NV/QR 017

NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

July 1, 1997 – September 30, 1997

TABLE OF CONTENTS

A. TELESCOPE USAGE

The following telescopes have been scheduled for research and maintenance in the following manner during the third quarter of 1997.

	140 Foot	12 Meter	VLA	VLBA
Scheduled Observing (hrs)	1912.50	726.00	1685.00	1042.50
Scheduled Maintenance and Equipment Changes	261.50	19.25	240.90	241.00
Scheduled Tests and Calibration	30.00	1462.75	288.20	359.00
Time Lost	68.50	37.75	75.83	52.60
Actual Observing	1844.00	688.25	1609.17	989.90

B. 140 FOOT OBSERVING PROGRAMS

The following line programs were conducted during this quarter.

No.	Observers	Programs
B662	Balser, D. Bania, T. (Boston) Huang, M. (Boston) Shah, R. (Virginia) Rood, R. (Virginia) Jackson, J. (Boston)	Measurements of ionized carbon in the Milky Way.
B667	Bates, N. (Princeton) Maddalena, R.	A 21 cm survey to detect high velocity gas in face-on galaxies.
B668	Burton, W. B. (Leiden) Hartmann, D. (CFA) Blitz, L. (UC, Berkeley)	21 cm observations of extensive high-velocity HI gas near M31 and M33.
B669	Burton, W. B. (Leiden)	21 cm HI observations of the properties of the Wannier, et al., enigmatic high-velocity clouds.
B677	Balser, D. Lockman, F. J.	21 cm observations of diffuse low surface brightness HII regions.
L319	Lockman, F. J. Murphy, E. (Johns Hopkins)	21 cm HI mapping of the galactic plane.
M405	Matthews, L. (SUNY) Gallager, J. (Wisconsin) van Driel, W. (Paris Obs)	An HI survey of southern extreme late-type galaxies in the local supercluster.
R269	Rupen, M. Holdaway, M.	HI total power observations as bias images to support VLA mosaicing projects.

No.	Observers	Programs
S415	Schloerb, F. P. (Massachusetts) Lovell, A. (Massachusetts) DeVries, C. (Massachusetts) Senay, M. (Massachusetts) Irvine, W. (Massachusetts) Wootten, H. A.	18 cm OH radio observations of comets Hale-Bopp and Wirtanen.
SETI	Tarter, J. (SETI)	Project Phoenix.
T336	Tifft, W. (Arizona)	Terminal 140 Foot standard 21 cm observations.
W361	Wiklind, T. (Chalmers, Onsala) Combes, F. (Paris Obs)	Studies at 749 and 845 MHz of the redshifted 21 cm HI absorption toward PKS1504+377, PKS1830-211, and other sources.

The following pulsar programs were conducted during this quarter.

No.	Observers	Programs
A118	Arzoumanian, Z. (Cornell) Nice, D. (Princeton) Taylor, J. (Princeton) McLaughlin, M. (Cornell)	Bimonthly timing of 63 pulsars at 575, 800, and 1650 MHz.
A132	Arzoumanian, Z. (Cornell) Nice, D. (Princeton)	Monitoring at 575 MHz of the evolution of the PSR B1957+20 eclipsing binary system.
B617	Backer, D. (UC, Berkeley) Sallmen, S. (UC, Berkeley) Foster, R. (NRL) Matsakis, D. (NRL)	Pulsar timing array observations at 800 and 1395 MHz.
N018	Nice, D. (Princeton) Thorsett, S. (Princeton)	Monitoring the irregularities in the rotation and orbital motion of an eclipsing binary pulsar, B1744-24A.
S419	Sallmen, S. (UC, Berkeley) Backer, D. (UC, Berkeley)	575 and 800 MHz polarimetry to decode millisecond pulsar magnetsphere.

The following very long baseline programs were conducted.

No.	Observers	Programs
BG062	Greenhill, L. (CFA), *et al.*	Observations of the nucleus of NGC 4258.
GG031	Galama, T. (Amsterdam), *et al.*	Determining motions and birthplaces of pulsars through VLBI astrometry.
GW016	Walker, R. C., *et al.*	Structure and motions in 3C120 at 1.6 GHz.
V022	Wilkinson, P. (Manchester)	HALCA: investigation of three gravitational milli-lens candidates.

V047	Gurvits, L. (JIVE)	HALCA: structure of extremely high redshift quasars.
V085	Schilizzi, R. (NFRA)	HALCA: morphological and spectral study of GPS galaxies and quasars.
VSOP	Tests/VSOG	HALCA in-orbit checkout.

C. 12 METER OBSERVING PROGRAMS

The following line programs were conducted during this quarter.

No.	Observers	Programs
A135	Apponi, A. (Arizona) Ziurys, L. (Arizona)	Evaluating the HCO^+/HOC^+ abundance ratio towards photo-dominated regions.
A136	Aalto-Bergman, S. (Chalmers, Onsala) Radford, S.	Study of molecular line ratios in the Arp 299 galaxy merger.
C307	Clancy, R. T. (SSI, Boulder) Sandor, B. (JPL)	Mars/Earth studies.
C316	Clancy, R. T. (SSI, Boulder)	Mars climate studies and spacecraft support.
J129	Jewell, P. (JCMT) Walker, C. K. (Arizona)	A study of SiO masers in evolved stars—polarization properties.
M400	Mauersberger, R. (Arizona) Havenith, M. (IAP, Bonn) Wilson, T. (MPIR, Bonn)	A search for interstellar van der Waals complexes.
M401	Mangum, J. Wootten, H. A. Butler, B. Bockelée-Morvan, D. (Paris Obs)	Study of the thermal evolution of Comet C/1995 01 (Hale-Bopp).
S424	Sage, L. (Maryland) Welch, G. (St. Mary's U.) Mitchell, G. (St. Mary's U.)	Study of molecular absorption lines in the spectrum of NRAO 150.
S425	Shah, R. (Virginia) Wootten, H. A. Carilli, C. Mangum, J.	Study of deuterium at $z = 0.89$ towards PKS 1830-211.
S427	Smith, B. (IPAC) Struck, C. (Iowa State)	Study of molecular gas in bridge/ring galaxy pairs.
S428	Benson, P. (Wellesley College) Gordon, M. Holder, B. (Wesleyan U.) Jorgenson, R. (Puget Sound U.) Strelnitski, V. (Maria Mitchell Obs)	Simultaneous monitoring of MWC349 in millimeter hydrogen recombination lines and in optical domain.

No.	Observers	Programs
T367	Turner, B.	Continuation of CH_3OH studies in translucent clouds.
T368	Turner, B.	A study of C_2H in translucent clouds.
T371	Turner, B.	How big can molecules get in translucent clouds? A search for even more complex species.
W392	Woodney, L. (Maryland) A'Hearn, M. (Maryland) McMullin, J. Samarasinha, N. (KPNO-NOAO)	Study of sulfur chemistry in Comet Hale-Bopp (C/1995 01).
W400	Woodney, L. (Maryland) A'Hearn, M. (Maryland) McMullin, J. Samarasinha, N. (KPNO-NOAO)	Study of sulfur chemistry in Comet Hale-Bopp (C/1995 01).
W406	Wootten, H. A.	Continuation of a study of deuterated ammonia in interstellar clouds.
Z147	Zhu, M. (Toronto) Bushouse, H. (STScI) Frayer, D. (Toronto) Seaquist, E. (Toronto)	Study of molecular gas in strongly interacting galaxies.

D. VERY LARGE ARRAY OBSERVING PROGRAMS

The Third quarter, 1997 was spent in the following configurations: C configuration from July 1 to July 22; CS configuration from July 22 to September 22; DnC configuration from September 22 to September 30.

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

No.	Observers	Programs
AA209	Aschwanden, M. (Maryland) Bastian, T. Brosium, J. (NASA/GSFC) Holman, G. (NASA/GSFC) Thompson, B. (NASA/GSFC) Jordan, S. (NASA/GSFC)	Multi-loop models of active regions. 2, 3.6, 6, 20 cm
AB805	Biretta, J. (STScI) Owen, F. Zhou, F. (NMIMT)	VLA monitoring of the M87 jet. 0.7, 1.3 cm
AB819	Balcells, M. (Laguna) van Gorkom, J. (Columbia) Sancisi, R. (Groningen/Kapteyn)	Accreting HI on NGC 3656. 20 cm line

No.	Observers	Programs
AB825	Barnes, D. (Melbourne) Webster, R. (Melbourne) Schmidt, R. (Potsdam)	Lens 2237+0305. 20 cm line
AB829	Beck, R. (MPIR, Bonn) Shoutenkov, V. (Lebedev) Shukurov, A. (Newcastle) Sokoloff, D. (Moscow/SSAI)	Polarization in barred galaxies. 20 cm
AB833	de Blok, E. (Groningen/Kapteyn) Verheijen, M. (Groningen/Kapteyn)	HI in low surface brightness galaxy UGC 128. 20 cm line
AB836	Bourke, T. (CFA) Myers, P. (CFA)	OH Zeeman observations of S88B. 20 cm line
AB837	Bosma, A. (Marseille Obs) Kristen, H. (Stockholm Obs) Teuben, P. (Maryland) Regan, M. (Maryland)	HI in the barred spiral NGC 1530. 20 cm line
AB845	Brown, A. (Colorado/JILA) Harper, G. (Colorado/JILA)	Mass loss from evolved K and M stars: comparison of K5 giants. 2, 3.6, 6 cm
AC483	Clarke, T. (Toronto) Kronberg, P. (Toronto) Bohringer, H. (MPIfEP, Garching)	Polarization of radio sources within and behind Abell clusters. 6, 20 cm
AC484	Clements, D. (IAP, Paris) Mundell, C. (Manchester) Baker, A. (Paris Obs) Lamb, S. (Illinois)	HI in ultraluminous IRAS galaxies. 20 cm line
AC487	Cartwright, J. (Caltech) Padin, S. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Shepherd, M. (Caltech)	VLA survey of CBI microwave background fields. 3.6 cm
AC488	Cotton, W. Condon, J. Broderick, J. (VPI & SU)	Low luminosity UGC AGNs. 3.6, 20 cm
AC489	Cotton, W. Bridle, A. Laing, R. (RGO) Giovannini, G. (Bologna)	Kinematics of jet deceleration: NGC 315. 6 cm
AC494	Crosas, M. (CFA) Reid, M. (CFA) Menten, K. (MPIR, Bonn) Carilli, C.	Search for molecular absorption from high z damped Ly systems. 0.7, 1.3, 6 cm line

No.	Observers	Programs
AC496	Condon, J. Yin, Q.	Radio selected sample of radio stars. 2, 3.6, 6, 20 cm
AD380	Dubner, G. (IAFE) Cillis, A. (IAFE) Holdaway, M. Kassim, N. (NRL) Mirabel, I. F. (CNRS, France)	Radio continuum observations in the direction of W50. 90 cm
AD402	Duc, P. (ESO) Brinks, E. (Guanajuato U.) Mirabel, I. F. (CNRS, France)	HI in the interacting system NGC 2992/3. 20 cm line
AD408	Dubner, G. (IAFE) Frail, D. Giacani, E. (IAFE) Goss, W.M. Holdaway, M. Velazquez, P. (IAFE)	Study of centrally influenced supernova remnants (SNRs). 20, 90 cm
AE110	Edge, A. (Cambridge) Allen, S. (Cambridge) Crawford, C. (Cambridge) Fabian, A. (Cambridge)	Radio properties of central galaxies in x-ray selected clusters. 6 cm
AE111	Edge, A. (Cambridge) Rottgering, H. (Leiden) van Haarlem, M. (NFRA) Bremer, M. (IAP, Paris) Rengelink, R. (Leiden)	Radio sources in distant x-ray selected clusters. 3.6, 20 cm
AE112	Estalella, R. (Barcelona) Anglada, G. (IAA, Andalucia) Beltran, M. (Barcelona) Rodriguez, L. (Mexico/UNAM) Torrelles, J. (IAA, Andalucia)	Spectral index of exciting sources of selected bipolar outflows. 6 cm
AF318	Florkowski, D. (USNO)	Monitoring the radio emission from the Wolf-Rayet binary HD 192641. 0.7, 2, 6, 20 cm
AF326	Frail, D. Kulkarni, S. (Caltech)	Search for radio counterparts of gamma-ray bursters with BeppoSAX. 20 cm
AF327	Falcke, H. (Maryland) Barvainis, R. (Haystack) Lehar, J. (CFA) Menten, K. (MPIR, Bonn) Birkinshaw, M. (Bristol, UK) Elvis, M. (CFA) Blundell, K. (Oxford)	Radio-spectra of radio quiet quasars. 3.6, 20 cm

No.	Observers	Programs
AG510	Gunn, A. (Manchester) Spencer, R. (Manchester) Migenes, V. (NAO, Japan) Umana, G. (Bologna) Trigilio, C. (Bologna) Budding, E. (Carter Obs)	Microwave survey of northern algol systems. 6 cm
AG512	Golla, G. (Bochum) Lutticke, R. (Bochum) Dettmar, R-J. (Bochum)	HI velocity field of box/peanut bulges: NGC 1055. 20 cm
AG516	Gao, Y. (Illinois) Lo, K. Y. (Illinois) Gruendl, R. (Illinois) Hwang, C-Y. (IAA, Taiwan)	Luminous IR galaxies in a merger sequence. 20 cm
AG518	Garcia-Sanchez, J. (Barcelona) Paredes, J. (Barcelona) Preston, R. (JPL) Jones, D. (JPL)	Multi-frequency observations of selected RS CVn binaries. 2, 3.6, 6, 20 cm
AG519	Gao, Y. (Illinois) Lo, K. Y. (Illinois) Gruendl, R. (Illinois) Hwang, C-Y. (IAA, Taiwan)	Pre-starbursts in pre-merging luminous IR Galaxies. 20 cm line
AG525	Goldschmidt, P. (Imperial College) Kukula, M. (Edinburgh) Dunlop, J. (Edinburgh) Miller, L. (Oxford)	Fraction of radio loud quasars in optically selected surveys. 6 cm
AH592	Hjellming, R. Rupen, M.	Monitoring galactic black hole x-ray transients. 2, 3.6, 6, 20 cm
AH603	Harper, G. (Colorado/JILA) Brown, A. (Colorado/JILA) Bennett, P. (Colorado/JILA) Hummel, C. (USRA) Walder, R. (SFIT, ETH)	Radio modulation of Zeta Aur's orbitally varying HII region. 3.6, 6 cm
AH604	Haarsma, D. (MIT) Hewitt, J. (MIT) Lehar, J. (CFA) Burke, B. (MIT)	Monitoring gravitational lens 0957+561. 3.6, 6 cm
AH606	Huchtmeier, W. (MPIR, Bonn) Hopp, U. (U. Munchen) Popescu, C. (MPIA, Heidelberg)	HI observations of dwarf galaxies in nearby voids. 20 cm line
AH608	Hunter, D. (Lowell Obs)	Four irregular galaxies spanning a range of star formation rates. 20 cm line

