NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

April 1, 1995 - June 30, 1995

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A. TELESCOPE USAGE

The following telescopes have been scheduled for research and maintenance in the following manner during the second quarter of 1995.

	140 Foot	12 Meter	VLA	VLBA
Scheduled observing (hrs)	1858.50	1908.50	1686.0	963
Scheduled maintenance and equipment changes	181.50	14.75	221.7	232
Scheduled tests and calibrations	143.75	255.50	281.3	334
Time lost	35.25	112.00	138.2	39
Actual observing	1823.25	1796.50	1547.8	924

B. 140 FOOT TELESCOPE

The following continuum programs were conducted during this quarter.

No.	Observer(s)	Program
D186	de Pater, I. (Calif., Berkeley) Heiles, C. (Calif., Berkeley) Maddalena, R. Wong, M. (Calif., Berkeley)	21 cm monitoring of the Comet-Jupiter crash.
M390	Margot, J-F. (Cornell) Campbell, D. (Cornell) Campbell, B. (Air & Space Museum) Butler, B.	1.5 and 5 GHz thermal emission observations of the moon.

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B637	Barnbaum, C. Morris, M. (UCLA) Omont, A. (IAP, Paris)	OH masers from circumstellar envelope of U Equ.
B639	Balser, D. Lockman, F. J. McKinnon, M.	Observations of helium, hydrogen, and carbon radio recombination lines toward pulsars.
F129	Frayer, D. (Virginia) Brown, R.	A search for redshifted 21 cm absorption at z = 0.579 toward 3C 196.

No.	Observer(s)	Program
H293	Haynes, M. (Cornell) Hogg, D. Maddalena, R. Roberts, M.	Evaluating galactic HI envelopes and a search for faint companions.
H304	Haynes, M. (Cornell) Giovanelli, R. (Cornell) Hagemann, K. (Wellesley) Dale, D. (Cornell) Dunnigan, M. (Wisconsin)	21 cm spectra of redshift independent distances to spiral galaxies.
L305	Liszt, H. Lucas, R. (IRAM)	18 cm observations for CII and CH toward Zeta Ophiuchi.
L306	Lockman, F. J. Savage, B. (Wisconsin)	21 cm measurements of HI emission towards newly discovered and unobserved quasars.
L307	Lockman, F. J. Savage, B. (Wisconsin) Danly, L. (STScI)	Continued HI studies toward a variety of objects.
M373	Murphy, E. (Virginia) Lockman, F. J. Savage, B. (Wisconsin)	A 21 cm deep search for high velocity clouds.
M385	Murphy, E. (Virginia) Lockman, F. J.	The magnetic field in galactic HI.
M387	Matthews, L. (SUNY) Gallagher, J. (Wisconsin)	A 21 cm HI survey of southern extreme late-type galaxies.
T336	Tifft, W. (Arizona)	Terminal 140 Foot standard 21 cm observations.
T346	Turner, B.	C_2S study of cirrus cores and small galactic plane clouds.
V083	van Zee, L. (Cornell) Haynes, M. (Cornell) Maddalena, R.	HI observations of galaxies with extended hydrogen envelopes.
W340	Wootten, H. A. Mangum, J. (Arizona)	A survey of H_2CO in protostellar clumps.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
A116	Arzoumanian, Z. (Cornell) Nice, D.	Observations at 550 MHz of the orbital fluctuations in the eclipsing pulsar binary PSR B1957+20.

No.	Observer(s)	Program
A118	Arzoumanian, Z. (Cornell) Nice, D. Taylor, J. (Princeton)	Bimonthly timing of 63 pulsars at 810 MHz.
A127	Arzoumanian, Z. (Cornell) Taylor, J. (Princeton) Nice, D.	L-band timing of PSR J0630+1036.
B617	Backer, D. (Calif., Berkeley) Sallmen, S. (Calif., Berkeley) Foster, R. (NRL) Matsakis, D. (NRL)	Pulsar timing array observations at 800 and 1395 MHz.
M386	McKinnon, M. Fisher, J. R.	A 1.3-1.8 GHz polarization model test and timing of young pulsar PSR B1823-13.
N016	Nice, D. Sayer, R. (Princeton)	A 370 MHz search for pulsed radio signals from x-ray pulsar RXJ 1838.4-0301.
S400	Sayer, R. (Princeton) Shrauner, J. (Princeton) Camilo, F. (Princeton) Taylor, J. (Princeton) Thorsett, S. (Princeton) Arzoumanian, Z. (Cornell) Nice, D.	370 MHz observations of relativistic effects in binary pulsars and timing of recently discovered pulsars.
S401	Sayer, R. (Princeton) Taylor, J. (Princeton) Nice, D.	370 MHz timing observations of a new relativistic binary pulsar.

The following very long baseline programs were conducted.

No.	Observer(s)	Program
GB025	de Bruyn, A., *et al.*	VLBI astrometry of pulsars at 18 cm with telescopes G, Y_{27}, and VLBA.
GC016	Gabuzda, D., *et al.*	6 cm second epoch observations of a 1 Jy sample of BL Lacertae objects with the 140 Foot and VLBA.
GD010	Despringre, V. (Toulouse Obs) Fraix-Burnet, D. (Toulouse Obs) Baudry, A. (Bordeaux)	6 cm observations of 3C 66B, with the 140 Foot, EVN, and MERLIN.
GR007	Rioja, M., *et al.*	6 cm unification model test: phase-reference mapping of weak-cored double with telescopes 140 Foot, VLA, and VLBA.

C. 12 METER TELESCOPE

The following research programs were conducted during this quarter.

No	Observer(s)	Program
B632	Balonek, T. (Colgate) Dent, W. (Massachusetts)	Study of the evolution of extragalactic radio sources at millimeter wavelengths.
B636	Butner, H. (DTM/Carnegie) Charnley, S. (NASA/Ames) Lada, E. (Maryland)	Detection of Alfven waves by molecular spectroscopy.
B640	Bower, G. (Calif., Berkeley) Backer, D. (Calif., Berkeley) Wright, M. (Calif., Berkeley)	Millimeter VLBI mapping of the galactic center and nearby AGN.
B641	Boselli, A (Paris Obs) Casoli, F. (Paris Obs) Lequeux, J. (Paris Obs) Gavazzi, G. (Brera Obs) Buat, V. (CNRS, France) Donas, J. (CNRS, France)	Study of the molecular gas content of strongly disturbed spirals in the Coma and A1367 clusters.
C291	Clancy, R. (Colorado) Sandor, B. (Colorado)	Microwave spectroscopy of terrestrial planetary atmospheres.
C292	Crutcher, R. (Illinois) Troland, T. (Kentucky)	CN Zeeman observations.
C295	Chernin, L. (Calif., Berkeley)	Study of unusual outflows from NGC 2024 FIR5 and FIR6.
E60	Eder, J. (NAIC) Salter, C. (NAIC)	Study of the relation between gas density and star formation in SO galaxies.
F127	Fuller, G. Latter, W. (NASA/Ames)	The high velocity HCO^+ in HH7-11: Stellar wind or shocked cloud material?
H294	Holdaway, M.	Study of linear polarization of flat spectrum quasars at 90 GHz.
H310	Hurt, R. (Calif., Riverside) Barsony, M. (Calif., Riverside) Wootten, H. A.	Study of molecular gas in the Serpens cloud protostars.
H312	Helfer, T. (Maryland)	Measurement of the CO flux from the galaxy NGC 6946.
J129	Jewell, P. Walker, C. K. (Arizona)	A study of SiO masers in evolved stars — polarization properties.

No.	Observer(s)	Program
K347	Kobulnicky, H. (Minnesota) Taylor, C. (Minnesota) Skillman, E. (Minnesota)	Molecular gas in very low-metallicity HII galaxies: A strong test for a metallicity-L_{CO} relation.
K349	Kutner, M. (RPI) Verter, F. (NASA/GSFC)	Study of strong molecular source in M31.
L299	Latter, W. (NASA/Ames) Jewell, P.	Study of a spectral bandscan of IRC+10216 in the 1.2 mm window.
L302	Lo, K. (Illinois) Ho, P. (CFA) Steidel, C. (MIT)	Study of molecular gas content of z ~ 0.1 to 0.3 IRAS galaxies.
L303	Liszt, H. Lucas, R. (IRAM)	Study of HCO^+ isotopic emission toward extragalactic continuum sources.
L304	Liszt, H.	^{13}CO and CS maps of Sgr D and Sgr E.
M389	Madden, S. (NASA/Ames) Charnley, S. (Calif., Berkeley)	An observational test of grain surface chemistry.
M392	McMullin, J. (Arizona)	Measurement of HCO^+ in NGC 1333 IRAS 4A and 4B.
P164	Papadopoulos, P. (Toronto) Seaquist, E. (Toronto)	A CO (1-0) survey of a complete AGN sample.
P169	Paglione, T. (Boston) Jackson, J. (Boston) Heyer, M. (Massachusetts) Ho, P. (CFA)	Study of dense gas in the galactic center.
P173	Papadopoulos, P. (Toronto) Seaquist, E. (Toronto)	A CO (1-0) survey of a complete AGN sample.
P174	Papadopoulos, P. (Toronto) Seaquist, E. (Toronto)	Study of CO J=2-1, 1-0 in Seyfert galaxies.
P632	Balonek, T. (Colgate) Dent, W. (Massachusetts)	Study of the evolution of extragalactic radio sources at millimeter wavelengths.
S390	Sage, L. (Maryland) Salzer, J. (Wesleyan U.) P. Knezek (Michigan) Bothun, G. (Oregon)	Study of molecular gas in dwarf elliptical galaxies.
S392	Slysh, V. (Lebedev) Kalenskii, S. (Lebedev) Val'tts, I. (Lebedev)	New methanol maser?

No.	Observer(s)	Program
S397	Snyder, L. (Illinois) Mehringer, D. (Illinois) Miao, Y. (Illinois) Kuan, Y. (Illinois)	Study of acetone in Sgr B2.
S402	Sage, L. (Maryland) Gao, Y. (SUNY)	A search for molecular gas in two recently-discovered galaxies: The Sagittarius dwarf and Dwingeloo 1.
S403	Snyder, L. (Illinois) Hollis, J. M. (NASA/GSFC) Miao, Y. (Illinois) Lovas, F. (NBS) Jewell, P.	Extending the search for interstellar glycine sources beyond Sgr B2.
T342	Turner, J. (UCLA) Martin, R. (Arizona) Ho, P. (CFA)	Study of CO in M83.
T345	Turner, B.	The chemistry of cirrus cores and small galactic plane clouds: HNC and nitrogen chemistry.
T350	Turner, B.	Sulfur chemistry of translucent clouds: A search for SO^+.
T351	Turner, B.	Study of the origin and chemistry of SiO.
T352	Tielens, A. (NASA/Ames) Boogert, A. (Leiden) Wesselius, P. (Groningen/Kapteyn) van Dishoeck, E. (Leiden) Latter, W. (NASA/Ames)	Study of the physical conditions and carbon budget around YSOs with ice bands.
W345	Walker, C. K. (Arizona) Jewell, P. Narayanan, G. (Arizona)	An experiment to detect linear polarization of mm emission lines.
W346	Womack, M. (Penn State)	Study of the dominant carbon-bearing molecules in comets and implications for protosolar nebula chemistry.
W347	Walker, C. E. (Arizona) Bechtold, J. (Arizona) Black, J. (Arizona) Tanner, A. (Arizona) Ge, J. (Arizona)	Studies of IRAS selected absorption line systems at millimeter wavelengths.
W352	Wolf-Chase, G. (NASA/Ames) Davidson, J. (NASA/Ames)	Millimeter observations of IRAS sources and outflows in the Mon OB1 dark cloud.
W354	Womack, M. (Penn State) Stern, A. (Southwest Research Inst.)	Study of carbon chemistry in near and distant comets.

No.	Observer(s)	Program
Z120	Ziurys, L. (Arizona State) Guélin, M. (IRAM)	Confirmation of circumstellar NaF: Testing fluorine nucleosynthesis in AGB stars.
Z123	Zhou, S. (Illinois) Evans, N. (Texas) Wang, Y. (Cambridge)	^{13}CO and $C^{18}O$ mapping of candidates for protostellar collapse.
Z125	Ziurys, L. (Arizona State) Anderson, M. (Arizona State) Apponi, A. (Arizona State) Guélin, M. (IRAM)	Confirmation of MgCCH in IRC+10216: Evaluating metal chemistry.

D. VERY LARGE ARRAY

The second quarter, 1995 was spent in the following configurations: D configuration from March 1 to June 5, AD configuration from June 5 to June 20; A configuration from June 20 to June 30.

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

No.	Observer(s)	Program
AA156	Antonucci, R. (Calif., Santa Barbara) Barvainis, R. (Haystack)	Molecular gas in high-redshift quasars? 1.3 cm line
AA186	Anantharamaiah, K. (Raman Institute) Phookun, B. (TIFR) Goss, W. M. Saikia, D. (TIFR)	Recombination lines from starburst galaxies. 3.6 cm line
AB705	Burke, B. (MIT) Becker, D. (MIT) Lehar, J. (CFA) Hewitt, J. (MIT) Roberts, D. (Brandeis)	Time delay of the gravitational lens 0957+561. 3.6, 6 cm
AB718	Brinks, E. Kunth, D. (Paris Obs) Lequeux, J. (Meudon) Mas-Hesse, M. (Madrid Obs) Sargent, W. (Caltech)	Neutral gas in blue compact galaxies: Population III or recent pollution? 20 cm line
AB734	Beck, R. (MPIR, Bonn) Ehle, M. (MPIR, Bonn)	Interarm magnetic fields in NGC 6946. 3.6 cm
AB736	Briggs, F. (Pittsburgh) Sorar, E. (Pittsburgh)	Coordinates and fluxes for an HI selected galaxy sample from Arecibo. 20 cm line

No.	Observer(s)	Program
AB737	Butler, B. Muhleman, D. (Caltech)	Observations of large icy bodies in the solar system. 0.7 cm
AB738	Butler, B. Muhleman, D. (Caltech)	Observations of Mars. 0.7 cm
AB740	Baum, S. (STScI) Colbert, E. (Maryland) O'Dea, C. (STScI) Pedlar, A. (Manchester)	Three archetypical Seyferts: MKN 6, NGC 3079, MKN 231. 6, 20 cm
AB741	Braatz, J. (Maryland) Wilson, A. (Maryland)	Mapping of H_2O megamasers in active galaxies. 1.3 cm line
AB743	Bontemps, S. (CNRS, France) Andre, P. (CNRS, France) Ward-Thompson, D. (Royal Obs)	Follow-up study of radio detected very young protostars. 2, 3.6, 6 cm
AB751	Butler, B. Muhleman, D. (Caltech) Slade, M. (JPL)	Goldstone/VLA radar imaging of Mercury. 3.6 cm
AB757	Bryce, M. (Manchester) Meaburn, J. (Manchester) Pedlar, A. (Manchester) Mellema, G. (Manchester)	Combined 5 GHz VLA-MERLIN observations of young planetary nebulae. 6 cm
AB758	Barnbaum, C. Palmer, P. (Chicago) Zuckerman, B. (UCLA)	Ultra-cold molecular clouds in the outer galaxy? 20 cm line
AB761	Burke, B. (MIT) Ekers, R. (CSIRO) Wright, A. (CSIRO) Fletcher, A. (MIT) Conner, S. (MIT) Griffith, M. (CSIRO)	PMN-VLA snapshot survey. 3.6, 6 cm
AC308	Condon, J. Cotton, W. Perley, R.	All sky survey. 20 cm
AC399	Cayatte, V. (Paris Obs) Boselli, A. (Paris Obs) Balkowski, C. (Paris Obs) van Gorkom, J. (Columbia)	HI distribution in the anemic galaxy NGC 4548. 20 cm line
AC408	Cox, A. (Wisconsin) Sparke, L. (Wisconsin) van Moorsel, G.	HI mapping of the polar-ring galaxies NGC 5122 and UGC 9562. 20 cm line

No.	Observer(s)	Program
AC418	Carilli, C. (CFA) Stocke, J. (Colorado/JILA) Shull, M. (Colorado/JILA) van Gorkom, J. (Columbia)	Search for neutral hydrogen emission in the low redshift Lyα forest. 20 cm line
AC419	Carilli, C. (CFA) van Ojik, R. (Leiden) Miley, G. (Leiden) Rottgering, H. (Cambridge) Lacy, M. (Oxford) Bremer, M. (Leiden)	Search for redshifted CO emission from z = 4.253 radio galaxy. 1.3 cm line
AC438	Carilli, C. (CFA) Perlman, E. (Maryland) Stocke, J. (Colorado/JILA) van Langevelde, H. (NFRA)	Search for OH absorption in PKS 1413+135, a galaxy at z = 0.25. 20 cm line
AD356	DePree, C. (North Carolina) Wood, D. Goss, W. M.	Line and continuum from two ultracompact HII regions. 0.7 cm
AD357	DePree, C. (North Carolina) Wood, D. Goss, W. M.	Observations of the circumstellar disks of massive star outflows. 0.7 cm
AD359	DePree, C. (North Carolina) Rodriguez, L. (Mexico/UNAM) Goss, W. M.	UC HII regions; photoevaporating disks or dense, warm, environment? 1.3 cm line
AD362	Davis, R. (Manchester) Eyres, S. (Manchester) Kenny, H. (Canadian Military) Bode, M. (Liverpool JMU) Dougherty, S. (Liverpool JMU) Lloyd, H. (Liverpool JMU) Cohen, R. (Manchester)	Simultaneous VLA/MERLIN observations of symbiotic stars. 6 cm
AD363	Dressel, L. (ARC) Jones, D. (JPL)	Compact radio sources associated with nuclear emission line regions. 20 cm
AF263	Feretti, L. (IR, Bologna) Giovannini, G. (IR, Bologna) Parma, P. (IR, Bologna) Laing, R. (RGO) Bridle, A. Perley, R.	Tests for kiloparsec-scale jet deceleration using 3C 31. 3.6, 6 cm
AF279	Frail, D. Goss, W. M.	Deep VLA imaging around PSR 1823-13. 90 cm

No.	Observer(s)	Program
AF288	Frayer, D. (Virginia) Brown, R. Vanden Bout, P.	Search for starburst regions associated with damped Lyα absorption. 3.6 cm
AF290	Foster, R. (NRL) Wolszcan, A. (Penn State) Cadwell, B. (Penn State) Anderson, S. (Penn State)	Astrometric measurements of two new millisecond pulsars. 20 cm
AF293	Falco, E. (CFA) Lehar, J. (CFA) Wambsganss, J. (API, Potsdam) Perley, R.	Gravitationally lensed QSO 2237+0305. 3.6 cm
AG421	Gaume, R. (USNO) Fischer, J. (NRL)	Monitoring the radio continuum flux density of NGC 2024-IRS2. 1.3, 2 cm
AG425	Ghigo, F. Appleton, P. (Iowa State)	Multi-wavelength continuum maps of ring galaxies. 2, 3.6 cm
AG427	Giacani, E. (IAFE) Dubner, G.(IAFE) Goss, W. M. Winkler, P. F. (Middlebury College) Frail, D.	Multi-frequency observations of the SNR W44. 3.6, 6 cm line
AG440	Gary, D. (Caltech) Zirin, H. (Caltech)	Quiet sun observations near solar minimum. 2, 3.6 cm
AG442	Gibson, S. (Wisconsin) Wood, D. Holdaway, M. Nordsieck, K. (Wisconsin)	Sub-parsec nebular filaments in the Pleiades region. 20 cm line
AG446	Girart, J. (CFA) Zhang, Q. (CFA) Tafalla, M. (CFA) Ho, P. (CFA) Curiel, S. (CFA) Torrelles, J. (IAA, Granada)	Ammonia temperature determinations in the Mon R2 core. 1.3 cm line
AG448	Greenhill, L. (CFA) Henkel, C. (MPIR, Bonn)	Monitoring the acceleration of water megamaser features in NGC 4258. 1.3 cm line

