) Kellermann, K. (NRAO) Kovalev, Y. (NRAO) Lobanov, A. (MPIfR) Ros, E. (MPIfR) Vermeulen, R. (ASTRON) Zensus, J.A. (MPIfR)	MOJAVE II. 2 cm	72.0
BL139	Lobanov, A. (MPIfR) Alef, W. (MPIfR) Arshakian, T. (MPIfR) Chavushyan, V. (INAOE) Mercado, A. (INAOE) Shapovalova, A. (SAO, Russia)	Pársec-scale radio emission accretion disk and broad line region in 3C 390.3. 1, 2, 0.7 cm	8.0
BL142	Loinard, L. (UNAM) Mioduszewski, A. (NRAO) Rodriguez, L. (MEXICO/UNAM) Torres, R. (MEXICO/UNAM)	Very accurate dynamical mass of a pre-main sequence spectroscopic binary. 2 cm	5.0

6. VLBA Observing Programs

No.	Observer(s)	Programs	Hours Observed
BL143	Loinard, L. (MEXICO/UNAM) Mioduszewski, A. (NRAO) Rodriguez, L. (MEXICO/UNAM) Torres, R. (MEXICO/UNAM)	Towards a very accurate distance to Perseus. 1 cm	5.0
BM227	Moscadelli, L. (Cagliari) Cesaroni, R. (Arcetri) Rioja, M. (OAN, Spain)	Ejection and deceleration of the H_2O masers in high mass protostellar IRAS 20126+4104. 1 cm	11.0
BM234	Menten, K. (MPIfR) Reid, M. (CfA)	Parallax and proper motion of Orion X-ray stars. 4 cm	10.0
BM235	Moellenbrock, G. (NRAO) Beasley, A.J. (NRAO) Claussen, M. (NRAO) Goss, W.M. (NRAO)	Parallax and proper motions of Galactic water masers. 1 cm	8.0
BM244	Moscadelli, L. (Cagliari) Beltran, M. (Barcelona) Cesaroni, R. (Arcetri) Codella, C. (Firenze) Furuya, R. (Caltech) Goddi, C. (Cagliari)	Gas kinematics around high-mass YSOs explored via maser associations. 1 cm	18.0
BM247	Marscher, A. (Boston) Aller, M. (Michigan) Chatterjee, R. (Boston) Jorstad, S. (Boston) McHardy, I. (Southampton)	Relation between the X-ray state and energy flow into jets of radio galaxies. 0.7 cm	48.0
BM248	Marscher, A. (Boston) Aller, M. (Michigan) D'Arcangelo, F. (Boston) Hagen-Thorn, V. (St. Petersburg) Jorstad, S. (Boston) Larionov, V. (St. Petersburg) McHardy, I. (Southampton)	Probing compact jets through multi-wave band variability and polarization. 0.7 cm	14.5
BO025	Orienti, M. (Bologna) Dallacasa, D. (Bologna)	Magnetic fields in extremely young radio sources. 2, 4, 6, 13, 20 cm	44.0
BP128	Peck, A. (CfA) Marrone, D. (Harvard) Myers, S. (NRAO) Taylor, G. (UNM) Zavala, B. (USNO)	Multi-wavelength analysis of record outburst in 3C454.3. 1, 2, 6 cm	12.0

6. VLBA Observing Programs

No.	Observer(s)	Programs	Hours Observed
BP131	Piner, B.G. (Whittier College) Edwards, P.G. (ISAS)	Toward establishing a confirmed sample of ultra-relativistic jets. 0.7 cm	12.0
BR100	Reid, M. (CfA) Greenhill, L. (CfA) Menten, K. (MPIfR) Moscadelli, L. (Cagliari) Xu, Y. (Nanjing) Zheng, X. (Nanjing)	Spiral structure and kinematics of the Milky Way. 2 cm	30.0
BR106	Reid, M. (CfA) Menten, K. (MPIfR)	Enigmatic star VY CMa. 0.7 cm	8.50
BR121	Reid, M. (CfA) Brunthaler, A. (MPIfR) Menten, K. (MPIfR) Xu, Y. (MPIfR) Zheng, X.-W. (Nanjing)	Trigonometric parallax for the Galactic Center. 1 cm	16.0
BS150	Savolainen, T. (Tuorla) Rastorgueva, E. (Tuorla) Takalo, L. (Tuorla) Valtaoja, E. (Tuorla) Valtonen, M. (Tuorla) Wiik, K. (Tuorla)	Multi-frequency Polarimetric VLBA monitoring of the next predicted outburst in OJ 287. 0.3, 0.7, 1, 2 cm	8.0
BS158	Shen, Z.Q. (Shanghai) Ho, P. (CfA) Lo, K.Y. (NRAO) Miyazaki, A. (Shanghai) Miyoshi, M. (NAOJ) Tsuboi, M. (NAOJ) Tsutsumi, T. (NAOJ) Zhao, J. (CfA)	Monitoring the temporal variation in the structure of Sgr A*. 0.3, 0.7 cm	7.0
BS160	Shen, Z. (ShAO) Chen,X. (ShAO) Jiang, D. (ShAO)	Simultaneous VLBA obs. of three 7mm SiO masers toward VX Sgr at five epochs. 0.7 cm	8.0
BS162	Soria-Ruiz, R. (OAN) Alcolea, J. (OAN) Bujarrabal, V. (OAN) Colomer, F. (OAN) Desmurs, J.-F. (OAN)	3 mm observations of HCN masers: 2nd attempt. 0.3 cm	15.0
BS169	Stanghellini, C. (INAF) Dallacasa, D. (Bologna) Hong, X.-Y. (Shanghai) Tao, A. (Shanghai) Venturi, T. (INAF)	Hot-spot separation velocity in three compact symmetric objects. 4 cm	7.75

6. VLBA Observing Programs

No.	Observer(s)	Programs	Hours Observed
BT085	Taylor, G. (UNM) Blandford, R. (Stanford) Fassnacht, C. (UC, Davis) Gehrels, N. (NASA) Michelson, P. (Stanford) Myers, S. (NRAO) Pearson, T. (Caltech) Readhead, T. (Caltech) Romani, R. (Stanford) Sjouwerman, L. (NRAO) Ulvestad, J.S. (NRAO) Walker, R.C. (NRAO) Weintraub, L. (Caltech)	Imaging and polarimetry survey (VIPS). 6 cm	65.15
BT087	Tafoya, D. (CfA) Gomez, Y. (MEXICO/UNAM) Patel, N. (CfA) Reid, M. (CfA)	Rotating magnetized disk in young planetary nebula K 3-35. 20 cm	9.2
BT088	Taylor, G. (UNM) Fassnacht, C. (UC, Davis) Healy, S. (Stanford) Helmboldt, J. (UNM) Myers, S. (NRAO) Pearson, T. (Caltech) Readhead, T. (Caltech) Romani, R. (Stanford) Sjouwerman, L. (NRAO) Walker, R.C. (NRAO) Weintraub, L. (Caltech)	Investigating supermassive binary black-hole candidates. 2, 4, 6 cm	17.0
BU031	Ulvestad, J.S. (NRAO) Neff, S. (NASA)	Search for young supernovae in Antennae galaxies. 13 cm	25.0
BV059	Vlemmings, W. (Manchester) Torrelles, J. (CSIC-IEEC) vanLangevelde, H. (JIVE)	Co-evolution of methanol and water maser filaments in Cepheus A star-forming region. 1 cm	10.0
BW082	Walker, R.C. (NRAO) Hardee, P. (Alabama) Junor, B. (LANL) Ly, C. (UC, Los Angeles)	Pilot project for an M87 movie at 43 GHz. 0.7 cm	10.0
BW086	Wiik, K. (Tuorla) Savolainen, T. (Tuorla)	Multi-frequency Polarimetric VLBA follow-up of 3C454.3. 1, 2, 4, 6 cm	12.0

6. VLBA Observing Programs

No.	Observer(s)	Programs	Hours Observed
RDV057	Gipson, J. (NASA)	Geodetic/astrometry observations. 4, 13 cm	24.0
RDV058	Gipson, J. (NASA)	Geodetic/astrometry observations. 4, 13 cm	25.0
RDV059	Gipson, J. (NASA)	Geodetic/astrometry observations. 4, 13 cm	24.0

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BALSER, D.S.; BANIA, T.M.; ROOD, R.T.; WILSON, T.L. "High-Sensitivity Radio Observations of the 8.665-GHz $^3He^+$ Hyperfine Line Emission from Planetary Nebulae."