No.	Observers	Programs
AH610	Haynes, M. (Cornell) Kornreich, D. (Cornell) van Zee, L. Lovelace, R. (Cornell)	HI mapping of optically asymmetric disk galaxies. 20 cm line
AH612	Ho, L. (CFA) Barthel, P. (Groningen/Kapteyn) Filho, M. (Lisbon)	Searching for central engine in LINERs. 3.6 cm
AH614	Herrnstein, J. Greenhill, L. (CFA) Moran, J. (CFA) Trotter, A. (CFA) Diamond, P. Braatz, J. (Maryland)	Polarimetry of the sub-parsec jet in NGC 4258. 1.3 cm
AH616	Habbal, S. (CFA) Gonzalez, R. (NAIC) Wang, H. (NJIT)	Solar macrospicules and jetlike events. 3.6, 6 cm
AH618	Hoare, M. (Leeds) Dyson, J. (Leeds) Williams, R. (Leeds)	Velocity structure of HI around cometary compact HII regions. 20 cm line
AH625	Hankins, T. (NMIMT) Weatherall, J. (NMIMT) Moffett, D. (Tasmania)	Emission bandwidth of the crab pulsar pulses. 2, 3.6, 6, 20 cm
AH632	Hewitt, J. (MIT) Chavushyan, V. (SAO, Russia) Vlasyuk, V. (SAO, Russia)	Optical lens 1520+530. 3.6, 20 cm
AI069	Ishida, C. (Hawaii) Hibbard, J.	HI observations of isolated, non-merging luminous infrared galaxies. 20 cm line
AI070	Ishwara-Chandra, C. (NCRA, India) Saikia, D. (NCRA, India) Kapahi, V. (NCRA, India)	Spectra of objects from the Molongolo survey. 2 cm
AJ259	Jura, M. (UCLA) Turner, J. (UCLA) van Dyk, S. (UCLA)	Dust in the egg nebula. 1.3, 2 cm
AK397	Kulkarni, S. (Caltech) Frail, D.	Search for radio counterparts of gamma-ray bursters with high energy transient experiment (HETE). 20 cm
AK431	Kovo, O. (Tel-Aviv U.) Turner, J. (UCLA) Beck, S. (Tel-Aviv U.)	Multi-frequency continuum maps of Wolf-Rayet dwarf galaxies. 2 cm

No.	Observers	Programs
AK438	Keohane, J. (Minnesota) Rudnick, L. (Minnesota) Koralesky, B. (Minnesota) Petre, R. (NASA/GSFC) Gotthelf, E. (NASA/GSFC) Allen, G. (NASA/GSFC)	Enhanced shock acceleration in the supernova remnant IC 443. 6, 20 cm
AK442	Kulkarni, S. (Caltech) Danner, R. (Caltech) Frail, D. Gotthelf, E. (NASA/GSFC)	Mysterious nebula in the globular cluster M28. 3.6 cm
AK443	Kurtz, S. (Mexico/UNAM) Hofner, P. (NAIC)	Methanol maser survey of massive star forming regions. 0.7, 1.3 cm line
AL383	Lisenfeld, U. (Arcetri) Alexander, P. (Cambridge) Pooley, G. (Cambridge)	Cosmic ray propagation and the star formation history of galaxies. 3.6, 6 cm
AL397	Longair, M. (Cambridge) Best, P. (Cambridge) Eales, S. (Cardiff) Rawlings, S. (Oxford) Rottgering, H. (Leiden)	6C radio galaxies at z~1. 3.6, 6 cm
AL401	Lacy, M. (Oxford) Ridgway, S. (Oxford) Rawlings, S. (Oxford) King, L. (Oxford)	Rotation measures of z~1 radio sources. 3.6, 6 cm
AL416	Lebron, M. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM) Lizano, S. (Mexico/UNAM)	Neutral flows from compact HII regions: 21 cm and C166 observations. 20 cm line
AL417	Lim, J. (IAA, Taiwan) Ho, P. (CFA)	HI distribution around luminous low-redshift quasars. 20 cm line
AL418	Lehar, J. (CFA) Falcke, H. (Maryland) Barvainis, R. (Haystack) Menten, K. (MPIR, Bonn) Birkinshaw, M. (Bristol, UK) Elvis, M. (CFA) Blundell, K. (Oxford)	Variability of radio quiet quasars. 3.6 cm
AL419	Leahy, J. (Manchester) Bridle, A. Strom, R. (NFRA)	Five large 3CR radio galaxies. 20 cm

No.	Observers	Programs
AL420	Lara, L. (IAA, Andalucia) Cotton, W. Feretti, L. (Bologna) Giovannini, G. (Bologna) Marcaide, J. (Valencia) Venturi, T. (Bologna)	New sample of large angular-size radio sources. 6, 20 cm
AL421	Lebron, M. (Mexico/UNAM) Gomez, Y. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM) Lizano, S. (Mexico/UNAM) Escalante, V. (Mexico/UNAM) Garay, G. (Chile)	Partially ionized and photo dissociated zone around HII region GGD12-15. 6 cm line
AL423	Lynds, R. (KPNO-NOAO) O'Neil, E. (KPNO-NOAO)	21-cm line emission of interacting galaxy NGC 6745. 20 cm line
AM544	Moore, C. (Groningen/Kapteyn) Lewin, W. (MIT) Rutledge, R. (MIT) van Paradijs, J. (Amsterdam)	Parallel x-ray and VLA observations of the rapid-burster. 3.6, 20 cm
AM553	Mirabel, I. F. (CNRS, France) Piro, L. (IAS, Frascati) Marti, J. (CNRS, France) Chaty, S. (CNRS, France) Rodriguez, L. (Mexico/UNAM) Mereghetti, S. (Milano Obs) Giommi, P. (SDC, Rome) Heise, J. (Utrecht)	TOO observations and monitoring of galactic hard x-ray sources. 6, 20 cm
AM556	McGaugh, S. (DTM/Carnegie) Pildis, R. (CFA) de Blok, E. (Groningen/Kapteyn)	Kinematics of extremely gas-rich low surface brightness dwarf galaxies. 20 cm line
AM559	Mundell, C. (Manchester) Pedlar, A. (Manchester) Shone, D. (Manchester) Cole, G. (Manchester) Thean, A. (Manchester) Brinks, E. (Guanajuato U.)	Neutral hydrogen study of interacting Seyferts. 20 cm line
AM560	Marti, J. (CNRS, France) Mirabel, I. F. (CNRS, France) Rodriguez, L. (Mexico/UNAM) Smith, I. (Rice) Liang, E. (Rice)	Coordinated observations of black hole candidate GRS 1758-258. 3.6, 6 cm
AM561	McIntyre, V. (Wollongong) Ostlin, G. (Uppsala Obs)	Structure of ISM in the quiescent dwarf galaxy Sextans B. 20 cm line

No.	Observers	Programs
AM563	McMahon, R. (Cambridge) Miley, G. (Leiden) Ciliegi, P. (Cambridge) Rowan-Robinson, M. (Imperial College)	Survey of ISO survey regions. 20 cm
AM564	Mirabel, I. F. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Supernova-molecular cloud interaction near GRS 1915+105? 20 cm line
AM565	Mirabel, I. F. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Flux variations in the lobes of 1E1740.7-2942. 6 cm
AM566	Mirabel, I. F. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Supernova remnant associated with GRS 1915+105. 20, 90 cm
AM570	Morris, D. (IRAM) Thum, C. (IRAM) Claussen, M.	Nature of HD 45677—another MWC349? 0.7, 1.3, 2, 3.6, 6, 20 cm
AM577	Marcha, M. (Lisbon) Browne, I. (Manchester) Dennett-Thorpe, J. (Lisbon) Anton, S. (Manchester)	Spectral energy distribution of low luminosity AGN. 0.7, 1.3, 2, 3.6, 6 cm
AN075	Naslund, M. (Stockholm Obs) Kristen, H. (Stockholm Obs) van Moorsel, G. Broeils, A. (Stockholm Obs)	UGC 9977—evolution of a warped galactic disk. 20 cm line
AO132	O'Dea, C. (STScI) Elvis, M. (CFA)	High redshift quasars with large x-ray absorbing columns. 0.7, 1.3, 2, 3.6, 6, 20, 90 cm
AO135	Osorio, M. (Mexico/UNAM) Lizano, S. (Mexico/UNAM) Kurtz, S. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM) Carral, P. (Guanajuato U.)	Millimeter continuum search for new galactic hot cores. 0.7, 1.3 cm
AP331	Pooley, G. (Cambridge) Hardcastle, M. (Bristol, UK) Riley, J. (Cambridge) Alexander, P. (Cambridge)	Constraining the luminosity function of jets in FRII radio galaxies. 3.6 cm
AP334	Perley, R. Carilli, C. Dreher, J.(SETI)	Observations of Cygnus A at 43 GHz. 0.7 cm
AP352	Pickering, T. (Arizona) Quillen, A. (Arizona) van Gorkom, J. (Columbia) Impey, C. (Arizona)	HI imaging of giant low surface brightness galaxies. 20 cm line

No.	Observers	Programs
AR377	Rudnick, L. (Minnesota) Koralesky, B. (Minnesota) Dickel, J. (Illinois)	Asymmetric expansion of the Kepler SNR shells. 6, 20 cm
AR378	Rudnick, L. (Minnesota) Koralesky, B. (Minnesota) Kassim, N. (NRL) Perley, R.	Dynamical evolution and current particle acceleration in Cas A. 3.6, 6, 20, 90 cm
AR382	Richer, J. (Cambridge) Chandler, C. (Cambridge)	SiO imaging of the jet from the driving source of HH211. 0.7 cm line
AR383	Richards, E. (Virginia) Windhorst, R. (Arizona State) Kellermann, K. Partridge, R. B. (Haverford College) Fomalont, E.	Spectral energy distributions of microJansky sources. 3.6 cm
AR384	Roberts, M. Haynes, M. (Cornell) Hogg, D.	Study of the asymmetry in apparently isolated galaxies. 20 cm line
AS568	Sramek, R. Weiler, K. (NRL) van Dyk, S. (UCLA) Panagia, N. (STScI)	Properties of radio supernovae. 1.3, 2, 3.6, 6, 20 cm
AS599	Stockton, A. (Hawaii) Ridgway, S. (Oxford)	Radio optical alignment in z~1 quasars. 3.6, 6 cm
AS606	Seaquist, E. (Toronto) Frail, D.	Third epoch observations of the nova remnant GK Per. 6 cm
AS608	Shang, Z. (Texas) Burstein, D. (Arizona State) Brinks, E. (Guanajuato U.) Zheng, Z. (Beijing Obs) Su, H. (Purple Mt.) Chen, J-S. (Beijing Obs)	Ring structure around NGC 5907. 20 cm line
AS611	Sparke, L. (Wisconsin) van Moorsel, G. Cox, A. (Iowa) Schwarz, U. (Groningen/Kapteyn) Erwin, P. (Wisconsin)	HI mapping of candidate polar ring galaxy NGC 2655. 20 cm line
AS612	Sridharan, T. (CFA) Zhao, J. (CFA) Hunter, T. (CFA) Ramesh, B. (NAO, Japan)	Isolated high mass protostellar candidates. 0.7, 1.3, 3.6 cm line

No.	Observers	Programs
AS615	Stringfellow, G. (Colorado/JILA) Brown, A. (Colorado/JILA)	Monitoring the flux of PMS variable EX Lupi. 0.7, 1.3, 2, 3.6, 6 cm
AS616	Shepherd, D. (Caltech) Kurtz, S. (Mexico/UNAM)	Molecules and continuum in the G192 massive molecular outflow. 0.7, 1.3, 3.6 cm line
AT204	Tingay, S. (JPL) Preston, R. (JPL) Meier, D. (JPL) Jones, D. (JPL) Murphy, D. (JPL) Jauncey, D. (CSIRO) Fujisawa, K. (ISAS, Japan) Hirabayashi, H. (ISAS, Japan) Edwards, P. (ISAS, Japan)	Monitoring of nuclear flux density of Centaurus A. 1.3, 3.6 cm
AT205	Tsarevsky, G. (CSIRO) Slee, O. (CSIRO) Norris, R. (CSIRO) Roy, A.	Survey of high redshift radio quiet and radio intermediate quasars. 20 cm
AT206	Thilker, D. (New Mexico State) Braun, R. (NFRA) Walterbos, R. (New Mexico State)	HI supershells in M33. 20 cm line
AT210	Thorsett, S. (Princeton) Taylor, J. (Princeton) Nice, D. (Princeton) Briskin, W. (Princeton)	Timing fast pulsars at the VLA. 6, 20, 90 cm
AU072	Uson, J. van Gorkom, J. (Columbia) Shambrook, A. (UC, Santa Cruz)	HI mapping of Abell 2029. 20 cm line
AV230	Verheijen, M. (Groningen/Kapteyn) Tully, R. (Hawaii)	Tully-Fisher relationship for galaxies in the Perseus-Pisces ridge. 20 cm line
AW362	White, S. (Maryland)	The stellar activity cycle on active stars. 3.6, 6, 20 cm
AW453	Wallace, B. (DRAO) Frail, D. Landecker, T. (DRAO)	P-band imaging of two filled-center supernova remnants. 90 cm
AW464	Wiesemeyer, H. (MPIR, Bonn) Gusten, R. (MPIR, Bonn)	Radio continuum search towards low-luminosity Class 0 sources. 3.6 cm
AW465	Wyrowski, F. (Koln) Walmsley, C. M. (Arcetri) Schilke, P. (Koln)	Revealing the small structure of Orion nebula PDR. 3.6 cm line

No.	Observers	Programs
AW466	White, S. (Maryland) Lee, J. (Maryland) Kundu, M. (Maryland) Thomas, R. (NASA/GSFC) Brosius, J. (NASA/GSFC)	Measuring the coronal abundance of iron relative to hydrogen. 3.6, 6, 20 cm
AW467	Wilcots, E. (Wisconsin) Pisano, D. (Wisconsin)	Gas dynamics in the NGC 672/IC 1727 system. 20 cm line
AY085	Yun, M. Hibbard, J.	Tidal HI in IR luminous mergers. 20 cm line
AY086	Yun, M. Verdes-Montenegro, L. (IAA, Andalucia) Huchtmeier, W. (MPIR, Bonn) del Olmo, A. (IAA, Andalucia) Perea, J. (IAA, Andalucia)	HI clouds in the densest compact groups. 20 cm line
AZ090	van Zee, L. Salzer, J. (Wesleyan U.) Skillman, E. (Minnesota)	Do star formation thresholds depend on metallicity? 20 cm line
AZ093	van Zee, L.	Gas distribution and kinematics of interacting dwarf galaxies. 20 cm line
AZ094	van Zee, L.	HI distribution and gas kinematics of UGC 521 and UGC 3672. 20 cm line
AZ095	Zhao, J-H. (CFA) Goss, W. M. Ulvestad, J.	Recombination line emission in starburst galaxy NGC 253. 0.7 cm line
BP035	Patnaik, A. (MPIR, Bonn) Porcas, R. (MPIR, Bonn) Kemball, A. Garrett, M. (NFRA)	VLBA polarimetry of gravitational lenses. 2, 3.6 cm
V347	Gurvits, L. (JIVE)	High redshift quasars. 6 cm phased array VLBI with HALCA

E. VERY LONG BASELINE ARRAY OBSERVING PROGRAMS

The following research programs were conducted during this quarter.