No.	Observer(s)	Program
AG455	Gurvits, L. (NFRA) Rioja, M. (NFRA) Schilizzi, R. (NFRA) Butcher, H. (NFRA) Foley, A. (NFRA) Fomalont, E. Claussen, M. Sasao, T. (Mizusawa Obs) Asaki, Y. (Mizusawa Obs)	Cluster-cluster VLA and WSRT VLBI test observations. 6 cm line
AG458	Guedel, M. (Paul Scherrer Institute) Benz, A. (SFIT, ETH) Guinan, E. (Villanova) Schmitt, J. (MPIfEP, Garching)	Two remarkably active, late F-type stars with widely different ages. 3.6 cm
AG461	Gomez, Y. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM)	Water maser emission in selected OH/IR stars. 1.3 cm line
AG467	Greenhill, L. (CFA)	Confirmation of a possible water maser in an IRAS galaxy. 1.3 cm
AH492	Hjellming, R. Gehrz, R. (Minnesota) Seaquist, E. (Toronto) Taylor, A. R. (Calgary)	Image and light curve evolution of radio novae. 1.3, 2, 3.6, 6, 20 cm
AH527	Hibbard, J. (Hawaii) Yun, M. (Caltech)	Mapping tidal HI in ultra-luminous IR galaxies. 20 cm line
AH535	Holdaway, M. Goss, W. M. Foster, S. Dubner, G. (IAFE)	1.4 GHz imaging survey of northern SNR. 20 cm
AH536	Healy, K.	Search for pulsar radio haloes. HTRP 90 cm
AH540	Hunter, D. (Lowell Obs) Wilcots, E. van Woerden, H. (Groningen/Kapteyn) Gallagher, J. (Wisconsin)	Enormous gas halo around the irregular galaxy NGC 4449. 20 cm line
AH541	Hogg, D. Roberts, M. Bregman, J. (Michigan)	Distribution of the interstellar medium in two Sa galaxies. 20 cm line
AH549	Hughes, V. (Queens) Macleod, G. (HartRAO)	Search for time-dependent sources in star-forming regions. 6 cm
AH551	Ho, L. (Calif., Berkeley) Van Dyk, S. (Calif., Berkeley)	Survey of nearby galactic nuclei. 3.6, 6 cm

No.	Observer(s)	Program
AH555	Ho, P. (CFA)	Centimetric observations of millimeter objects studied at BIMA. 0.7, 1.3 cm
AI058	Ivison, R. (Royal Obs) Hall, P. (CSIRO) Yates, J. (Bristol, UK)	Water maser emission from R Aquarii. 1.3 cm line
AJ244	Jaffe, W. (Leiden) Ford, H. (Johns Hopkins)	Search for water megamasers in radio galaxies. 1.3 cm line
AJ246	Jura, M. (UCLA) Turner, J. (UCLA) Ghez, A. (UCLA)	HR 4796B: a nearby pre-main sequence star. 3.6 cm
AJ248	Johnston, K. (USNO) De Vegt, C. (Hamburg U.) Florkowski, D. (USNO)	Radio positions and proper motions of optically bright stars. 6 cm
AK368	Kaufman, M. (Ohio State) Brinks, E. Elmegreen, B. (IBM) Elmegreen, D. (Vassar College) Struck-Marcell, C. (Iowa State)	Radio continuum observations of ocular and caustic galaxies. 6 cm
AK369	Kenny, H. (Canadian Military) Taylor, A. R. (Calgary) Ivison, R. (Royal Obs) Seaquist, E. (Toronto)	CH Cygni: Monitoring of the radio jet in outburst. 1.3, 3.6 cm
AK372	Knapp, G. (Princeton)	Continuum observations of evolved stars. 2, 3.6, 6 cm
AK376	Kulkarni, S. (Caltech) Frail, D.	Search for the radio counterparts of gamma ray bursters. 20 cm
AK379	Krause, M. (MPIR, Bonn) Wielebinski, R. (MPIR, Bonn)	Sensitive polarization study of M104 at wavelength 6 cm.
AK381	Kellermann, K. Shaver, P. (ESOC) Wall, J. (RGO)	Radio spectra of faint red radio galaxies. 1.3, 2, 3.6, 6, 20 cm
AK384	Kundu, M. (Maryland) Gopalswamy, N. (Maryland) Shibata, K. (Mitaka)	Radio signatures of coronal x-ray jets. 2, 3.6, 20, 90 cm
AK385	Kurtz, S. (Mexico/UNAM) Costero, R. (Mexico/UNAM)	S128: ionized outflow or HII regions in projection. 2 cm line

No.	Observer(s)	Program
AK390	Kantharia, N. (Raman Institute) Anantharamaiah, K. (Raman Institute) Dwarakanath, K. (Raman Institute) Payne, H. (STScI) Erickson, W. (Maryland)	Carbon and hydrogen recombintion lines at 330 MHz. 90 cm line
AK391	Kellermann, K. Schmidt, M. (Caltech)	Are there radio silent quasars? 3.6 cm
AK400	Kobulnicky, H. (Minnesota) Vacca, W. (Hawaii) Hogg, D.	A starburst core and probable radio supernova in Henize 2-10. 3.6, 6 cm
AK408	Kollgaard, R. (Penn State) Bade, N. (Hamburg U.) Brinkman, W. (MPIfEP, Garching) Reimers, D. (Hamburg U.) Laurent-Muehleisen, S. (Penn State) Nass, P. (Hamburg U.)	Optically faint objects in an x-ray flux limited sample. 6 cm
AL324	Laine, S. (Florida) Gottesman, S. (Florida)	High resolution study of gas dynamics of NGC 7479. 20 cm
AL345	Lazareff, B. (IRAM) Castets, A. (IRAM) Cernicharo, J. (Yebes Obs) Lefloch, B. (IRAM)	Boundary pressure in star-forming cometary globules. 6 cm
AL346	Leone, F. (Catania) Umana, G. (CNR/IRA-Frascati) Trigilio, C. (CNR/IRA-Frascati)	Millimeter observations of magnetic, chemically peculiar stars. 0.7 cm
AL352	Liszt, H. Lucas, R. (IRAM)	HC_3N and OH absorption toward extragalactic continuum sources. 0.7, 20 cm line
AL360	van Langevelde, H. (NFRA) van Paradijs, J. (Amsterdam) Spruit, H. (MPIfEP, Garching)	Search for SiO masers in OH359.762+0.120. 0.7 cm line
AM437	Moffett, D. (NMIMT) Reynolds, S. (N.C. State) Dubner, G. (IAFE) Giacani, E. (IAFE) Reynoso, E. (IAFE) Dickel, J. (Illinois) Winkler, P. F. (Middlebury College) Goss, W. M.	Expansion of Tycho's SNR, 3C 10. 20 cm

No.	Observer(s)	Program
AM471	Margot, J.-F. (Cornell) Campbell, D. (Cornell) Campbell, B. (Air & Space Museum) Butler, B.	Thermal emission observations of the moon. 6, 20, 90 cm
AM474	Marvel, K (New Mexico State) Diamond, P.	Monitoring masers in AGB stars. 0.7, 1.3, 20 cm line
AM479	Morrison, G. (New Mexico) Owen, F.	Imaging of very rich Abell clusters. 20 cm
AM481	Mirabel, F. (CNRS, France) Chaty, S. (CNRS, France) Rodriguez, L. (Mexico/UNAM) Marti, J. (Barcelona)	Hard x-ray sources in the galactic bulge. 6 cm
AM482	Mirabel, F. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Monitoring the superluminal source GRS1915+105. 3.6 cm
AM487	Masson, C. (CFA) Kawamura, J. (CFA)	Expansion of compact HII regions. 2, 3.6 cm
AM493	Menten, K. (CFA) Megeath, S. (MPIR, Bonn) Reid, M. (CFA)	Radio source population(s) of the NGC 6334-I star forming region. 3.6 cm
AM498	Menten, K. (CFA)	OH maser in VY CMa.
AN065	Nordgren, T. (Cornell) Salpeter, E. (Cornell) Terzian, Y. (Cornell)	HI morphology in three close galaxy pairs. 20 cm line
AO122	Owen, F. Perley, R. Cotton, W. Postman, M. (STScI) Condon, J.	Deep A-array survey near 1015+51. 20 cm
AO123	O'Donaghue, A. (St. Lawrence U.) Eilek, J. (NMIMT) Owen, F.	Examining the morphological and dynamical basis for FRI/FRII boundary. 20 cm
AP303	Patterson, J. (Columbia) Fang, Y. (Columbia) Caillault, J-P. (Georgia)	Radio light curves of V471 Tauri. 3.6, 6 cm
AP308	Paredes, J. (Barcelona) Jordi, C. (Barcelona) Marti, J. (Barcelona) Rodriguez, L.F. (Mexico/UNAM)	A jet from a main sequence star. 3.6 cm

No.	Observer(s)	Program
AP314	Pratap, P. (Massachusetts) Ho, P. (CFA) Patel, N. (CFA) Zheng, X. (CFA)	Mosaic of the NGC 7538 molecular cloud in ammonia 1,1 and 2,2. 1.3 cm line
AP316	Palmer, P. (Chicago) Ostro, S. (JPL) Hudson, S. (Washington) Yeomans, D. (JPL) de Pater, I. (Calif., Berkeley) Snyder, L. (Illinois)	Radar astrometry of the near earth asteroid 1991JX. 3.6 cm line
AP319	de Pater, I. (Calif., Berkeley)	Jupiter after the comet crash. 90 cm
AR327	Ryder, S. (Alabama) McIntyre, V. (CFA) Zasov, A. (Moscow State)	Possible HI superbubble in NGC 157. 20 cm line
AR328	Rodriguez, L. (Mexico/UNAM) Contreras, M. (Mexico/UNAM) Gomez, Y. (Mexico/UNAM)	Ionized winds from massive stars. 0.7, 3.6, 6 cm
AR333	Rubin, V. (DTM/Carnegie) van Gorkom, J. (Columbia)	An HI image of the multi-spin galaxy NGC 4550. 20 cm line
AR335	Rawlings, S. (Oxford) Lacy, M. (Oxford) Blundell, K. (Oxford) Serjeant, S. (Oxford)	An HST sample of quasars at $0.5 < z < 0.7$. 3.6, 6, 20 cm
AR336	Rottgering, H. (Cambridge) Windhorst, R. (Arizona State) Schilizzi, R. (NFRA)	Radio structure of faint blue galaxies. 3.6 cm
AR342	Ratner, M. (CFA) Bartel, N. (York U.) Lebach, D. (CFA) Lestrade, J.-P. (Paris Obs) Shapiro, I. (CFA)	Survey of radio sources near candidate guide stars for GP-B. 3.6 cm
AS525	Sramek, R. Weiler, K. (NRL) Van Dyk, S. (Calif., Berkeley) Panagia, N. (STScI)	The properties of radio supernovae. 1.3, 2, 3.6, 6, 20 cm
AS534	Sevenster, M. (Leiden) Lindqvist, M. (Leiden) Habing, H. (Leiden) van Langevelde, H. (NFRA)	1612 MHz OH survey to complete IRAS/OH surveys. 20 cm line

No	Observer(s)	Program
AS547	Schulman, E. (Michigan) Bregman, J. (Michigan) Brinks, E.	Deep HI observations of NGC 1300 in front of QSO 0318-196. 20 cm line
AS549	Scheuer, P. (MRAO) Laing, R. (RGO) Dennett-Thorpe, J. (MRAO) Bridle, A.	Jet and spectral-index asymmetries in nearby FRII radio galaxies. 3.6, 6 cm
AS551	Smith, B. (Texas) Higdon, J.	Multi-frequency radio continuum mapping of four nearby spiral galaxies. 2, 3.6, 6, 20 cm
AS553	Schiminovich, D. (Columbia) van Gorkom, J. (Columbia) vander Hulst, J. (Groningen) Oosterloo, T. (CSIRO)	HI observations of NGC 474 and five other shell galaxies with disks. 20 cm line
AS555	Skinner, C. (STScI) Becker, R. (Calif., Davis) Barlow, M. (U. College London) Sylvester, R. (U. College London)	Millimeter observations of Vega-excess stars. 0.7 cm
AS557	Slysh, V. (Lebedev) Dzura, A. (Lebedev) Kalenskii, S. (Lebedev) Valtts, I. (Lebedev) Kogan, L.	Methanol masers and their environment. 0.7 cm line
AT139	Taylor, C. (Minnesota) Brinks, E. Skillman, E. (Minnesota)	BCDs: search for neutral hydrogen companions. 20 cm line
AT170	Thuan, T. (Virginia) Brinks, E. Pustil'nik, S. (SAO, Russia) Lipovetsky, V. (SAO, Russia) Izotov, Y. (Kiev U.)	HI mapping of extremely metal-deficient blue compact galaxies. 20 cm line
AT172	Thornley, M. (Maryland) Mundy, L. (Maryland)	Cold gas on sub-kiloparsec scales in nearby flocculent galaxies. 20 cm line
AT176	Thorsett, S. (Princeton) Taylor, J. (Princeton) McKinnon, M. Hankins, T. (NMIMT) Stinebring, D. (Oberlin College)	Timing fast pulsars at the VLA. HTRP 6, 20, 90 cm
AT178	Tafalla, M. (CFA) Bachiller, R. (Yebes Obs)	NH_3 (3,3) maps of L1448-RED and HH2-11. 1.3, 2 cm line

No.	Observer(s)	Program
AT180	Tieftrunk, A. (MPIR, Bonn) Wilson, T. (MPIR, Bonn) Claussen, M. Gaume, R. (USNO) Johnston, K. (USNO)	Ammonia (1,1) and (2,2) lines in W3. 1.3 cm line
AU058	Urbanik, M. (Jagellonian) Soida, M. (Jagellonian) Beck, R. (MPIR, Bonn) Braine, J. (MPIR, Bonn)	Magnetic field in the flocculent galaxy NGC 4414. 3.6, 6 cm
AV215	Velusamy, T. (JPL) Kuiper, T. (JPL) Langer, W. (JPL) Migenes, V. (CSIRO)	CCS mapping of fragments in dark cloud core TMC-1+L149. 1.3 cm line
AV216	Verdes-Montenegro, L. (IAA, Andalucia) Ho, P. (CFA) Zavagno, A. (IAA, Andalucia)	Radio continuum source exciting HH 25 and HH 26? 0.7, 1.3, 2, 3.6 cm
AW362	White, S. (Maryland)	The stellar activity cycle on active stars. 3.6, 6, 20 cm
AW389	Weiner, B. (Rutgers) Sellwood, J. (Rutgers) van Gorkom, J. (Columbia) Williams, T. (Rutgers)	Mapping the dark matter in barred spiral galaxies. 20 cm line
AW396	Wilcots, E. Brinks, E. Baum, S. (STScI)	HI study of the environments of Seyfert galaxies. 20 cm line
AW397	Willson, R. (Tufts)	Chromospherically active stars. 3.6, 6, 20 cm
AW399	White, S. (Maryland) Beasley, A. Franciosini, E. (Florence)	High-frequency polarization of RS CVn systems. 1.3, 2, 3.6 cm
AW404	Wilcots, E. Hodge, P. (Washington)	HI study of nearby irregular IC 1613. 20 cm line
AW407	Wootten, H. A. Fuller, G.	Ammonia around the very young outflow object L483-FIR. 1.3 cm line
AW408	Wootten, H. A. Mangum, J. (Arizona)	Ammonia distribution around the very young sources in L1448. 1.3 cm line
AW412	Wootten, H. A. Claussen, M. Wilking, B. (Missouri)	Water masers near low mass stellar objects. 1.3 cm line

No.	Observer(s)	Program
AW413	Wilson, T. (MPIR, Bonn) Kobulnicky, H. (Minnesota) Dickey, J. (Minnesota)	Column density of galactic HI and OH toward extragalactic sources. 20 cm line
AW414	White, S. (Maryland) Lim, J. (IAA, Taipei) Duncan, R. (CSIRO) Drake, S. (NASA/GSFC)	Two luminous blue variable candidates. 2, 3.6, 6 cm
AY066	Young, L. (Illinois)	HI in three local group dwarf galaxies: NGC 185, NGC 205, LGS 3. 20 cm line
AY067	Young, L. (Illinois)	Search for HI in the local group elliptical galaxy NGC 147. 20 cm line
AY071	Yun, J. (Lisbon) Moreira, M. (Lisbon) Torrelles, J. (IAA, Granada)	Search for continuum emission from embedded sources in Bok globules. 3.6 cm
AZ068	van Zee, L. (Cornell) Broeils, A. (Cornell) Haynes, M. (Cornell) Salzer, J. (Wesleyan U.)	HI mapping of extreme M_H/L galaxies. 20 cm line
AZ070	van Zee, L. (Cornell) Broeils, A. (Cornell) Haynes, M. (Cornell) Salzer, J. (Wesleyan U.)	HI Mapping of isolated dwarf galaxies. 20 cm line

E. VERY LONG BASELINE ARRAY

No.	Observer(s)	Program
BA007	Alef, W. (MPIR, Bonn) Preuss, E. (MPIR, Bonn) Kellermann, K.	Superluminal motion in the lobe-dominated radio galaxy 3C 390.3. 6 cm
BA010	Altunin, V. (JPL) Migenes, V. (CSIRO) Slysh, V. (Lebedev)	OH maser survey in search of nonscattered masers. 18 cm
BB021	Barvainis, R. (Haystack) Lonsdale, C. (Haystack)	Free-free absorption from the obscuring tori of NLRGs. 2, 3.6, 6, 18 cm

No.	Observer(s)	Program
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
BB034	Bujarrabal, V. (Yebes Obs) Alcolea, J. (Yebes Obs) Colomer, F. (Yebes Obs)	Interferometric SiO observation of OH/IR stars.
BB039	Bloom, S. (Pelham Manor, NY)	Flat spectrum, radio-loud quasars with spectral peaks near 43 GHz. 1.3, 3.6 cm
BB040	Boboltz, D. (VPI & SU) Diamond, P. Kemball, A. Claussen, M. Kogan, L.	A polarization survey of OH masers in circumstellar envelopes. 18 cm with single VLA
BB041	Beasley, A. Fomalont, E.	Absolute core motions of superluminal radio sources. 3.6 cm
BC025	Conway, J. (Chalmers, Onsala) Romney, J. Rupen, M. Beasley, A.	HI absorption against 3C 84. 18 cm
BC033	Cai, Z. (Beijing Obs) Nan, R. (Beijing Obs) Tian, W. (Beijing Obs) Gabuzda, D. (Lebedev) Taylor, A. R. (Calgary) Schilizzi, R. (NFRA) Inoue, M. (Nobeyama)	VLBI polarimetry of the high rotation measure source 3C 147. 6 cm
BC034	Conway, J. (Chalmers, Onsala) Wrobel, J.	Helical distortions of the jet in Mrk 501. 18 cm

No.	Observer(s)	Program
BC040	Clark, T. (NASA/GSFC) Ryan, J. (NASA/GSFC) Ma, C. (NASA/GSFC) Vandenberg, N. (Interferometrics) Gipson, J. (Interferometrics) Himwich, W. (Interferometrics) MacMillan, D. (Interferometrics) Potash, R. (Interferometrics) Gordon, D. (Hughes) Niell, A. (Haystack) Corey, B. (Haystack) Rogers, A. (Haystack) Eubanks, T. (USNO) Fomalont, E. Walker, R. C.	NASA space geodesy program geodetic observations for 1995. 3.6, 13 cm
BC045	Coles, B. (Calif., San Diego) Grall, R. (Calif., San Diego) Klingesmith, M. (Calif., San Diego)	Interplanetary scintillation measurements of the solar wind speed. 3.6 cm
BD021	Diamond, P. Kemball, A. Benson, J. Junor, W. (New Mexico) Dhawan, V.	Monitoring stellar SiO masers. 0.7 cm with single VLA
BD023	Denn, G. (Iowa) Mutel, R. (Iowa)	Monitoring BL Lac, with polarization. 1.3, 2, 3.6 cm
BD024	Dewey, R. (Princeton) Beasley, A. Frail, D.	Pulsar test observations with the VLBA. 18 cm
BD026	Diamond, P. Kemball, A. Goss, W. M. Taylor, G. (Caltech)	Mapping the small scale structure of the interstellar HI. 21 cm with phased VLA
BG022	Gussie, G. (Tasmania) Norris, R. (CSIRO) Ellingsen, S. (Tasmania) McCulloch, P. (Tasmania) Diamond, P.	Proper motion study of 12 GHz methanol masers. 2 cm
BG035	Garrett, M. (Manchester) Calder, R. (Manchester) Porcas, R. (MPIR, Bonn) Patnaik, A. (MPIR, Bonn)	PKS 1830-211: A search for 10^4-10^6 $M_\odot$ black holes in the halo. 2 cm