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EXPANDED VERY LARGE ARRAY (EVLA)

EVLA Milestones

Milestones	Original Date	Revised Date	Date Completed
1. New GPS timing source installed	07/13/06		07/13/06
2. Prototype correlator installation plan	07/31/06		07/14/06
3. RTP data multicast from L352	07/29/05	07/31/06	07/15/06
4. Receiver stability tests: 8, 22, and 45 GHz	12/19/03	07/31/06	07/16/06
5. Check for interference and bandpass shapes: 8, 22, and 45 GHz	03/15/04	07/31/06	07/16/06
6. C-band OMT - assembly	07/11/06		07/24/06
7. Start EVLA conversion of antenna 23	08/02/06		08/02/06
8. Finalize L-band 3D OMT drawing	08/28/06		08/08/06
9. Investigate probable error in Tsys measurement	06/05/06	08/14/06	08/14/06
10. Hardware acceptance tests complete on antenna 18	05/05/06	07/18/06	08/16/06
11. Antenna 18 turnover to Operations	08/17/06		08/17/06
12. Order production Ka-band feed components	08/18/06		08/18/06
13. Implement TP detectors for auto level setting (software)	04/28/06	08/01/06	08/29/06
14. Prototype Utility module functional checkout on antenna	08/31/06		08/31/06
15. One IF pair working on antenna 26	09/11/06		09/11/06
16. Issue FY 2007 budget plan	09/15/06		09/15/06
17. Test UX converter's converted path	09/15/06		09/15/06
18. EVLA-NRAO project data model to ALMA	09/01/05	09/15/06	09/18/06
19. Finalize design specifications for L-band OMT	09/24/06		09/24/06
20. Internal review of mechanical design of Ka-band RF tree	09/26/06		09/26/06
21. Develop plan to implement feed dry-air system	09/26/06		09/26/06
22. New VLA correlator controller operational, controlled from Modcomps	08/30/05	07/14/06	09/26/06
23. Hardware acceptance tests complete on antenna 24	05/23/06	07/27/06	09/28/06
24. Antenna 24 turnover to Operations	07/28/06		09/29/06
25. Implement antenna auto phasing	06/05/06	10/03/06	
26. Start EVLA conversion of antenna 17	10/04/06		
27. Hardware acceptance tests complete on antenna 26	10/12/06		
28. Antenna 26 turnover to Operations	10/13/06		
29. Specify extensions to EVLA script and obs2script	10/17/05	10/16/06	

PROJECTS

1. Expanded Very Large Array

Milestones	Original Date	Revised Date	Date Completed
30. Baseline Board prototype available	08/30/06	10/16/06	
31. Implement tipping curves for opacity determination	10/16/06		
32. Install prototype F317 in antenna	10/17/06		
33. Develop plan to insulate antenna feed-cone metal	10/20/06		
34. C-band OMT - broadband test in receiver	08/31/06	10/30/06	
35. Report on Receiver stability, bandpass shapes, linearity of RF design	08/12/05	10/30/06	
36. L-band wideband receiver installed	04/21/06	10/30/06	
37. Complete Part 2 hardware bench integration	03/03/03	11/01/06	
38. Final agreement between EVLA & ALMA on "Science View" of PDM	11/01/06		
39. Hardware acceptance tests complete on antenna 23	11/02/06		
40. Install wideband C-band receiver on antenna	11/02/06		
41. GUIs available for initial EVLA antenna OPS checkout	06/01/06	11/03/06	
42. Antenna 23 turnover to Operations	11/03/06		
43. L-band sensitivity tests with wideband receiver	09/08/06	11/10/06	
44. Write SNOW program to prevent snow accumulation	11/13/06		
45. AOC–VLA data link upgraded	11/15/06		
46. Correlator shielded chamber completed	11/21/06		
47. Monitor and Control CDR	12/05/06		
48. Conduct risk and contingency analysis	12/12/06		
49. Final testing of VLA setup in the Observation Executor	11/30/06		
50. Start EVLA conversion of antenna 19	12/05/06		
51. Functional test of visibility pipe	12/15/06		
52. ESO–ALMA NGAS hardware/software installed	08/31/06	12/15/06	
53. Provide capability for moving-source observation	12/18/06		
54. Implement listener thread in Observation Executor	12/18/06		
55. New VLA correlator controller controlled from EVLA M&C system	11/30/05	12/22/06	
56. Implement visibility data record	12/29/06		
57. Updated HLA	05/01/06	01/15/07	
58. OPT outputs a VLA observe script	10/25/06	02/15/07	
59. Archive records written using Modcomp-independent format	03/13/06	02/15/07	

1. Expanded Very Large Array

Milestones	Original Date	Revised Date	Date Completed
60. VLBA data in ALMA science-data model	05/08/06	02/15/07	
61. Access to archive tool via portal	06/14/06	12/15/07	

Project Management

The funding for the EVLA project deviated from original plans in 2004 when $3.9M was advanced to accelerate the project. The advancement left some uncertainty in what the actual funding might be in the later years of the project. The revised funding profile was clarified and agreed upon with the National Science Foundation (NSF).

The project office completed a number of planning documents over the last quarter. The EVLA FY 2007 Program Plan and EVLA Long Term Plan were developed. The semi-annual report on EVLA progress was submitted to the NSF. The response to the 2006 EVLA Advisory Committee Report was prepared.

Our first attempt to develop project performance metrics was completed.

Systems Integration

Antenna 24 was outfitted with a full set of EVLA hardware and has been used in test observations. It was turned over to operations for astronomical observations in late September.

Antenna 26 has been outfitted with an X-band front end and complete sets of electronics hardware for two functioning IFs on the antenna. First fringes at X-band were recorded in mid-September. The outfitting of the remaining two IFs and the installation of the LSC and UX converters are expected to be complete in mid October. We expect to turn over the antenna to Operations shortly thereafter.

Electronics outfitting has just begun on antenna 23. We expect it to be operational in early November.

Civil Construction

Work on the shielded room for the EVLA correlator is nearly complete. The HVAC equipment for the correlator room has been installed, plumbed, and electrically connected. The insulation contract for the HVAC equipment plumbing was completed in August. The HVAC system will be started as soon as the floor is completed and the room has been cleaned. The installation of room lighting is complete. The installation of the correlator power plant is tentatively set for the first quarter of CY 2007.

The completion of the shielded-room floor was delayed by late material delivery. The floor contractor is now scheduled to complete his work in October 2006. The electrical grounding of the room floor was completed in September.

The final acceptance of the FM200 fire-suppression system in the shielded room is scheduled for October 2006. After its final acceptance, the FM200 system will be put into operation, but the FM200 storage tanks will be electrically disconnected until the correlator is installed. The NRAO safety department will coordinate training sessions with the FM200 contractor to train NRAO personnel on the operation and maintenance of the system. The pre-action sprinkler system is completed and operational.

1. Expanded Very Large Array

The construction of the hallway adjacent to the correlator room is nearly complete. The hallway's ceiling, sprinklers, and lighting were installed. The only work remaining in the hallway is the installation and wiring of its smoke detectors.

Antennas

The mechanical outfitting of antenna 23 was completed in late September 2006. The fabrication of mechanical components for the next three EVLA antennas is ongoing. Insulation for the feed tower and horns is being designed and installed.

The fiberglass lamination of L-band feed horns 1 through 14 is complete. The lamination of horn 15 is in progress. Storage fixtures have been built for the L-band horns and installed in the antenna assembly building. Feed moisture detectors on antennas 13 and 16 are being monitored. Requisitions were issued for the production order of Ka-band feed horns and a full-size prototype S-band horn.

Front End

Antenna 24, the fifth EVLA antenna to be upgraded, received its interim C-band and Q-band front ends in August and September, respectively. Antenna 26 had its X, L, and K-band systems installed in September. The K-band receiver is the first fully EVLA-compatible receiver to be delivered. With the new EVLA card cage, it will have the enhanced monitor and control system. All the new cable trays and the front-end electronics racks were installed in antenna 23, the seventh EVLA antenna, during September.

Progress has been made on the EVLA prototype L-band receiver. Earlier tests indicated that the wideband orthomode transducer (OMT) could only be cooled to a disappointing 100 K over a three-day period. Modifications to the dewar now allow us to achieve 53 K in about 24 hours. This is well within the design goal. In regards to the 1–2 GHz OMT design, the spacing of its four internal fins has been finalized as have the desired lengths of the coaxial probes. The first OMT prototype has been removed from the prototype receiver so that problems with the contacts of its shorting pins can be addressed. Additionally, the aluminum fins of the first OMT will be plated with copper to help reduce insertion loss. The second OMT has been optimized and will be used for the next round of cooled RF tests, which will include the investigation of various foam materials for use as vacuum windows.

The dimensions and fin spacings of the 4–8 GHz C-band OMT have been finalized and drawings for a new set of fins, as well as the required test fixtures, have been submitted for fabrication. Meanwhile, the next interim C-band receiver (S/N 6 which is slated for antenna 26) is being prepared to evaluate the old narrow-band septum polarizers salvaged from the VLA A-Racks. These have been modified to fit within the new C-band EVLA dewar. While we wait for the wideband OMT to enter production, this recycling of old hardware will allow us to avoid buying expensive VLBA-style septum polarizers, which would eventually have to be thrown away. The S/N 6 receiver will also be used to carry out cooled RF tests on the first wideband prototype OMT.

The mechanical design of the new Ka-band receiver is nearing completion. A new 3-D drawing is being used to optimize the placement of the components of the RF tree inside the dewar with the goal of minimizing any unnecessary insertion loss in the signal path. Mechanical drawings for the prototype Ka-band receiver should be ready for submission to the machine shop by the end of October.

1. Expanded Very Large Array

The latest revision of the circuit board used in the F317 EVLA front-end monitor and control module is being tested in the lab. It should be ready for trials on antenna 26 soon. Final revisions of the control/sensor and bias boards used in the new card cage have been made. The next purchase order will be for full production quantities of these boards. The prototype of the new "stacked" diode protection board has been found to work well on the bench. It will be tested in the C-band S/N 6 receiver.