No.	Observers	Programs
BA026	Aaron, S. (MPIR, Bonn) Wardle, J. (Brandeis) Roberts, D. (Brandeis) Paragi, Z. (SGO, Hungary) Fejes, I. (SGO, Hungary) Murphy, D. (JPL)	Imaging of misaligned jets at 327 MHz. 90 cm
BB023	Beasley, A. Conway, J. (Chalmers, Onsala) Dhawan, V. Walker, R. C. Wrobel, J. Patnaik, A. (MPIR, Bonn) Muxlow, T. (Manchester)	VLBA calibrator survey. 3.6 cm
BB075	Biretta, J. (STScI) Junor, W. (New Mexico)	Search for superluminal motion in the nucleus of M87. 18 cm with VLA single antenna
BB076	Bower, G. (UC, Berkeley) Backer, D. (UC, Berkeley) Wright, M. (UC, Berkeley)	Monitoring of the gamma-ray blazar NRAO 530. 0.7, 1.3 cm
BB077	Bondi, M. (Bologna) Dallacasa, D. (Bologna) Marcha, M. (Lisbon) Stanghellini, C. (Bologna)	Polarization and structure of flat spectrum radiogalaxies. 6 cm with VLA single antenna
BB078	Bradshaw, C. (George Mason) Fomalont, E. Geldzahler, B. (George Mason)	Sco X-1. 6, 18 cm with VLA single antenna
BC065	Clark, T. (NASA/GSFC) Ma, C. (NASA/GSFC) Ryan, J. (NASA/GSFC) Vandenberg, N. (Interferometrics) Himwich, E. (Interferometrics) Gordon, D. (NASA/GSFC) Eubanks, T. M. (USNO) Fey, A. (USNO) Gaume, R. (USNO) Fomalont, E. Walker, R. C.	Geodesy/astrometry observations for 1997. 3.6, 11 cm
BC067	Coles, W. (UC, San Diego) Ye, S. (UC, San Diego) Massey, W. (UC, San Diego)	Measurement of solar wind speed near the sun using IPS. 2, 3.6, 6 cm

No.	Observers	Programs
BC070	Charlot, P. (Paris Obs) Sol, H. (Paris Obs) Vicente, L. (Paris Obs)	Multi-frequency monitoring of BL Lac object OJ287. 1.3, 3.6, 6 cm
BC071	Conway, J. (Chalmers, Onsala) Rantakyro, F. (Bologna) Polatidis, A. (Chalmers, Onsala) Wehrle, A. (JPL)	Combined VSOP-VLBA-CMVA imaging of 3C273. 0.7 cm
BC072	Cotton, W. Fanti, C. (Bologna) Dallacasa, D. (Bologna) Foley, A. (NFRA) Schilizzi, R. (NFRA) Spencer, R. (Manchester)	Mapping Faraday rotation in the core of 3C138. 6 cm with VLA single antenna
BD037	Denn, G. (Iowa) Mutel, R. (Iowa)	Polarized VLB jet of BL Lac. 1.3, 2, 6 cm
BD041	Dewey, R. (Princeton) Beasley, A. Balsano, R. (Princeton)	Proper motions of pulsars in supernova remnants. 18 cm
BD045	Dhawan, V. Kellermann, K. Romney, J.	Monitoring the accelerating, bent jet in 3C84. 0.7 cm with VLA single antenna
BD046	Diamond, P. Kemball, A. Boboltz, D. (Haystack)	Monitoring SiO masers through a cycle of Mira TX Cam. 0.7 cm with VLA single antenna
BF032	Faison, M. (Wisconsin) Diamond, P. Goss, W. M. Kemball, A. Taylor, G.	Imaging small-scale galactic HI structure. 18 cm with phased VLA
BF033	Frail, D. Taylor, G. Beasley, A.	Radio counterpart of GRB970508. 3.6 cm
BG062	Greenhill, L. (CFA) Herrnstein, J. Trotter, A. (CFA) Moran, J. (CFA) De Pree, C. (Agnes Scott College) Cecil, G. (North Carolina)	Jet structure in NGC 4258. 18 cm with phased VLA

No.	Observers	Programs
BG070	Gallimore, J. (MPIfEP, Garching) Mundell, C. (Manchester) Pedlar, A. (Manchester) Baum, S. (STScI) O'Dea, C. (STScI)	Imaging the ionized Torus in NGC 4151. 3.6 cm with phased VLA
BG071	Goodman, A. (CFA) Greenhill, L. (CFA)	Zooming in on pre-main sequence star forming regions. 3.6 cm with phased VLA
BJ026	Jones, D. (JPL) Wehrle, A. (JPL)	The inner accretion disk in NGC 4261 (3C270). 0.7, 1.3 cm
BK052	Kellermann, K. Zensus, J. A. Vermeulen, R. (NFRA) Cohen, M. (Caltech)	Kinematics of quasars and AGN. 2 cm
BL038	Lestrade, J-F. (Paris Obs) Phillips, R. (Haystack) Jones, D. (JPL) Preston, R. (JPL)	Search for extrasolar planets by VLBI astrometry. 3.6 cm with phased VLA
BL049	Lestrade, J-F. (Paris Obs) Phillips, R. (Haystack) Jones, D. (JPL) Preston, R. (JPL)	A possible Jupiter-mass planet orbiting Sigma 2 CrB. 3.6 cm with phased VLA
BM072	Marscher, A. (Boston) Wehrle, A. (JPL) Xu, W. (JPL)	Coordinated multi-band observations of gamma-ray blazars. 0.7, 1.3 cm
BM076	Molnar, L. (Iowa) Mutel, R. (Iowa) Spangler, S. (Iowa)	Survey of interstellar scattering towards Cygnus X. 1.3, 2 cm with phased VLA
BM078	Marvel, K. (Caltech) Boboltz, D. (Haystack)	Water masers associated with a proto-planetary nebula. 1.3 cm
BM080	Moellenbrock, G. (ISAS, Japan) Roberts, D. (Brandeis) Wardle, J. (Brandeis)	Polarization structure monitoring of gamma-ray blazars. 0.7, 1.3, 2, 3.6 cm
BM082	Mattox, J. (Boston) Buckley, J. (CFA)	Parsec scale radio structure of TeV gamma emitter Mrk 501. 1.3, 2, 3.6 cm
BM090	Menten, K. (MPIR, Bonn) Patnaik, A. (MPIR, Bonn) Reid, M. (CFA) Carilli, C.	The z=0.685 molecular cloud observed toward Einstein ring B0218+357. 0.7 cm

No.	Observers	Programs
BP036	Polatidis, A. (Chalmers, Onsala) Conway, J. (Chalmers, Onsala) Murphy, D. (JPL)	Coordinated monitoring of 1928+738 from VSOP and millimeter VLBI. 0.7 cm
BT028	Tingay, S. (JPL) Preston, R. (JPL) Jones, D. (JPL) Murphy, D. (JPL) Meier, D. (JPL) Jauncey, D. (CSIRO) Reynolds, J. (CSIRO) Tzioumis, A. (CSIRO) McCulloch, P. (Tasmania) Lovell, J. (Tasmania) Costa, M. (Tasmania)	Monitoring of Centaurus A at 8.4 and 22 GHz. 1.3, 3.6 cm
BT035	Tingay, S. (JPL) Preston, R. (JPL) Jauncey, D. (CSIRO) Murphy, D. (JPL)	Outbursting source 2255-282. 0.7, 1.3, 6 cm
BV024	Vermeulen, R. (NFRA) van Langevelde, H. (NFRA) Kellermann, K. Zensus, J. A. Cohen, M. (Caltech)	Shroud around the twin jets of NGC 1052. 0.7, 1.3, 2, 3.6, 6, 18 cm
BW031	Wehrle, A. (JPL) Unwin, S. (JPL) Zook, A. (Pomona College) Xu, W. (JPL)	3C279: coordinated multi-wavelength observations and evolution. 0.7, 1.3, 2, 6 cm
BW032	Wrobel, J. Condon, J. Baum, S. (STScI) Xu, C. (Maryland)	Jets, black holes, and gas disks in UGC radio galaxies. 18 cm
BW034	Wilkinson, P. (Manchester) Marlow, D. (Manchester) Browne, I. (Manchester) Jackson, N. (Manchester) Readhead, A. (Caltech) Fassnacht, C. (Caltech) de Bruyn, A. G. (NFRA) Myers, S. (Pennsylvania)	VLBA observations of JVAS/CLASS gravitational lens candidates. 6 cm with VLA single antenna
BW035	Wilson, A. (Maryland) Ulvestad, J. Colbert, E. (STScI) Roy, A.	Radio emission from accretion Tori in Seyfert galaxies. 3.6 cm

No.	Observers	Programs
BW037	Wootten, H. A. Marvel, K. (Caltech) Claussen, M. Wilking, B. (Missouri)	Water masers associated with protostar IRAS 16293-2422. 1.3 cm with VLA single antenna
BZ022	Zensus, J. A. Kellermann, K. Vermeulen, R. (NFRA) Cohen, M. (Caltech)	Submilliarcsecond imaging of quasars and AGN. 2 cm
GC018	Conway, J. (Chalmers, Onsala) Owsianik, I. (Copernicus/Torun)	CSO's with detected hotspot advance speeds. 6 cm
GG031	Galama, T. (Amsterdam) vanden Heuvel, E. (Amsterdam) de Bruyn, A. G. (NFRA) Vermeulen, R. (NFRA) Campbell, R. (NFRA) Lestrade, J-F. (Paris Obs) Verbunt, F. (Utrecht) Schilizzi, R. (NFRA)	Determining motions of pulsars through VLBI astrometry. 18 cm
GG032	Giovannini, G. (Bologna) Arbizzani, E. (Bologna) Feretti, L. (Bologna) Venturi, T. (Bologna) Cotton, W. Lara, L. (IAA, Andalucia) Taylor, G.	FRI radio galaxies 1144+35 and 3C338. 3.6 cm VLA single antenna
GL021	Lonsdale, C. (Haystack) Diamond, P. Smith, H. (UC, San Diego) Lonsdale, C. (Caltech)	OH megamaser and continuum emission in Arp 220. 6, 18 cm with phased VLA
GM030	Marcaide, J. (Valencia) Ros, E. (Valencia) Guirado, J. (Valencia) Perez-Torres, M. (Valencia) Alberdi, A. (ESA, Spain) Diamond, P. Shapiro, I. (CFA) Preston, R. (JPL) Jones, D. (JPL) Schilizzi, R. (NFRA) Mantovani, F. (Bologna) Trigilio, C. (Bologna) van Dyk, S. (UCLA) Weiler, K. (NRL) Whitney, A. (Haystack)	Monitoring the expansion of SN 1993J. 6 cm with phased VLA

No.	Observers	Programs
GM032	Minier, V. (Chalmers, Onsala) Booth, R. (Chalmers, Onsala) Conway, J. (Chalmers, Onsala)	VLBI of 6.7 GHz and 12.2 GHz methanol masers. 2 cm
GP015	Polatidis, A. (Chalmers, Onsala) Wilkinson, P. (Manchester)	Monitoring the dramatic changes in the nuclear jet of 3C380. 6 cm with VLA single antenna
GP016	Polatidis, A. (Chalmers, Onsala) Xu, W. (JPL) Wilkinson, P. (Manchester) Readhead, A. (Caltech) Pearson, T. (Caltech) Taylor, G. Conway, J. (Chalmers, Onsala)	Second epoch observations of compact symmetric objects from the PR. 3.6 cm with VLA single antenna
GS012	Snellen, I. (Leiden) Schilizzi, R. (NFRA) de Bruyn, A. G. (NFRA) Miley, G. (Leiden) van Langevelde, H. (NFRA)	Are all GPS galaxies compact symmetric objects? 18 cm
GV015	Venturi, T. (Bologna) Giovannini, G. (Bologna) Cotton, W. Feretti, L. (Bologna) Lara, L. (IAA, Andalucia) Marcaide, J. (Valencia)	VLBI observations of three FRII radio galaxies. 6 cm with VLA single antenna
GW016	Walker, R. C. Ulvestad, J. Muxlow, T. (Manchester) Benson, J.	Structure and motions in 3C120 at 1.6 GHz. 18 cm with VLA single antenna
V015	Vestrand, W. (New Hampshire)	Two epoch mapping of three variable CGRO blazars. 18 cm
V017	Giovannini, G. (Bologna)	VSOP observations of two BL-lac type objects: Mrk 421 and Mrk 501. 18 cm
V025	Kemball, A.	Space VLBI polarimetry with VSOP. 18 cm with phased VLA
V030	Preston, R. (JPL)	Pearson-Readhead survey from space. 6 cm
V034	Murphy, D. (JPL)	Continuous monitoring of 1928+739. 6 cm
V047	Gurvits, L. (JIVE)	Structure of extremely high redshift quasars at 1.6 and 5 GHz. 6, 18 cm
V083	Langston, G.	High frequency variables. 18 cm
VSOP	Tests/VSOG	HALCA in-orbit checkout. 6, 18 cm, and 18 cm with phased VLA

F. SCIENCE HIGHLIGHTS

Socorro

VLA and VLBA monitoring of radio emission from the gamma-ray burst of 8 May 1997 showed intensity fluctuations for the first few weeks. These fluctuations subsequently were damped. The fluctuations are interpreted as the result of scintillation due to inhomogeneities in the interstellar medium. Under this interpretation, the angular size of the source in the first few weeks was approximately 3 microarcseconds, corresponding to a linear size of 10^{17} cm at the presumed distance of this object (10^{28} cm). The damping of the scintillation is presumed to be due to relativistic expansion of the fireball to an angular size no longer subject to scintillation. VLBA studies of the radio source constrain the proper motion to less than 50 milliarseconds per year and the annual parallax to less than 1 milliarcsecond, strengthening the case for a cosmological distance.