No.	Observer(s)	Program
BG042	Guirado, J. (JPL) Jones, D. (JPL) Preston, R. (JPL) Lara, L. (IAA, Andalucia) Marcaide, J. (Valencia) Rao, P. (NCRA, India) Sherwood, W. (MPIR, Bonn)	Einstein Ring candidate PKS 1830-211. 3.6 cm
BK016	Kellermann, K. Zensus, J. A. Cohen, M. (Caltech) Vermuelen, R. (Caltech) Gurvits, L. (NFRA) Lobanov, A. (Lebedev)	2 cm VLBA survey. Two scheduled with BK 23
BK023	Kellermann, K. Zensus, J. A. Cohen, M. (Caltech) Vermeulen, R. (Caltech) Gurvits, L. (NFRA) Lobanov, A. (Lebedev)	2 cm VLBA survey. Two scheduled with BK 16
BK031	Kemball, A. Porcas, R. (MPIR, Bonn) Patnaik, A. (MPIR, Bonn)	VLBI polarimetry of gravitational lens system 0218+357. 2, 3.6, 6 cm
BL013	Lestrade, J-F. (Meudon) Phillips, R. (Haystack) Jones, D. (JPL) Preston, R. (JPL)	Test of phase-referenced observations with the VLBA. 3.6 cm
BL019	Lobanov, A. (Lebedev) Zensus, A. J.	Relativistic shocks in 3C 345. 1.3, 2, 3.6, 6 cm
BM027	Matveyenko, L. (Lebedev) Diamond, P.	The H_2O supermaser region of the Orion Nebula. 1.3 cm
BM036	Moran, J. (CFA) Miyoshi, M. (NAO, Japan) Inoue, M. (Nobeyama) Nakai, N. (Nobeyama) Hernstein, J. (CFA) Greenhill, L. (CFA) Diamond, P.	Measurement of proper motions of the water vapor masers in NGC 4258. 1.3 cm
BM038	Marscher, A. (Boston) Moore, E. (Boston) Wehrle, A. (JPL) Georganopoulos, M. (Boston)	Coordinated multi-band observations of blazars. 1.3 cm

No.	Observer(s)	Program
BM044	Mutel, R. (Iowa) Sauerbrei, P. (Iowa)	Multifrequency maps of AR Lac and Algol. 2, 3.6, 6 cm with phased VLA
BM045	Mattox, J.R. (NASA/GSFC) Marscher, A.P. (Boston) Wagner, S. (Heidelberg Obs)	Radio structure and flaring gamma ray emission of blazars. 1.3, 2 cm
BM046	Mutel, R. (Iowa) Molnar, L. (Iowa) Goss, W. M.	HI absorption maps of ISS sources. 18 cm with phased VLA
BM047	Marscher, A. (Boston) Gomez, J. (Boston) Wehrle, A. (JPL) Georganopoulos, M. (Boston)	Coordinated multiband observations of blazars. 1.3 cm
BO001	Ojha, R. (Brandeis) Aaron, S. (Brandeis) Moellenbrock, G. (Brandeis) Wardle, J. (Brandeis) Roberts, D. (Brandeis)	Polarization in the disrupted jet of 3C 48. 13 cm
BP017	Patnaik, A. (MPIR, Bonn) Porcas, R. (MPIR, Bonn) Browne, I. (Manchester) Muxlow, T. (Manchester)	VLBA observations of two small separation gravitational lens systems. 2 cm
BP018	Pauliny-Toth, I. (MPIR, Bonn) Kellermann, K.	Morphology and spectral distribution of 2134+004. 2, 3.6 cm
BR025	Russell, J. (NRL) Fey, A. (NRL) Fomalont, E. Johnston, K. (USNO)	Astrometric observations for radio/optical reference frame. 3.6 cm
BR033	Rodriguez, L. (Mexico/UNAM) Gomez, Y. (Mexico/UNAM)	Kinematic structure of OH maser emission in selected OH/IR stars. 18 cm
BS015	Spencer, R. (Manchester) Newell, S. (Manchester)	VLBI observations of Cyg X-3 in the quiescent state. 2 cm
BS019	Sjouwerman, L. (Leiden) Diamond, P. van Langevelde, H. (NFRA) Winnberg, A. (Chalmers, Onsala) Habing, A. (Leiden) Lindqvist, M. (Leiden)	Stellar proper motions in galactic center from SiO and H_20 masers. 1.3 cm
BS022	Simon, R.	VLBI observations of turbulence in the interplanetary medium. 6, 90 cm

No.	Observer(s)	Program
BS023	Stacy, J. (New Hampshire) Vestrand, W. (New Hampshire) Biretta, J. (STScI)	VLBI observations of selected gamma-ray blazars. 3.6 cm
BT010	Taylor, G. (Caltech) Ge, J-P. (Brandeis) Pearson, T. (Caltech) Roberts, D. (Illinois)	Faraday rotation measures of CSS sources. 6, 18 cm with single VLA
BT014	Taylor, G. (Caltech) Readhead, T. (Caltech) Pearson, T. (Caltech) Wilkinson, P. (Manchester) Henstock, D. (Manchester)	Compact symmetric objects discovered in second Caltech-Jodrell survey. 3.6, 18 cm
BV005	Vermeulen, R. (Caltech) Schilizzi, R. (NFRA) Spencer, R. (Manchester) Fejes, I. (Budapest)	Spectral index imaging of the jets of SS433. 2, 6, 18 cm
BV012	van Langevelde, H. (NFRA) Chapman, J. (CSIRO) Killeen, N. (CSIRO)	OH/IR stars and galactic center distance. 18 cm
BW005	Wrobel, J. Conway, J. (Chalmers, Onsala) Terlevich, R. (RGO)	Testing the starburst model for NGC 5548's Seyfert 1 nucleus. 3.6 cm
BW011	Wehrle, A. (JPL) Leon, F. (Catania)	Orientation of radio jet and dust torus in NGC 4261 (3C 270). 3.6, 18 cm
BZ013	Zheng, X. (Nanjing) Moran, J. (CFA) Reid, M. (CFA)	OH masers in G34.3+02: Bow shock or champagne flow? 18 cm
GB025	de Bruyn, A. (NFRA) Vermeulen, R. (Caltech) Verbunt, F. (Utecht) Lestrade, J-H. (Meudon) Schilizzi, R.(NFRA) van de Heuvel, E. (Amsterdam)	Determining motions and birthplaces of pulsars through VLBI astrometry. 18 cm
GC016	Gabuzda, D. (Lebedev) Cawthorne, T. (Lancashire)	Second epoch observations of a 1 Jy sample of BL Lacertae objects. 6 cm
GC017	Conway, J. (Chalmers, Onsala) Schilizzi, R. (NFRA) van Langevelde, H. (NFRA)	HI absorption observations of 3C 236. 18 cm

No.	Observer(s)	Program
GM024	Marcaide, J. (Valencia) Ros, E. (Valencia) Alberdi, A. (IAA, Andalucia) Diamond, P. Shapiro, I. (CFA) Guirado, J. (JPL) Preston, R. (JPL) Jones, D. (JPL) Witzel, A. (MPIR, Bonn) Schilizzi, R. (NFRA) Mantovani, F. (Bologna) Trigilio, C. (Bologna) Whitney, A. (Haystack)	Radio shell expansion in SN 1993J. 6 cm
GR007	Rioja, M. (NFRA) Alberdi, A. (IAA, Andalucia) deBruyn, G. (NFRA) Elosegui, P. (CFA) Guirado, J. (JPL) Lara, L. (IAA, Andalucia) Saikia, D. (NCRA, India)	Unification model test: phase-reference mapping of weak-cored double. 6 cm
GR010	Rupen, M. Bartel, N. (York U.) Conway, J. (Chalmers, Onsala) Beasley, A. Sramek, R. Romney, J. Bietenholz, M. (York U.) Weiler, K. (NRL) van Dyk, S. (NRL) Panagia, N. (STScI) Titus, M. (Haystack) Cannon, W. (York U.) Popelar, J. (Ottawa) Graham, D. (MPIR, Bonn) Venturi, T. (Bologna) Umana, G. (Bologna) Davis, R. (Manchester) Rius, A. (IAA, Andalucia) Altunin, V. (JPL) Jones, D. (JPL)	VLBI imaging of supernova 1993J in M81. 3.6, 6, 18 cm
GS010	Snellen, I. (Leiden) Schilizzi, R. (NFRA) de Bruyn, G. (NFRA) Miley, G. (Leiden)	Morphologies of faint gigahertz peaked spectrum sources. 6 cm

F. SCIENTIFIC HIGHLIGHTS

Green Bank

Observation with the 140 Foot Telescope of OH emission and absorption spectra toward a sample of compact extragalactic millimeter-wave continuum sources show that there are some OH emission features which have no counterpart in either OH absorption or in the spectra of other molecules like CO, HCO^+, and HCN. The OH emission lines, however, match the deepest HI absorption components. This implies that interstellar OH must be widespread and must exist in clouds that are mainly atomic and have little H_2 or other molecular species.

Investigators: H. Liszt (NRAO) and R. Lucas (IRAM)

Tucson

Outflows from High Mass Stars – Observers have used the 12 Meter Telescope to study regions of high mass star formation. Relatively few outflows from high mass stars have been identified to date and little is known about the global properties of these energetic sources. The goal of this project was to define the properties of high mass YSOs and to add to the available number of sources that can be studied in depth.

Using the on-the-fly (OTF) mapping technique at the 12 Meter during February 1995, the group mapped seven high mass star formation regions in ^{12}CO(J=1-0). Each region had been identified during a previous survey run at the 12 Meter as having high velocity wings in the ^{12}CO line profile, suggesting the presence of bipolar outflows from high mass stars. Two of the sources had been mapped previously at a lower sensitivity and were known to be bipolar outflows. The OTF maps confirmed the existence of these bipolar outflows and allowed a better determination of the mass and energetics of the high velocity gas in the outflow lobes. Four of the remaining sources were discovered to be bipolar outflows. The high velocity gas in the final source was created by a superposition of velocity components. The masses calculated for the outflows have > 7 solar masses in the high velocity gas – this is several times larger than typically found for low mass sources and indicates that a high mass star is likely to be the driving engine. The observers have also recently obtained interferometric maps of two of the outflows in ^{12}CO(J=1-0) which will be combined with the OTF maps to allow a better determination of the total flux in the outflow lobes combined with high spatial resolution.

Investigators: D. Shepherd and E. Churchwell (Univ. Wisconsin, Madison)

Confirmation of Interstellar Acetone – The 12 Meter Telescope has been used to confirm the presence of interstellar acetone. Acetone is one of the most important molecules in organic chemistry and was the first 10-atom molecule reported in the interstellar medium. The detection of acetone was reported some years ago by Combes *et al.* (1987 **A&A**, 180, L13) in the Sgr B2(OH) complex, although the spectral features were rather weak and the detection not well-established. Based on recent BIMA interferometer maps, the present group had determined that large molecules such as methyl formate, vinyl cyanide, and ethyl cyanide were most abundant in the Sgr B2(N) position of the molecular cloud complex, which is about 1.3' north of Sgr B2(OH). Sgr B2(N) is a dusty region where grain-surface chemistry – a possible formation mechanism for large molecules – may occur. Positioned on Sgr B2(N), the 12 Meter was used to detect six new transitions of acetone, which independently and conclusively confirms the previous detection. Maps of several acetone transitions have been made with BIMA.

Investigators: L. E. Snyder, Y. Miao, D. M. Mehringer, and Y.-J. Kuan (Univ. Illinois), J. M. Hollis (NASA/Goddard), P. R. Jewell (NRAO), and F. J. Lovas (NIST)

Socorro

X-Ray Nova Becomes Prime Target for Jet-Accretion Disk Studies – An observing campaign with both the VLA and the VLBA, aimed at the Galactic x-ray source J1655-40, has shown two highly collimated relativistic jets, one on each side of the source, which expand and decay over a few days. The jet ejection, at 92 percent of the speed of light, appears episodic and asymmetric; the alternate brightening and fading of the jets cannot be explained by relativistic beaming. The highly collimated jets exhibit "wiggles" with a

period of approximately three days. As the radio observations were nearing publication, optical observers reported that the system is an eclipsing spectroscopic binary, with an invisible primary component of between 4 and 5.2 solar masses – above the stable limit of a neutron star, thus confirming suspicions that the primary is a black hole. The orbital period of the secondary is 2.62 days, within the uncertainty of the three-day period observed in the radio-jet "wiggles." The fortuitous wealth of known parameters makes this system, at a distance of only 3.2 kpc, the best known system for studying relativistic jets from accretion disks.

Investigators: R. Hjellming and M. Rupen (NRAO)

G. PUBLICATIONS

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

H. CHARLOTTESVILLE ELECTRONICS

Amplifier Development, Design, and Production

Evaluation of the AlInAs/GaInAs/InP devices from Hughes has continued. These devices have now been successfully incorporated into existing NRAO amplifier designs for 26-36 GHz, 38-45 GHz, 40-50 GHz, and 60-80 GHz.

A total of fourteen amplifiers (eleven 26-36 GHz, two 38-45 GHz and one 40-50 GHz) with InP devices were delivered this quarter.

Work continues on the production of 4-6 GHz amplifiers and 18-26 GHz amplifiers.

Work is continuing to resolve the instability problems with InP devices at lower frequencies (12-18 GHz). The maximum frequency of oscillation of these InP devices is greater than 150 GHz. Therefore, an adequate knowledge of models of different components used in the amplifier construction (device inclusive) which are valid over a sufficiently wide frequency range is required.

The new PC-based HFET test station is nearing completion. Measurements of amplifier noise and gain using this system agree well with measurements obtained using the older automated system. Minor software and hardware modifications are currently being implemented.

Superconducting (SIS) Millimeter-Wave Mixer Development

Work has begun on the design of an SIS image-separation mixer on a chip. For the 200-300 GHz band, the mixer will be on a 2 x 1 mm quartz chip mounted in a waveguide block with separate RF and LO waveguide ports. Two IF outputs from the mixer connect to an IF quadrature hybrid at 4 K. The USB and LSB IF signals appear at the third and fourth ports of the hybrid.

In a joint NRAO/UVA project, a 690 GHz mixer with a planar (*i.e.*, whiskerless) Schottky diode and no mechanical tuners achieved an overall receiver noise temperature of 4290 K (DSB). This is close to the best result ever reported (3800 K) for a room temperature receiver at this frequency. The mixer noise temperature was 3610 K DSB and the conversion loss 10.2 dB DSB. The mixer may be suitable for atmospheric monitoring at the MMA sites.

A low-loss vacuum window has been designed for the new 8-beam, 3-mm receiver being built in Tucson. This window has a 3.5" clear aperture (*cf.*, 3.0" for our earlier windows) and uses a layer of expanded PTFE supporting a coated polypropylene vacuum barrier.

4-6 GHz bias-T's for the high-IF 3-mm SIS receiver have been fabricated and sent to Tucson.

During this quarter we have assembled and tested five SIS mixers. We have also mounted and DC-tested 30 SIS chips from UVA wafers to provide feedback on their quality control.

Electromagnetic Support

Polarizers with a bandwidth ratio of approximately 1.5:1 are required for the VLA upgrade receivers, particularly for the 18 to 26.5 GHz receiver. A paper study of the various designs was completed and it was decided to build the polarizer in two stages: the phase shifter and the orthomode junction. Phase shifters in the rectangular waveguide section, where all four walls are loaded with dielectric or artificial dielectric, are shown in the literature to meet the bandwidth requirements. The same type of load can be used on all four walls or identical loads on opposite walls. Computer programs were written to calculate asymptotic propagation constants for dielectric loading, as well as for artificial dielectric loading. The accuracy of the programs was checked by comparison with published results.

Two sets of loads and the corresponding widths of the waveguide have been chosen using the above program for a polarizer which meets the bandwidth specification. The same type of loads will be used on all four walls. The accuracy of the results will be cross-checked using the HP-HFSS program.

GBT Spectrometer

All remaining circuit board designs for the GBT spectrometer were completed during the last quarter. Designs for the long-term accumulator and system monitor circuit cards were completed and prepared for wirewrapping, as were four other circuit card designs completed earlier.

All multi-layer cards for the GBT spectrometer were received during the quarter. Parts for these cards have been received and they are now ready for assembly. Assembly of the high-speed samplers was begun during the last quarter.

All motherboard designs for the GBT spectrometer were completed during the quarter and finished PC boards have been received. A card cage for the motherboards was designed and a prototype completed.

A test fixture to test both sampler designs used in the GBT spectrometer was completed and used successfully to test the prototype 100 MHz sampler.

The first production run for the 1024 lag correlator chip to be used in the GBT spectrometer was begun in April.

I. GREEN BANK ELECTRONICS

GBT Development

Construction of eight 1-8 GHz converter modules was completed and they were individually tested. Design and construction of the X21 multiplier 10.5 GHz LO3 module was completed, and testing of four of the LO2 synthesizers was completed. These components, along with a MCB interface module, were completed and installed in the converter rack A, which is undergoing integrated testing. Preparations continue for the installation at the 140 Foot of rack A, along with two optical IF links, planned for the third quarter. Design and construction of the LO reference distribution system continued. The digital continuum receiver back-end was completed and control programming is nearing completion. Design of a switching signal distribution system progressed. Work began on adapting the holography front-end box to the GBT application. Components, with the exception of the optical transmitters and receivers, were ordered to allow construction of eight optical IF links. Final selection of the optical tx/rx vendor will await results of the 140 Foot tests.

The active surface group accepted the final batch of the 2400 surface actuators, and the degreasing and inspection process has been completed. Programming of the surface control system continued. On-the-ground outfitting of the actuator control room was completed to the extent possible.

Design of the digital correlator for the 256 K channel spectrometer is now largely complete. Construction and integration is well underway. The third wafer run is expected to be completed in August. We are awaiting receipt of components for construction of the first two 1.6 GHz analog filter modules for use with the spectrometer high-speed samplers. Little progress was made on the 100 MHz analog filter/converter design, or on the spectrometer computer system, because personnel were occupied with higher priority work.

Site Operations

Maintenance, repair, and installation support was supplied to the 140 Foot, the 85-1 and 2 interferometer antennas, the USNO VLBI station, and the OVLBI earth-station terminal. Seventeen receiver installations and feed changes were completed at the 140 Foot. Significant effort was put into understanding causes of cryogenics problems seen on systems kept cold for long periods. Procedures for maintaining system vacuum integrity were reviewed and changes implemented.

A VLBA data acquisition system was received, installed at the 140 Foot, and used for the first time. Fringes were confirmed during a test run, and this DAS will now be used for routine VLBI network runs. Approval was received to cease support of MK II observations and plans are being made to remove the associated equipment. The SAO hydrogen maser was temporarily removed from service for replacement of vac-ion pumps, and then was returned to use.

J. TUCSON ELECTRONICS

Eight-Beam Receiver Progress

A successful observing test with the 1.3 mm, eight-beam SIS receiver was conducted in mid-May. Four of the eight beams were installed for the tests and all four performed extremely well. Particular attention was paid to the beam shapes and efficiencies and the performance was found to be exactly as intended.

Having passed this initial checkout, the receiver should now proceed to completion rather quickly. At this writing, the remaining four beams are being installed. The beam rotator, software control, and final electrical wiring work will be completed in the next few weeks. The staff plans to conduct further test and commissioning observations in the early autumn and expects to release the receiver to observers by mid-autumn. Observers may submit proposals for use of the 8-beam receiver at any of the upcoming deadlines.