Local Oscillator (LO) System

Work continues to improve the operational stability of the L302 frequency synthesizer. The L302 seems responsible for the majority of the random and unpredictable behavior occasionally noticed in the EVLA antennas. This work has concentrated on the direct digital synthesizer printed-circuit board, the automatic gain control (AGC) circuitry and firmware, and the microwave reference inputs to the module. The fringe amplitude dropout problems in the L302 are now well understood and have been fixed, mostly with software

In other parts of the LO system, new optical receivers and transmitters, which have better performance and lower cost, have been identified for the LO reference system. The round-trip phase system is still undergoing tests. The testing has been complicated by excessive temperature variations within the vertex-room cabin. Completion of the last of the master rack modules has been delayed.

Fiber Optics

The Digital Transmission System (DTS) modules, the formatter, and the de-formatter continue to be built to meet the antenna outfitting schedule. Antenna 23 is outfitted with fiber-optic cable. The remainder of the fiber cables in the vertex room of antenna 23 will be installed after the local-oscillator and utility racks are installed.

The prototype design of the 3-bit, 4GHz sampler is complete. The sampler circuit board is built, and tests have begun to measure the performance of the new Rockwell RAD-006 sampler chip used in the board. The chip itself was proven to be functioning reasonably on the first attempt to test the board. Further development is needed in the FPGA de-multiplexer to continue the evaluation of the chip and board. After evaluation this quarter, this prototype design will help the project determine if it will use the Rockwell-based design or the existing ALMA design.

We are starting to receive the sampler chips and the de-multiplexer chips for the 1 GHz sampler in addition to the half transponders. These purchases are for the production quantities for the project. In the fourth quarter of CY 2006 we will evaluate production-quantity purchases for the remaining fiber on the antennas and the erbium-doped fiber amplifiers.

Intermediate Frequency (IF) System

A layout flaw was discovered on the circuit board in the 4P converter (T301). The flaw caused the 1024 MHz local oscillator to radiate. The board had to be respun, but the T301s is now in full production.

An isolation problem in the baseband downconverter (T304) was solved by adding an isolation amplifier. Further testing revealed another isolation problem in the IF section of the T304, requiring the installation of board covers with RF-absorbing material. The T304 is still waiting on the gain-slope equalizing filters

under development at the NRAO Central Development Laboratory. These filters will be retrofitted into the modules at a later date.

The T301, T302 (LSC converter), and T303 (UX converter) modules in two antennas are now controlled by the converter interface (M301) module. The M301 will be placed in full production in the fourth quarter of CY 2006.

Correlator

The fabrication of the baseline board was further delayed by a plated thru-hole-to-power-plane clearance problem that was missed in the design for manufacturing checks. Fortunately, this problem could be fixed in the boards that had been fabricated, reducing further delays. A good board was delivered to the assembly house on September 21. We were told that the assembled baseline board should be complete and in Penticton by about October 16. The board test fixture, software, and people are ready for its arrival.

The fabrication of the station board went more smoothly, and the board was delivered to the assembly house on September 25 with no problems reported, other than it being delayed from that quoted. Expected delivery of the fully assembled board is mid November, held up somewhat by a missing FPGA part, which the contractor is trying to expedite. Activity in the industry is accelerating, and part shortages are an unwelcome side effect.

The bidding/tendering process for the -48 VDC power plant and all of the cable connecting the station boards to the baseline boards is complete. It is expected that the contract for the power plant will be signed shortly and for the cable within the next month or so.

Monitor and Control (M&C) System

The M302 and M303 utility modules, responsible for a variety of functions including emergency stops, fire alarms, and ACU and power resets, have been field tested in antenna 24. A respin is needed on the M302 printed circuit board. The redesign is ready for manufacture.

The software for the F320 transition front-end controller has been modified to give it the capability to detect which receivers are or are not connected to the controller. This modification eases a number of operational issues.

The F317 front-end controller software has been rethought and reworked. A single F317 will now be capable of controlling four, rather than five, front ends. This change was necessary to eliminate several problematic aspects of the design.

The software for the module interface board has been enhanced to include what is termed the “ostream”. The ostream (for observing data stream) is a real-time multicast of any or all monitor points known to a module. It is a data stream that is separate and distinct from the monitor-data archive stream and is suitable for use in real-time tasks such as round-trip phase correction and calculations and corrections based on total power. The ostream is also needed for the interim data-capture and format (IDCAF) component that is under development. The ostream has been implemented for both EVLA and VLA antenna monitor data.

1. Expanded Very Large Array

The new correlator controller was reinstalled on September 26, 2006 and has been declared operational. It will now remain in the system on a permanent basis. This accomplishment achieves a major milestone for the EVLA M&C Transition System. It is now possible to proceed with development and testing of the software that will allow control of the VLA correlator by the EVLA M&C System.

The hardware board for what is termed the visibility pipe is now being wire-wrapped. The visibility pipe is the means by which data from the VLA correlator will be distributed within the EVLA M&C System. The visibility pipe will also require some software development. We hope that testing of the visibility pipe will begin in December 2006.

Development work continues on the IDCAF component of the Transition System. IDCAF is the software that will be responsible for forming and writing the (VLA format) archive records. To have access to the needed data and meta-data, IDCAF requires the ostream, changes to the Observation Executor, and the visibility pipe. We hope that IDCAF will enter the initial testing stage sometime in January or February 2007.

Science Support Systems (SSS)

The High-Level Architecture (HLA) effort continued to concentrate on the development of models for its various components. Models for Project, Program Block, Scheduling Block, Scan, and Source are all nearly complete. The Model for Resources (telescope resources include antennas, front ends, and back end [WIDAR]) will be developed over the upcoming quarter. These models will be used by all SSS and some M&C subsystems. The first application to use these models is the Observation Preparation Tool (OPT).

A third release of the VLA/GBT Proposal Submission Tool (PST) took place in September 2006 for the October 2 proposal deadline. We anticipate well over 100 proposals to be submitted in this cycle. For the first time, the VLA and GBT were supported within a single online tool (the PST), marking the beginning of a new era in which NRAO has observatory-wide software tools. The VLA/GBT PST is the prototype for the EVLA PST—the only change necessary will be in the definition of hardware setups, requiring only relatively modest additions to the current code.

Internal releases of the Observation Preparation Tool (OPT) continued to occur. The OPT now uses the Source, Scan, and Scheduling Block common Models. Testing by AOC scientific staff began in earnest, allowing very early input on functionality and look-and-feel of the tool.

Hardware was acquired to support the ESO/ALMA NGAS and has been installed at the AOC (a number of disks and switches and a controlling computer). The hardware will be used within the VLA/VLBA/GBT archive storage and access system as a test of how it might be applicable for the EVLA. Installation of NGAS software has been attempted on a number of occasions, but the software was not designed to be as portable as might be desired so the system is not yet fully deployed.

NEW INITIATIVES

Square Kilometer Array (SKA)

Following meetings this summer of the ISSC and the various SKA committees and working groups, it has become clear that it will be difficult to meet all the SKA specifications of sensitivity, frequency coverage, field of view, and resolution at an acceptable cost. Evaluation of the four proposed SKA sites resulted in a short list of possible sites located in Western Australia and South Africa. However, there is a potential threat to the WA site from iron-mining activities. A decision on relocating the ISPO is planned for sometime next year. During 2007 the Engineering Working Group plans to develop a conceptual system design and cost estimate to present to an independent Engineering Advisory Committee headed by Alan Rogers. Issues to be considered in developing the SKA operations plan have been studied and a report issued. Following the advice of the Funding Agency Working Group (FAWG), the ISSC has agreed to extend the current MOU with no change in subscription. However, in-kind contributions from the participating parties will be required to maintain the aggressive program developed by the ISPO. The NRAO is evaluating how it can contribute to the planned ISPO SKA development effort. The FAWG has proposed to establish an SKA Forum with representation from the FAWG, the ISSC, and the major SKA demonstrator projects. The ISPO has established tiger teams to develop a schedule for decision making and for establishing site infrastructure. Opportunities for U.S. participation in the European Framework 7 Program are under discussion. Discussions in the U. S. have continued to define the NRAO role in the U.S. Technology Development Program and to help in the evaluation and performance improvement of the ATA feed/receiver system.

The Long Wavelength Array (LWA)

The LWA project completed installation of the hardware for its demonstrator station (LWDA) on the VLA site in October. The LWDA first observations of the sky with LWDA were also made in October. In a short drift-scan movie online at http://www.phys.unm.edu/~lwa/lwda.shtml one can easily identify the radio sources Cas A, Cyg A, and Sgr A.

The Frequency Agile Solar Radio Telescope (FASR)

On behalf of the wider solar and space-physics communities, the NRAO has proposed to play a leadership role in the FASR project. In close partnership with the university community, the NRAO would lead the construction of the FASR facility in this model. NSF funds to the NRAO and its university partners will be used to produce an operations and maintenance plan for the FASR facility in order to clarify long-term costs. To this end the FASR partnership is working on defining a reference instrument to serve as the cost basis for operations and maintenance planning. The partnership has identified several R&D targets and will seek funding for a design and prototyping effort in the coming year.

Space VLBI

We have continued discussions by telecon with the Russian RadioAstron and also, at a meeting in Prague, with Japanese VSOP-2 mission planners in preparation for the missions including the potential use of NRAO facilities. RadioAstron is planned for a mid-2008 launch, but there is little expectation outside of Russia that this will happen. The head of the Russian Space Agency has written to George Bush to emphasize the importance of NASA support for the success of the mission. To date there has been no response. VSOP-2 is now a funded project in Japan with a planned launch in 2011 or 2012. The limited budget of $100 M, which includes development and operations but not launch, appears inadequate to allow a significant contribution from Japan toward the operation of participating NRAO telescopes.