Investigators: *D. Frail; S. Kulkarni (Caltech); L. Nicastro and M. Feroci (BeppoSAX GRB team); and G. Taylor and A. Beasley.*

The subarsecond radio structure of the galaxy NGC 1068 was imaged using the VLBA and the phased VLA. This observation produced the first direct image of a parsec-sized, ionized gas disk surrounding an active galactic nucleus (AGN). The disk is seen nearly edge-on, and individual clouds observed within the ionized disk are opaque to high-energy radiation, consistent with schemes for unifying the classification of AGN. Because the projected axes of the disk and the AGN are aligned, the researchers infer that the ionized gas disk traces the outer regions of the long-sought inner accretion disk.

Investigators: *J. Gallimore (Max-Planck Institute); and S. Baum and C. O'Dea (STScI).*

Tucson

Mars Global Surveyor (MGS), which entered Mars orbit on 12 September 12 1997 is an orbiter mission which will conduct, among other things, the first global mapping of the surface mineralogy and elevations, magnetic field measurements, and high/medium resolution imaging. During the next three months, Todd Clancy of the Space Science Institute and Brad Sandor of JPL will conduct observations of the martian CO absorption using the 12 Meter Telescope which are being used to provide atmospheric sounding measurements of the martian atmosphere in support of the aerobraking maneuvers of the MGS orbiter. During these aerobraking maneuvers, MGS will dip into the upper atmosphere of Mars in order to circularize it's orbit for mapping operations. Because the three month aerobraking phase of MGS coincides with the global dust storm season on Mars, it is important to obtain real-time characterizations of the Mars atmosphere during this period.

12 Meter observations of the martian atmospheric CO absorption provide measurements of the dust heating of the lower martian atmosphere (0-50 km). These measurements will provide early warning to associated changes in the atmospheric densities to be encountered by the MGS orbiter. For example, the 12 Meter observations from 12-21 September showed cold, dust free atmospheric conditions for the Mars atmosphere as MGS entered orbit. However, they also indicated a significant trend of increasing atmospheric temperatures up to 21 September, which points to increasing dust loading of the lower atmosphere. This inferred increase in the martian atmospheric dust loading was consistent with the increased atmospheric density experienced by the MGS orbiter as it made its first aerobraking maneuver. Since observations of the martian atmosphere are being taken every three days at the 12 Meter, it will soon be possible to determine whether the current dust behavior is a short-term phenomenon such as observed during the March-July period, or is the beginning of truly global dust storm activity on Mars.

Investigators: *R. T. Clancy (Space Science Institute) and Brad Sandor (JPL)*

As this comet leaves the solar system, a final experiment designed to study the physical and chemical composition and evolution of comet Hale-Bopp has been performed this fall at the 12 Meter. Measurements of a number of sulfur-bearing molecules, including CS and H_2S, has been added to information obtained last winter and spring to revealed and chronicle the chemical evolution of the comet both pre- and post-perihelion.

Investigators: *M. A'Hearn (Univ. of Maryland); J. McMullin; N. Samarasinha (NOAO), L. Woodney (Univ. of Maryland).*

Green Bank

Single-dish 21 cm line spectra of spiral galaxies can provide an economical means of investigating the presence of non-circular motions and asymmetries in the HI layer. Such asymmetries might be indicative of galaxies undergoing tidal interaction. A recent study of the HI line profiles from more than 100 isolated spirals using the 140 Foot Telescope shows that half of the galaxies show significant HI profile asymmetries. The lop-sidedness must arise from non-circular motions in the HI gas, confusion with unidentified companions, or true distortions in the HI distribution.

Investigators: M. Haynes (Cornell); L. van Zee; D. Hogg; R. Maddalena; and M. Roberts.

G. PUBLICATIONS

Attached as Appendix A is a listing of all preprints received in the NRAO Charlottesville library during the reporting period authored by NRAO staff or based on observations on NRAO telescopes.

H. CHARLOTTESVILLE ELECTRONICS

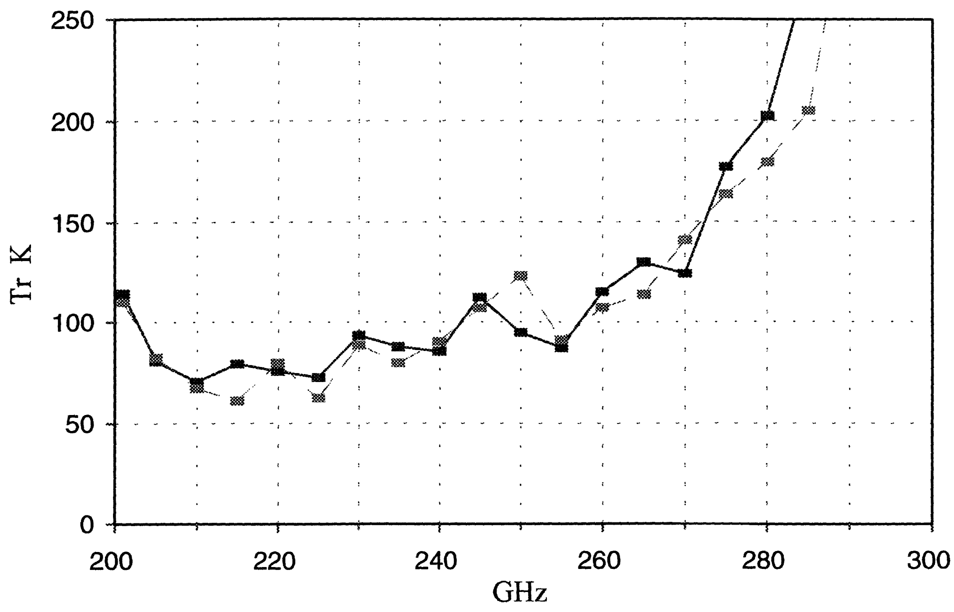
Amplifier Development, Design, and Production

Amplifier development for MAP has now conquered the process details which delayed production of flight hardware in earlier months. The first ten Q-band amplifiers have been completed, and the first five of these have been shipped to Princeton. The remainder are awaiting final testing. The prototype 6-stage W-band amplifier has been completed and tested at room temperature; it performs well and is anticipated to satisfy MAP requirements. The prototype V-band amplifier is nearing completion and should be tested shortly. Construction of the prototype Ka-band amplifier has begun. Drawings for the K-band amplifier will be complete by the end of October. The present forecast is that the present schedule, showing completion of all amplifiers by the end of June 1998 (satisfactory to Princeton and NASA), will be met.

The first production 1.7-2.7 GHz amplifiers for the GBT S-band receiver were completed and delivered to Green Bank. Two Q-band amplifiers for the VLA were repaired. Construction of the prototype 385-520 MHz balanced amplifier for the GBT prime focus receiver was started. Ka-band amplifiers for ground-based cosmic background radiation experiments were successfully built by E. Blackhurst (Jodrell Bank), J. Cartwright (CalTech), and J. Kovac (U. of Chicago).

Superconducting (SIS) Millimeter-Wave Mixer Development

The single-chip 200-300 GHz sideband-separating SIS mixer described in the last quarterly report has been improved by reducing the RF leakage under the substrate. The 2 x 1 mm quartz chip, fabricated at JPL, contains two mixers, an RF quadrature hybrid, LO power splitter, and two LO couplers. The design of this mixer is described in detail in MMA Memo No. 151. The receiver noise temperature and sideband separation are plotted below as functions of frequency.



Noise temperature of the complete SSB receiver, measured at each IF output.

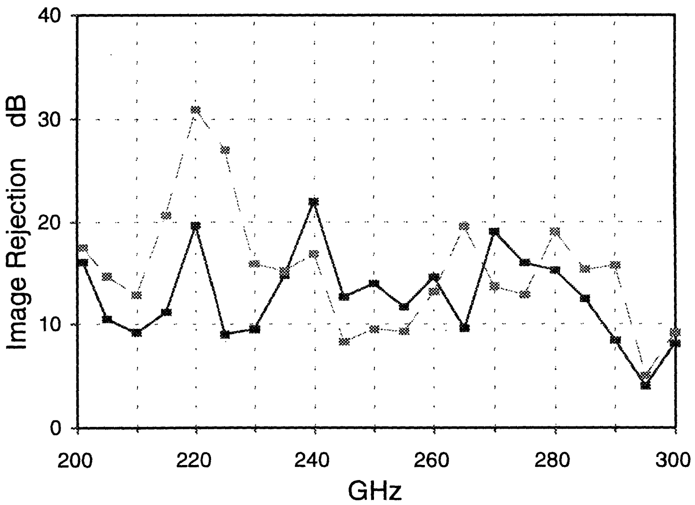


Image rejection of the complete image-separating receiver, measured in each sideband.

While the image rejection is sufficient to reduce the contribution of atmospheric noise in the image band to an acceptable level, it should be possible to improve it considerably. There are three contributing factors: (i) some residual RF leakage under the substrate which still allows a small amount of LO power to enter the signal port at the other end of the substrate, whence it enters the quadrature hybrid and is coupled to the SIS mixers with inappropriate phases relative to the desired LO power; (ii) the resistance of the cold load on the fourth port of the input quadrature hybrid is 36 percent too high; and (iii) for the mixers tested, the junctions were not identical, as was evident from the I-V curves. It is hoped to correct these deficiencies on the next wafer.

The desirability of image-rejecting or sideband-separating mixers in the context of the MMA has been discussed by A. Thompson and A. Kerr in MMA Memo No. 168. A perceived drawback of sideband-separating mixers is that the IF circuits would have to be doubled (compared with a DSB receiver). This is not necessary. If only one of the IF outputs from the mixer is used, it can be switched between upper and lower sidebands simply by reversing the polarity of the bias on one of the constituent mixers. On the other hand, if only the IF amplifiers for the unwanted channel are included, then single-dish continuum observations may be made using 32 GHz bandwidth (16 GHz from each of two polarizations), decreasing the required observing time by a factor of two at a modest cost.

During this quarter we have assembled and tested six SIS mixers, and mounted and DC-tested five SIS chips, using chips from two UVA wafers and two JPL wafers. We also recontacted and tested two frequency triplers.

Electromagnetic Support

VLA - Preliminary design of feeds to cover the 1 to 8 GHz range was carried out. There are three feeds, each with a bandwidth ratio of 2:1 in this range. The L-band feed (1-2 GHz) has an outside diameter of 85" at the aperture and is about 230" long. This feed will have an illumination taper of -10 dB at 1 GHz and -12.6 dB between 1.2 and 2.0 GHz at the edge of the existing subreflector. The other feeds will have a taper of about -13 dB. The illumination efficiency and spillover of these feeds on the VLA antenna are to be calculated in the next few months.

Investigation is in progress into the cause of resonances at particular frequencies observed on the K-band (18-26.5 GHz) receiver.

GBT Spectrometer

During the last quarter, all residual construction items of the GBT spectrometer were completed. The last item done was the installation of external bin select cables to the accumulators.

Long-term testing has mostly been completed with error-free overnight end-to-end system testing having been performed in all quadrants. Long-term integrations on "blank sky" test signals on both the high-speed and low-speed samplers indicate normal integrating down of the noise level with time. The high-speed samplers did show some discrete jumps in the noise level during these long-term integrations, but otherwise integrated down normally over a 96-hour run. The anomalies may be due to instabilities in the noise generator rather than the samplers or spectrometer; in operations, the individual spectra would be retained and rejected in final data reduction.

The "ground bounce" problem, known to exist in the correlator chip used in the GBT spectrometer, was studied at the system level during the quarter. Testing done on the system indicated that the strategy used to avoid the problem in operation has been successful. In operation, the temperature of the rack should probably be monitored to assure that the cards are all using the delays appropriate for optimal performance.

Software development for the GBT spectrometer continues to be a problem. Both Charlottesville and Green Bank engineering staff have joined in the software effort, and this has helped greatly in system testing, but not in the development of operational software.

The Tucson spectrometer has progressed. Orders for most of the parts for this system have been placed. All of the memory and correlator printed circuit cards for this system have been assembled and are awaiting testing. The cards ordered by UMASS have been mostly completed and partially tested. Only the wirewrap control card has not been completed.

Preliminary design considerations on the MMA correlator have continued. The main thrust of the MMA correlator study during this quarter has dealt with expansion of the array to include European participation.

Frequency Coordination

In the area of frequency coordination, the main activity during the last quarter has been planning for forthcoming tests of radiation from the Motorola/IRIDIUM series of satellites in the 1610.6-1613.8 MHz radio astronomy. In full operation, the downlinks from these satellites will produce sidebands in the 1612 MHz OH band through intermodulation effects from the downlink signals in the 1621.35-1626 MHz band. It was originally hoped to perform test measurement on the satellites early this year, but delays in launching, plus a long schedule of checkout of the operation of the satellites, have resulted in Motorola not yet being able to provide a satellite for testing. The test will require special software to be loaded into a satellite since it is necessary to simulate high traffic conditions and with the normal operating software, this would only occur with a high density of uplink transmissions. Observations will be made using three antennas of the VLA in Socorro and the 140 Foot in Green Bank. The angular motion of the satellites is too high for these antennas to follow, so the tests will depend upon beam transits which last for a few tenths of a second only. Observations may also be made at Tucson using a small antenna of the University of Arizona which has a tracking capability, but it is not yet certain that this antenna will be available. It is expected that the tests will occur in the second half of the coming quarter.

The test preparations at NRAO have included fitting filters to certain antennas to cut out the main downlink signal and checking of software for orbit prediction.

I. GREEN BANK ELECTRONICS

Electronics Design Reviews

Independent engineers and scientists from other NRAO sites completed extensive design and progress reviews of the GBT Electronics, Active Surface, and Laser Metrology systems. The reports were detailed, generally favorable, and indicate that the electronics for the GBT is progressing well.