The beam array is in a 4 x 2 rectangular configuration with each beam separated by 87". The array can be rotated under computer control to any arbitrary position angle and can track changes in source parallactic angle. The mixers are tunerless SIS devices. The staff has not yet quantified the actual tuning range, but expects the mixers to cover most of the 200 - 260 GHz band. The mixers have double-sideband response with an equivalent SSB system temperature of about 700 K (T_R*) under modestly good weather conditions; future improvements in T_{sys} are expected. Discrete grid mapping will definitely be supported in the initial release of the instrument. In a separate development project, we are also working to implement spectral line on-the-fly (OTF) mapping with rapid data dumps from the hybrid spectrometer. The hybrid spectrometer is required for eight-beam data acquisition.

Summer Shutdown Plans

The 12 Meter will suspend visitor observing from July 13 to September 12 for the annual summer "monsoon" season in the southwest. The staff will use the time for significant upgrades and the installation of new telescope equipment. This summer, a number of improvements will be made to the 2 and 3 mm receiver and to the 1 mm receiver. The receiver group will also be completing the 8-beam receiver this summer. The electronics group will be concentrating on projects relating to the hybrid spectrometer, including filter shapes and sampler performance and the completion of a flexible IF distribution system. The computing group will focus on the implementation of on-the-fly observing with hybrid spectrometer, the completion of new observer interfaces to the telescope control system, and a new status and monitor display system. The site operations group will conduct the annual inspection and maintenance of the dome and telescope. Although the number of projects is quite large, visitor observing will resume about a week earlier than in the past few years.

MMA Site Test Interferometer Installed in Chile

Over the last 18 months, we have developed and constructed two site test interferometers in Tucson. These instruments measure variations over a 300 m baseline in the electrical path length through the atmosphere by observing 11.5 GHz beacons on geostationary communications satellites. The first interferometer was installed at the VLBA site on Mauna Kea (3720 m) in 1994 September and has been collecting data since. In 1995 April, following the successful deployment by a Socorro team of a container with a solar and wind power system, a satellite telephone, and a 225 GHz tipping radiometer, we installed the second interferometer at 5000 meters near Cerro Chajnantor about 50 km east of San Pedro de Atacama. Data summaries from both instruments are received daily in Tucson. Initial indications of the Chilean site are very, very encouraging. We are now beginning detailed analysis of the data from both sites and will post the results in the NRAO WWW pages when they are available.

K. SOCORRO ELECTRONICS

VLA 1.3 - 1.7 GHz Receiver Improvements

One of the two remaining spare front ends was completed and tested. The remaining spare will be used for cryogenic testing of resonance suppression in the orthomode transducer. Prototypes of a new Walsh function phase switching scheme in the F2 first local oscillator successfully removed the out-of-band signals which are imaged to appear in-band. This method will replace the planned frequency converter F15 with a much less expensive system which can be completed on all antennas by the fourth quarter of this year.

VLA 40 - 50 GHz Receivers

Assembly of the first of three additional front ends started last quarter. All three should be assembled, tested, and installed in time for the 1995/1996 winter atmosphere.

New VLA Correlator Controller

Work is progressing on the serial control interface to the VLA correlator. Circuitry has been prototyped on the Radstone PME VP-1 VME bus interface card to read and write from some RAM and a counter, and to generate a 92 uSec interrupt. Software has been written to test the performance of transfers and interrupt response time. It was discovered that some bandwidth is being lost due to the LAN controller on the Motorola MVME 147 processor card which has shared RAM. All in all, the performance was found to be acceptable. The shift out/in registers and steering circuitry are being worked on.

VLA Antenna B-Rack Shields and Optical Fibers

Twenty-six shields with optical fibers have been installed in antennas. We expect to complete all antenna B-racks in July.

VLA Monitor and Control Upgrades

Taking advantage of D-configuration this quarter, we completed a number of VLA monitor and control upgrades. The M5 command simulator was changed to reduce parity errors and enable a single shot command. The M2, data tap, was changed to reduce emitted RF noise and received new LEDs. The M4 also was changed to reduce RFI emissions. New filter capacitors were changed in the M8, FRM power supply. The M26, Y-com monitor, modules were upgraded to enable monitoring of the ACU power supplies.

GPS Receivers

We are developing a universal interface to connect any brand/model GPS receiver to the VLBA station computer without software changes.

Virtual Instrument Recorder (VIR)

This system is being developed to replace the eight channel digital data tap which uses an eight channel analog recorder. The analog recorder has reached the end of its repairable life. This older system required engineers or technicians to travel to the VLA Site to set-up and retrieve the data. We are in the process of implementing hardware and software to provide AOC access to on-line VLA site monitoring and data recording using a graphical interface. This system will provide simultaneous multichannel and multiuser capability. It will be installed in the last quarter of 1995.

VLBA Maser Frequency Standard

The vacuum leak in maser #11 was repaired at the Sigma Tau Corp. factory in early March and returned to the AOC in late April. The intermediate frequency level decay is large but hopefully in a few months the decay will lessen to an acceptable rate. The EFOS maser Allen Variance stability has returned to acceptable levels in spite of low cavity Q. EFOS returned to the VLA in mid June.

VLBA Recorders and Playback Drives

Recent work toward improving reliability of playback drives at the correlator has focused on the vacuum loss and tape slippage problem, and some progress occurred. Efforts will continue. Work progressed on improving the tape container for better resistance to damage in shipment.

Data Acquisition System for Green Bank

The entire DAS was shipped to Green Bank in January and was installed at the 140 Foot Telescope. A successful test of this system using the VLBA was completed on April 25. This project is now completed.

VLBA Correlator

LSI Logic completed the failure analysis of several failed VLBA1 custom integrated chips. The report states that it is expected that there will not be an increase in the failure rate, as the rate of failure and the failure mechanisms are consistent with LSI reliability data that show failure rates remain constant for the equivalent of greater than 50 years of field operation.

We are waiting for the next tele-conference with Hall-Mark and LSI to determine what recourse we have. LSI has asked if we want the failed chips replaced, but has not answered the question of whether it is even possible to replace the chips.

Engineering and Services Division completed the installation of the dedicated cooling units on May 16. The exit air temperature from the correlator racks is now approximately 8 to 10°C lower than before.

An additional four VLBA1 chips have failed so far in the second quarter, all prior to the addition of the dedicated cooling. The lack of failures in the four weeks since installation of the cooling units is encouraging but not yet statistically significant.

Interference Protection

The on-line interference monitoring system at the VLA, announced in the previous Quarterly Report, was used to document over fifty incidents of strong interference within radio astronomy protected bands since the beginning of 1995. Though identification of the sources of the interference has not been accomplished and is expected to be difficult because of the intermittent nature of the signals, a report has been prepared for NSF and CORF and further investigation is planned. Records of interference in the adjacent bands have led to an improved dialog with the DOD Area Frequency Coordinator for the New Mexico area.

Planning, design, and procurement has begun for a portable digital spectrometer for use in monitoring low level RFI. The spectrometer will be a single signal 1024 channel XF autocorrelator built with boards designed for the GBT correlator and populated with early Canaris chips that fall short of full bandwidth designed value. The design calls for baseband conversion so that the test

instrument can be used on the output of P and L band receivers and at IF monitor points. Further description can be found in VLA/VLBA Interference Memo #7 available from slucero@nrao.edu.

A record of L band interference at the VLA is available via the NRAO home page, http://info.aoc.nrao.edu/, under the topic "VLA." Further information on VLA interference is available under VLAIS also accessible from the home page. Expanding and updating interference information on the World Wide Web will be an important priority during the upcoming quarter.

L. OBSERVATORY COMPUTING AND AIPS

Detailed plans were developed and implemented this quarter for the rather meager computing RE budget. It was possible to address only the most urgent needs around the Observatory, with an emphasis on improvements which would allow the NRAO to better support users and visitors to NRAO sites. In Tucson, a dual processor Sparcstation 20 was procured to allow for a second "heavy" data processing machine at the 12 Meter. This will partially ease the large computing load from the "on-the-fly" observing technique. Tucson also used some of the computing RE budget to acquire computing equipment to improve the reliability and capabilities of its online control system. In Socorro, two similar machines were procured to provide significant upgrades to existing public workstations. The main server machine in Socorro was also upgraded to improve capacity and reliability. In Charlottesville, a single workstation was purchased to provide a machine for postdoc use. The RE budget also covered processor upgrades to a number of existing workstations, which will decrease the pressure on the large public machines around the Observatory. Finally, several small pieces of peripheral computing hardware (tape drives and networking equipment) are being procured to cover immediate needs.

Besides the computing RE funds, Socorro and Green Bank used local M&S funds to buy two smaller single user workstations at each site, the CDL bought a single machine, and the AIPS++ project purchased a new server for Socorro. Combined with the RE purchases, this brings the total computer purchases for 1995 to 14 (including three machines ordered last year and delivered this year). At the current rate, it will take approximately 15.1 years to roll over the workstation population at the NRAO. The typical useful lifetime of a scientific workstation is three to five years.

The network bandwidth into Green Bank has emerged as a significant issue during this quarter. The AIPS++ project is providing substantial support for the GBT tests taking place this summer in Green Bank; the limited network bandwidth is hampering that effort. Green Bank users and observers also grumble at the lack of bandwidth into the site. The obvious solution – putting a wide bandwith "T1" line into Green Bank – is difficult because of the remoteness of the Green Bank site and the technical limitations of the local service provider. We are continuing efforts to resolve these issues and determine the actual cost of improved service into Green Bank.

By 7 July 1995, 116 copies of the 15JAN95 release of "Classic AIPS" had been shipped either over the Internet or by magnetic tape. Eighty of the copies were of the full binary release, some for each of SunOS (4.x.y), Solaris (Sun), AIX (IBM), OSF/1 (DEC Alpha), Linux (PCS), IRIX (SGI), and HP-UX (Hewlett-Packard). Preparations for the 15JUL95 release are well underway. This release will be copyrighted by AUI and given away under the "GNU General Public License" via anonymous ftp. This will make it easier for potential users, in and out of astronomy, to obtain a copy of AIPS. To maintain some idea of how many sites are using AIPS and to keep some control over demands on our time for user assistance, we will keep a record of all fetches of AIPS via ftp and require sites to "register" with us before receiving assistance. In the registration process, sites will provide information about themselves and their use of AIPS which will enable us to set priorities if requests for user assistance become excessive. Commercial customers who have paid a registration fee will have their contribution rolled over into a maintenance contract for the outstanding part of their contract. We will be charging such organizations a fee for assistance in the future.

The re-write of the AIPS CookBook continued during the quarter with a complete re-write of the two chapters (now combined into a single chapter) on imaging, deconvolution, and self-calibration. The new chapter emphasizes IMAGR and SCMAP and deprecates the use of older imaging tasks such as MX and HORUS. All chapters of the CookBook are made available via the World Wide Web (WWW). Users can fetch the new chapters as they are actually completed by fetching the files via the WWW (or via anonymous ftp).

The new imaging task, IMAGR, was enhanced to allow images as large as 8192 pixels on a side, to allow up to 500 Clean windows per field and to correct several minor data handling and gridding bugs. The iterative self-cal/imaging task SCMAP was enhanced by

adding all of the advanced imaging features of IMAGR, including the interactive TV display and windowing options. The verb FILEBOX was created to assist users in preparing long lists of Clean windows. The object-oriented software in AIPS was improved to control access to the "array processor" (large common memory area) and to provide more TV display options including wedges, labeling, and color table handling.

A new task for amplitude calibration, primarily in VLBI, called APCAL was added to the system. It uses system temperature and gain curve tables produced by ANTAB to determine atmospheric opacity and other amplitude corrections which it then applies to the basic AIPS calibration SN table. The new task BLAVG averages cross-polarized data over baselines and time to enable all available data to be used for deriving R-L phase and delay differences between IFs. These differences must be found and removed in order to average cross-hand data over frequency channels and IFs. The new task FXVLB has also appeared in preparation for improvements – not yet implemented – in the amplitude decorrelation correction of VLBA data.

The making of images from the "on-the-fly" observing mode of the 12 Meter Telescope was corrected by the removal of an occasionally significant bug and by the addition of an option to create images of the image reliability. The latter are used with the new task WTSUM to do sums of images weighted correctly by their expected noise. A bug in the source-finding task SAD which caused it to reject too many sources was removed. The AIPS FITS writer stopped writing an excess record on empty table extension files. The AIPS TV was given four more graphics planes for line drawing in additional colors and was changed to try to reduce its impact on user terminal windows when it uses a non-default color map. Previously, TV instructions as well as other lines were often invisible in those terminal windows when the cursor was on the TV window. The AIPS scripts were changed to use Perl in places (when possible) to let them run very much faster.

M. AIPS++

Inside NRAO, AIPS++ is now treated as a construction project with dedicated staff and budget. A fulltime project manager has been appointed. The NRAO AIPS++ group split into two principal groups: one in Charlottesville concerned mainly with support of single dish processing, and another in Socorro, concerned with project management and synthesis support. In addition, NRAO plans dedicated AIPS++ programmers at both the Green Bank and Tucson sites.

The immediate goals of the Project have been defined to be consolidation and testing of the AIPS++ library, and development of a few key applications chosen to provide unique astronomical capabilities. The long-term goal of the Project has been defined to be the achievement of functional equivalence to AIPS by 2000. At that point, AIPS will be a very small subset of AIPS++ and most applications areas will look quite different from the corresponding areas in AIPS.

A development plan for the next 12-18 months has been instituted to provide a coherent overall picture of the direction of the Project in the intermediate term (see http://aips2.nrao.edu/aips++/docs/html/devplan.html). Tracking of progress in AIPS++ is now performed using a target dates mechanism (see, for example, http://aips2.nrao.edu/aips++/docs/html/targets.html).

The following applications are now present and being developed further: a tool for on-the-fly mapping using the 12 Meter Telescope in rapid scanning mode, a self-calibration/deconvolution tool used principally on ATCA data, and a tool for plotting and manipulating data from the GBT systems integration tests on the 140 Foot Telescope.

Documentation for both users and programmers is now available via the WWW and is being developed further (see http://info.cv.nrao.edu/aips++/docs/html/aips++.html).

The following infrastructure library changes have occurred. A system for class documentation is now in place, numerous improvements have been made to the Glish system used for task control and command line interface (CLI), and a very capable tool for visualization (AIPSView) has been developed by the BIMA group at NCSA.

Intellectual developments are also crucial for the long-term success of AIPS++. A partial design for UV plane calibration and imaging (UVCI) was completed by a team drawn from Australia National Telescope Facility (ATNF), Netherlands Foundation for

Research in Astronomy (NFRA), and NRAO. A collaboration of NFRA and ATNF personnel has developed a very general formalism for the calibration of synthesis polarimetric observations.

N. SOCORRO COMPUTING

In March, a meeting was held with all AOC scientific staff in order to discuss our computing priorities. This was prompted by our wish to spend our limited Research Equipment budget as efficiently as possible. The prevailing opinion was that we should limit use of our powerful IBM machines to the most CPU- and disk-intensive projects. Currently, many medium sized projects require too much CPU and/or disk space for our SPARC station IPX systems to handle, and thus are forced to compete for limited IBM time. The plan is to start gradually replacing visitor IPX workstations, beginning with two dual-processor SPARC station 20s later in the summer; and to enhance the CPU power of around 60 percent of the remaining IPX-class Suns (including the rest of the visitor workstations) by upgrading them with the Weitek CPU chip, which is capable of boosting CPU performance by 70-80 percent.

We anticipate another performance improvement when we install the new fast disks on four of the most powerful IBM workstations. With the current older disks, many AIPS applications are I/O limited. The new disks are expected to arrive in June or July. One intended use for the existing disks after the replacement is to increase disk space on the SPARC visitor workstations, which, combined with the Weitek upgrade, is then expected to create a serious alternative to the IBMs for many medium-sized projects.

As of June 26, all 32 Weitek chips have arrived. The chips will be installed gradually over a period of four weeks, during which the upgrade to Solaris is planned as well. The two new Sparc station 20s are expected to arrive shortly and be fully operational by mid-August.

We also are expecting a replacement for zia, which has been a general purpose server (e-mail, ftp, etc.) for many years. Key reasons for its replacement are severe overloading of the present machine and increasing difficulty in upgrading.

O. VLBA OPERATIONAL STATUS

During the second quarter of 1995 (period ending June 22, 1995) a total of 58 projects were correlated (48 VLBA, 4 Tests and 6 Global). This is almost exactly the same throughput as in the first quarter of the year. However, closer examination shows that this was achieved through an increase in the number of VLBA projects. The processing of global projects still remains extremely labor intensive and progress in alleviating the pain of such projects has been slow. The biggest obstacle to efficient correlation of global projects remains the incompleteness of the logs and the need for clock searches for non-VLBA stations. We hope to soon be introducing the software patches needed to overcome the short comings of the logs from some foreign stations.

We performed a major update of the correlator software early in the second quarter and this has resulted in a more robust operation of the correlator. Work is continuing for the next major update in the fall. This coming update is expected to be very painful as many aspects of the correlator software will be changed in order to introduce many of the new features for which observers have been waiting. However, the new software will be thoroughly tested prior to its use on routine projects.

All of the final shipment of thin tapes has been received, inspected, and transferred to self packing reels. The VLBA was scheduled for 60 percent of the time during March. The amount of astronomical observing will be increased slowly during the next quarter as the efficiency of correlator operations improves.

P. GREEN BANK TELESCOPE PROJECT

Antenna

During April, all welding on the elevation shaft was completed. The bearing housings were set in place atop the alidade towers, some 165 feet above ground level. The housings were accurately leveled and positioned to receive the two parts of the 150 foot long

shaft. Axle support cradles were placed on the temporary support tower, which had been erected earlier, midway between the alidade towers. The shaft was raised during the first week in May. Each portion weighted slightly over 100 tons. When the shaft was placed the two sections were pulled together using a complex jacking arrangement, thus preparing for the final weld. The inward movement of the alidade support towers provided an excellent check of the design calculations which predicted both the tower deflections and stress in the shaft accurately. The final weld joining the sections was made and erection of the box girder truss surrounding the elevation shaft began.

Trial assembly on the ground of the remainder of the trusses which make up the 143 foot x 172 foot box girder is in progress and the 91 foot radius elevation wheel along with its 22 counterweight boxes is on site awaiting erection. Concurrently, preparations have been made for building the 11,000 member reflector tipping structure and the individual members have begun to arrive on site.

The reflector backup structure will be constructed on a 150 foot x 150 foot concrete pad adjacent to the alidade. At the contractor's plant in Sterling, Virginia, 700 of the 2004 reflector surface panels have already been constructed. Fabrication of the subreflector continues.

Open Loop Active Surface

In order to give cohesiveness and continuity to the active surface software design, a detailed software design effort is underway. In June 1995, a requirements document, including a system block diagram, system description, and list and description of requirements, was generated.

The order for 2400 actuators from Industrial Devices Corporation was completed during the period, with the receipt of the last 188 actuators. Due to delays in motor delivery, several actuators were delivered without motors. After the motors are delivered, NRAO will install and test the remaining actuators. All actuators, except those without motors, have now gone through NRAO acceptance testing.

Progress has also been made on the actuator cable tester. The cable tester, bought from Cirris, has been returned to the supplier for testing due to a "noisy voltage" error message. In the meantime, work is progressing on a test program for the actuator cables. A switch box to switch between the cable tester and actuator tester was built in June.

Active Surface Closed Loop

Instrument Optics – The instrument optical design has made major progress this period. Experimental data conclusively proved the need for an optical isolator on the laser diode in order to prevent phase shifts of as much as 200 microns. With the addition of the isolator, the instrument agreed with an HP laser interferometer to within the specification of the interferometer (1 ppm) over a range of 18374.6 mm. Experimental data also proved that the optimum focal length should be around 150 mm. With these two components finalized, the optical system has been designed and production on five units has begun. The instrument base design is being completed by NRAO personnel.

140 Foot Telescope Demonstration – All damaged fiber optic ethernet cables are being replaced by direct burial cables. IRIG-B is now available at the control panels. The V-cup mounts on the monuments have been leveled to $\pm$ 0.01" with an N3 optical level. Work on the hydrostatic level continues in an attempt to improve this measurement.