GREEN BANK OPERATIONS

As the 2007 fiscal year began on October 1, 2006, we have modified the GBT's goals here to reflect the goals established in our 2007 Program Plan. Additionally, we have consolidated the goals to reflect the project rather than the division in which work will be done. These goals will be tracked through FY 2007.

GBT Site Milestones for FY 2007

Milestone	Original Date	Revised Date	Date Completed
Azimuth Track Refurbishment			
1. All components on site	03/30/07		
2. Begin track-replacement field work	05/01/07		
3. Work Plan and schedule complete	10/01/06	10/10/06	
4. First 24 wear and base plates manufactured	01/31/07		
5. Next 24 wear and plates manufactured	04/30/07		
6. Refurbishment starts	04/30/07		
7. Refurbishment complete	08/31/07		
8. Telescope performance restored	08/31/07		
Caltech Continuum Backend			
1. Project Complete	10/01/06	10/27/06	
C-band Receiver Upgrade			
1. Upgrade Complete	02/15/07[1]		
2. Commissioning Complete	03/01/07[2]		
Dynamic Scheduling			
1. Test Phase Complete	04/31/07		
2. Proposal Review	06/01/07		
3. Stage I tools complete, dynamic scheduling commences	02/01/08		
4. Stage II tools complete	02/01/09		
Ka-band Receiver			
1. Lab tests complete	10/15/06	10/10/06	
2. Commissioning complete	11/31/06	11/13/06	
Q-band Receiver			
1. Lab tests complete	10/15/06	10/20/06	
2. Commissioning complete	10/31/06	12/14/06[2]	
Penn Array Receiver[3]			
1. In-progress review	08/01/06		08/01/06
2. Lab tests complete	02/20/05		09/10/06
3. Commissioning commences	02/21/05	09/11/06	09/11/06
4. Document commissioning results	12/31/06		

OPERATIONS

1. Green Bank Operations

Milestone	Original Date	Revised Date	Date Completed
PTCS			
1. Tajectory Generation and Servo Improvements complete	12/31/06		
2. PLC interlock system installed	08/31/07		
3. Small-scale surface errors characterized	08/31/07		
4. Laser rangefinder V2 development complete	09/31/07		
Spectrometer Long-Term Accumulator (LTA) Upgrade			
1. LTA design review	10/18/06		
2. LTA upgrade complete	10/01/07		
Zpectrometer[4]			
1. Zpectrometer installed on telescope	10/01/06	10/30/06	
2. Lab test complete	09/30/06		09/20/06
3. Commissioning tests complete	12/01/06		
Other			
1. Attend NRAO-wide Software Engineering Conference	08/08/06		08/08/06
2. GBT RFI Monitor Station Complete	09/01/06	12/31/06	
3. 140' MLLN tunable Receiver	08/18/06	11/30/06	
4. GBT M&C Upgrade	08/31/07		

Notes:

1 Actual date for C-band completion is dependent on the winter Penn Array schedule.

2. Q-band commissioning dates were moved back in an effort to limit the total commissioning time (and maintain astronomy time) on the GBT.

3. Penn Array Receiver progress has been slowed by difficulties in fabricating the detector array.

4. Zpectrometer is a collaboration.

NEW MEXICO OPERATIONS

VLA and VLBA Milestones

Management and Scientific Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Return EVLA antennas 14 and 16 to operational VLA	05/20/06	08/01/06	08/01/06
2. Return EVLA antenna 13 to operational VLA	08/01/06		08/01/06
3. Return EVLA antenna 18 to operational VLA	08/15/06		08/17/06
4. Release revised version of VLA/GBT proposal tool	09/10/06		09/15/06
5. Return EVLA antenna 24 to operational VLA	09/15/06	10/02/06	09/29/06
6. Convert VLA and High Sensitivity Array to Mark 5	09/30/06		09/30/06
7. VLA–VLBA Proposal and Large Proposal Deadline	10/02/06		
8. Host 22nd Annual New Mexico Symposium	10/06/06		
9. Return EVLA antenna 26 to operational VLA	10/31/06		
10. Return EVLA antenna 23 to operational VLA	12/31/06		
11. AIPS 31DEC06 Frozen; 31DEC07 Released	12/31/06		
12. Decommission final tape drives on VLBA correlator	12/31/06		
13. VLA–VLBA Proposal Deadline	02/01/07		
14. Return EVLA antenna 17 to operational VLA	02/28/07		
15. First shared-risk science with EVLA 22 GHz tuning	04/30/07		
16. Retire VLA Modcomp Computers	03/31/06	06/15/07	

Notes:
12. Waiting for 3 playback drives on order, which will give the VLBA a 17-station Mark 5 playback capability.
16. Competing with EVLA software development and checkout, which take higher priority. This item has been delayed into 2007 in order to enable personnel resources to be spent on development for the prototype EVLA correlator.

Computer Infrastructure Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Generate AOC–VLA link upgrade plan	05/30/06	08/31/06	08/15/06
2. Create Gold Book replacement proposal	07/15/06		09/01/06
3. Bring up EVLA Antenna-23 Network	10/20/06		
4. Switchover to new AOC/VLA OC-3 link	12/01/06		
5. Complete AOC network renumbering	12/15/06		
6. Install new central Network Appliance file server	12/31/06		
7. Conduct requirements survey for calendaring	08/01/06	12/31/06	
8. Establish network tunnel to DRAO	08/31/06	03/31/07	

Milestones	Original Date	Revised Date	Date Completed
9. Establish network tunnel to ESO	09/30/06	03/31/07	

Notes:
4. Requires further cooperation from DRAO and ESO
7. Delayed to accommodate other CCE projects
8 and 9. Hardware ordered

Operations Software Support Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Correlator controller operational by Modcomps	04/05/05	07/14/06	09/26/06
2. Correlator controller operational by EVLA monitor and control	04/04/05	10/30/06	
3. Transcribe VLA observe/system files	11/30/02	01/31/07	
4. Translate and copy stored VLA monitor data from 9-track to DAT	03/31/04	06/30/07	

Electronics Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Complete a VLA prototype ACU system	07/20/07		
2. Install multi-turn FRM Encoder at PT VLBA	07/14/06		07/30/06
3. Upgrade the TAC and Servo Boards at MK	07/30/06		07/30/06
4. Scheduled Maintenance Visit MK VLBA	07/30/06	07/26/06	08/06/06
5. Support John Hopkins University APL Observation	09/09/06		09/09/06
6. Replace PT VLBA Maser #4 with Maser #10	09/10/06		09/10/06
7. Pickup refurbished Maser #13 from Sigma Tau	09/20/07		
8. Scheduled Maintenance Visit HN VLBA	09/27/06		09/28/06
9. Repair VLA Operations IAT / LST Clock	09/28/06		09/28/06
10. Revise TARS RFI MOU	10/20/06		
11. Develop a VLA RFI Plan	12/01/06		

Engineering Services Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Complete Mauna Kea VLBA Peak major maintenance	07/26/06		08/06/06
2. Complete Hancock VLBA Peak major maintenance	09/27/06		09/28/06
3. Complete CnB array reconfiguration	09/29/06		09/29/06
4. Complete C array reconfiguration	10/20/06		

2. NEW MEXICO OPERATIONS

Milestones	Original Date	Revised Date	Date Completed
5. Complete DnC array reconfiguration	01/26/07		
6. Complete D array reconfiguration	02/16/07		

Notes:
1. Extended to replace AZ #1 drive wheel

NA ALMA SCIENCE CENTER

NAASC Milestones July–September 2006

Milestones	Original Date	Revised Date	Date Completed
1. NAASC organizational meeting	07/05/06		07/05/06
2. Submit Quarterly Report	07/11/06		07/11/06
3. Set Operations Plan writing assignments	07/20/06		
4. ARC Manager face-to-face meeting at ESO—resolve computation of ARC value	07/22/06		07/22/06
5. Revise ALMA Operations Budget, including ACA, new staffing ramp/up, and running costs	07/30/06		
6. NAASC organizational meeting: review ARC CSV plan	08/02/06		08/02/06
7. Tucson face-2-face meeting with NRC; JAO AIV–CSV team.	08/03 – 08/05/06		08/05/06
8. Draft plan for ARC's role in the CSV	08/10/06		
9. New draft NAASC Operations Plan ready for review by e2e, Directors office, NRAO operations	08/15/06		08/31/06
10. New draft NAASC Operations Plan ready for review by NRC, ANASAC	08/25/06		09/07/06
11. Arrange for ANASAC face-to-face meeting in Charlottesville; ANASAC telecon	08/25/06		09/07/06
12. Submit articles for NRAO October Newsletter	09/07/06		09/07/06
13. ANASAC face-to-face meeting in Charlottesville	09/8–9/06		09/28/06
14. Participate in ASAC face-to-face meeting (Florence)	09/15–0917/06		09/17/06
15. Set up webpage for NAASC workshop on protoplanetary disks	09/20/06	11/10/06	
16. NAASC Operations Plan internal review	09/22/06	10/18/06	

Future NAASC Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Submit NAASC proposal to NSF	10/27/06	10/31/06	
2. Submit ALMA Operations plan to Board	10/11/06	10/31/06	
3. Participate in NSF review of NAASC plan	Spring 07		
4. CASA alpha python testing	10/15/06		
5. ALMA External Offline software test 2006.10-6	10/30/06	03/07/07	

3. NA ALMA Science Center

Milestones	Original Date	Revised Date	Date Completed
6. Review of ALMA Operations Plan at Madrid Board face-to-face meeting	11/09/06		
7. 2nd NAASC workshop	06/22/07		
8. Spectral-line catalogue—continue resolving species	Ongoing		
9. Spectral-line catalogue—organize working group, first meeting in Charlottesville, Spring 07	04/05/07		
10. Meeting with CCAT/others	04/05/07		

CENTRAL DEVELOPMENT LAB

Amplifier Design and Development Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Evaluation of TRW Cryo-3 devices to determine noise, signal and dc properties at cryogenic temperatures	04/01/2004	ongoing	
2. Design/redesign of cryogenic amplifiers using Cryo-3 TRW devices for EVLA, VLBA, GBT and ALMA covering frequency range from 1 to 120 GHz	04/01/2004	12/31/2006	

Notes:
2. Redesign of 18-26 GHz was completed and experimental evaluation is ongoing. The redesign of 26-40 GHz amplifiers for EVLA and the development of demonstration amplifiers for ALMA band 1 and band 2 receivers is in progress.