GBT IF System

The testing of the 100 MHz converter filter modules is now complete. Only one set of tests failed. This had to do with temperature stability of a particular amplifier. The fix for this problem is presently in work.

Extensive temperature testing of the phase calibrator from Haystack, the GBT version and a USNO version, has been completed. We discovered that the difference in phase delay versus temperature was attributable to whether or not the microwave PIN switch contained an internal TTL driver. When the USNO phase calibrator is tested with the switch, without the TTL driver, the temperature coefficient is slightly better than the Haystack version. The GBT version, with Motorola prescalers, proved to have a much higher temperature coefficient. The final design is completed, however, a new PC board must be fabricated to accommodate the GEC Plessey prescaler before the GBT phase calibrators are complete.

GBT Fiber IF System

Construction of the loop filter is complete with the high-powered photo diode. We are currently constructing chassis with loop filter, laser diode, laser driver, MZ modulator, and temperature controller for laser diode. System tests were begun the last week of September.

Mechanical design work is beginning on a temperature controlled chamber for temperature-sensitive components.

A continuum filter bank, to be located in the receiver room, was designed and orders for parts have been placed. Most parts have been received. We will bread-board the system and test it next quarter.

C-Band - The hardware for the GBT C-Band receiver was completed this quarter. It was then rigorously tested. Some testing still remains. It was installed at the 140 Foot and made a very successful first observation.

S-Band - OMT ridge drawings were completed and submitted to the shop. All RF components have been received and tested. A decision has been made to not use cryogenic circulators in the receiver front-end.

LO Reference Distribution System

The hardware for this system is now 100 percent complete, with the exception of one bug fix. The bug is an intermittent problem that gives a glitch in the data once every few hours. We believe that we have identified the problem but have not had time to fully test the fix yet.

Holography

The digital electronics was upgraded to increase the data throughput by a factor of four. The waveguide transition is complete, and wiring for the receiver box temperature control is in progress.

GBT Servo System

The feed-arm system field test procedures were run on the system this past quarter. Overall the system performed quite well, there remains a few issues which need to be addressed. We are working with Contractor on these issues.

GBT Mock-up

The GBT Mock-up has been and is presently a means of integrating the Electronics hardware and M&C software. Much progress has been made in integrating and testing many of the GBT Electronics subsystems.

GBT Atmospheric Monitoring System (Water Vapor Radiometer)

The hardware for the Water Vapor Radiometer was almost completed during this quarter. We expect to have a completely functional system within a couple weeks.

Site Operations

Project Phoenix (SETI) - During observations in August we noticed that the temperature inside the receiver (chassis) was running above set point. Since then we have made extensive in-lab air-flow measurements to determine how to properly address the problem.

OVLBI - We interviewed for the open technician position. The technician we selected accepted our offer and will begin October 20th. The system has operated very well over the past quarter. Next quarter, after the technician arrives, we plan on addressing the "to-do" list, and also begin addressing the spares issues.

Interference Protection Group - Electronics is an integral part of the Inteference Protection Group. Over the past quarter we have tested many subsystems, identifying sources of RFI in each subsystem. These are systems such as Laser Metrology subsystems, Weather System subsystems, personal computers, local area networks, business band transceivers, etc.

As usual, maintenance, repair, and installation support was supplied to the 140 Foot, USNO 20-Meter, and the OVLBI earth-station telescopes. This includes electronic maintenance, electronic design projects to assist users for special projects, and cryogenic support for virtually every receiver in Green Bank. Normal day-to-day support of UNIX workstations, weather station, time systems, and local area networks.

J. TUCSON ELECTRONICS

68-115 GHz Receiver

New mixers have been installed in the low frequency pair of this receiver, resulting in appreciably improved performance over the 68-90 GHz band.

1-mm Array 220-250 GHz Receiver

This receiver is now in routine use. Several early operational problems have been identified and solved. We have identified two faults in this system which may be the source of the problems with baseline stability which sometimes affects wide-bandwidth measurements. This receiver is the ideal candidate for the development of automatic tuning of receivers, and the software to realize this has been developed and implemented. Although all of our receivers are tuned remotely over the computer network at the telescope site (or even tuned over the Internet from our downtown offices), the precise tuning still relies on the telescope operator closing the loop. The receiver characteristics are such that a simple lookup table of tuning parameters is not adequate to ensure optimum performance. With eight receivers to tune, this clearly puts considerable demand on the operator and can lead to inefficiency in the setup time needed for a new observer, even though the individual receiver channels are less complex to tune than our regular single-beam systems. We are currently using the experience gained with automating the 1 mm Array system to modify the tuning procedure for all receivers on the 12 Meter Telescope.

The 8-Channel, 4-Beam, 3-mm System.

A commercially available frequency tripler for the LO has been tested and works well at 4 K. This validates the concept of using coaxial lines to input the LO to the dewar at one third of the LO frequency. The dewar has been built and awaits testing. The design of the basic receiver insert has been completed, and fabrication has begun. A crossed-grid polarization diplexer designed to operate at 4 K has been constructed and tested. A prototype 2-channel system will be tested later this year.

Planned Wideband Continuum Receiver.

The availability of HEMT amplifiers covering the frequency range from 70 - 90 GHz raises the possibility of building a continuum receiver with a sensitivity of around 50 mJy per root sec; the extraordinarily high sensitivity comes from the very wide bandwidths. The major problem to be overcome is the "1/f" noise which has been reported from early experiments. Although not necessarily worse in this system than in other HEMT amplifiers, the extremely large (bandwidth times integration time) product means that much lower levels of "1/f" gain modulation can dominate the residual noise in the detected output from the receiver. Progress with this project is dependent on available manpower, and has been given lower priority than the multi-beam systems mentioned above.

New Phase Lock Control

One of the most efficient observing modes, generally applicable to relatively narrow bandwidth observations, is frequency switching. Unlike other switching schemes, in this observing mode the object of interest is in the telescope beam and in the spectrometer passband for 100 percent of the time. At present we are limited in our ability to frequency-switch, in both switching rate and in total frequency throw, by the analog phase lock system. We have designed, tested, and installed a digital phase lock system into our 2/3 mm receiver that combines both frequency and phase control and provides faster, reliable switching over a broader frequency range. We can now routinely switch by as much as ± 35 MHz, making frequency switching useable for a wide variety of research projects. We are currently producing digital phase lock systems for all of our receivers.

Another capability which will become practical, thanks to the enhanced digital phase lock, is "sideband smear" operation. This is a powerful technique of reducing confusion in spectral line observations from features appearing in the unwanted sideband. The principles have been established during some ad-hoc test observations performed at the 12 Meter, and have been described in conference proceedings. The practical implementation of a usable system at the 12 Meter has been hampered by the performance of the phase lock system; fast switching times over a relatively large bandwidth are required. The digital phase lock should solve these problems.

Receiver Component Servo Systems

Given the importance of the accuracy and reliability of the servo drivers for the components of the 12 Meter receivers, we have investigated these aspects on our 1mm Array system. By implementing a periodic test and maintenance procedure for all of the mechanical systems in these servo drivers, we have dramatically improved the accuracy, reliability, and repeatability of these systems. This will have direct impact on our ability to quickly and automatically tune all of the 12 Meter receivers.

Cryogenics

All receivers on the 12 Meter Telescope rely heavily on reliable operation of cryogenic systems. A new cryogenic compressor system has been developed for our closed-cycle 4 K refrigerator. The individual compressor units for the Gifford-McMahon refrigerator and the Joule Thomson expansion valve have been combined into a single unit, resulting in a smaller installation with lower power consumption. All four of these units have been fabricated, tested, and installed on the telescope.

Quadrant Detector and Thermal Sensors

One of the main contributions to pointing changes on the 12 Meter Telescope is lateral movement of the subreflector, with respect to the main telescope surface. This is caused by unbalanced thermal effects on the subreflector support structure. We have installed a system on the 12 Meter to sense these changes, we have a laser quadrant detector to measure the lateral motion of the subreflector mount, with respect to the telescope central hub structure, and we have thermistors continuously monitoring the temperature of the feed legs and other parts of the telescope structure. We are currently trying to build up statistics to enable us to understand the detailed relationship between the thermal distribution of the telescope and telescope pointing offsets. At a later date we hope to incorporate the thermal data into our telescope pointing model to give real time pointing corrections.

New Digital Spectrometer

Work has begun on a new digital spectrometer for the 12 Meter Telescope which will be copied from the GBT design. The new spectrometer will have twice the instantaneous bandwidth currently available for our multi-beam systems, and will use a single wideband sampler for each IF channel, so avoiding the persistent platforming problems experienced with our existing hybrid correlator spectrometer. This new correlator will support the existing 1.3 mm and 3 mm, and any future, multi-beam systems on the telescope. In anticipation of this development, the Tucson programming staff have been participating in the development of real time software for the GBT spectrometer.

Major Improvements Completed During Summer Shutdown Period

During the 1997 summer shutdown period, the following improvements were made to the 12 Meter system:

(1) New UPS system. Two Franklin UPS systems were installed this summer replacing the Atlas UPS system. These new UPS systems have larger capacity than the old systems and have been installed in parallel for greater reliability. A modern lightning arresting system was installed to protect the new UPS system. These additions will help minimize observing downtime from power related failures.

(2) New low-noise mixers for the 68-90 GHz system. These new mixers yield approximately ten percent better system temperatures. At 90 GHz, the performance of these new 68-90 GHz mixers is the same as that of the mixers for the 90-116 GHz band.

(3) New analysis computer and operating system. A Sparc Ultra II dual-processor workstation (called modelo) is now the observer's main computer. We have also "upgraded" all workstations to Solaris.

(4) New central selection mirror and vane servo. The central selection mirror and hot load vane have new servo systems. These new servos should be faster and more reliable. The speed and accuracy of the central selection mirror servo system has shortened the time necessary to switch from one receiver to another to less than five seconds, which will allow easier cross-correlation between pointing with the various 12 Meter receivers. For example, we are investigating the possibility of using pointing measurements at 3 mm to predict the pointing offsets for the 1mm systems.

(5) New central cold-load system. The central selection mirror has been equipped with a cold-load system which we will use to conduct more accurate receiver tuning and monitoring of the receiver temperatures. Since we will no longer need to use the sky as a cold-load for tuning, the biggest immediate advantage of this new central cold-load system will be in the tuning of the 1 mm receivers. We are also investigating the possibility of using this central cold-load system for an improved antenna temperature calibration scheme.

(6) New digital phase lock for 2/3 mm receiver. Two new digital phase lock boxes (dplb) have been installed in the 2/3 mm receiver. These new lock boxes will allow for easier phase locking of these receivers and frequency switch throws as large as ±35 MHz. All of the 12 Meter receivers will eventually be outfitted with new dplb systems.

(7) New filter bank switcher. An electronic filter bank switcher system has been installed. It is now no longer necessary to move the multi-pin connectors which feed the filter banks, improving the reliability of these back-ends, and minimizing the number of bad channels in these spectrometers.

(8) On-line CLASS data converter. The uni2class UniPOPS-to-CLASS data format converter is now integrated into the control system. All scans except continuum and OTF measurements are automatically converted to CLASS format and put in a file called class.12m in the observer's directory. The usual SDD-format data files which we have used for several years continue to be written, with no change. Although writing data simultaneously in both data formats does take more disk space, this is not a significant overhead.

(9) NRAO Tucson home page. We have revised the NRAO Tucson Home Page. New and updated information has been added to this site, including the ability to access our historical tipper data archive.

(10) User's manual update. The 12 Meter User's Manual has been revised. In addition to some minor rearranging, the continuum and spectral line observing sections have been rewritten and several new appendices have been added. Comments on this document are appreciated.

K. SOCORRO ELECTRONICS

VLA Upgrade Prototype: K-Band Front-End

Development work continued on a full waveguide band front end in the frequency range of 18 GHz to 26.5 GHz. The Central Development Lab completed an improved prototype polarizer consisting of a waveguide phase shift section and an OMT section. An electroformed phase shift section has replaced the machined section and provides better performance. The VLA machine shop has fabricated two dewars. The first front-end was installed on Antenna 9 in September. The assembly of the second front-end has started and will be installed next quarter. The components for the third and fourth front-ends are on order, and the VLA machine shop is fabricating the dewar components. These front-end units will be assembled and testing will start after receiving the cooled amplifiers from CDL during the second quarter of 1998. They will be installed on two antennas during the third quarter of 1998. The three sub-band total power monitors for estimating atmospheric phase variations will be installed on these front-ends. Preliminary system tests of the first front-end indicates that, with a zenith atmospheric temperature of 20 K, the total system temperature will be about 50 K. This is about three times more sensitive than the present narrow band K-Band front ends.

VLA, VLBI, and Pulsar Improvements

The LO/IF group completed major improvements in the VLBI and pulsar back-ends. They installed an analog-sum buffer equalizing amplifier for each of the four analog-sum IFs along with a VLBI baseband switch. The switch connects any of 16 baseband inputs to the four inputs of the 600 MHz VLBA upconverter. Four inputs come from the analog-sum buffers and 12 inputs come from the four IFs of one antenna on each arm. The switch was constructed by modifying surplus Wandel & Goltermann matrix switches. It allows the observer to select antenna outputs for each VLBI IF via the observe file. Both single-dish and phased array observations correlated successfully with this new system.

The group also installed a new pulsar patch panel. This connects the four IF outputs from the analog-sum buffer to the 14-channel video converter pulsar system, the wideband detectors, and digital scopes. The paths within the panel provide amplification and continuously variable gain control. The panel was used successfully in L-band observations of pulsars.

VLA Correlator Controller

The limited time available for online programming has delayed the required software. The hardware was completed, except for the data link, during the first quarter of 1997. If software is ready, the data link will be tested during the fourth quarter.

Amplitude Equalizers for the VLA

The average passband for the VLA antennas has a large slope across the 50 MHz passband. This reduces the effective bandwidth and changes the effective center frequency during the 50 MHz bandwidth continuum observations. A simple R-L-C equalizer circuit to correct the bandpass slope has been tested using a spectrum analyzer in the laboratory. The circuit is placed between two existing amplifier stages in the output of the T4 module to provide adequate isolation for the impedance mismatch caused by the network. The attenuation caused by the circuit can be counteracted by removing the 7.5 dB attenuator at the output of the T4 module. This is an inexpensive solution to flatten the bandpass. The effective continuum bandwidth will be limited by the low pass filter in the T4 module. We plan to further investigate and implement the equalizer modification during the last quarter.