GBT Ground-Based Laser Location Survey – The GBT center line has been surveyed with respect to monument KING 1991, and a permanent azimuth marker has been established in cooperation with CRSI to marker CRSI EAST. The GBT ground-based laser locations have been marked off at a 120 meter radius.

Weather Station – Calibration of the GBT weather station has led to the discovery of several problem areas. The dew point sensor has been returned to the manufacturer for calibration and work continues to resolve a possible cross-check discrepancy between the temperature instrument and a calibrated thermometer. A discrepancy of about 180 degrees between the observed position of the weather vane (wind direction) and readings obtained from the weather center has been resolved.

Panel Setting Tool – The tilt sensor on the prototype panel setting tool was returned to the manufacturer, where it was found that the temperature compensation on this instrument was incorrect. NRAO is awaiting it's return to evaluate it's suitability.

Software – Work continues on the software that will enable the mirror to track a moving retro-reflector. Software to support the Bancomm bc630AT Real Time Clock board has been written and tested. The bc630AT will be used to decode the IRIG-B time code signal and to generate heartbeat interrupts for the tracking software. These interrupts will be synchronized to the IRIG-B time code. Although reading the IRIG-B time code did not prove to be a problem, difficulties were encountered when attempting to generate interrupts with this board. The heartbeat interrupts are a key to the accuracy of the tracking software. This problem is being resolved with the manufacturer. In preparation for the 140 Foot Telescope demonstration, a small server computer that provides the 140 Foot Telescope encoder readings over the LAN has been brought back on line. A Windows 3.1 client program has been written to display this data anywhere over the LAN. Code from this client will be used in the 140 Foot Telescope demonstration software to generate tracking instruction for the lasers. The frame grabber server program that provides pictures of the GBT construction site (see GBT memo #123) has been modified to restrict access to the nrao.edu domain. The software can accommodate other machines or domains as needed.

Servo – A teleconference with CRSI/PCD was held. Several outstanding issues, including spare boards, auto-stow, and the redundant cable-wrap were discussed. Also, progress on the feed arm servo was discussed. CRSI/PCD feels they are making adequate progress, and are still committed to supporting field tests in Green Bank in the fall. Factory tests of the feed arm servo have been moved from August to September. Progress on the possibility of adding jerk control to the GBT AZ/EL servo was discussed.

Some simulations have been run at CRSI/PCD and the results were not very encouraging; a report is forthcoming. The auto-stow issue has been discussed extensively at CRSI during the past month. We have recently received a preliminary revised procedure for auto-stow from CRSI for review.

Spare boards for the servo system were ordered this period. The order was placed at this time primarily to allow testing of the boards at the CRSI/PCD facility while the GBT servo system is still there. A teleconference was held with staff from Charlottesville, Green Bank, and JPL to discuss recent work at JPL on a trajectory preprocessor for the GBT. Preliminary results indicate that a significant improvement in position switching response of the GBT may be possible.

Electronics

Construction of eight 1-8 GHz converter modules was completed and they were individually tested. Testing of the X21 multiplier 10.5 GHz LO3 module was completed, and testing of four of the LO2 synthesizers was completed. These components, along with a MCB interface module, were completed and installed in the converter rack A, which is undergoing integrated testing. Preparations continue for the installation at the 140 Foot Telescope of rack A, along with two optical IF links, planned for the third quarter. Design and construction of the LO reference distribution system continued. The digital continuum receiver backend was completed and control programming is nearing completion. Design of a switching signal distribution system progressed. Work began on adapting the holography front-end box to the GBT application. Components, with the exception of the optical transmitters and receivers, were ordered to allow construction of eight optical IF links. Final selection of the optical tx/rx vendor will wait results of the 140 Foot Telescope tests.

Design of the digital correlator for the 256K channel spectrometer is now largely complete. Construction and integration is well underway. The third wafer run is expected to be completed in August. NRAO is awaiting receipt of components for construction of the first two 1.6 GHz analog filter modules for use with the spectrometer high-speed samplers. Limited progress was made on the 100 MHz analog filter/converter design and on the spectrometer computer system.

Work continued on the system for distribution of time-critical switching signals.

Monitor and Control

Work continues on the DCR software. Design and implementation work centered on control and scan sequencing software. By the end of the period a rudimentary running system was complete. Work continues on the Console rewrite. The Console is the program

for producing graphical user interface for controlling GBT devices. The main thrust of this effort is to improve the look and feel of the interfaces. By the end of the period a basic library was released for alpha use and for use in the July test, including a new parameter flags' feedback display and an added manager component.

Work was completed on making the GBT control interfaces (panels) accessible from Glish. A base class was designed to allow each control program to send events and receive events from Glish scripts. Glish interfaces to the spectral processor, DCR, antenna, and scan coordinator were completed.

The BFP analysis and development was brought to a conclusion, and GBT Memo 131 (GBT Best-Fitting-Paraboloid [BFP] in C) was finalized and distributed. The BFP software will be a key component of the M&C pointing, focus tracking and active optics subsystems.

Work has begun on ray tracing the Gregorian optics to derive the Gregorian focus tracking algorithm. The first step is that a ray tracing package developed early in 1994 is being upgraded.

Data Analysis

A continuing program to maintain and test the AIPS++ development installation in Green Bank was initiated. The migration to Solaris 2.4 and the CenterLine C++ compiler is now complete. The AIPS++ group successfully compiled data analysis software needed for the July integration tests using the Green Bank AIPS++ system.

Sample FITS data for the digital continuum receiver was generated and tested. The initial FITS data format for the DCR is now complete. Several simulated DCR datasets were also tested. Work continued on the GLISH user interface for the July tests.

Q. PERSONNEL

New Hires

J. Eilek	Visiting Scientist	06/01/95
R. Lively	Scientific Programmer	06/01/95

Terminations

G. Carrad	Visiting Elec. Engineer I	04/28/95
W. R. Burns, Jr.	Deputy Asst. Director/Computing Operations and Programs	04/28/95
J. Horstkotte	Sr. Scientific Programming Analyst	05/19/95
J. Eilek	Visiting Scientist	06/30/95
R. Taylor	Visiting Scientist	06/30/95

Change in Title

P. Diamond	to Deputy Asst. Director, Socorro Operations	04/01/95
B. Glendenning	to Deputy Asst. Director, AIPS++ Project	04/01/95
J. Uphoff	to Systems Analyst	04/01/95
T. Cornwell	to Scientist-Asst. Director, AIPS++ Project	04/01/95
G. Hunt	to Deputy Asst. Director, Computing	05/01/95

Other

R. Heald	return from leave of absence	04/16/95

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MATHIEU, R.D.; ADAMS, F.C.; FULLER, G.A.; JENSEN, E.L.N.; KOERNER, D.W.; SARGENT, A.I. Submillimeter Continuum Observations of the T Tauri Spectroscopic Binary GW Orionis.

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MINTER, A.H.; SPANGLER, S.R. Observation of Turbulent Fluctuations in the Interstellar Plasma Density and Magnetic Field on Spatial Scales of 0.01 to 100 Parsecs.

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TAYLOR, G.B.; GE, J.-P.; O'DEA, C.P. High Faraday Rotation Measures of the Steep Spectrum Quasar 3C 216.

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WOLLACK, E.J. High-Electron-Mobility-Transistor Gain Stability and Its Design Implications for Wide Band Millimeter Wave Receivers.

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US/GR BK/

NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

July 1, 1995 - September 30, 1995

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A. TELESCOPE USAGE

The following telescopes have been scheduled for research and maintenance in the following manner during the third quarter of 1995.

	140 Foot	12 Meter	VLA	VLBA
Scheduled observing (hours)	1672.00	653.75	1736.9	1006
Scheduled maintenance and equipment changes	312.75	6.00	233.1	336
Scheduled tests and calibration	212.00	1536.25	244.1	332
Time lost	59.50	57.50	86.8	40.6
Actual observing	1612.50	596.25	1650.1	965.4

B. 140 FOOT OBSERVING PROGRAMS

The following continuum programs were conducted during this quarter.

No	Observer(s)	Program
D186	de Pater, I. (Calif., Berkeley) Heiles, C. (Calif., Berkeley) Maddalena, R. Wong, M. (Calif., Berkeley)	21 cm monitoring of the Comet-Jupiter crash.

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
A123	Azcarate, I. (IAR, Argentina) Cersosimo, J. (Univ. Puerto Rico) Wilkes, L. (Univ. Puerto Rico)	21 cm search for new evidence of the warping in the galactic plane. Part II.
B609	Bania, T. (Boston) Rood, R. (Virginia) Balser, D.	X-band measurements of the cosmic abundance of ^{3}He.
B643	Braatz, J. (Maryland) Wilson, A. (Maryland)	Monitoring of H_2O megamasers in active galaxies.
G343	Gibson, S. (Wisconsin) Wood, D. Holdaway, M. Nordsieck, K. (Wisconsin)	21 cm mapping of galactic neutral hydrogen in the Pleiades region.

No.	Observer(s)	Program
273	Lockman, F. J.	HI mapping of Ursa Major.
L305	Liszt, H. Lucas, R. (IRAM)	18 cm observations for C II and CH toward Zeta Ophiuchi.
M385	Murphy, E. (Virginia) Lockman, F. J.	The magnetic field in galactic HI.
M391	Magnani, L. (Georgia) Hartmann, D. (CFA) Dame, T. (CFA) Thaddeus, P. (CFA)	A search at 3.335 GHz for CH emission from diffuse molecular gas.
P176	Patel, N. (Massachusetts) Goldsmith, P. (Cornell)	Monitoring a water maser system towards IC 1396 region.
S399	Shah, R. (Boston) Bania, T. (Boston) Jackson, J. (Boston)	C91α studies of photodissociation regions: Density and temperature structure of the partially ionized medium.
T359	Thaddeus, P. (CFA)	H_2C_7 search toward TMC-1 and IRC+10216.
V082	Verschuur, G. (Rhodes College)	Tests of a new 18 cm feed to measure the Zeeman effect in thermal OH sources.
W280	Wootten, H. A.	H_2O monitoring in star forming cores in Rho Oph.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
A116	Arzoumanian, Z. (Cornell) Nice, D.	Observations at 550 MHz of the orbital fluctuations in the eclipsing pulsar.
A118	Arzoumanian, Z. (Cornell) Nice, D. Taylor, J. (Princeton) Taylor, H. (Princeton)	Bimonthly timing of 63 pulsars at 810 MHz.
B617	Backer, D. (Calif., Berkeley) Sallmen, S. (Calif., Berkeley) Foster, R. (NRL) Matsakis, D. (NRL)	Pulsar timing array observations at 800 and 1395 MHz.
B644	Backer, D. (Calif., Berkeley) Zepka, A. (Calif., Berkeley) Sallmen, S. (Calif., Berkeley)	Pulsar flux density and pulse morphology observations at 3 GHz.

No.	Observer(s)	Program
M386	McKinnon, M. Fisher, J. R.	A 1.3-1.8 GHz polarization model test and timing of young pulsar PSR B1823-13.
S400	Sayer, R. (Princeton) Taylor, J. (Princeton) Nice, D.	370 MHz timing observations of a new relativistic binary pulsar.
S401	Sayer, R. (Princeton) Shrauner, J. (Princeton) Camilo, F. (Princeton) Taylor, H. (Princeton) Taylor, J. (Princeton) Thorsett, S. (Princeton) Arzoumanian, Z. (Cornell) Nice, D.	370 MHz observations measuring the relativistic effects in binary pulsars and timing of recently discovered pulsars.

C. 12 METER TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
A129	Apponi, A. (Arizona State) Ziurys, L. (Arizona State)	Evaluating the nitrogen/oxygen chemical network: additional mapping of NO and N_2O in Sgr B2.
B648	Bieging, J. (Arizona)	Mapping CO emission toward four AGB stars.
E61	Evans, A. (Hawaii) Sanders, D. (Hawaii) Mazzarella, J. (Caltech)	CO (1→0) observations of powerful radio galaxies detected by IRAS.
H305	Hughes, D. (Oxford) Rawlings, S. (Oxford) Dunlop, J. (Liverpool) Eales, S. (Cardiff)	A CO survey of the only complete sample of high-redshift radio galaxies.
H306	Hughes, D. (Oxford)	Study of blue compact galaxies as templates for high-redshift galaxies: the gas-to-dust ratio in a low metallicity environment.
K350	Kutner, M. (RPI) Mead, K. (Union College)	A new look at molecular ring clouds.
L304	Liszt, H.	^{13}CO and CS maps of Sgr D and Sgr E.
L313	Charnley, S. (NASA/Ames) Latter, W. (NASA/Ames)	Study of methanol in IRC+10216.
M394	Murphy, E. (Virginia)	A search for molecular gas in galactic high velocity clouds.
O44	Young Owl, R. (Illinois) Meixner, M. (Illinois)	Determination of the structure of the molecular gas in the reflection nebula NGC 2023.

No.	Observer(s)	Program
T350	Turner, B.	Sulfur chemistry of translucent clouds: a search for SO^+.
T358	Tielens, A. (NASA/Ames) Boogert, A. (Leiden) Wesselius, P. (Groningen) van Dishoeck, E. (Leiden) Latter, W. (NASA/Ames)	Study of the physical conditions and carbon budget around YSOs with ice bands.
W350	Welch, G. (St. Mary's Univ., N.S.) Mitchell, G. (St. Mary's Univ., N.S.) Sage, L. (Nature)	Study of molecular gas and star formation in NGC 205.
W356	Walker, C. K. (Arizona) Narayanan, G. (Arizona)	Study of the effects of clustered star formation on molecular outflow activity.

D. VERY LARGE ARRAY

Third quarter 1995 was spent in the following configurations: A configuration from July 1 to September 5, and BnA configuration from September 5 to September 31.

No.	Observer(s)	Program
AA187	Akujor, C. (MPIR, Bonn) Garrington, S. (Manchester)	Polarization observations of compact steep spectrum sources at 22 GHz. 1.3 cm
AA188	Anglada, G. (Barcelona) Estallella, R. (Barcelona) Villuendas, E. (Barcelona) Rodriguez, L. (Mexico/UNAM) Girart, J. (CFA) Torrelles, J. (IAA, Andalucia)	Imaging of thermal jets in low luminosity molecular outflow sources. 3.6 cm
AA189	Acord, J. (MPIR, Bonn) Hofner, P. (Koln) Afflerbach, A. (Wisconsin) Churchwell, E. (Wisconsin) Walmsley, C.M. (Koln)	Water masers in UC HII regions: disks or outflows? 1.3 cm
AA193	Anantharamaiah, K. (Raman Institute) Roy, A. (Raman Institute) Goss, W. M. Zhao, J.-H. (SA/IAA, Taiwan)	Recombination lines from external galaxies. 20 cm line
AB705	Burke, B. (MIT) Becker, D. (MIT) Lehar, J. (CFA) Hewitt, J. (MIT) Roberts, D. (Brandeis)	Time delay of the gravitational lens 0957+561. 3.6, 6 cm

No.	Observer(s)	Program
AB740	Baum, S. (STScI) Colbert, E. (Maryland) O'Dea, C. (STScI) Pedlar, A. (Manchester)	Three archetypical Seyferts: MKN 6, NGC 3079, MKN 231. 6, 20 cm
AB746	Birkinshaw, M. (CFA) Worrall, D. (CFA)	HI absorption line feature in NGC 6251. 20 cm
AB747	Baan, W. (NAIC) Uglesich, R. (Columbia) Haschick, A. (Haystack)	Nuclear dynamics of NGC 6240. 20 cm
AB748	Braatz, J. (Maryland) Wilson, A. (STScI)	Mapping of H_2O megamasers in active galaxies. 1.3 cm
AB749	Barthel, P. (Groningen/Kapteyn) Hoekstra, H. (Groningen/Kapteyn) Hes, R. (Groningen/Kapteyn)	Beamed 60 micron radiation in lobe dominated quasars? 1.3, 2, 6 cm
AB750	Barthel, P. (Groningen/Kapteyn) Lonsdale, C. (Haystack) Vestergaard, M. (CFA) Miley, G. (Leiden)	High redshift quasar morphologies. 6, 20 cm
AB751	Butler, B. Muhleman, D. (Caltech) Slade, M. (JPL)	Goldstone/VLA radar imaging of Mercury. 3.6 cm
AB755	van Breugel, W. (LLNL) Dey, A. (LLNL) Dickinson, M. (STScI) Spinrad, H. (Calif., Berkeley)	Deep VLA imaging of two z ~ 1 radio galaxies. 3.6, 6 cm
AB756	Bagchi, J. (NCRA, India) Chandra, I. (NCRA, India) Kapahi, V. (NCRA, India)	A peculiar radio source. 6, 20 cm
AB759	Browne, I. (Manchester) Wilkinson, P. (Manchester) Sykes, C. (Manchester)	Ring and halo in the gravitational lens B0218+357. 6, 20 cm
AB760	Browne, I. (Manchester) Wilkinson, P. (Manchester) Sykes, C. (Manchester) Muxlow, T. (Manchester) Jackson, N. (Manchester) Myers, S. (Caltech) Fassnacht, C. (Caltech) Readhead, A. (Caltech) Pearson, T. (Caltech) de Bruyn, A. (NFRA) Snellen, I. (Leiden)	Deep imaging of the new quadruple lensed system 1608+656. 1.3, 2, 3.6, 6, 20 cm

No.	Observer(s)	Program
AB761	Burke, B. (MIT) Ekers, R. (CSIRO) Wright, A. (CSIRO) Fletcher, A. (MIT) Conner, S. (MIT) Griffith, M. (CSIRO)	PMN-VLA snapshot survey. 3.6, 6 cm
AB762	Barnbaum, C. Morris, M. (UCLA)	Circumstellar OH maser of extraordinary star, U Equ. 20 cm
AB766	Blundell, K. (Oxford) Rawlings, S. (Oxford) Lacy, M. (Oxford) Littlewood, C. (Oxford) Willott, C. (Oxford) Serjeant, S. (Oxford)	The evolution of radio quasars and their environments from z = 0.5-3. 3.6, 6, 20 cm
AB768	Brown, A. (Colorado/JILA) Deeney, B. (Colorado/JILA) Gudel, M. (SFIT, ETH) Skinner, S. (Colorado/JILA) Stewart, R. (CSIRO)	Simultaneous radio (VLA+AT) and EUV from binary flare star CC Eri. 3.6, 20 cm
AC420	Carilli, C. (CFA) Rottgering, H. (Cambridge) Best, P. (Cambridge) Owen, F.	Two classic "alignment effect" high-z radio galaxies. 3.6, 6, 20 cm
AC424	Callcut, J. (Michigan State) Winfrey, S. (Michigan) Wootten, H. A.	Determining characteristics of S106FIR using water masers. 1.3 cm
AC427	Crane, P. (Interferometrics) Cowan, J. (Oklahoma) Primini, F. (CFA) Roberts, D. (Illinois) Dickel, J. (Illinois)	Variability of the nuclear source in M31. 3.6 cm
AC429	Cowan, J. (Oklahoma) Branch, D. (Oklahoma)	Search for extragalactic intermediate age supernovae. 20 cm
AC430	Chambers, K. (Hawaii)	6C radio soures suitable for study with adaptive optics. 3.6 cm
AC432	Capetti, A. (STScI) Axon, D. (STScI) Macchetto, D. (STScI) Pedlar, A. (Manchester)	Radio outflow in Seyfert galaxies. 2 cm
AC434	Curiel, S. (CFA) Rodriguez, L. (Mexico/UNAM) Moran, J. (CFA) Canto, J. (Mexico/UNAM)	Radio monitoring of the Serpens radio jet. 2, 3.6, 6 cm