Other Projects: Research on noise properties of heterostructure bipolar transistors (HBT's) continues.

Amplifier Production Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Build/upgrade/repair cryogenic amplifiers using Cryo-3 TRW devices for EVLA covering frequency range from 1 to 50 GHz	12/31/2015		Ongoing activity
2. Build/upgrade/repair cryogenic amplifiers using Cryo-3 TRW devices for VLBA, GBT covering frequency range from 1 to 95 GHz	ongoing		Ongoing activity
3. New amplifier test system development	06/30/2006	12/30/2006	

Notes:
1 and 2. Second quarter production totaled 22 new and upgraded amplifiers, including L (1-2 GHz), C (4-8 GHz), K (18-26 GHz) and Q (40-50 GHz) band units for the EVLA and Q-band LNAs for the GBT receiver project.
3. The PC / LabVIEW based noise measurement system is operational, producing measured data identical to the old ADIOS system, verifying calibration continuity between the NRAO-built and commercial hardware. Three systems in roll-around carts have been completed, with recent software additions allowing the capture of analog data in conjunction with HPIB (IEEE-488) instrumentation. Testing and software refinements will continue.

Other Projects:
The Chemistry Lab plated approximately 40 grams of gold in support of ALMA construction, amplifier production, and various GBT projects. That represents a gold value of about $800 and an estimated job cost of $12,000, if done commercially. A new alkali copper process has been added, aiding in the production of high quality electroformed components.

4. Central Development Lab

MMIC Design and Development Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Develop differential LNA for balanced feeds	12/1/2006	4/1/2007	
2. Develop integrated wideband LNA-feed package	12/1/2006	4/1/2007	
3. Evaluate Adaptive Digital Image-Rejection approach for wideband downconversion	12/1/2006		
4. Design/Revise DSN front-end modules for wider bandwidth	9/30/2006		8/11/2006
5. Test the revised DSN wideband downconverter	1/1/2007		
6. Design wideband downconverter module for the Allen Telescope Array	3/1/2007		
7. Package and measure wideband 11-34 GHz LNA	3/1/2007		
8. Design GaAs W-Band power amplifiers to improve reliability of millimeter-wave local oscillators	3/1/2007	ongoing	
9. Development of wideband low phase noise MMIC VCO	10/1/2007		
10. Millimeter/Sub-millimeter HBT MMIC development	10/1/2007		

Notes:
1. Extensive effort has been put into designing this MMIC. Some progress has been made, but the combination of specs on input impedance, noise temperature, and dynamic range are proving to be most challenging.
5. The module design referred to in item 4 was completed, and the drawings sent to JPL for fabrication. Tests are expected to begin at JPL by the end of the year.
7. This task has been delayed due to an error in fabrication at the foundry.
8. The design for a new GaAs power amp for ALMA Band 3 (up to 108 GHz) has been completed and is in fabrication. Designs have been started for Bands 7 and 10 using an experimental short-gate-length (70nm) GaAs pHEMT process at BAE. If successful, the Band 7 PA will be the first broadband medium power amplifier that extends above W-Band (75-110 GHz).
9. This is a joint R&D effort of the NRAO-CDL and ASIAA, Taiwan to develop low-cost, low-power alternatives to Yig-Tuned Oscillators (YTOs) for local oscillators. WIN Semiconductor has finished a wideband Heterostructure Bipolar Transistor (HBT) Voltage-Controlled Oscillator (VCO) MMIC wafer run; samples are to be delivered to the CDL for testing.
10. This is a collaborative project of the NRAO-CDL, U. of Illinois, BAE and UVA and is funded by the DARPA SWIFT program. A 340 GHz HBT VCO MMIC with integrated waveguide transitions has been fabricated and is currently under test.

Superconducting Millimeter-Wave Receiver Development Milestones

Milestones	Original Date	Revised Date	Date Completed
350-µm Receiver Technology Development			
1. Demonstrate NbTiN/insulator/Nb tunnel junction	10/01/2006		

4. Central Development Lab

Milestones	Original Date	Revised Date	Date Completed
Balanced SIS Mixer Development			
2. Complete first balanced SIS mixer with superconducting IF hybrid	01/01/2007		
3. Complete first balanced sideband-separating mixer	10/1/2007		
4. 385-500 GHz SIS mixer Development	09/30/2005	12/31/2006	
5. Measure IF characteristics of a diffusion-cooled HEB mixer	06/30/2006		

Notes:
1. This project is being done with the University of Virginia Microfabrication Laboratory. The withdrawal of promised funding from UAZ will delay the fabrication and testing of RF structures using NbTiN SIS junctions.
3. This project is the next step towards the ultimate low-noise SIS receiver. It builds on 2, above, to make a balanced sideband-separating SIS mixer with very low noise and low LO power requirement. Such mixers will be essential for future coherent mm/sub-mm focal plane and beam forming array receivers.

Electromagnetic Support Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Design of EVLA 12-18 GHz feed	09/30/2004	12/31/2006	
2. Develop dual frequency 345/800 MHz feed for the GBT	09/30/2005	02/15/2007	
3. Measure EVLA 2-4 GHz feed	03/31/2007		
4. Design of 84-106 GHz phase shifter	12/31/2006		09/30/2006
5. Prototype at K-band, W-band phase shifter fabricate and measure	03/31/2007		

Notes:
2. An existing 600 MHz short-backfire antenna feed was configured to model the new 345 MHz and 800 MHz feeds. Measurements of these configurations were completed and design analysis of the dual band feed is in progress.
4. The design of the W-band (84-106 GHz) phase shifter was completed. However, this phase shifter has been optimized to work over the entire 75-110 GHz band with a differential phase shift of 90°±3.6°. Fabrication of a prototype scaled to K-band (18-26 GHz) is in progress. This design is about 30% shorter than the present K-band design and can be used for the EVLA X- and Ku-band designs.

Green Bank Solar Radio Burst Spectrometer (GB/SRBS) Milestones

Milestones	Original Date	Revised Date	Date Completed
GB/SRBS Phase II:			
1. 70-300 MHz, dual polarization, log-periodic on 45-foot telescope, new analog spectrometer	03/31/2005	05/15/2006	06/16/2006

4. Central Development Lab

Milestones	Original Date	Revised Date	Date Completed
GB/SRBS Phase III:			
2. 10-80 MHz, dual polarization, four crossed dipoles, new digital spectrometer	09/30/2005	03/15/2007	
3. 80-300 MHz, dual polarization, log-periodic on 45-foot telescope, new digital spectrometer	09/30/2005	11/05/2006	
4. 300-2500 MHz, dual polarization, 45-foot telescope with log-periodic feed, new digital spectrometer	09/30/2005	11/05/2006	

Notes: The low frequency antenna work has been delayed until spring, 2007.

The Precision Array to Probe the Epoch of Reionization (PAPER) Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Four portable sleeved-dipole elements	09/15/2005		09/15/2005
2. Eight-element, full-Stokes array in Green Bank	03/31/2006	06/15/2006	08/25/2006
3. 32-element prototype array, operating in the 100-200 MHz band in Green Bank	12/31/2006	09/30/2007	
4. Sixteen elements array in Western Australia	12/15/2006	04/15/2007	

Notes:

2. The eight-element, full-Stokes array has been deployed at the Green Bank site in mid-August 2006. The array consists of eight portable sleeved-dipole elements on ground screens that are connected to a central correlator via coaxial cable. The dipoles, active baluns, transmission line drivers, and receivers were developed by students at the NRAO-UVA Instrumentation Program.

3. Completion of the 32-element array is now scheduled for late summer, 2007.

4. The size of the Western Australia array has been increased to sixteen elements. Deployment has been rescheduled for April, 2007.

Frequency-Agile Solar Radiotelescope (FASR) Development Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Develop FASR engineering R&D planning document	04/28/2006		04/28/2006
2. Develop FASR engineering design document	06/16/2006	12/15/2006	

Notes:

2. This will be a dynamic document that will be updated periodically to incorporate the latest results from the R&D work.

CHILE OPERATIONS

Local Labor Milestones

Milestones	Original Date	Revised Date	Date Completed
1. ALMA Head of HR for Chile in place	01/10/06		07/10/06
2. Documents above approved by NSF			07/13/06

Notes:
1. Started work at ALMA central offices on July 19.

Business/Contracting Milestones

Milestones	Original Date	Revised Date	Date Completed
1. ALMA Recreation room dedicated	07/04/06		07/04/06
2. Start work in the cabling and Fiber Optics conduits for antenna contractors areas	09/01/06		09/01/06

Notes:
1. Pool room, projection room, TV, exerciser. Finished in June 27, 2006, dedicated July 4, 2006.
2. To be finished November 15, 2006.