Increasing the VLA Continuum Bandwidth

Work on increasing the VLA continuum bandwidth on all four IFs from three antennas continues. We plan to increase the bandwidth, at first, to 70 MHz per IF using existing electronics in the back-end. The IF filters needed in the F7 and F8 front-end modules are being fabricated in the VLA machine shop. The cost of the modifications to increase the bandwidth to 70 MHz should be less than about $1K/antenna. We plan to have the system ready for tests during the last quarter of 1997.

VLA FRM Tester

An FRM repeatability tester to replace the current 1979 unit has been designed. This new unit will use a laptop computer and the special DCS interface will be on a PCMCIA card. Software development continues. This system has some future implications for other field testing of VLA equipment, and possible field testing of future NRAO antenna systems.

GPS Receivers

The VLBA Odetics 325 GPS receivers will not function after August 1999 and are not fixable. We are searching for low-cost compatible replacements. One possibility is the Radiocode model which has worked well at the VLA and now is at VLBA North Liberty. A second Radiocode was ordered, but delivery is five months late because of a compatibility problem. A Truetime Model XL-AK-600 was received and its firmware was changed to emulate an Odetics. Emulation of existing interface software may be too expensive for future replacement receivers, that would require new station on-line software.

VLBA Masers

Maser #1 was returned from the Fort Davis station to evaluate excessive IF level degradation over time. At the Array Operations Center (AOC), a new IF module seems to correct the problem, but longer test time will measure the decay rate. The defective module will be repaired with emphasis on connecting aging effects in components.

VLBA Prototype 3-mm Receiver

The initial prototype 80-90 GHz receiver was removed from the Pie Town antenna during August to serve as a model for the construction of the second receiver. The Pie Town receiver will be reinstalled in early October for observations later in the month. Mike Balister is completing dewar assembly of receiver SN2 in Charlottesville with support by some of the unique capabilities of CDL staff in custom waveguide fabrication and electroforming techniques. Receiver 2 will be installed at Los Alamos next quarter. Components have been ordered for Receivers 3 and 4. Construction will continue during the fourth quarter as manpower and component availability allows.

VLBA Correlator

Three old VLBA1 ASICs have failed in the third quarter. The new ASICs continue to work with no failures. The new FFT to MAC backplane cables have been fabricated and installed. These provide increased reliability, since the old cables kept working loose. Fabrication is proceeding on the PBI to FFT cables. The Fractional Sample Time Correction (FSTC) fix for 2 K FFTs has been implemented and awaits formal system testing before being installed at an update (as part of the FSTC fix for 1 K and the fix for 64 point FFTs). The new test rack has been completed and checked out. This rack allows spare cards to be used in a simple two-station, four-baseband channel offline system. Customized software functions will be developed as required for use in the test rack. A 4 msec offset in the application of the pulsar model was identified. The cause of the error was found and corrected.

VLBA Data Acquisition and Playback

All tape drives at the correlator as well as at the VLBA sites now are designated as thin tape only. As of September 1997, the VLBA no longer accepts thick tape for correlation. Efforts have been made to evaluate thin tapes and provide feedback to non-VLBA stations which have recently upgraded recording equipment for thin tape operation.

The first two triple-cap headstacks purchased by NRAO have been received from the Spin Physics facility of Datatape, Inc. Testing is ongoing, and it is expected that these headstacks will be in use on playback drives soon. Two triple-cap headstacks also have been ordered from Metrum. The main benefit expected from the triple-cap headstacks is lower replacement cost due to longer head stack lifetime.

More work has been done for the formatter expansion project, which will make it possible to double the current recorded bandwidth at the VLBA sites by recording on two tape drives at the same time. The formatter firmware has been tested in the lab, using station software updated to support this mode of operation. The new firmware is intended to be backward-compatible so that it will run in any VLBA formatter, whether it is an expanded formatter or not. There will be a backward compatibility test of the firmware at the Pie Town VLBA site soon. After this, the three extra formatter boards required for the two tape mode will be installed at Pie Town, and the station computer software will be updated so that the new mode can be tested.

VLBA Data Acquisition Rack

A newly designed P107 power supply will replace the marginal P103 supply which powers the 8-baseband converter (BBC) modules. The new module has higher current capacity and is directly compatible. The retrofit will continue through 1998.

Interference Protection

The grayscale plotting routine used for the display of VLA W8 pad L-band monitor data has been migrated from PV-WAVE to IDL and standardized using a fixed grayscale power level. The data logging software time resolution has been reduced from the previous 15 minute collection interval to just five minutes. Additional data logging programs have been written to allow the detailed monitoring of just the 1610 MHz to 1630 MHz portion of L band in anticipation of the upcoming IRIDIUM tests. Currently, the W8 pad data logging software is configured to log just this subset of L band, in order to provide detailed, channelization information on current IRIDIUM satellite test transmissions. The most current week of these grayscale plots is available for viewing in the lobby of the AOC.

New, high resolution SYSQUIK plots for P band and L band also are available for viewing in the lobby of the AOC as well as on the NRAO-Socorro home page under "Special Topics and Observing Modes." The new plots show the true spectral shape of RFI more clearly, allowing spectral line users of the VLA to utilize narrow, quiet zones between the frequencies of chronic RFI emitters. These new plots, as well as courser resolution C, U, and K band plots are updated monthly, the week after double maintenance week.

Work is rapidly progressing on the development of the new VLA RF Environmental Monitoring System (RF-EMS). A 54-foot fold-over tower has been installed near the east end of the VLA site, and the equipment shelter has been moved to a new concrete slab. The AC power service for the RF monitor shelter was upgraded, and a telephone line was installed. The initial checkout of software to control and log data from a military surplus channelizing receiver produced promising results. A new, multi-band, low-noise front-end is under development at the AOC. The new front-end will include distributed, microprocessor based I/O control for band selection, calibration, and Automatic Gain Control (AGC).

IRIDIUM Satellite Tests

The 1994 MOU between NRAO and Motorola Satellite Communications, Inc., requires cooperative work on a test program to determine the IRIDIUM satellite system signal levels at the Observatory sites. Motorola intends not to exceed a spectral power flux density (SPFD) of -223 dB(W/m^2/Hz) at the VLA at all times. VLA test objectives are to measure (A) the impact of IRIDIUM emissions on VLA observations of 1612 MHz OH, and (B) the spectral power flux density (SPFD) of IRIDIUM emissions in the 1610.6-1613.8 MHz radio astronomy band.

Our test plan for objective A calls for measurements with two subarrays. One subarray of three antennas will use special 1612 MHz bandpass filters to minimize gain compression from the satellite's main emissions at 1621.35-1626.50 MHz. The second subarray will use 24 antennas in normal mode to determine the effects of gain compression caused by the satellite's main emission.

Tests for objective B use the antenna at W8 with a modified L-band front-end, a direct coax connection from the front-end to the test back-ends in the control building. Test back-ends include a digital spectrometer and the pulsar HTRP. Spectral differences taken synchronously with the IRIDIUM transmission on/off cycle remove GLONASS satellite emissions.

A cooled bandpass filter for the 1612 MHz RA band inside the W8 antenna L-band dewar is in line for IRIDIUM testing. Cooled switches bypass it for normal operation. Otherwise, the normal unfiltered cooled amplifier configuration will gain-compress sufficiently to impair satellite spurious emission measurements when the satellite is in the VLA main beam.

The three antenna subarray test system, including the synchronous detection algorithms for the digital spectrometer and HTRP, was tested on the VLA and appears to be working properly.

Motorola has drafted a test plan which will be finalized next quarter. The tests with NRAO will begin after special software in the test satellite is debugged, probably sometime next quarter.

L. COMPUTING AND AIPS

This past quarter has seen the completion of the implementation of major computing related Research Equipment procurements, as well as testing and evaluation of lower cost computing hardware. Final plans for other RE spending this year have been finalized, and the remaining RE related procurements are expected to be completed in October and early November.

Staff Workstations

Replacing or upgrading aging workstations used by NRAO staff is a high priority. Many workstations at the Observatory are upwards of five years old, and are reaching the end of their useful life. Fortunately, this year's Research Equipment budget has allowed the start of a long-term effort to address these problems. During the past quarter about 20 percent of the workstations used by NRAO were upgraded to modern workstations, with substantial improvements in performance and capability. This upgrade effort has significantly reduced pressure on NRAO's public workstations, allowing improved computing support for NRAO visitors.

There remain a few high priority machines which we hope to upgrade this calendar year. This will involve upgrading another approximately ten workstations, plus the purchase of one additional workstation for a new programming position which has recently been filled for the GBT project.

Linux Testing and Evaluation

Linux testing and development continues at NRAO, an investment which will both allow NRAO to provide support to our outside users running the Linux operating system as well as provide potential savings for some workstation upgrades. Roughly ten Linux workstations have been installed and are being supported at the Charlottesville site, with a smaller number of similar workstations installed in Socorro. Most technical issues associated with these machines have been resolved, and a few issues deferred. The Linux machines are in routine use everyday for programming and data reduction. Several outstanding issues remain unresolved, part of the process of NRAO gaining familiarity and experience with Linux. Outstanding issues at present are (1) support by Linux for multiprocessor machines is problematic at present, although improvements are expected in the near term; (2) supporting a large number of Linux machines in a networked computing environment appears to be feasible, but experience is needed before a large-scale effort would make sense at NRAO; and (3) maximizing the FORTRAN performance of Linux-based machines remains problematic, although there are several compilers available for Linux which may be promising. For the latter issue, compiler difficulties remain to be resolved, although the actual problems may be caused by subtle errors in the code being tested. For the present, a stable and reliable FORTRAN compiler does exist for Linux, in the form of the f2c FORTRAN converter and the GCC C compiler.

In a related effort, a low-cost "clone" workstation has been undergoing tests and evaluation using the Linux operating system. This particular workstation uses a DEC Alpha CPU chip, which holds the promise of extremely fast performance. Recent tests using the benchmark test suite in AIPS have been successful, resulting in the best price/performance ratio NRAO has ever measured for a workstation running AIPS software. AIPS users can now, in principle, acquire a ~$5,000 workstation which will run AIPS with approximaely three times the performance of a $15,000 workstation from only a year ago.

Ultimately, the Linux installation efforts at NRAO will accomplish two goals: (1) devising efficient methods for NRAO to support its small (but growing) population of Linux workstations, and (2) allow a detailed evaluation of the current readiness (or lack thereof) of Linux for a major installation at NRAO in the future.

Software

AIPS - It was decided to delay the AIPS release originally targeted for May 1997 to August 1997 to allow testing of the release with real data from the HALCA orbiting VLBI experiment. The routines and modifications required for orbiting VLBI appear to be functional and have been tested carefully, including tests with real data from HALCA. As the data rate from the HALCA mission increases in the coming months further changes, corrections, or bug fixes may be needed in AIPS; a minor release of AIPS is planned for November to make any changes required for HALCA data available. The next major release of AIPS of general interest will likely be in April 1998. The April 1998 release will be a significant release, with the planned merging of AIPS with the developments which have occurred in the (formerly) experimental CVX version of AIPS.

1997 RE Budget

As discussed above, the major effort with this year's RE funding was to upgrade staff workstations. Through the remainder of the year, there are funds within the RE budget for printers to address the needs at NRAO for improved color output. Planning has started for the procurement of a high quality network color printer for each of NRAO's principle sites. A small committee will evaluate the available options; under consideration is a dual printer option which would make available low-cost inkjet-based printing (satisfactory for much of our color output for viewgraphs and the like) and a high quality full color printer with near-photographic quality at somewhat higher per-page costs.

NRAO is also acquiring a pair of high performance DLT tape drives for testing and evaluation. The DLT tape drives offer the potential of increasing the performance of data handling with tapes by a factor of five to ten. This has the potential to ameliorate the bottleneck posed by current tape data rates and capacities.

Partnership with NCSA

The NSF has formally decided to fund the NCSA (the National Computational Science Alliance, formerly the National Center for Supercomputing Applications). NRAO is a part of the "Alliance," and will be funded at a modest level starting 1 October 1997. During the first year, funds will be available for 1.5 to 2 positions at NRAO, increasing to two full time positions in subsequent years. The emphasis for NRAO's involvement will be in two areas: (1) developing applications which can efficiently utilize parallel architecture computers to solve large problems in radio astronomy, and (2) networking support and development to devise methods to allow NRAO users straightforward access to large computing facilities. The latter will enable access to facilities whose capabilities are well beyond those available at either NRAO or our users' home institutions. We anticipate that NCSA will become one node on NRAO's intranet, allowing guaranteed levels of network access to NCSA's facilities in Illinois from NRAO.

VLA Archive Project

With the hire of Tami Hale, the Computer Operations Department is fully staffed again. Tami replaces Gayle Rhodes, who in her turn, replaced Theresa McBride earlier this year. As a result, there is excellent progress on the VLA archive project. Earlier this summer the correction of missing antenna files for the years 1976 to 1982 was completed and work has started on the remainder of the VLA archive project for the years 1985 to 1987. We intend to finish this project in the course of 1998, by which time the complete VLA archive will be available on 8 mm Exabyte tape, and the complete catalog of observations will be accessible on the Web. Sometime before then, we will examine various possibilities (e.g., optical storage, DVD) as a possible future medium for the VLA (and possibly VLBA) archive.

AOC Computing

During July and August, 23 new SPARC Ultra 1/170 workstations were installed on staff desktops at the AOC. The systems which were replaced, mostly SPARCstation IPXs, were in turn trickled down to staff with even slower systems. In total, 60 upgrades were done, and the 23 trade-ins were all SPARCstation 1s and old IPCs. The Sun at the VLA site, used for near-real-time observing and data reduction, was upgraded from a SPARC 2 to a SPARC 20 with vastly improved performance. All the Suns at the VLA site now are running Solaris 2.5.1, as are the majority of systems at the AOC. All of the AOC systems that are available for visitors are now either dual-processor SPARC 20s or Ultras.

Wiring of the AOC for switched Ethernet now is complete. Testing during the summer revealed that all the systems on a given subnet will have to be migrated at once rather than individual systems, as was hoped. As a result, the move was delayed until after all workstation upgrades were completed. We expect to begin this move in September; since it requires considerable coordination with staff. It will probably will take a couple of months before all AOC workstation subnets are connected to switched Ethernet.

In order to streamline management of Socorro WWW pages, we have begun to reinstate revision control of all pages that are suited to this. A limited number of employees are authorized to create/modify pages, and the revision control ensures that changes are properly logged and any previous version can be retrieved at any time.