No.	Observer(s)	Program
AC435	Curiel, S. (CFA) Rodriguez, L. (Mexico/UNAM) Pedlar, A. (Manchester) Canto, J. (Mexico/UNAM)	On the nature of the double radio source associated with L1551 IRS5. 2, 3.6 cm
AC437	Curiel, S. (CFA) Eiroa, C. (Madrid Obs) Canto, J. (Mexico/UNAM)	Circumstellar disk structures around very YSOs. 0.7, 1.3, 3.6 cm
AC438	Carilli, C. (CFA) Perlman, E. (Maryland) Stocke, J. (Colorado/JILA) van Langevelde, H.	Search for OH absorption in PKS 1413+135, a galaxy at z = 0.25. 20 cm
AC440	Claussen, M. Hofner, P. (Koln)	Search for non-thermal continuum emission from hot molecular outflow. 20 cm
AC441	Cotton, W. Swain, M. (Rochester) Bridle, A. Kassim, N. (NRL)	J2146+82 – large radio galaxy with misaligned outbursts? 3.6, 6 cm
AC442	Conner, S. (MIT) Garnavich, P. (CFA) Turner, E. (Princeton) Schechter, P. (CFA) Burke, B. (MIT)	New gravitational lens candidates from the MIT-Green Bank-VLA survey. 2, 3.6, 6 cm
AC444	Colomer, F. (Yebes Obs) Cernicharo, J. (Yebes Obs) Baudry, A. (Bordeaux) Gonzales-Alfonso, E. (Yebes Obs) Alcolea, J. (Yebes Obs) Marvel, K. (New Mexico State) Herpin, F. (Bordeaux)	Study of high velocity SiO and H_20 maser emission from evolved stars. 0.7 cm
AC455	Camilo, F. (Princeton) Lundgren, S. (NRL) Foster, R. (NRL)	Accurate position for PSR J1022+1001. 20 cm
AD361	Dahlem, M. (STScI) Dettmar, R.-J. (Bochum) Golla, G. (Toronto)	Search for radio knots in NGC 891. 6 cm
AD363	Dressel, L. (ARC) Jones, D. (JPL)	Compact radio sources associated with nuclear emission line regions. 20 cm
AD364	De Pree, C. (North Carolina) Cecil, G. (North Carolina) Greenhill, L. (CFA) Moran, J. (CFA)	High resolution continuum imaging of the large scale jet in NGC 4258. 20 cm

No.	Observer(s)	Program
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AD366	De Pree, C. (North Carolina) Gaume, R. (USNO) Goss, W. M.	High resolution line and continuum observations of Sgr B2. 0.7 cm
AD368	Domgorgen, H. (Bonn U.) Dahlem, M. (STScI) Golla, G. (Toronto)	The ISM in NGC 2188: a case study for disk-halo interaction. 3.6 cm
AD369	Danner, R. (Caltech) Kulkarni, S. (Caltech)	Soft X-ray sources in high galactic latitude clouds. 6, 20 cm
AD372	De Pree, C. (North Carolina)	Variable source in NGC 6951. 6, 20 cm
AE101	Echevarria, L. (UCLA) Morris, M. (UCLA)	Probing the nature of the galactic center threads. 3.6, 6 cm
AE104	Erickson, W. (Maryland) Perley, R. Kassim, N. (NRL) Jacobson, A. (LANL)	Improving ionospheric models for low frequency VLA observations. 90, 400 cm
AE105	Elias, N. (USNO)	Monitoring Algols KX And and V367 Cyg. 6 cm
AF292	Fruchter, A. (STScI) Thorsett, S. (Princeton) Goss, W. M.	Pulsar proper motions. 20 cm HTRP
AF294	Frail, D. Kulkarni, S. (Caltech) Vasisht, G. (Caltech)	The soft gamma ray repeater SGR 1806-20. 3.6, 6 cm
AF295	Fomalont, E. Goss, W. M.	Finding list of background sources for pulsar astrometry. 90 cm
AF298	Frail, D. Goss, W. M.	An unusual head-tail source in the galactic plane. 20 cm
AG415	Gomez, Y. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM) Moran, J. (CFA)	Angular expansion of compact planetary nebulae. 3.6 cm
AG421	Gaume, R. (USNO) Fischer, J. (NRL)	Monitoring the radio continuum flux density of NGC 2024-IRS2. 1.3, 2, 3.6, 6, 20 cm
AG443	Gray, R. (Gray Data)	High-sensitivity search of the "Wow" locale for 21 cm radio signals. 20 cm

No.	Observer(s)	Program
AG448	Greenhill, L. (CFA) Henkel, C. (MPIR, Bonn)	Monitoring the acceleration of water megamaser features in NGC 4258. 1.3 cm
AG449	Gizani, N. (Manchester) Leahy, J. (Manchester) Garrington, S. (Manchester) Perley, R.	Faraday rotation in Hercules A. 20 cm
AG450	Green, D. (Cambridge) Cowan, J. (Oklahoma)	Search for young galactic SNRs: a follow-up. 20 cm
AG452	Gerritsen, J. (Groningen/Kapteyn) Barthel, P. (Groningen/Kapteyn) Sramek, R. Sanders, D. (Hawaii)	Radio emission in radio-quiet QSOs – starburst or AGN? 3.6 cm
AG453	Gaume, R. (USNO) Martin-Pintado, J. (Yebes Obs) Planesas, P. (Yebes Obs) Goss, W. M.	Radio continuum spectral index of NGC 7538 IRS 1. 0.7, 1.3, 2, 3.6, 6 cm
AG454	van Gorkom, J. (Columbia) Baum, S. (STScI)	HI absorption in elliptical radio galaxies. 20 cm
AG456	Gregg, M. (LLNL) Becker, R. (Calif., Davis)	Radio haloes around late-type stars. 6 cm
AG457	Girart, J. (CFA) Curiel, S. (CFA) Rodriguez, L. (Mexico/UNAM)	The exciting sources of HH objects. 3.6 cm
AG461	Gomez, Y. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM)	Water maser emission in selected OH/IR stars. 1.3 cm
AG462	Gallimore, J. (Maryland) Baum, S. (STScI) Claussen, M.	Enigmatic H_2O masers in the hidden Seyfert 1 nucleus of NGC 1068. 1.3 cm
AG464	Gothaskar, P. (NCRA, India) Anantharamaiah, K. (Raman Institute) Rao, A. P. (NCRA, India)	Scattering in the solar wind. HTRP 2, 3.6, 6, 20, 90 cm
AG466	Golla, G. (Toronto) Kronberg, P. (Toronto)	Supernova remnants in NGC 4631. 3.6, 6 cm
AH492	Hjellming, R. Gehrz, R. (Minnesota) Seaquist, E. (Toronto) Taylor, A. R. (Calgary)	Image and light curve evolution of radio novae. 1.3, 2, 3.6, 6, 20 cm

No.	Observer(s)	Program
AH528	Harvanek, M. (Colorado/JILA) Stocke, J.(Colorado/JILA) Ellingson, E. (Colorado/JILA)	Morphology of 3CR radio galaxies at z = 0.15-0.65. 20 cm
AH546	Harper, G. (Colorado/JILA) Brown, A. (Colorado/JILA) Hummel, C. (USNO) Walder, R. (SFIT, ETH)	Search for radio emission from eclipsing binary Zeta Aurigae. 3.6 cm
AH549	Hughes, V. (Queens) MacLeod, G. (HartRAO)	Search for time-dependent sources in star forming regions. 6 cm
AH551	Ho, L. (Calif., Berkeley) Van Dyk, S. (Calif., Berkeley)	Survey of nearby galactic nuclei. 6 cm
AH552	Hewitt, J. (MIT) Langston, G. Burke, B. (MIT) Trotter, C. (MIT)	Completion of a flux-limited sample of the MG survey. 6 cm
AH554	Holdaway, M. Kobulnicky, H. (Minnesota)	Flat spectrum extragalactic sources behind the plane. 1.3, 3.6 cm
AH557	Hofner, P. (Koln) Stecklum, B. (MPIR, Bonn)	M8 revisited: What is ionizing the hourglass? 3.6, 6 cm
AH558	Ho, L. (Calif., Berkeley) Maoz, D. (Tel-Aviv U.) Barth, A. (Calif., Berkeley)	UV-dark LINERs: Obscured AGNs? 3.6, 6 cm
AH559	Ho, L. (Calif., Berkeley) Van Dyk, S. (Calif., Berkeley)	The nature of low luminosity active galactic nuclei. 3.6 cm
AH564	Higdon, J. Wallin, J. (George Mason)	Radio continuum study of the cartwheel ring galaxy. 20 cm
AI057	Ivison, R. (Royal Obs) Seaquist, E. (Toronto)	Second-epoch imaging of RX Puppis during a phase of low excitation. 3.6 cm
AI059	Ishwara-Chandra, C. (NCRA, India) Kapahi, V. (NCRA, India) Saikia, D. (NCRA, India) Subrahmanya, C. (NCRA, India)	Polarization studies of Molonglo complete sample. 3.6, 20 cm
AJ245	Johnston, H. (Utrecht) Strom, R. (NFRA) Verbunt, F. (Utrecht)	An X-ray knot expelled by the Vela supernova. 20 cm
AJ246	Jura, M. (UCLA) Turner, J. (UCLA) Ghez, A. (UCLA)	HR 4796B: nearby pre-main sequence star. 3.6 cm

No.	Observer(s)	Program
AJ248	Johnston, K. (USNO) De Vegt, C. (Hamburg U.) Florkowski, D. (USNO)	Radio positions and proper motions of optically bright stars. 6 cm
AJ249	Johnston, K. (USNO) De Vegt, C. (Hamburg U.) Gaume, R. (USNO) Fey, A. (USNO)	Radio emission of the T Tau system. 0.7, 1.3, 2, 3.6, 6, 20 cm
AJ251	Jura, M. (UCLA) Balm, S. (UCLA) Turner, J. (UCLA) Kahane, C. (Grenoble)	Big grains around the red rectangle? 0.7, 1.3, 2, 3.6 cm
AK376	Kulkarni, S. (Caltech) Frail, D.	Search for the radio counterparts of gamma ray bursters. 20 cm
AK394	Kukula, M. (Liverpool JMU) Pedlar, A. (Manchester) Hamilton, N. (Manchester) Baum, S. (STScI) O'Dea, C. (STScI)	Seyferts from the 12-micron galaxy sample. 3.6 cm
AK401	Kobulnicky, H. (Minnesota) Dickey, J. (Minnesota) Holdaway, M.	Molecular absorption survey toward scatter-broadened radio sources. 2, 3.6, 20 cm
AK403	deKoff, S. (STScI) Biretta, J. (STScI) Baum, S. (STScI) Sparks, W. (STScI) Miley, G. (Leiden) Macchetto, D. (STScI)	HST/VLA snapshot survey of 3CR radio galaxies. 2, 3.6 cm
AK404	King, L. (Oxford) Browne, I. (Manchester) Patnaik, A. (MPIR, Bonn) Wilkinson, P. (Manchester)	1938+666: an intriguing gravitationally lensed source. 2 cm
AK405	Kraemer, K. (Boston) Jackson, J. (Boston) Ho, P. (CFA) Zhang, Q. (CFA) Davis, C. (MPIR, Bonn)	Search for shock-excited NH_3 (3,3) masers in outflow sources. 1.3 cm
AK406	Kukula, M. (Liverpool JMU) Dunlop, J. (Liverpool JMU) Rawlings, S. (Oxford) Hughes, D. (Oxford) Taylor, G. (Liverpool JMU)	Radio properties of radio-quiet quasars – AGN or starburst? 3.6, 6 cm

No.	Observer(s)	Program
AK407	Kukula, M. (Liverpool JMU) Pedlar, A. (Manchester) Holloway, A. (Manchester) Meaburn, J. (Manchester) Baum, S. (STScI)	Unusual shells in the Seyfert galaxy Markarian 6. 3.6, 20 cm
AK409	Kenny, H. (Canadian Military) Taylor, A. R. (Calgary) Eyres, S. (Manchester) Ivison, R. (Royal Obs) Seaquist, E. (Toronto) Davis, R. (Manchester)	CH Cygni: stellar jet imaging. 1.3, 3.6, 20 cm
AK410	Knopp, G. (Hawaii) Chambers, K. (Hawaii)	High redshift radiogalaxies – morphology and polarization. 3.6, 20 cm
AK411	Kassim, N. (NRL) Reynolds, S. (North Carolina State) Moffett, D. (NMIMT)	330 MHz observations of bright supernova remnants. 90 cm
AK413	Kassim, N. (NRL) Perley, R. Erickson, W. (Maryland)	74 MHz observations of strong sources – large angular size objects. 90, 400 cm
AK414	Kronberg, P. (Toronto) Allen, M. (Toronto)	High resolution radio spectral index studies of the nucleus of M82. 3.6 cm
AK420	Kollgaard, R. (Penn State) Ghisellini, G. (Torino) Maraschi, M. (Genova U.) Pesce, J. (STScI) Sambruna, R. (STScI) Urry, C.M. (STScI)	Multifrequency monitoring of blazars. 1.3, 2, 3.6, 6, 20 cm
AK421	Kobulnicky, H. (Minnesota) Skillman, E. (Minnesota)	HI mapping of the nearby peculiar starburst galaxy NGC 5253. 20 cm
AL353	Ludke, E. (UFSM, Brazil)	Faraday effect in CSS sources. 1.3 cm
AL355	Lacy, M. (Oxford) Rawlings, S. (Oxford) Blundell, K. (Oxford)	A new Einstein ring: 6C 0551+587. 3.6, 6 cm
AL357	Lehar, J. (CFA) Kochanek, C. (CFA)	Gravitationally lensed radio source MG0751+2716. 2, 3.6 cm
AL361	Lim, J. (SA/IAA, Taiwan) White, S. (Maryland)	Radio luminosity function of F-M dwarf stars in the Pleiades. 3.6 cm
AM474	Marvel, K. (New Mexico State) Diamond, P.	Monitoring masers in AGB stars. 0.7, 1.3, 20 cm

No.	Observer(s)	Program
AM480	Miranda, L. (Madrid Obs) Torrelles, J. M. (IAP, Granada) Eiroa, C. (Madrid Obs)	Spatio-kinematical structure of compact very young PNs. 3.6 cm
AM481	Mirabel, I. F. (CNRS, France) Chaty, S. (CNRS, France) Rodriguez, L. (Mexico/UNAM) Marti, J. (Barcelona)	Hard X-ray sources in the galactic bulge. 6 cm
AM482	Mirabel, F. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Monitoring the superluminal source GRS 1915+105. 3.6 cm
AM483	Miralles, M. (Massachusetts) Ho, P. (CFA)	UC HII region IRAS 18057+0121. 3.6 cm
AM484	Myers, S. (Caltech) Jackson, N. (Manchester) Blandford, R. (Caltech) Browne, I. (Manchester) de Bruyn, A. (NFRA) Fassnacht, C. (Caltech) Miley, G. (Leiden) Nair, S. (Manchester) Pearson, T. (Caltech) Readhead, A. (Caltech) Schilizzi, R. (NFRA) Sykes, C. (Manchester) Wilkinson, P. (Manchester)	Cosmic Lens All Sky Survey (CLASS). 3.6 cm
AM486	Martin-Pintado, J. (Yebes Obs) Gaume, R. (USNO) Johnston, K. (USNO)	The CRL 618 molecular outflow. 1.3 cm
AM487	Masson, C. (CFA) Kawamura, J. (CFA)	Expansion of compact HII regions. 2, 3.6 cm
AM488	Martin-Pintado, J. (Yebes Obs) Gaume, R. (USNO) Planesas, P. (Yebes Obs) Johnston, K. (USNO) Thum, C. (IRAM)	Neutral circumstellar disk in MWC 349. 20 cm
AM490	Muxlow, T. (Manchester) Pedlar, A. (Manchester) Wilkinson, P. (Manchester) Axon, D. (STScI)	Combined 5 GHz VLA-MERLIN image of starburst activity in M82. 6 cm
AM492	Moran, E. (LLNL) van Bruegel, W. (LLNL)	Peculiar IRAS galaxies of unusual X-ray brightness. 6, 20 cm
AM494	Menten, K. (CFA) Reid, M. (CFA)	Wide field observations of the compact radio sources in Orion Nebula. 1.3, 3.6 cm

No.	Observer(s)	Program
AM495	Menten, K. (CFA) Reid, M. (CFA)	Using H_2O masers around the galactic center as astrometry tools. 1.3 cm
AM496	Marscher, A. (Boston) Moore, E. (Boston) Bania, T. (Boston)	Variable molecular absorption toward extragalactic continuum sources. 6 cm line
AM497	Migenes, V. (CSIRO) Bowers, P. (NRL) Cohen, R. (Manchester) Shepherd, M. (Caltech) Ludke, E. (UFSM, Brazil)	High dynamic range maps of OH maser shells. 20 cm
AM501	Morganti, R. (Bologna) Killeen, N. (CSIRO) Tadhunter, C. (Sheffield) Clark, N. (Sheffield)	Powerful radio galaxy PKS 2250-41. 1.3, 2, 3.6, 6 cm
AM506	McMahon, R. (Cambridge) Beeharry, G. (Cambridge)	Radio properties of radio quiet quasars at $z > 4$. 20 cm
AM508	Menten, K. (CFA) Reid, M. (CFA)	Molecular absorption in lens B0218+357. 2 cm
AN066	Navarro, J. Bailes, M. (CSIRO) Bell, J. (Mt. Stromlo)	Accurate positions for three millisecond pulsars. 20 cm HTRP
AO122	Owen, F. Perley, R. Cotton, W. Postman, M. (STScI) Condon, J.	Deep A-array survey near 1015+51. 20 cm
AP296	Preston, R. (JPL) Folkner, W. (JPL)	Earth-based observation of Galileo probe for Jupiter wind estimation. 3.6 cm
AP302	Pooley, G. (Cambridge) Hardcastle, M. (Cambridge) Alexander, P. (Cambridge) Riley, J. (Cambridge)	Jets in nearby FRI radio galaxies. 3.6, 20 cm
AP315	Pooley, G. (Cambridge) Hardcastle, M. (Cambridge) Riley, J. (Cambridge) Alexander, P. (Cambridge)	Constraining the luminosity function of jets in FRII radio galaxies. 3.6 cm
AP319	dePater, I. (Calif., Berkeley)	Jupiter patrol: aftermath of Comet-Jupiter crash. 20, 90 cm
AP320	dePater, I. (Calif., Berkeley) Dickel, J. (Illinois)	Saturn's atmosphere during ring plane crossing. 6, 20 cm

No.	Observer(s)	Program
AP322	Patel, N. (CFA) Zhang, Q. (CFA) Ho, P. (CFA) Goldsmith, P. (NAIC)	Water maser emission from IC 1396E. 1.3 cm
AR334	Roser, H.-J. (MPIA, Heidelberg) Perley, R. Meisenheimer, K. (Royal Obs)	High frequency mapping of the jet of 3C 273. 0.7, 1.3, 2, 3.6, 6, 18 cm
AR335	Rawlings, S. (Oxford) Lacy, M. (Oxford) Blundell, K. (Oxford) Serjeant, S. (Oxford)	An HST sample of quasars at $0.5 < z < 0.7$. 3.6, 6, 20 cm
AR338	Reipurth, B. (ESO) Marti, J. (Barcelona) Rodriguez, L. (Mexico/UNAM)	High velocity proper motions in the HH 80-81 thermal radio jet. 3.6 cm
AR339	Rawlings, S. (Oxford) Serjeant, S. (Oxford)	Is FSC 10214+4724 gravitationally lensed? 3.6, 6 cm
AR341	Reid, M. (CFA) Masson, C. (CFA) Menten, K. (CFA) Moran, J. (CFA) Wilner, D. (CFA)	Synchrotron emission from the H_2O maser source in W3OH. 3.6 cm
AR342	Ratner, M. (CFA) Bartel, N. (York U.) Lebach, D. (CFA) Lestrade, J.-F. (Paris Obs) Shapiro, I. (CFA)	Survey of radio sources near candidate guide stars for GP-B. 3.6 cm
AR343	Rengelink, R. (Leiden) Bremer, M. (Leiden) Rottgering, H. (Cambridge) Miley, G. (Leiden)	Finding the most distant galaxies from WENSS. 20 cm
AR344	Rucinski, S. (York U.)	Close binary ER Vul: a multi-wavelength campaign. 3.6 cm
AS516	Shaver, P. (ESO) Wall, J. (RGO) Kellermann, K.	Accurate positions of unidentified flat-spectrum Parkes sources. 3.6 cm
AS559	Steffen, W. (Manchester) Holloway, A. (Manchester) Pedlar, A. (Manchester) Dyson, J. (Manchester) Meaburn, J. (Manchester) Axon, D. (STScI)	Radio outflow in Seyfert galaxy IRAS 0421+040P06. 3.6, 20 cm