Other Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Environmental reporting to CONAMA	Monthly		Monthly

Notes:
1. Monthly reports are sent to CONAMA; in their latest site visit on September 2006, they congratulated ALMA for their environmental awareness.

E2E OPERATIONS

e2e Management & Administration Activities

Milestones	Original Date	Revised Date	Date Completed
1. Conduct meeting with CADC on archive possibilities	07/31/06		07/19/06
2. Revitalize Observatory Computing Council (OCC)	07/31/06		
3. Conduct all-NRAO Software Conference	08/10/06		08/10/06
4. Plans presented at all-NRAO Software Conference	08/08/06		08/08/06
5. Establish coordinated software calendar for FY 2007 work	09/30/06		09/30/06
6. Coordinate efforts of work teams and reporting process	09/30/06		09/30/06
7. Strategic alliances for external funding established	09/30/06		09/30/06
8. External funding plan established	09/30/06		09/30/06
9. Social-network analysis early results disseminated	12/31/06		
10. Proposals for external funding developed and issued	12/31/06		

NRAO Participation in the National Virtual Observatory (NVO) Project

Milestones	Original Date	Revised Date	Date Completed
1. Draft SSA 1.0 (spectral access) protocol document	05/01/06	10/12/06	
2. VOClient software for NVO summer school	07/31/06		08/29/06
3. DAL service reference code in Java	07/31/06	deferred	
4. Draft V1.0 Cone Search specification	08/15/06		09/10/06
5. Draft V1.0 Simple Image Access specification	08/15/06	11/01/06	
6. Draft V1.0 Simple Line Access specification	08/15/06		08/15/06
7. NVO Summer School (Aspen)	09/06/06		09/06/06
8. IVOA interoperability workshop (Moscow)	09/17/06		09/17/06
9. Draft SSA 1.0 data model (Spectrum) document	10/12/06	deferred	
10. Scalable data analysis framework BoF at ADASS	10/16/06		
11. NVO fall team meeting (Annapolis)	11/09/06		
12. VOClient enhancements including SSA support	12/01/06		
13. Draft chapters for NVO end-of-grant-period book	12/01/06		
14. Promote Cone Search to PR (prelim. recommendation)	12/01/06		
15. Promote Simple Image Access to PR	12/01/06		
16. Promote Simple Spectral Access to PR	12/15/06		
17. Promote Line Access Protocol to PR	12/15/06		

OPERATIONS

6. e2e Operations

Milestones	Original Date	Revised Date	Date Completed
18. Contribute pre-proposals to NVO facility proposal	11/20/06		
19. Contribute final proposal input to NVO facility proposal	12/31/06		
20. Conduct Fall 2006 joint meeting of NRAO/NVO	12/31/06		
21. Scalable data analysis framework functional prototype	02/15/07		
22. Initial working draft SIA V2 document	05/01/07		
23. Initial working draft table access protocol document	05/01/07		
24. Concept for handling SEDs and spectral aggregates	05/01/07		
25. IVOA interoperability meeting (China)	05/14/07		

NRAO Archive Infrastructure & Interfaces

Milestones	Original Date	Revised Date	Date Completed
1. Acquire and install ESO/NGAS Archive Software	01/15/06		09/30/06
2. Install archive host prototype #2	07/01/06		07/01/06
3. Document physical architecture of existing system	08/30/06		08/30/06
4. Integrate NGAS archive system into existing NRAO science data archive	09/30/06		09/30/06
5. Document role of archive facilities in NRAO Integrated Science Center vision, including envisioned physical and application architectures	09/30/06	02/28/07	
6. Develop second-generation archive interface prototype based on existing servlets	10/31/06	Deferred	
7. Updates to SIAP image server	11/15/06	10/31/06	
8. Complete VO-Google Pre-prototype	12/31/06		
9. Core Science Group releases new archive interface	12/01/06	05/31/07	
10. Complete transfer of historical VLBA tape archive	12/31/06		
11. Complete transfer of 1.5 TByte historical GBT science data	12/31/06		
12. Construct global calibrator source database for all NRAO telescopes	05/30/07		

NRAO Proposal Infrastructure & Interfaces

Milestones	Original Date	Revised Date	Date Completed
1. Develop transition plan	09/30/06	11/15/06	
2. Effect transition of NRAO PST & Database to e2e Ops	12/31/06	02/15/07	

OPERATIONS

6. e2e Operations

Scheduling & Metrics Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Establish communications with VLA/VLBA, EVLA, GBT, ALMA working groups and staff members	08/30/06		08/30/06
2. Develop coordination calendar for scheduling efforts across Observatory	12/31/06		

Data Processing (CASA/GBTIDL) Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Integrate CASA/GBTIDL milestones into upcoming quarterly reports	09/30/06	12/31/06	

NRAO Pipeline Infrastructure & Interfaces

Milestones	Original Date	Revised Date	Date Completed
1. Schedules generated for all pipeline pilot projects	08/01/06		08/01/06
2. Pipeline reductions for first 50% pilot projects complete	07/05/06		07/05/06
3. Pipeline reductions for remainder complete	08/15/06		08/15/06
4. Pilot plans for Fall 2006 observing complete	09/01/06		09/01/06
5. Data Product Generation Plan complete with detailed assignments for new, temporary data analysts	07/31/06		08/15/06
6. Develop process for augmenting archive with new data products, e.g. images, produced by pipelines	08/15/06		08/15/06
7. VLA/VLBA calibrator polarization monitoring pipeline simplified and transitioned to Socorro data analysts for routine population of NRAO archive with relevant images and updates to web interface	08/31/06		08/31/06
8. Institute coordination between all data analysts	08/10/06		08/10/06
9. Summary statistics and report on existing VLA/VLBA pipeline in AIPS	09/30/06	11/15/06	
10. Start working through past VLA archive data with AIPS pipelines to generate science products	10/01/06		09/18/06
11. First half of VLA archive processed via pipeline	06/30/07		
12. Requirements for pipeline improvements set	09/30/07		
13. Second half of VLA archive processed via pipeline	06/30/08		
14. Develop plan for common VLA/Chandra sources	12/31/06		
15. Explore possibility of common NRAO/HST sources	12/31/06		
16. Explore possibility of common NRAO/Spitzer sources	12/31/06		

6. e2e Operations

Milestones	Original Date	Revised Date	Date Completed
17. Process in place for a data analyst to pipeline and archive straightforward VLA/VLBA observations within two weeks of data availability	01/31/07		
18. Feedback from researchers regarding utility of pipelined products available and disseminated	06/30/07		

COMPUTER AND INFORMATION SERVICES

Observatory-wide Milestones

Milestones	Original Date	Revised Date	Date Completed
1. First draft of data security policy (a)	08/31/06		08/31/06
2. Install secure certificates for web and mail services (a, b, c)	09/15/06		09/15/06
3. Migration to RedHat Enterprise Linux 4 complete (b)	05/31/06	09/30/06	09/30/06
4. Acquire new hardware to support AOC/VLA OC-3 link (d)	09/30/06		09/30/06
5. Investigate network monitoring software (d)	10/31/06		
6. Upgrade link between UVa and NRAO-CV to 100Mbps(d)	10/31/06		
7. Authenticated outgoing mail (SMTP) (b)	11/30/06		
8. Switch over to new AOC/VLA OC-3 link (d)	11/30/06		
9. Deployment of Symantec Anti-virus version 10 (a, b)	07/31/06	12/31/06	
10. Complete computer inventory facility (b)	12/31/06		
11. Acquire and deploy network monitoring software (d)	12/31/06		
12. Final version of data security policy (a)	12/31/06		
13. Upgrade link between UVa and NRAO-CV to 1 Gbps (d)	01/31/07		

Notes:

6. This will also increase the bandwidth service between Green Bank and the Internet and research networks from 10Mbps to 20Mbps.

9. The current version of Symantec Anti-Virus has been deployed on all servers across the NRAO. However, there have been significant difficulties in deploying it on the clients. We are working with the vendor to solve these problems.

(a) Security
(b) Common Computing Environments
(c) World-wide web infrastructure
(d) Telecommunications

Charlottesville Computing Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Upgrade primary mail gateway	07/01/06		07/01/06
2. Order computer upgrades for older desktop computers	07/15/06		07/15/06
3. Upgrade link to UVa to 10 full duplex	08/31/06		08/31/06
4. Migration to RedHat Enterprise Linux 4 complete	05/31/06	09/30/06	09/30/06

EDUCATION AND PUBLIC OUTREACH

Publications Milestones

Milestones	Original Date	Revised Date	Date Completed
1. General public brochure delivered by printer to NRAO	05/26/06	11/5/06	
2. Issue submission call for October Newsletter	08/01/06		08/01/06
3. 2nd annual AUI / NRAO Image Contest submission deadline	09/01/06		09/01/06
4. Announce 2nd annual AUI/NRAO Image Contest winners	10/13/06		
5. Issue submission call for January Newsletter	11/1/06		
6. January Newsletter delivered to printer	12/15/06		
7. Initiate 2007 NRAO Calendar design	11/10/06		
8. 2007 NRAO Calendar delivered by printer	12/22/06		
9. Select images for 2 new, large-format posters	11/11/06		
10. Printer delivers posters	12/22/06		
11. Announce 3rd annual AUI/NRAO Image Contest	01/10/07		

Notes:
1. This schedule revision driven by the decision to use an external graphic-design contractor and high-quality printer.
4. Image Contest winners and images on-line at www.nrao.edu/imagegallery/image_contest/image_contest_2006_prizes.shtml.