AIPS Details

System - During the third quarter of 1997 we continued to concentrate on Space VLBI related applications. AIPS produced the very first images made by an array of telescopes including HALCA. In August, we released the 15APR97 version of AIPS. As mentioned in earlier reports, this delay was caused by our desire to ship a version of AIPS that was demonstrated to handle Space VLBI data.

In spite of the delay in 15APR97, we still are planning a 15OCT97 release, since by then more and more varied Space VLBI data will have passed through AIPS. We intend this release to be a more robust version of 15APR97. After this release, we plan to use the experimental version of AIPS CVX as TST (15APR98). This version of AIPS does not currently have the robustness of 15OCT97, but offers exciting new capabilities in the areas of 3-D imaging, on-the-fly mapping, etc. We are confident that this version of AIPS will be as robust as 15OCT97 by next spring.

Personnel - In September 1997, Gustaaf van Moorsel stepped down as head of AIPS in order to concentrate more on AIPS++ related matters. Tony Beasley will oversee the AIPS group. Eric Greisen is planning to rejoin the AIPS group later this fall.

New Capabilities - OMFIT has been rewritten in many ways. Many new models have been included and subjected to user testing. The error analysis has been considerably improved. Baseline stacking is now supported in FRING for multiple integration times, as required by VSOP/HALCA. BLING has been reworked to use dynamically allocated memory rather than the AP. This allows it to search extremely large delay-rate spaces as may be required during the HALCA in-orbit checkout. JMFIT underwent a thorough update during which several bugs were fixed. A start was made to allow AIPS/AIPS++ interoperability, which eventually will allow AIPS tasks to be run from AIPS++. INDXR was completely rewritten in order to add the capacity for merging atmospheric delay and clock offset information from VLBA model-components (MC) tables into newly created CL tables when MC tables are present.

For full VSOP support, it was necessary to introduce a new random parameter. The VLBA correlator can change correlation modes with great flexibility, leading to time-variable rate and delay de-correlation corrections which depend on the type of frequency and time filtering performed in the correlator. The most general solution to this problem was to implement a correlation_id random parameter for VLBA datasets which points to the recorded correlation modes stored in the existing CQ table. This change made it possible to allow time variable correlation mode changes in general, although only time variable OVLBI filtering is activated at present.

The new adverb ALIAS has been introduced to facilitate the calibration of Space VLBI data. Antennas specified via this adverb will be treated as identical for the purposes of certain tasks. This allows HALCA, which appears in AIPS as a conglomerate of tracking stations, to be calibrated as one individual antenna and to be viewed as such for some plotting tasks. RESEQ is a new task which will, via the ANTENNAS input, renumber antennas in a UV file. Space VLBI requires the ability to alias stations together at some points in the data reduction stream. This is the first step for that requirement. RESEQ will renumber all antennas specified in the ANTENNAS adverb to ANTENNAS(1), or, using INFILE, to some desired order.

Year 2000 Issues

When the Year 2000 (Y2K) arrives in just over 800 days, the potential exists for many computer systems, software, and ‘smart’ hardware containing embedded microprocessors to malfunction, if not updated or replaced by then.

The convention of using two digits for the year instead of four has created a potential century-change time bomb inside date-aware software and hardware. Its effects may be widespread, and disastrous for organizations which are unprepared.

The NRAO has begun assessing the potential for Y2K problems in its hardware and software. We believe that our Y2K problems will be manageable, as long as we move aggressively to address them soon. We have formed a working group with representatives from each of the NRAO's major sites, and from the Business and Personnel divisions, to identify and help mitigate potential Y2K problems. The members of this group are: R. Simon and G. Hunt (Computer Division), A. Beasley (AOC), R. C. Bignell (Personnel), A. Bridle (Charlottesville), J. Desmond (Fiscal), J. Hagen (Tucson), and B. Vance (Green Bank).

As part of our efforts to raise awareness and foster internal communications about Y2K matters, a Web page has been created at http://www.cv.nrao.edu/y2k/. NRAO users may find this web site a useful source of links to information available on the Internet about Y2K issues.

A detailed inventory of NRAO's possible points of exposure to Y2K problems is now underway. The Observatory does not use massive amounts of customized date-aware computer software, so we should not face the severe problems which confront many businesses and financial institutions. We recognize, however, that we are not immune to such problems. The broad areas where potential risks exist are as follows:

Fiscal, Payroll, and Personnel - These functions at NRAO are of high priority for the smooth operation of the Observatory. Many have been outsourced to vendors with aggressive Y2K compliance efforts, and their progress will be monitored closely. Those supported by internally-written software are actively being reviewed.

Telescope Operations - Most of NRAO's online systems should be Y2K compliant by design, because they rely on Julian dates unaffected by the century change. Because of the uniqueness and complexity of these systems we plan to evaluate their Y2K compliance by actual testing as soon as possible, after an overall code review. Detailed tests will require considerable planning to ensure a straightforward return to normal operations once the tests are done.

Embedded Chips - Many of our most complex electronics systems use embedded PC's and chips. Detailed testing will be needed to reveal if any mission-critical systems are not Y2K compliant, and thus require update or replacement. There are numerous old Intel-architecture based computers in use, many of which are not expected to be fully Y2K compliant. The essential question is, "How important is their non-compliance?" We will focus our attention initially only on mission-critical systems, as identified by the site managers; others will be renovated or replaced as part of normal refurbishment.

Communications - Our phone systems and PBX's, the NRAO Intranet linking our sites, the Internet, and long distance telephone services are all potentially vulnerable. We are reviewing the weaknesses or potential problems in the hardware that are owned by NRAO.

Utilities and Other Key Outside Services - We are aware that, even if we have our own house in good order by the year 2000, preparedness in the commercial and governmental world around us is a matter for great concern. Our Y2K contingency planning will therefore consider possible disruptions in outside services and utilities essential for our operations.

Computing Facilities and Software - The century change problem can affect the operating systems, utility scripts, and application software run on Observatory computers, including UNIX workstations, PC's, and Fiscal systems. An initial review of NRAO's vulnerabilities in these areas is in progress. Of particular interest to users of FITS data is the fact that the original FITS specification was not Y2K compliant; a new FITS specification is now available and will be incorporated into NRAO software which reads or write FITS data (for further details see ftp://fits.cv.nrao.edu/fits/documents/proposals/year2000.txt).

The full size of the Y2K problem at NRAO cannot be accurately estimated until inventory, assessment, and initial testing of critical and high priority systems has been completed. We hope to complete this phase of Y2K work at NRAO by the end of 1997.

M. AIPS++

AIPS++ is now in second beta release (of three expected before a limited public release next year). In addition, AIPS++ is in use at a number of AIPS++ consortium observatories:

- ATNF: At the Parkes telescope for Parkes Multi-beam observing.
- NRAO: At Green Bank, for support of the GBT engineering.
- NFRA: At WSRT, integrated into the Telescope Management System.

In Single-Dish support, we continued development of the single-dish analysis program, concentrating on improving the plotter capabilities. Much work this last quarter has been dedicated to improving our handling of SDFITS. We continue to provide support for the use of AIPS++ by the GBT engineers.

In Synthesis Support, as planned, we have re-written the gridding and FFT code to improve the performance for both spectral line and large continuum processing. We also considerably improved the performance of the sort and selection routines. We added support for manipulating lists of components, most particularly converting them to images.

We continue development of a sophisticated Glish-based tool for visualizing visibility data from a MeasurementSet. Jan Noordam of NFRA is writing this application entirely in Glish. As such, it is an excellent test and demonstration of the Glish programmability. For efficiency purposes, we have provided C++-based access to the MeasurementSet via a Distributed Object. This type of development (astronomer in Glish, project support via C++ and Glish-bound Distributed Objects) is a good model for future development by astronomers in AIPS++. The UV visualizer will be released into the system after testing by the local staff in Dwingeloo.

In Measures, we continued adding capabilities to the system. We now have the JPL DE-200 ephermeris built-in so that the position of Mars is available from C++ and from Glish. We continue to add table support for Measures. We expect this to be very useful in many different applications.

In Glish support, our main activity was to respond to bug reports. We are concerned that our development of GUIs in Glish may be stressing Glish too much. An initial implementation of a sophisticated plotter object shows unacceptable memory and resource usage. Implementation of garbage collection inside Glish has not helped this significantly. We are currently re-implementing some key parts of the GUI framework to see if the memory usage can be improved.

In AIPS++ Infrastructure, our work continues to be driven by the needs of applications development. We also continue to develop a graphical user interface for standard AIPS++ Distributed Objects, based upon the tk widgets now bound to Glish. The table system was augmented by the completion of the Table Query Language (TaQL), an SQL-like query language. We made considerable improvements to the table browser: editing of values, user-controlled formatting,
generation of sub-tables by TaQL-query, improved scrolling speed, etc.

In Visualization and Image Analysis, we continued development of the image display library, a joint undertaking of ATNF (Tom Oosterloo) and BIMA/NCSA (John Pixton). The core library is finished and well-documented but as yet only a few demonstration and test programs have been written. This work is now in hiatus following the departure of both Tom and John. We expect that some small amount of work will occur in the next few months, but our major development in this area will resume with the arrival of David Barnes, at Epping, to work in AIPS++ February 1998.

In the System area, we started (and are close to finishing) a port to the IRIX native compiler, including optimizations for parallelization. We also continued an evaluation of the Kuck and Associates C++ compiler. This includes a number of optimizations not present in other C++ compilers and may improve the performance of our code. This work now continues at NFRA. If this is successful, we plan to use this compiler for generating binaries for distribution. We have started re-implementation of our "do-it-yourself" template-handling mechanism. The goals of this are to cut down compilation time by suitably grouping templates and by eliminating unused templates. We expect to complete the implementation of this approach in the next quarter.

In Documentation, we continued adding material to the reference manual. We have deferred production of a *cookbook* until the interfaces, most particularly the GUIs, settle down. We have hired a Information Services Coordinator in Socorro (50 percent time) to work on improving the Web interface for our documentation and to provide technical editing for our documentation.

In Management, we conducted a Birds-Of-a-Feather session (jointly with the AIPS project) at the ADASS meeting in Sonthofen. In addition, we gave a computer demonstration of AIPS++.

The second beta release was made on September 11, 1997. Little feedback has been received. Some problems with FITS reading and writing were noted (and will be fixed in the next patch).

N. THE GREEN BANK TELESCOPE

Antenna

The major portions of the tipping structure of the Green Bank Telescope (GBT) are in place atop the alidade as of September 1997. These include the elevation shaft, box structure, horizontal section of the feed arm, and the elevation wheel. Primary elements of the servo and electrical systems have been installed on the alidade and the antenna is rotated frequently to aid in the erection process.

The reflector backup structure (BUS) has been completed on the 175-foot square concrete slab at the telescope site and lifting of its 22 modules onto the box girder has begun. The entire BUS was constructed on the ground and consists of 7,652 different members and joints weighing approximately 2.1 million pounds. During construction, all joints in the BUS were aligned with a positional accuracy of ± 0.25 inches. When finished, the jacks at the top of the 110 scaffolding towers were backed-off, leaving the BUS supported only by the 17 reinforced concrete piers on which it was built. The deflected shape of the BUS under gravity load was measured to verify the predicted values of the finite element analysis.

The Contractor has brought in additional heavy lifting equipment to reposition the 11 modules on the left side of the BUS because they are out of range of the main tower derrick. Individual modules will be sequentially placed at the base of the main derrick; the surface panel support actuators will be installed; and the module will then be lifted and placed on the box structure. Modules vary in weight between 25 tons and 74 tons, the rigging used for lifting weighs an additional 40 tons, making the heaviest lift 114 tons. As the modules are placed on the structure, the 1,072 interconnecting beams between the modules will be reinstalled for both stability and accurate positioning of neighboring units. Completion of the reflector BUS is scheduled for mid 1998.

The upper 60-foot portion of the feed-arm was trial erected at the site including the deployable prime focus boom, the prime focus rotation mount, the subreflector, and the subreflector adjustment mechanism. The feed/receiver room has been located nearby with the secondary focus feed turret in its roof. The feed arm servo, which controls all of the above equipment, has been installed and tested along with some of the NRAO monitor and control hardware. Photogrammetric setting of the subreflector surface and calibration of the six subreflector "Stewart platform" actuators remains to be done. These calibrations will be made by the next quarter.

The 200-foot dual tower section of the vertical feed arm was trial erected at the Contractor's fabrication plant in Mexia, Texas. It has been disassembled and shipped to the Green Bank site where final assembly will begin mid October 1997. It is scheduled for erection after the BUS is in place. At that time it will be installed on the structure along with the upper 60-foot tip of the feed arm.

The 2,004 main reflector panels are now in production at the Contractor's plant. Installation and alignment of the surface is scheduled for late summer of 1998.

Servo

(Progress on the GBT servo is addressed in the Green Bank Electronics section of this report.)

Spectrometer

(Progress on the GBT spectrometer is addressed in the Charlottesville Electronics section of this report.)

Electronics

(Progress on GBT electronics is addressed in the Green Bank Electronics section of this report.)

Metrology

Production - Machine shop work on the instrument bases is going well, and should be complete by mid-November. Some problems are anticipated chromating the bases because they are larger than the dip vats, however, a solution is being developed. Seven 10-inch spheres have been turned and will be sent out to be anodized. This will bring the total number built to ten. Work on the V mounts and retainer rings are underway. The second weather station has been calibrated and was brought into specification. Most of the semi-rigid cables for the instrument bases have been built. A verbal approval on the instrument safety issue has been received from the FAA and FDA.

Experimental Work - Testing was done on the 1500 MHz oscillator enclosures. Some additional work must be done before they are mounted in the bases. A number of experiments were conducted to understand the interaction between polarization/signal level/distance. The work will continue in the next quarter.

Software - With the completion of the modifications to the ZIY program to interface to precision pointing in May, and successful testing in August, the focus of the metrology group has returned to the instrument system. Features have been added to: save the data to files (as an alternate to Excel) for rapid data acquisition experiments; auto-connect the ZY instruments to the ZIY (when the ZY is turned on, it shows up on the status screen automatically); a graphical display program was written to convert distances to an analog output and display two distances in near real time on the x,y input of an oscilloscope. Tests were conducted to verify that the year 2000 will not be a problem for the ZY and ZIY machines. Experiments were conducted to measure the Ethernet overhead for sending short command and data strings. For normal operations, it is not a problem. For the faster JPL project it would be a problem however, so we will go back to a serial prot (used prior to 1992) for this application. With the faster boards we are now using 133 MHz in the embedded systems, a real recovery time problem was discovered with Bancom IRIG boards. This has been corrected by making a slight modification to the Bancom board to generate an interrupt, and thus using an interrupt service routine instead of polling. Present work concentrates on an assembly language routine to smoothly track moving coordinates.