No.	Observer(s)	Program
AS561	Stockton, A. (Hawaii) Ridgeway, S. (Hawaii)	Radio-optical survey of a complete z ~1 3CR sample of galaxies. 3.6, 20 cm
AS562	Stocke, J. (Colorado/JILA) Rector, T. (Colorado/JILA) Perlman, E. (Maryland)	High dynamic range mapping of 1 Jy BL Lac objects. 20 cm
AS564	Slysh, V. (Lebedev) Kalenskii, S. (Lebedev) Valts, I. (Lebedev) Dzura, A. (Lebedev) Kogan, L.	Imaging of Class I methanol masers. 0.7 cm
AS567	Sramek, R. Weiler, K. (NRL) Van Dyk, S. (Calif., Berkeley) Panagia, N. (STScI)	A revisit to possible radio supernovae. 3.6 cm
AS572	Saikia, D. (NCRA, India)	Mildly active galaxies with nuclear radio rings and spirals. 2, 3.6, 6 cm
AS573	Saikia, D. (NCRA, India) Jeyakumar, S. (NCRA, India) Thomasson, P. (Manchester)	Three highly distorted compact steep-spectrum radio galaxies. 2, 3.6, 6 cm
AT165	Taylor, G. (Caltech) Readhead, A. (Caltech) Vermeulen, R. (Caltech) Pearson, T. (Caltech) Henstock, D. (Manchester) Wilkinson, P. (Manchester)	Kiloparsec-scale structure of the second Caltech-Jodrell Bank survey. 20 cm
AT176	Thorsett, S. (Princeton) Taylor, J. (Princeton) McKinnon, M. Hankins, T. (NMIMT) Stinebring, D. (Oberlin College)	Timing fast pulsars at the VLA. HTRP 6, 20, 90 cm
AT181	Torrelles, J. (IAP, Granada) Rodriguez, L. (Mexico/UNAM) Ho, P. (CFA) Gomez, J. (Boston) Garay, G. (Chile) Curiel, S. (CFA)	The powerful thermal radio jet in Cep A HW 2. 1.3 cm
AT182	Thomson, R. (Cambridge) Mackay, C. (Cambridge) Wright, A. (CSIRO)	Polarization mapping of the jet of the quasar 3C 273. 6 cm

No.	Observer(s)	Program
AT183	Tyson, A. (Bell Labs) Stocke, J. (Colorado/JILA) Harvanek, M. (Colorado/JILA) Rhee, G. (Nevada)	Deep VLA imaging of 0957+561. 3.6, 20 cm
AU062	Ulvestad, J. (JPL) Antonucci, R. (Calif., Santa Barbara)	Monitoring of compact sources in NGC 253. 3.6, 6 cm
AU063	Umana, G. (CNR/IRA-Frascati) Trigilio, C. (Bologna) Franciosini, E. (Florence) Chiuderi-Drago, F. (Florence)	Radio spectra of active binaries during flares. 1.3, 2, 3.6, 6, 20 cm
AW362	White, S. (Maryland)	The stellar activity cycle on active stars. 3.6, 6, 20 cm
AW411	Warner, P. (Cambridge) Minns, A. (Cambridge) Riley, J. (Cambridge)	The structures and spectra of a homogeneous sample of radio sources. 3.6, 20, 90 cm
AW416	Wiercigroch, A. (JPL) Ulvestad, J. (JPL)	Compact radio sources in LINERS. 3.6 cm
AW418	van der Werf, P. (Leiden)	The starburst nucleus in M83. 6 cm
AW424	Winnberg, A. (Chalmers) Engels, D. (Hamburg U.)	Water maser flare in RX Boo. 1.3 cm
AY069	Yusef-Zadeh, F. (Northwestern) Roberts, D. (Illinois) Biretta, J. (STScI)	Proper motion of ionized gas at the galactic center. 2, 6 cm
AZ072	Zhang, Q. (CFA) Ho, P. (CFA) Kraemer, K. (Boston) Jackson, J. (Boston)	Ammonia masers associated with mass outflow in star-forming regions. 1.3 cm

E. VERY LONG BASELINE ARRAY

No.	Observer(s)	Program
BA013	Aaron, S. (Brandeis) Wardle, J. (Brandeis) Roberts, D. (Brandeis)	Quest for helical jets. 18 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, with VLA single antenna

No.	Observer(s)	Program
BB042	Bondi, M. (Manchester) Junor, W. (New Mexico) Mantovani, F. (Bologna)	Compact steep-spectrum sources with very high rotation measures. 3.6 cm, with VLA single antenna
BB043	Beasley, A. Bastian, T. Niell, A. (Haystack)	High frequency VLBA observations of AE Aqr. 1.3 cm
BB046	Bower, G. (Calif., Berkeley) Backer, D. (Calif., Berkeley) Wright, M. (Calif., Berkeley)	High frequency mapping of nearby active galactic nuclei. 1.3 cm
BB047	Baudry, A. (Bordeaux) Diamond, P.	Mapping a new OH maser line with the VLBA. 2 cm
BB050	Blundell, K. (Oxford) Lacy, M. (Oxford)	PC-scale jets and core of the radio-quiet quasar E 1821+643. 3.6, 6 cm with phased VLA
BB051	Barsony, M. (Calif., Riverside) Lonsdale, C. (Haystack) Phillips, R. (Haystack)	Protostellar outflow source L1551/IRS5. 20 cm
BB053	Bower, G. (Calif., Berkeley) Backer, D. (Calif., Berkeley) Wright, M. (Calif., Berkeley)	Dramatic flare in the extremely flat-spectrum QSO NRAO 530. 1.3, 3.6 cm with VLA single antenna
BC040	Clark, T. (NASA/GSFC) Corey, B.E. (Haystack) Eubanks, T. (USNO) Fomalont, E. Gipson, J. (Interferometrics) Gordon, D. (NASA/GSFC) Himwich, W. (Interferometrics) Ma, C. (NASA/GSFC) MacMillan, D. (Interferometrics) Niell, A. (Haystack) Potash, R. (Interferometrics) Rogers, A. (Haystack) Ryan, J. (NASA/GSFC) Vandenberg, N. (Interferometrics) Walker, R. C.	NASA space geodesy program geodetic observations for 1995. 3.6 cm
BC043	Conway, J.(Chalmers, Onsala) Venturi, T. (Bologna) Giovannini, G. (Bologna) Feretti, L. (Bologna) Beasley, A.	HI absorption observations of the nearby CSO 4C31.04. 18 cm with VLA single antenna
BC044	Conway, J. (Chalmers, Onsala) Wrobel, J. Carilli, C. (CFA) Blanco, P. (Calif., San Diego)	HI absorption toward the nucleus of Cygnus A. 18 cm with phased VLA

No.	Program	Program
BC045	Coles, B. (Calif., San Diego) Grall, R. (Calif., San Diego) Klingesmith, M. (Calif., San Diego)	Interplanetary scintillation measurements of the solar wind speed. 1.3, 6, 3.6, 2 cm
BC047	Coles, B. (Calif., San Diego) Grall, R. (Calif., San Diego) Klinglesmith, M. (Calif., San Diego)	Interplanetary scintillation measurements of the solar wind speed. 2, 3.6 cm
BC048	Clark, T. (NASA/GSFC) Ryan, J. (NASA/GSFC) Ma, C. (NASA/GSFC) Vandenberg, N. (Interferometrics) Gipson, J. (Interferometrics) Himwich, W.E. (Interferometrics) Mac Millan, D.S. (Interferometrics) Potash, R. (Interferometrics) Gordon, D. (NASA/GSFC) Neill, A. Haystack) Corey, B. (Haystack) Rogers, A. (Haystack) Eubanks, T. (USNO) Fomalont, E. Walker, R. C.	Revised: NASA space geodesy program observations for June-December, 95. 3.6 cm
BC049	Cawthorne, T. (Lancashire) Hutchison, J. (Lancashire)	Polarization sensitive observations of 4C 71.07. 3.6, 6 cm
BD021	Diamond, P. Kemball, A. Benson, J. Junor, W. (New Mexico) Dhawan, V.	Monitoring stellar SiO masers. 0.7 cm VLA single antenna
BD023	Denn, G. (Iowa) Mutel, R. (Iowa)	Monitoring BL Lac, with polarization. 1.3, 2, 3.6 cm
BD026	Diamond, P. Kemball, A. Goss, W. M. Taylor, G. (Caltech)	Mapping the small scale structure of the interstellar HI. 18 cm with phased VLA
BF013	Fomalont, E. Goss, W. M. Lyne, A. (Manchester) Manchester, R. (CSIRO)	Pulsar parallax and proper motions: Second and third epochs. 18 cm
BF014	Fix, J. (Iowa) Claussen, M.	Secular variations in the OH line profiles of U Her. 18 cm with VLA single antenna
BF015	Fomalont, E. Bradshaw, C. (George Mason) Geldzahler, B. (George Mason)	The parallax of Sco X-1. 6 cm with VLA single antenna

No.	Observer(s)	Program
BG015	Greenhill, L. (CFA) Diamond, P. Gwinn, C. (Calif., Santa Barbara) Moran, J. (CFA)	Tracing the dynamics of a protoplanetary disk. 0.7 cm
BG030	Gabuzda, D. (Lebedev) Cawthorne, T. (Lancashire)	Linear polarization of BL Lacertae objects. 1.3 cm with EB
BG043	Giovannini, G. (Bologna) Cotton, W. Feretti, L. (Bologna) Lara, L. (Bologna) Marcaide, J. (Valencia) Venturi, T. (Bologna)	VLBA observations of six low power compact radio galaxies. 6, 18 cm with VLA single antenna
BG045	Greenhill, L. (CFA) Moran, J. (CFA) Danchi, W. (Calif., Berkeley) Bester, M. (Calif., Berkeley)	Snapshot survey of SiO maser stars at maximum and minimum luminosity. 0.7 cm with VLA single antenna
BH010	Hewitt, J. (MIT) Haarsma, D. (MIT) Katz, C. (MIT) Moore, C. (MIT) Trotter, C. (MIT)	Gravitational lens monitoring with the VLBA. 3.6, 18 cm
BH011	Hough, D. (Trinity U.) Vermeulen, R. (Caltech) Readhead, A.(Caltech)	Search for superluminal motion in lobe-dominated quasars. 3.6 cm
BJ018	Jones, D. (JPL) Jauncey, D. (CSIRO) Meier, D. (JPL) Murphy, D. (JPL) Preston, R. (JPL) Reynolds, J. (CSIRO) Tingay, S. (Mt. Stromlo) Tzioumis, A. (CSIRO)	Confirmation of a counterjet in Centaurus A. 3.6 cm
BK033	Kollgaard, R. (Penn State) Gabuzda, D. (Lebedev) Feigelson, E. (Penn State)	The parsec-scale morphology of X-ray selected BL Lacertae objects. 6 cm
BL016	van Langevelde, H. Schilizzi, R. (NFRA) Israel, F. (Leiden) Diamond, P. Beasley, A. Conway, J. (Chalmers, Onsala)	OH lines in Centaurus A. 18 cm

No.	Observer(s)	Program
BL020	Ludke, E. (UFSM, Brazil) Sanghera, H. (NFRA) Cotton, W.	Resolving faraday effects in CSS jets. 6 cm
BL021	van Langevelde, H. Diamond, P. Schilizzi, R. (NFRA) Cotton, W.	The parallax of nearby Miras. 18 cm
BL023	Lazio, T. (Cornell) Cordes, J. (Cornell) Frail, D.	Compact sources toward the galactic center. 1.3, 3.6 cm with phased VLA
BL025	Lazio, T. (Cornell) Cordes, J. (Cornell)	Compact doubles and AU scales in the neutral interstellar medium. 20 cm
BL030	Lonsdale, C. (Haystack) Barthel, P. (Groningen/Kapteyn)	Resolving the interaction edge of 3C 205 south. 6 cm with phased VLA
BM008	Migenes, V. (CSIRO) Bowers, P. (NRL) Cohen, R. (Manchester) Shepard, M. (Caltech)	OH maser shells. 18 cm with VLA single antenna
BM043	Marvel, K. (New Mexico State) Diamond, P.	Continued monitoring of water masers around AGB stars. 1.3 cm
BM045	Mattox, M. (NASA/GSFC) Marscher, A. (Boston) Wagner, S. (Heidelberg Obs)	Study of correlation between parsec scale radio structure and flaring in gamma ray emission of blazars. 1.3, 2 cm
BM047	Marscher, A. (Boston) Gomez, J. (Boston) Wehrle, A. (JPL) Georganopoulos, M. (Boston)	Coordinated multiband observations of blazars. 1.3 cm
BO002	Otterbein, K. (MPIR, Bonn) Krichbaum, T. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Wagner, S. (Heidelberg Obs)	Ultraluminous quasar S5 0836+710. 1.3, 3.6 cm
BP020	Patnaik, A. (MPIR, Bonn) Porcas, R. (MPIR, Bonn) Browne, I. (Manchester)	0218+357 gravitational lens images. 1.3, 2 cm
BP021	Perlman, E. (Maryland) Stocke, J. (Colorado/JILA) Carilli, C. (CFA) Conway, J. (Chalmers, Onsala)	CSO PKS 1413+135. 2, 3.6 cm

No.	Observer(s)	Program
BP022	Patel, N. (CFA) Goldsmith, P. (NAIC) Greenhill, L. (CFA) Hernnstein, J. (CFA) Ho, P. (CFA) Moran, J. (CFA) Zhang, Q. (CFA)	Water maser emission from a circumstellar disk around IRAS 21391+5802. 1.3 cm
BS020	Snellen, I. (Leiden) Fassnacht, C. (Caltech) de Bruyn, G. (NFRA) Schilizzi, R. (NFRA) Browne, I. (Manchester) Jackson, N. (Manchester) Wilkinson, P. (Manchester) Myers, S. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Miley, G. (Leiden)	VLBI imaging of two new gravitational lens systems. 2, 6 cm
BS025	Shaffer, D. (Nevada) Kellermann, K.	CTD93: A gravitational minilens? 2, 3.6, 6, 18, 90 cm
BS027	Sivagnanam, P. (Meudon) Diamond, P. Etoka, S. (Meudon)	Anomalous structures and kinematics of OH circumstellar shells. 18 cm with phased VLA
BT017	Taylor, G. (Caltech) Vermeulen, R. (Caltech) Pearson, T. (Caltech) Readhead, T. (Caltech) Wilkinson, P. (Manchester) Browne, I. (Manchester)	Completing a flux limited VLBI survey of 295 flat spectrum sources. 6 cm
BV015	Vermeulen, R. (Caltech) Taylor, G. (Caltech) Cohen, M. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Xu, W. (JPL) Wilkinson, P. (Manchester) Browne, I. (Manchester) Henstock, D. (Manchester)	Caltech-Jodrell snapshot survey of superluminal motion. 6 cm
BV017	Venturi, T. (Bologna) Cotton, W. Feretti, L. (Bologna) Giovannini, G. (Bologna) Lara, L. (Bologna) Marcaide, J. (Valencia)	Proper motion monitoring in two FRI radio galaxies. 3.6, 6, 18 cm with phased VLA

No.	Observer(s)	Program
BW008	Walker, R. C. Fomalont, E.	VLBA baselines. 3.6 cm
BW017	Wilkinson, P. (Manchester) Browne, I. (Manchester) Nair, S. (Manchester)	The gravitational lens B0218+357. 18, 90 cm with VLA single antenna
BZ012	Zensus. J.A. Porcas, R (MPIR, Bonn) Lobanov, A. (Lebedev) Leppanen, K. (Helsinki)	Weak cores in double lobed radio quasars. 2, 3.6 cm with EB
BZ014	Zensus, J. A. Kellermann, K. Vermeulen, R. (Caltech) Cohen, M. (Caltech)	2 cm survey.
GR010	Rupen, M. Bartel, N. (York U.) Conway, J. (Chalmers, Onsala) Beasley, A. Sramek, R. Romney, J. Bietenholz, M. (York U.) Weiler, K. (NRL) van Dyk, S. (NRL) Panagia, N. (STScI) Titus, M. (Haystack) Cannon, W. (York U.) Popelar, J. (Ottawa) Graham, D. (MPIR, Bonn) Venturi, T. (Bologna) Umana, G. (CNR/IRA-Frascati) Davis, R. (Manchester) Rius, A. (Barcelona) Altunin, V. (JPL) Jones, D. (JPL)	VLBI imaging of supernova 1993J in M81. 3.6, 6, 18 cm with phased VLA and EB

F. SCIENCE HIGHLIGHTS

Green Bank

HI emission has been detected on the 140 Foot Telescope from 25 optically selected extreme late-type galaxies that had no previous information on redshift or HI. All the galaxies appear to be Sd-Im systems, and are members of the local supercluster. One may be a new member of the local group. The observations have uncovered a diverse set of gas-rich galaxies, two of which may belong to the class of giant, low surface brightness Malin 1 type disk galaxies.

Observers: L. Matthews (SUNY Stony Brook), J. GallagherIII (U. Wisc.), and J. Littleton (WV Univ.).

Tucson

A Better Look at the Structure of Molecular Cloud Complexes – Preliminary results from the first oversampled, high spatial resolution CO map of a region of the Galactic plane show far more structure on a wider range of size scales than previous surveys. A

one square degree on-the-fly map was made with the 12 Meter Telescope in the direction of the tangent point of the Scutum Arm in order to determine cloud properties. The results will be compared with those of previous low resolution or coarsely sampled surveys.

Observers: K. Mead (NRAO) and M. Kutner (Rensselaer)

Socorro

Brightness Distribution of Jupiter's Synchrotron Radiation Changed by Comet Impacts – Analysis of VLA data obtained before, during, and after Comet Shoemaker-Levy 9 collided with Jupiter in July 1994 has revealed that the brightness distribution of Jupiter's synchrotron radiation changed significantly during the week of cometary impacts. The VLA images show a dramatic local enhancement in the radiation belts, concentrated near the magnetic equator. Predictions before the event had suggested that the planet's radio emission would decrease, but instead the radio observations with the VLA, the 140 Foot Telescope, and other instruments showed a dramatic increase in the radio flux density during the six days of cometary bombardment. Continued monitoring of the planet will help researchers gain the full yield of information from what they call "a unique experiment to unravel one of the outstanding issues in magnetospheric physics: the renergization and radial transport mechanism of the energetic electrons in Jupiter's radiation belts."

Investigators: I. de Pater, C.Heiles, and M Wong (Berkeley); R. Maddalena, (NRAO); M. Bird and O. Funke (Bonn); J. Neiderhoefer (MPIfR); R.M. Price, M. Kesteven, and M. Calabretta (CSIRO); M. Klein, S. Gulkis and S. Bolton (JPL); R. Foster (NRL); S. Sukumar (DRAO); R. Strom and T. Spoelstra (Dwingeloo); R. LePoole (Leiden Univ.); M. Robison (NM Tech); R. Hunstead, D. Campbell-Wilson, and T. Ye (Univ. of Sydney); G. Dulk (Astrophysical, Planetary and Atmospheric Sciences, Boulder, CO); and Y. Leblanc, P. Galopeau, E. Gerard,and A. Lecacheux (Observatoire de Paris).

VLBA Images Reveal Dramatic Changes in Circumstellar Maser-Ring Structure – VLBA images of the evolved M-type giant star TX Cam made at four epochs show that the circumstellar SiO maser rings change dramatically from epoch to epoch. The high-resolution VLBA images show that the environment close to this pulsating star probably changes dramatically at different points through its 557-day pulsation cycle. Further work will seek to model the dynamics of the circumstellar shell, based on monitoring the movement of individual maser spots. The VLBA images of this star, some 500 pc distant, have a resolution of approximately 170 microarcseconds.

Investigators: P. Diamond, A. Kemball, V. Dhawan, J. Benson, and A. Zensus (NRAO), and W. Junor, (UNM).