World Wide Web Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Draft WWW webmaster position description	07/24/06	09/01/06	08/29/06
2. Draft WWW EPO content position description	07/24/06	09/01/06	08/29/06
3. Draft NRAO WWW concept paper	07/24/06	08/13/06	08/13/06
4. Confirm FY07 WWW budget availability	09/14/06		09/22/06
5. Advertise for WWW positions[1]	10/06		10/15/06
6. EPO WWW Content Specialist selection complete	12/15/06		

Notes:
5. Additional advertising was conducted the week of 10/22/06.

ALMA EPO Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Coordinate FY 2007 ALMA EPO program with the NAASC	07/17/06		07/17/06

8. Education and Public Outreach

Milestones	Original Date	Revised Date	Date Completed
2. Organize inaugural ALMA EPO meeting at IAU	08/23/06		08/23/06
3. Complete Sister Cities MoU	11/17/06		
4. Complete ALMA brochure (English, Spanish)	11/08/06		
5. ALMA EPO WG face-to-face meeting (Madrid)	11/16/06		
6. Update ALMA brochure for interferometry school (Chile)	12/01/06		
7. Update ALMA brochure for AAS meeting (Seattle)	12/08/06		
8. Complete draft ALMA EPO Program Plan	12/15/06		
9. Complete draft ALMA EPO Policies & Procedures	12/15.06		

Astronomical Community Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Ship exhibits and ancillary materials to IAU in Prague	08/01/06		08/01/06
2. IAU General Assembly (Prague) exhibition	08/14–25/06		08/25/06
3. Complete annual exhibits revision	12/15/06		
4. Ship exhibits/materials to Winter AAS meeting	12/27/06		
5. NRAO Town Hall at Winter AAS meeting	01/08/07		
6. Winter AAS meeting /exhibition ends (Seattle)	01/10/07		

Notes:
2. EPO will operate and staff an NRAO exhibit at the IAU, and is collaborating with ESO and the NAOJ on the ALMA exhibits at the IAU.

Management EPO Milestones

Milestones	Original Date	Revised Date	Date Completed
1. Submit draft FY 2007 EPO Program Plan	07/06/06		
2. Summer Student lecture re EPO	08/03/06		
3. ASP EPO meeting (Baltimore)	09/16–18/06		
4. NM Tech Skeen Library public talk (Socorro, NM)	10/5/06		
5. Johns Hopkins Univ Ctr for Talented Youth (UVa) talk	10/21/06		
6. VA Piedmont Tech Tour (NTC)	10/26/06		
7. NRAO CV Open House	11/5/06		
8. ALMA EPO WG meeting (Madrid, Spain)	11/16/06		
9. Winter AAS meeting (Seattle)	01/5-9/07		
10. Royal Astronomical Society talk	01/10/07		

8. Education and Public Outreach

Milestones	Original Date	Revised Date	Date Completed
11. Penticton talk	01/12/07		

Custom School & Civic Group Program Milestones

Milestones	Original Date
1. 2005 WV Governor's School for Math & Science Reunion	07/07–08/06
2. 2006 VA Governor's School for Math & Science	07/25/06
3. Tygarts Valley Summer Enrichment	08/17/06
4. Guardian Angel Regional Catholic School	09/27/06
5. Marshall University	10/06/06
6. Boy Scout Troop #225	10/07/06
7. Boy Scout Troop 22	10/13-14/06
8. Lynchburg College	10/19/06
9. FSC	10/21/06
10. Trinity Area School	10/27-28/06
11. West Stanley High School	11/16-19/06

Formal Education & Conference Program Milestones

Milestones	Original Date
1. ERIRA	07/08–16/06
2. Chautauqua 2006 (Socorro)	07/12–14/06
3. Goddard Center for Astrobiology	07/14/06
4. NASA/NRAO Joint Institute	07/16–21/06
5. Radio Astronomy for Teachers	07/17–19/06
6. 2006 WV Governor's School for Math & Science	07/30–08/12/06
7. Pocahontas County GEAR UP Camp	08/13-16/06
8. Science Bowl 2006	11/02/06

ADMINSTRATION

Environment, Safety, and Security (ES&S)

On the ALMA Project, ES&S participated in several design reviews and developed the training program to assure safety at the antenna test facility in New Mexico. In New Mexico, ES&S procured the USVI emergency generator permits and participated in the successful completion of the halon testing at the AOC. In Green Bank, efforts addressed the site fire-detection system including upgrades to the panels in the warehouse and works areas. In Charlottesville, the first NRAO Safety Committee meeting was held and employees were offered training in cardio-pulmonary resuscitation. In the next quarter efforts will include the implementation of the NRAO pandemic response program as well as participation in the implementation of the fire-detection and card-access systems in Charlottesville.

ALMA

Work on the ALMA project included several design reviews including the Vertex antenna pre-production design review, the ACA back-end and front-end equipment installation plan, the seismic design review for the electronic-racks support structure, and the Band 7 cartridge safety documentation. At the antenna test facility in New Mexico, ES&S prepared the safety training requirements that are planned for implementation in October–November 2006. Together, these training sessions will establish the minimum requirements to assure safe operation and maintenance of the prototype antennas.

NRAO–New Mexico

In New Mexico, ES&S completed the implementation of the U.S. Department of Transportation drug and alcohol testing program for commercial drivers. This included providing awareness training for supervisors. Also this quarter, the Emergency Services group elected a new chief and began training efforts to assure that all the EMS providers are current on the required certifications. At the AOC, ES&S is involved in the control of expansion into restricted egress areas. The Site Safety Representatives are working with local management to assure that the means of egress are appropriately signed and illuminated as well as to assure that equipment does not encroach on the necessary exit routes. The AOC halon fire-protection testing was successfully completed this quarter, and the safety acceptance of the clean-agent fire-suppression system for the EVLA correlator was successfully completed. This quarter, the X-ray machine in the AOC was recalibrated, and personnel training was completed. Lastly, the emergency-generator EPA permits were received from the Virgin Islands Department for the Protection of Natural Resources.

NRAO–Green Bank

In Green Bank, the Bunkhouse fire-alarm box/panel, smoke-detector heads, pull stations, and flow-control device were upgraded. Lightning knocked out the fire-alarm panels in the Warehouse and Works area which were subsequently replaced with new EST fire-control panels. At the Science Center, the fire-alarm system is not operating properly owing to interference that is causing the system to send random error messages. ES&S is working with Maintenance and Electronics to correct the problem. ES&S was involved in the planning and review of the of the feed-arm repair at the GBT. The repair consisted of repairing a crack in a structural beam that supports the receiver room. The GB site annual elevator-safety

inspection was completed. Lastly, the site security surveillance system was updated, and training on its use was provided to key personnel by the system representative.

NRAO-Charlottesville

This quarter, the first Charlottesville Safety Committee meeting was held. As a result of this meeting several potential safety items were discussed and quarterly meetings are planned. Cardio-Pulmonary Resuscitation refresher training was performed for employees in Charlottesville, and the NTC facility has had safety signage installed. ES&S coordinated a pickup of hazardous waste generated from the chemistry lab operations. Lastly, ES&S developed the Scope of Work and participated in the contractor-selection process for fire detection and alarm systems as well as the card access system. Award and installation of the fire detection and card access systems is anticipated next quarter.

Future Efforts

In the next quarter, the site safety representatives will pursue the implementation of the pandemic response program, completion of the site safety inspection in Green Bank, and will also work with the vendors in the installation of the fire detection system in Charlottesville.

PROGRAM MANAGEMENT OFFICE

Program Management Office and Web-Based Business Services Initiative

During this quarter, the Program Management Office (PMO) focused almost entirely on the completion of the Web-Based Business Services (WBBS) initiative. Work on WBBS included three main areas: completion of the original base contract with Partners' Consulting to install the PeopleSoft-based business software system; addressing the items identified in the WBBS Service Review by key users that was conducted in March 2006; and investigation of a third-party system for Electronic Timekeeping (ETK) that provides an improved user interface and will support an option to enter percentage of total time worked on a task as well as total hours worked by task.

Progress was made on each of these areas. We anticipate that in the last quarter of 2006, nearly all items in both the base contract and the Service Review contract will be closed out. In addition, a company has been identified (Qqest) that has demonstrated a product that may meet our needs for a more flexible ETK system. Further investigation of this system will occur in the last quarter of this year and the first quarter of 2007.

Toward the end of this reporting quarter, the planned transition of responsibility for operations and maintenance of WBBS from PMO to the Administration Division occurred. This transition will be completed in the last quarter of 2006.