GBT Performance Measurement Program - A review of RSI's alignment procedures and drawings has been conducted. A memo will be released in early November pointing out what needs to be done.

Active Surface

Some time was put into preparing for and participating in a design review of the active surface system. In addition, a short demonstration of the system for the Advisory Committee was created for the annual meeting to be held during the next quarter.

Monitor and Control

In preparation of release 2.7 of the Monitor and Control software, several tasks have been completed: changed from the old compiler, which is no longer supported, to the compiler provided by the Free Software Foundation (g++); changed to a superior tool for tracking changes to the source code (CVS); to support the previous changes, rewrote all files associated with building the system (makefiles); upgraded the VxWorks operating system on the single board computers to the currently supported revision (5.3).

Progress continues on the evaluation of the graphical user interface (GUI) tools which will be used to provide controls for the telescope operators and the engineers.

The microwave tipper control software was completed. Tests on the focus tracking and the feed arm servo were also successfully completed. As a result of recommendations made by the GBT Software Review Committee and the Advisory Committee, the Monitor and Control effort will now come under the direction of the GBT Manager of Software Development, who starts work during the next quarter.

O. PERSONNEL

New Hires

Bania, Thomas	Visiting Scientist	8/15/97
Bauer, Franz	Junior Research Associate	9/02/97

Fagg, Harry	Visiting Electrical Engineer I	7/21/97
Helfer, Tamara	Assistant Scientist - Research Support	9/02/97
Hibbard, John	Research Associate	8/01/97
Lugten, John	Antenna Engineer I	8/01/97
Palmer, Patrick	Visiting Scientist	7/01/97
Peck, Alison	Junior Research Associate	9/15/97
Porta, Leonel	Junior Research Associate	8/25/97

Terminations

Bania, Thomas	Visiting Scientist	8/15/97
Barnes, Zachariah	Junior Engineering Associate	8/22/97
Bronfman, Leonardo	Visiting Scientist	7/31/97
Dyer, Kristy	Graduate Research Assistant	7/22/97
Fore, Samantha	Junior Engineering Associate	8/15/97
Palmer, Patrick	Visiting Scientist	7/31/97
Petticrew, Amy	Junior Engineering Associate	9/12/97
Ray, Jason	Junior Engineering Associate	8/08/97
Richards, Eric	Junior Research Associate	8/31/97

Promotions

Beasley, Anthony	to Deputy Asst Director - Socorro Opns	8/01/97
Dhawan, Vivek	to Associate Scientist - Socorro Opns	7/01/97
Garwood, Robert	to Associate Scientist - Research Support	7/01/97
Holdaway, Mark	to Associate Scientist - Research Support	7/01/97
Kemball, Athol	to Associate Scientist - Research Support	7/01/97
McKinnon, Mark	to Deputy Asst Director - Green Bank Opns	9/15/97
Minter, Anthony	to Assistant Scientist - Green Bank Opns	9/01/97
Oty, James	to Electrical Engineer I	7/01/97
Peck, George	to Electrical Engineer I	7/01/97
Radford, Simon	to Associate Scientist - Research Support	7/01/97

Other

Diamond, Philip	began Leave for Professional Advancement	8/06/97
Payne, John	transferred from Charlottesville to Tucson	9/01/97
Roberts, Morton	began Gradual Retirement	9/01/97
Zensus, J. Anton	began Leave for Professional Advancement	9/13/97

PREPRINTS RECEIVED, JULY - OCTOBER, 1997

AARON, S.E.; WARDLE, J.F.C.; ROBERTS, D.H. A Multifrequency VLBI Polarization Study of the CSS Quasar 3C309.1.

ALBERDI, A.; KRICHBAUM, T.P.; GRAHAM, D.A.; GREVE, A.; GREWING, M.; MARCAIDE, J.M.; WITZEL, A.; BOOTH, R.S.; BAATH, L.B.; COLOMER, F.; DOELEMAN, S.; MARSCHER, A.P.; ROGERS, A.E.E.; SCHALINSKI, C.J.; STANDKE, K. The High-Frequency Compact Radio Structure of the Peculiar Quasar 4C39.25.

ALEF, W.; PREUSS, E.; KELLERMANN, K.I.; GABUZDA, D. Sub-milliarcsec Structure of 3C 111 at 0.7 and 3.6 cm.

ARGON, A.L.; GREENHILL, L.J.; MORAN, J.M.; REID, M.J.; MENTEN, K.M. Proper Motions and the Distance to a Water Vapor Maser in the Galaxy M 33.

ATHREYA, R.M.; KAPAHI, V.K.; MCCARTHY, P.J.; VAN BREUGEL, W. Large Rotation Measures in Radio Galaxies at z > 2.

BANIA, T.M.; BALSER, D.S.; ROOD, R.T.; WILSON, T.L.; WILSON, T.A. 3He in the Milky Way Interstellar Medium: Summary of Relevant Observations.

BEASLEY, A.J.; ALEF, W. Improving Mark III Correlator Models After Correlation.

BLUNDELL, K.M.; BEASLEY, A.J. The Central Engines of Radio-Quiet Quasars.

BLUNDELL, K.M.; RAWLINGS, S.; EALES, S.A.; TAYLOR, G.B.; BRADLEY, A.D. A Sample of 6C Radio Sources Designed to Find Objects at Redshift > 4 - I. The Ratio Data.

BOCKELEE-MORVAN, D.; GAUTIER, D.; LIS, D.C.; YOUNG, K.; KEENE, J.; PHILLIPS, T.; OWEN, T.; CROVISIER, J.; GOLDSMITH, P.F.; BERGIN, E.A.; DESPOIS, D.; WOOTTEN, A. Deuterated Water in Comet C/1996 B2 (Hyakutake) and Its Implications for the Structure of Primative Solar Nebula.

BROSCH, N.; ALMOZNINO, E.; HOFFMAN, G.L. Current Galaxy Formation in the Virgo Cluster. I. VCC 144: A First-Time Galaxy.

CARILLI, C.L.; MENTEN, K.M.; REID, M.J.; RUPEN, M.; CLAUSSEN, M. Imaging the Absorbing Cloud at z = 0.88582 Toward 1830-211.

CARILLI, C.L.; MENTEN, K.M.; REID, M.J.; RUPEN, M.P.; YUN, M.S. Redshifted Neutral Hydrogen 21cm Absorption Toward Red Quasars.

CARKNER, L.; MAMAJEK, E.; FEIGELSON, E.; NEUHAUSER, R.; WICHMANN, R.; KRAUTTER, J. Radio Emission from ROSAT Discovered Young Stars in and Around Taurus-Auriga.

CLAUSSEN, M.J.; FRAIL, D.A.; GOSS, W.M.; GAUME, R.A. Polarization Observations of 1720 MHz OH Masers Toward the Three Supernova Remnants W 28, W 44, and IC 443.

COMBES, F.; WIKLIND, T.; NAKAI, N. New Upper Limits on the Interstellar O2 Abundance.

DENNETT-THORPE, J.; BRIDLE, A.H.; SCHEUER, P.A.G.; LAING, R.A.; LEAHY, J.P. Asymmetry of Jets, Lobe Length and Spectra Index in Quasars.

DHAWAN, V.; KELLERMANN, K.I.; ROMNEY, J.D. High Resolution Radio Imaging of the Nucleus of NGC 1275 (3C84)

DHAWAN, V.; KELLERMANN, K.I.; ROMNEY, J.D. The Slow Jet in the Nucleus of 3C84.

DHAWAN, V.; MIRABEL, I.F.; RODRIGUEZ, L.F. VLBA Observations of GRS1915+105.

DUC, P.-A.; BRINKS, E.; WINK, J.E.; MIRABEL, I.F. Gas Segregation in the Interacting System Arp 105.

EMERSON, D.T. The Work of Jagadis Chandra Bose: 100 Years of Mm-Wave Research.

FALCKE, H.; GOSS, W.M.; HO, L.C.; MATSUO, H.; TEUBEN, P.; WILSON, A.S.; ZHAO, J.-H.; ZYLKA, R. Sgr A* and Company -- Multiwavelength Observations of Sgr A* and VLA Search of "Sgr A*'s" in LINERs.

FASSNACHT, C.D.; PEARSON, T.J.; BLANDFORD, R.D.; READHEAD, A.C.S. Measuring the Hubble Constant with the Gravitational Lens System Class 1608+656.

FERNINI, I.; BURNS, J.O.; PERLEY, R.A. VLA Imaging of Fanaroff-Riley II 3CR Radio Galaxies. II. Eight New Images and Comparisons with 3CR Quasars.

FRAIL, D.A.; KULKARNI, S.R.; NICASTRO, L.; FEROCI, M.; TAYLOR, G.B. The Radio Afterglow from the gamma-ray Burst of 8 May 1997.

MARCAIDE, J.M.; ALBERDI, A.; ROS, E.; DIAMOND, P.; SHAPIRO, I.I.; GUIRADO, J.C.; JONES, D.L.; MANTOVANI, F.; PEREZ-TORRES, M.A.; PRESTON, R.A.; SCHILIZZI, R.T.; SRAMEK, R.A.; TRIGLIO, C.; VAN DYK, S.D.; WEILER, K.W.; WHITNEY, A.R. Deceleration in the Expansion of SN 1993J.

MATVEENKO, L.I.; DIAMOND, P.J.; GRAHAM, D.A. The H2O Supermaser Emission Region in Orion KL.

MEGEATH, S.T.; WILSON, T.L. The NGC 281 West Cluster. I. Star Formation in Photoevaporating Clumps.

MEHRINGER, D.M.; GOSS, W.M.; LIS, D.C.; PALMER, P.; MENTEN, K.M. VLA Observations of the Sagittarius D Star-Forming Region.

MINNS, A.R.; RILEY, J.M.; WARNER, P.J.; RIOJA, M.J.; ROTTGERING, H.J.A. The Nature of a Homogeneous Sample of Compact Radio Sources Variable at 151 MHz.

MIODUSZEWSKI, A.J.; HJELLMING, R.M.; RUPEN, M.P.; WALTMAN, E.B.; POOLEY, G.G.; GHIGO, F.D.; FENDER, R.P. An Image of a Highly Relativistic Jet from a Large Flare in the X-ray Binary Cyg X-3.

MOORE, C.B.; HEWITT, J.N. 15 GHz Monitoring of the Gravitational Lens MG 0414+0534.

OTTERBEIN, K.; KRICHBAUM, T.P.; KRAUS, A.; WITZEL, A.; HUMMEL, C.A.; ZENSUS, J.A. S5 0836+710: A Kelvin-Helmholtz Instable Jet on Parsec Scales?

OWEN, F.N.; EILEK, J.A. The Complex Core of Abell 2199: The X-ray and Radio Interaction.

OWEN, F.N.; LEDLOW, M.J.; MORRISON, G.E.; HILL, J.M. The Cluster of Galaxies Surrounding Cygnus A.

PAPADOPOULOS, P.P.; SEAQUIST, E.R. Physical Conditions of the Molecular Gas in Seyfert Galaxies.

PATNAIK, A.R.; PORCAS, R.W. VLBI Observations of the Gravitational Lens B 1422+231.

PAULINY-TOTH, I.I.K. Structural Variations in the QSS 3C 454.3.

PEARSON, T.J.; BROWNE, I.W.A.; HENSTOCK, D.R.; POLATIDIS, A.G.; READHEAD, A.C.S.; TAYLOR, G.B.; THAKKAR, D.D.; VERMEULEN, R.C.; WILKINSON, P.N.; XU, W. The Caltech-Jodrell Bank VLBI Surveys.

PERLEY, R.A.; ROSER, H.-J.; MEISENHEIMER, K. The Radio Galaxy Pictor A -- A Study with the VLA.

PICKERING, T.E.; IMPEY, C.D.; VAN GORKOM, J.H.; BOTHUN, G.D. Neutral Hydrogen Distributions and Kinematics of Giant Low Surface Brightness Disk Galaxies.

PRESTON, R.A.; TINGAY, S.J.; JONES, D.L.; MURPHY, D.W.; MEIER, D.L.; JAUNCEY, D.L.; REYNOLDS, J.E.; TZIOUMIS, A.K.; LOVELL, J.E.J.; MCCULLOCH, P.M.; COSTA, M.E.; NICOLSON, G. The Counterjet in the Nucleus of Centaurus A.

REID, M.J.; READHEAD, A.C.S.; VERMEULEN, R.C.; TREUHAFT, R.N. Toward a Trigonometric Parallax of Sgr A*

REYNOSO, E.M.; MOFFETT, D.A.; GOSS, W.M.; DUBNER, G.M.; DICKEL, J.R.; REYNOLDS, S.P.; GIACONI, E.B. A VLA Study of the Expansion of Tycho's Supernova Remnant.

REYNOSO, E.M.; MOFFETT, D.A.; GOSS, W.M.; DUBNER, G.M.; DICKEL, J.R.; REYNOLDS, S.P.; GIACANI, E.B. A VLA Study of the Expansion of Tycho's Supernova Remnant.

RIOJA, M.J.; PORCAS, R.W. Multi-frequency VLBA=Effelsberg Observations of 1038+528 A/B.

ROBERTS, M.S. Global Properties of Galaxies Along the Hubble Sequence.

ROS, E.; MARCAIDE, J.M.; GUIRADO, J.C.; RATNER, M.I.; SHAPIRO, I.I.; KRICHBAUM, T.P.; WITZEL, A.; PRESTON, R.A. High Precision Astrometry with Closure Constraints.

ROSER, H.-J.; MEISENHEIMER, K.; NEUMANN, M.; CONWAY, R.G.; DAVIS, R.J.; PERLEY, R.A. The Jet of the Quasar 3C273 at High Resolution.

RUPEN, M.P.; BEASLEY, A.J.; BARTEL, N.; BIETENHOLZ, M.F.; GRAHAM, D.A.; ALTUNIN, V.I.; JONES, D.L.; CONWAY, J.E.; VENTURI, T.; UMANA, G.; RIUS, A. VLBI Observations of Supernova 1993J: The First 1000 Days.

SCHULMAN, E.; FRENCH, J.C.; POWELL, A.L.; EICHHORN, G.; KURTZ, M.J.; MURRAY, S.S. Trends in Astronomical Publication Between 1975 and 1996.