PERSONNEL

NEW HIRES

Chung, Aeree	Jansky Fellow	10/09/06
Grider, Ronald	Software Engineer I	08/09/06
Malagon, Hector	Electronics Engineer III	10/02/06
Marrone, Daniel	Jansky Fellow	09/01/06
Mundnich, Martin	Mechanical Engineer I	09/11/06
Pilleux, Mauricio	ALMA Business Manager	09/01/06
Reid, Robert	ALMA Postdoc	09/01/06
Rodriguez, Anthony	Product Assurance Engineer I	07/31/06
Valasquez, Phil	Electronics Engineer III	10/02/06
Wang, Wei-Hao	Jansky Fellow	09/01/06

REHIRE

Palmer, Patrick	Visiting Scientist	07/01/06

TERMINATIONS

Stuteville, Jimmie	Safety Officer	09/30/06
Qifeng Yin	Scientist/A	09/30/06
Turner, Barry	Astronomer	09/30/06

TRANSFERS

Lacasse, Richard	Electronics Engineer, Senior (GB to CV)	07/01/06
Van Moorsel, Gustaaf	Scientist/CS	08/01/06
Tody, Douglas	e2e Operations	07/01/06

PROMOTIONS

Butler, Bryan	Division Head EVLA Computing	08/01/06
Chandler, Claire	Scientist	07/01/06
Hibbard, John	Scientist	07/01/06
Pospieszalski, Marian	Scientist/SRE w/tenure	07/01/06
Shelton, Amy	Division Head, GB Software Development	08/01/06
Ulvestad, James	Scientist, w/tenure	07/01/06

BUDGET

The table below represents NRAO Operations (without EVLA) expenses and commitments for Fiscal Year 2006 as reported at Work Breakdown Structure (WBS) Level 1.

The available funds for NRAO Operations (without EVLA) total $52,132k. This amount includes $45,292k in new NSF Funds ($50,732k less $5,440k for EVLA Phase 1 construction), $1,926,616 in prior-year commitments, $901,824 in prior-year operations carryover and $4,011,535 in Green Bank track-repair carryover. A total of $50,732k in new NSF funds for NRAO Operations has been received.

NRAO Operations Expenses and Commitments FY 2006 Year to Date (October 1, 2005 to September 30, 2006)

Work Breakdown Structure Element Level 1	Salaries & Benefits	Materials & Services	Travel	Revenue or Cost Recovery	Total
Observatory Management	$3,541,130	$1,883,937	$348,416	($18,801)	$5,754,682
Education and Public Outreach	$390,975	$197,223	$30,691	($155,389)	$463,500
Central Development Lab	$1,031,686	$450,989	$26,536	(82,326)	$1,426,886
Green Bank Operations	$7,460,658	$2,944,580	$165,047	($665,069)	$9,905,216
New Mexico Operations	$11,895,933	$4,651,802	$198,892	($101,227)	$16,645,399
ALMA Operations	$686,206	$219,230	$51,975	($6,215)	$951,196
Computer and Information Services	$769,317	$692,395	$28,829		$1,490,542
Division of Science and Academic Affairs	$3,671,321	$505,431	$258,062	($4,975)	$4,429,839
	$29,447,225	**$11,545,587**	**$1,108,448**	**($1,034,002)**	**$41,067,258**

APPENDIX

Acronyms and Abbreviations

ACRONYMS AND ABBREVIATIONS

Acronym	Definition
AAS	American Astronomical Society
ACA	ALMA Compact Array
ACU	Antenna Control Unit
ADIOS	Analog Digital Input Output System
AGN	Active Galactic Nucleus, or Active Galactic Nuclei
AIPS	Astronomical Image Processing System
AIV	Assembly, Integration, and Verification
ALMA	Atacama Large Millimeter Array
ANASAC	ALMA North American Scientific Advisory Committee
AOC	Array Operations Center (Socorro, NM)
AOS	Array Operations Site (ALMA)
APL	Applied Physics Laboratory (Johns Hopkins U.)
ARC	ALMA Regional Center
ASAC	ALMA Scientific Advisory Committee
ASP	Astronomical Society of the Pacific
ATA	Allen Telescope Array
AUI	Associated Universities, Incorporated
BAE	British Aerospace Engineering
C-band	4–8 GHz
CADC	Canadian Astonomical Data Center
CASA	Common Astronomy Software Applications
CCAT	Cornell–Caltech Atacama Telescope
CCE	Common Computing Environment
CDL	Central Development Laboratory (Charlottesville, VA)
CDR	Critical Design Review
CIS	Computer and Information Services
CMB	Cosmic Microwave Background radiation
CSV	Commissioning and Science Verification
CV	Charlottesville
CY	Calendar Year
DAL	Data Access Layer (VO interface to science data)
DARPA	Defense Advanced Research Projects Agency
DAT	Digital Audio Tape
DRAO	Dominion Radio Astrophysical Observatory
DSAA	Division of Science and Academic Affairs
DSN	Deep-Space Network (NASA)
DTS	Digital Transmission System
e2e	End-to-End
EMS	Emergency Medical Services
EPA	Environmental Protection Agency
EPO	Education and Public Outreach
ES&S	Environment, Safety, and Security (NRAO)
ESO	European Southern Observatory
ETK	Electronic Time Keeping

APPENDIX

Acronyms and Abbreviations

Acronym	Definition
EVLA	Expanded Very Large Array
EVN	European VLBI Network
FASR	Frequency-Agile Solar Radiotelescope
FAWG	Funding Agency Working Group (SKA)
FM200	Fire-suppression system
FPGA	Field-Programmable Gate Array
FY	Fiscal Year
GaAs	Gallium Arsenide
GB	Green Bank
GB/SRBS	Green Bank Solar Radio Burst Spectrometer
GBT	Green Bank Telescope
GBTIDL	GBT Interactive Data Language
GHz	Gigahertz
GPS	Global Positioning System
GRB	Gamma-Ray Burst
GUI	Graphical User Interface
HBT	Heterostructure Bipolar Transistor
HEB	Hot-Electron Bolometer
HI	Neutral hydrogen
HLA	High-Level Architecture
HN	Hancock, NH (VLBA station)
HR	Human Resources
HAS	High Sensitivity Array
HST	Hubble Space Telescope
HVAC	Heating, Ventilation, and Air Conditioning
IAT	International Atomic Time
IAU	International Astronomical Union
IDCAF	Interim Data Capture and Format
IDL	Interactive Data Language
IF	Intermediate Frequency
IR	Infrared
ISPO	International SKA Project Office
ISSC	International SKA Steering Committee
IVOA	International Virtual Observatory Alliance
JAO	Joint ALMA Office
JPL	Jet Propulsion Laboratory
K-band	18–26.5 GHz
Ka-band	26.5–40 GHz
keV	Kilo electron-Volts
Ku-band	12–18 GHz
L-band	1–2 GHz
LNA	Low-Noise Amplifier
LO	Local Oscillator
LST	Local Sidereal Time
LTA	Long-Term Accumulator (GBT spectrometer)

APPENDIX

Acronyms and Abbreviations

Acronym	Definition
LWA	Long-Wavelength Array
LWDA	Long-Wavelength Development Array
M&C	Monitor and Control
MERLIN	Multi-Element Radio-Linked Interferometer
MHz	Megahertz
MK	Mauna Kea (VLBA station)
MLLN	MIT–Lincoln Labs–NRAO
mm	Millimeter
MMIC	Monolithic Microwave Integrated Circuit
MOU	Memorandum of Understanding
NA	North American / Not Applicable / Not Available
NAASC	North American ALMA Science Center
NAOJ	National Astronomical Observatory of Japan
NASA	National Aeronautics and Space Administration
Nb	Niobium
NbTiN	Niobium Titanium Nitride
NGAS	Next Generation Archive System
NRAO	National Radio Astronomy Observatory
NRC	National Research Council (Canadian)
NSF	National Science Foundation
NTC	NRAO Technology Center (Charlottesville)
NVO	National Virtual Observatory
OMT	Orthomode Transducer
OPS	Operations
OPT	Observation Preparation Tool
OSC	Observatory Science Council
OSF	Operations Support Facility
OSHA	Occupational Safety and Health Administration
P-band	327 MHz
PAPER	Precision Aray to Probe the Epoch of Reionization
PC	Personal Computer
PDM	Project Data Model
PEP	Performance Evaluation Process
pHEMT	pseudomorphic High-Electron-Mobility Transistor
PMO	Program Management Office
PR	Preliminary Recommendation
PST	Proposal Submission Tool
PT	Pie Town (VLBA station)
PTCS	Precision Telescope Control System
Q	Quarter
Q-band	40–50 GHz
QSO	Quasi-stellar Object
R&D	Research and Development
REU	Research Experiences for Undergraduates (NSF program)
RF	Radio Frequency

APPENDIX

Acronyms and Abbreviations

Acronym	Definition
RFI	Radio-Frequency Interference
RTP	Round-Trip Phase
S-band	2–4 GHz
SED	Spectral Energy Distribution
SIA	Simple Image Access
SIAP	Simple Image Access Protocol
SIS	Superconductor–Insulator–Superconductor
SKA	Square Kilometre Array
S/N	Serial Number
SSA	Simple Spectral Access (NVO term)
SSS	Science Support Systems
SWIFT	Secure Wireless and Fault-tolerant Tunable networks (DARPA program)
submm	submillimeter
TARS	Tethered Aerostat Radar System
TB	Technical Building
TP	Total Power
TRW	TRW Corporation
Tsys	System noise Temperature
U-band	12–18 GHz
USVI	U.S. Virgin Islands
UVa	University of Virginia
UVML	University of Virginia Microfabrication Laboratory
VCO	Voltage-Controlled Oscillator
VLA	Very Large Array
VLBA	Very Long Baseline Array
VLBI	Very Long Baseline Interferometry
VO	Virtual Observatory
VSOP	VLBI Space Observatory Program
VSOP-2	VSOP successor
WBBS	Web-Based Business Services
WBS	Work Breakdown Structure
WG	Working Group
WIDAR	Wideband Digital Interferometric Architecture (EVLA correlator)
WWW	World-Wide Web
X-band	8–12 GHz
XRF	X-Ray Flash