G. PUBLICATIONS

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

H. CHARLOTTESVILLE ELECTRONICS

Amplifier Development, Design and Production

A total of 19 amplifiers (twelve 4.0-6.0 GHz and seven 18-26 GHz) was delivered this quarter.

Work continues on the 290-395 MHz amplifier prototype. The input stage of the amplifier was designed empirically with the aid of a single-ended test fixture. This fixture was developed for use with all amplifiers in the 290-1200 MHz frequency range.

The new PC-based HFET test station is nearly completed. The dewar coaxial transitions and cold attenuator were calibrated and complete system evaluation has begun.

Development of 60-90 GHz amplifiers resumed. A WR-10 waveguide single-stage test fixture has been built and tested in order to evaluate devices and circuit models at millimeter-wave frequencies (75-110 GHz).

A total of seven 40-50 GHz amplifiers using InP devices has been delivered this quarter.

Superconducting (SIS) Millimeter-Wave Mixer Development

Work continues on the design of an SIS image separation mixer on a chip. For the 200-300 GHz band, the mixer will be on a 2 x 1 mm quartz chip mounted in a waveguide block with separate RF and LO waveguide ports. To verify the design of the 200-300 GHz planar quadrature hybrid, a model scaled in frequency by 1/1000 was constructed. The measured results agreed well with the predictions of the electromagnetic simulator used in designing the circuit. A complete frequency-scaled image separation mixer was constructed using the model quadrature hybrid with standard (unselected) commercial 200-300 MHz mixers and (2 MHz IF) hybrid. This gave an image rejection of 15-25 dB across most of the band and 12.5 dB at the low frequency end. This is adequate for the intended purpose of suppressing atmospheric noise in the image band, which otherwise degrades the system sensitivity.

We have supplied eight very low loss vacuum windows for the 200-300 GHz receiver on the 12 Meter Telescope. These 3-inch diameter windows use a layer of expanded PTFE to support a coated polypropylene vacuum barrier.

During this quarter we have assembled and tested 11 SIS mixers, and mounted and DC-tested 25 SIS chips from UVa. We also repaired and tested one varactor multiplier from the 12 Meter Telescope.

Electromagnetic Support

Work on the phase shifter for the VLA 18-26.5 GHz band continues. Phase shifters with loads of the same type on all the four walls did not meet the bandwidth requirements. Theoretical analysis shows that a phase shifter with dielectric loading on one set of walls and corrugations on the other set of walls would give a differential phase shift of $90° \pm 3.5°$ for the two orthogonal polarizations over the entire band. A phase shifter of the kind mentioned here and transitions that are required for connection to the test setup have been fabricated.

GBT operating efficiency from prime focus was computed for frequencies between 300 and 1200 MHz. Above 680 MHz, patterns of corrugated horns have been used, while at lower frequencies short backfire feed patterns have been used.

GBT Spectrometer

During the last quarter construction of the GBT spectrometer was begun. EMI racks were received and bins for both the sampler and digital racks were mounted. All multi-layer cards were assembled and, except for some missing IC's, are ready for card testing.

All wirewrap cards in the system were sent to an outside vendor for wrapping. This includes the correlator bin back planes.

The design of a long-term accumulator card test fixture was completed and construction of the unit has begun.

The first production run of the 1024-lag correlator chip was completed in September and resulted in a much higher yield than expected. Prototype runs of the correlator chip had yields in the 15 to 19 percent range. The run just completed resulted in a yield of 63 percent. The high yield means that no additional wafer runs will have to be ordered for the GBT spectrometer.

OVLBI Earth Station

Construction of a satellite frame generator for the Russian Radioastron OVLBI antenna was started. This decoder is identical to that used in the NRAO Green Bank Earth Station and will be provided to the Russian Astro Space Center for testing of the Russian earth station.

Using an accelerometer and low frequency spectrum analyzer, a few attempts have been made to measure the vibration modes and damping of the GBT. The new lowest vibration modes were found very close to the predicted values. The data on damping is not conclusive at this point and more work is required in this area.

I. GREEN BANK ELECTRONICS

Servo System

We continue to monitor the progress of the GBT Servo system, having technical teleconferences a couple times a month with the vendor. Checkout and in-house testing for the Feed Arm servo system is scheduled to occur over the next few months.

Using an accelerometer and low frequency spectrum analyzer, a few attempts have been made to measure the vibration modes and damping of the GBT. The new lowest vibration modes were found very close to the predicted values. The data on damping is not conclusive at this point, and more work is required in this area.

Spectrometer

Construction of the 1.6 GHz filter module prototypes has begun. Two-thirds of the 1.6 GHz samplers are built, and analog cards for 100 MHz samplers are built. The third wafer run, for the correlator chip is now complete and the yield was much better then originally anticipated.

IF/Converter Racks

All purchased components required to construct the second converter rack are on order and construction of this rack has begun.

Prime Focus Receivers

One prime focus temperature controller is completed with all functions tested. Fabrication of the second controller is completed and testing has begun.

Active Surface

The interactive Status/Control software that engineers and operators will use to diagnose the 2200+ actuators on the GBT has been written and tested on a simulator.

Testing/Integration

In July and August we ran several days of tests at the 140 Foot using a significant amount of GBT Electronics hardware. Specifically two GBT receivers (X and Ku band), fiber optic IF links, the second and third LOs, 1-8 GHz Converter Modules, Square Law Detectors, and the Digital Continuum Receiver were tested. These tests focused on continuum observations of the types which will be needed during the earliest commissioning phases of the GBT, they were very successful.

Site Operations

Maintenance, repair, and installation support was supplied to the 140 Foot, the 85-2 and 3 interferometer, the USNO VLBI station, and the OVLBI earth-station terminal.

J. TUCSON ELECTRONICS

The 12 Meter summer shutdown concluded on September 12, and visitor observing resumed on that date. While the summer monsoons were in progress, the following projects were completed.

Hybrid Spectrometer On-the-Fly Acquisition. A major accomplishment of the summer was the implementation of on-the-fly (OTF) data acquisition with the hybrid spectrometer. With the hybrid spectrometer OTF capability, observers have more bandwidth and resolution options to complement the filter bank OTF acquisition. In addition, the hybrid spectrometer is essential for OTF data acquisition with the 8-beam receiver, which is expected back on the telescope in late autumn. As with the filter banks and digital continuum backend, the hybrid spectrometer dumps data every 100 milliseconds, tagged with the actual telescope position. A major component of the project was developing a digital signal processing system that is able to perform the FFTs of the autocorrelations in real-time. The implementation is ready to be used by observers while refinements continue through the autumn. Filter bank OTF acquisition continues to be available simultaneously.

With the availability of both hybrid spectrometer and filter bank OTF observing, the data rate for OTF observing goes up considerably. The sustained data rates are now 4.9 MB per minute of observing, amounting to over 5 GB of raw data per typical day. We have recently installed several more high capacity disk drives, giving the Observatory about 32 GB of total raw disk space and 9 GB of AIPS reduction storage. Although this seems a huge amount of disk space by past standards, it can be exhausted in just a few days

of OTF observing. The staff is developing data management procedures to cope with this deluge of data, but it will be essential that observers participate actively in data management if there is to be sufficient disk space.

2 and 3 mm and 1 mm Receiver Upgrades. The receiver group made a number of improvements to the 2 and 3 mm receiver package. In particular, problems with noise pickup on the bias lines to the 2 and 3 mm mixers were addressed with better connectors and grounding. The excess noise, which affected continuum observing, is now much lower, although further improvements are planned.

The window material covering the dewar ports of the 1 mm receiver was replaced with a material that is less likely to absorb ambient water vapor. This should fix the anomalous noise temperatures in the 270-300 GHz mixer set that occurred last spring. Improvements to the sideband injection tone system and the mounting of the image sideband rejection filter are also underway. This receiver will be re-installed on the telescope on the first of November.

Eight-Beam Receiver. Work on the 8-beam receiver was put on hold during the summer given the urgency of work on the other receivers. However, the receiver group has now resumed work and has completed the installation of the final four beams. As reported in the last Newsletter, the first four beams were successfully tested on the telescope in May. Work on the beam rotation system is also well toward completion. We have scheduled tests for the full receiver during several sessions in December and currently plan to release the receiver to observers in January.

Additional Computing Projects. In addition to the hybrid spectrometer OTF implementation, several other computing projects were completed. An on-line data browser for the quick display of both OTF mapping data and conventional single-point observations is available. An improved, color status display allowing numerous monitoring and status windows was also installed.

Site Maintenance and Improvements. The Operations Group was very busy this summer with the annual dome door and drive system inspection. As the result of an aggressive maintenance program, the failure rate of the dome door drive components has been brought to a very manageable level. Only a small number of failed components were found this summer. The operations group upgraded the electrical systems on the telescope and have installed a new grounding system which we hope will diminish lightning damage which has affected the telescope almost yearly. The operations group also conducted their annual painting and sprucing up campaign around the dome and laboratory and have made some improvements to the comfort of the observer dormitory.

K. SOCORRO ELECTRONICS

VLA 1.3 - 1.7 GHz Receiver Improvements

One of the two remaining spare front ends was completed and tested. The remaining spare will be used for cryogenic testing of resonance suppression in the orthomode transducer.

Prototypes of a new Walsh function phase switching scheme in the 200 MHz output of the L2 first local oscillator successfully removed the out-of-band signals which are imaged to appear in-band. The scheme also greatly reduces the 1400 MHz spurious signal in L-band. This method replaces the formerly planned frequency converter F15 with a much less expensive system which can be completed on all antennas by the end of this year.

VLA Upgrade Prototype Front End

Development work is proceeding on a full waveguide band front end in the frequency range of 18 GHz to 26.5 GHz. The design includes three sub-band system temperature monitors for estimating atmospheric phase variations. A polarizer consisting of a waveguide phase shift section and an OMT section are under development by the Central Development Lab in Charlottesville. Other components are being selected and will be ordered the first part of the next quarter. Assembly is expected to start in the first quarter in 1996.

VLA 40-50 GHz Receivers

Three additional front ends are assembled. One was installed on antenna 6 and another on antenna 11. The third for antenna 20 is waiting for repair of several failed components. All should be tested and installed by late October in time for the 1995/1996 winter atmosphere.

In order to provide adequate LO coherency after the large frequency multiplication, all 13 Q-band antennas plus 6 others have been retrofitted with low phase noise SC-cut VCXOs. The Wenzel Corp. 10 MHz units are an exact replacement in the L1 module. They have better phase noise than the original units, which have degraded over their 17 years of operation.

New VLA Correlator Controller

A new project plan was developed. Work in hardware and software areas progresses. The serial I/O will be tested in December.

VLA Antenna B-Rack Shields and Optical Fibers

Twenty-eight shields with optical fibers have been installed in antennas. The project is complete. However, tests indicated shielding effectiveness is about 15 dB at P-band instead of the expected 35 dB. Leakage paths will be located and corrected.

VLA L6 Synthesizer Upgrade

A two-year effort ended with the sixtieth L6 upgrade with a new phase lock loop board. The original boards had become unreliable causing unacceptable losses of phase lock.

VLA T4 Baseband Filter Upgrade

Investigations of poor antenna passbands resulted in the discovery of T4 baseband filter problems. Over the last 17 years, carbon composition resistors within the T4s have changed resistance as much as 50 percent and have also become reactive. Nearly all of the 115 T4 modules have been tested and repaired within the past year. Module passbands of each baseband filter now are within 0.25 dB of the average.

VLA Virtual Instrument Recorder (VIR)

This system is being developed to replace the eight channel digital data tap which uses an eight-channel analog recorder. The analog recorder has reached the end of its repairable life. This older system required engineers or technicians to travel to the VLA site to set-up and retrieve the data. We are in the process of implementing hardware and software to provide AOC access to on-line VLA site monitoring and data recording using a graphical interface. This system will provide simultaneous multichannel and multiuser capability. It was installed at the VLA for testing, and should be functional next quarter.

GPS Receivers

The effort to develop a universal interface to connect any brand/model GPS receiver to the VLBA station computer without software changes encountered unexpected setbacks. The VME computer requires faster response than the interface can provide, and the Trak GPS computes GPS – station clock time offsets incompatibly with the Odetics receivers.

VLBA Correlator

We accepted a replacement offer of 1000 VLBA1 ASIC chips, at no cost to NRAO, from LSI Logic. LSI expects 10X reduction in the failure rate of the replacements with respect to the originals. At an approximate failure rate of two chips per month, the quantity of 1000 should keep the correlator running for about 40 years. Delivery of the new chips will be February 1996. We plan to install the new chips in the FFT section of the correlator because it is easier to identify a failed chip there than in the MAC section. Three ASIC chips have failed since the new cooling units came online May 16, which translates to about 0.7 chips per month.

VLBA Data Acquisition and Playback

Work continues on improving reliability of the system and on prolonging headstack life to reduce operating cost. Tests began to identify and eliminate an intermittent "barrel roll" problem in the formatter. Also tests began to determine the maximum relative humidity (RH) which avoids excessive headstack wear. Design work began to deliver lower RH air to the area of the headstacks.

Interference Protection

One of the NSF summer student research assistants initiated a radio frequency interference (RFI) test at the VLA for the band 304-348 MHz (P-band), much like the existing RFI test for the band 1215- 1750 MHz (L-band). Like the L-band test, the results are available from the NRAO home page on the World Wide Web. Overlays with identifying text information are available for both P and L-band plots. Both snapshot tests will be made about once a month. Further details are in VLA-VLBA Interference Memo No. 9.

As a temporary means to provide some VLBA RFI information to observers, spectrum snapshots made at the VLBA 500-1000 MHz IF with a swept frequency spectrum analyzer are also available on the Web.

Tests of the new GE electrode-less RF Genura lamp show radiated emission at 2.56 MHz and its harmonics. Test data was sent to the NSF Electromagnetic Spectrum Management Office.

L. OBSERVATORY COMPUTING AND AIPS

Discussions have started with the NRAO staff this quarter regarding the long-term strategy NRAO should pursue in computing. These discussions are especially important in view of the ongoing budget constraints faced by NRAO. The broad outlines of the most critical needs and issues are clear:

The problem of an aging computer infrastructure at NRAO will become acute over the next year or two. The Observatory current replacement rate for scientific workstations is much lower than can be sustained over the long term. This is a "maintenance" problem.

There are not enough publicly available high-end workstations to meet the demand from NRAO visitors and staff members. We are close in this area, but someone keeps raising the bar! This is a "capacity" problem.

Larger problems now involve data sets so large that a small number of workstations with much greater performance than any currently at the Observatory are needed. This is a "capability" problem.

Computing personnel for support and programming are stretched extremely thin, resulting in delays dealing with problems or software development. This is a "support" problem.

Recent instrumental developments at NRAO (especially with the VLBA and the 12 Meter) have dramatically increased the typical size of data sets that users must work with. This severely strains our networking, data storage, and tape facilities. This is a "data volume" problem.

Over the next few months the above issues will guide the setting of priorities in computing for next year and beyond. The primary goals remain support of NRAO users and maximizing the science which can be done with NRAO facilities.

Delivery of all workstations ordered under the 1995 RE budget were received this quarter. New dual-processor workstations are now available for use by visitors and NRAO staff members in Socorro and Tucson; a few other machines were also upgraded. This has helped reduce the sign-up delays for using the large public workstations, but visitors to NRAO still need to make arrangements up to two months in advance to be assured access to the workstation they need.

Contacts with network providers to get a definitive bid for improved network bandwidth into Green Bank have continued. Network providers have not yet given us definitive bids. We are continuing efforts to resolve various issues and determine the actual cost of improved service into Green Bank.

Agreement was reached this quarter between NRAO and the Space VLBI project at JPL to partially fund a new position for the AIPS project which will be dedicated to supporting data reduction for Space VLBI in AIPS. This has allowed the creation of a new programming position in the AIPS group. The VSOP satellite will be launched in September 1996, so this hire will be especially timely. The recruitment process is well along.

The first release of AIPS under a "GNU General Public License" rather than a "user agreement" took place during this quarter. The 15JUL95 release became available through anonymous ftp on August 18. The source code and full binary forms for a variety of architectures are found in directory aips/15JUL95 (and below) on the computer known as baboon.cv.nrao.edu. Since then, 67 sites have copied some or all of AIPS to their machines. To provide more information on AIPS use, and to provide data which will allow us to

set priorities, a registration system has been established. Although the AIPS code is now free and anonymous, help with installation and use of AIPS requires a site "registration" which is also at no charge to institutions engaging in research in astronomy. To date, 37 non-NRAO sites have registered the 15JUL95 release, indicating that they expect to run it on 223 computers. Tape copies of AIPS are also available, currently without a media charge. So far 27 copies have been shipped on tape to 18 sites.

The change to a GNU license not only simplifies portions of the distribution. It also allows us to use other peoples' code directly when that code is also released under a GNU license. We are creating a GNU directory tree within the AIPS directory structure to support the inclusion of GNU-licensed software. The first such package is the "readline" routines used by the Bash shell to handle terminal input. (Korn and other Unix shells have similar functionality.) Users of 15JAN96 AIPS now have emacs-like (or vi-like) commands to edit the current input line, to recover and edit previous input lines, and even to do symbol completion in which a partially-typed symbol is completed by the readline software when the Tab key is hit (or a list of possible completions is shown). This function even knows that a task name cannot be the first symbol on a line.

The re-write of the CookBook continued during the quarter at a slower pace. The big change was the addition of an Index to all chapters of the CookBook. Appendix Y on file sizes was re-written and several chapters had minor revisions made to reflect the most recent changes in AIPS. All chapters of the CookBook are made available via the World Wide Web. Users can fetch the new chapters as they are actually completed by fetching the files via the WWW (or via anonymous ftp). AIPS is at WWW URL http://www.cv.nrao.edu/aips/.

VLBA data processing received a lot of attention during the quarter. Two new polarization tasks were contributed by Kari Leppanen: BLAVG which allows a more robust estimation of differential polarization delay offsets and LPCAL which calibrates polarization, allowing for spatial structure in the calibrator source. The new task PCCOR generates calibration data from the pulse-cal table to correct the instrumental delay and phase offsets between individual baseband converters. Also added was a more robust and complete method of correcting for amplitude losses due to averaging and FFTs prior to complete delay correction. The new task SNEDT allows interactive editing and smoothing of calibration tables using the TV display. A preliminary version of OMFIT was submitted by Ketan Desai, Naval Research Laboratory, to combine self-calibration with uv-plane model fitting. The plot task VPLOT was generalized to allow automatic data editing and to improve performance still further.

Of interest both to VLA and to VLBA, the new task FIXWT determines proper uv-data weights by estimating the noise in the data. Spectral bandpass calibration will soon be made more flexible with improved signal-to-noise using polynomial fits to the bandpass rather than channel-by-channel averaging. The AIPS tasks which support the 12 Meter on-the-fly imaging mode were enhanced to allow time smoothing, additional channel selection, and a wider range of convolution functions. PostScript display tasks were given the COPIES adverb, LWPLA was changed to use the full grey-scale range (avoiding a TeX bug), and TVRGB was given the ability to write a full-color PostScript output The AIPS user-number conversion procedures EHEX and REHEX were made available also as verbs inside AIPS.

M. AIPS++

Progress was made in many areas of the project. The most important achievement was the participation in the tests of the GBT Monitor and Control system on the NRAO 140 Foot Telescope. This was the first mission-critical use of AIPS++ and demonstrated the usability and reliability of several AIPS++ components: the Glish system, the Table system, and various fitting and plotting capabilities. In other areas, development proceeded as required to support this work and application development in other areas. We continue with our strategy of developing a few key applications with the goals of testing the AIPS++ infrastructure and attracting early adopters to AIPS++. The consortium interactions are working well. The Project Manager visited ATNF in August and took part in a number of useful discussions. This has led to a collaboration between ATNF and NCSA/BIMA on Image Analysis and Visualization.

The tests of the GBT monitor and control system on the 140 Foot Telescope were designed to test both the monitor and control system and various parts of the electronics. AIPS++ was to provide the analysis capabilities. The goals were to load monitor and astronomical data from a number of FITS binary tables into the AIPS++ Table system and to provide analysis and plotting capabilities. The timeline for this development was agreed in collaboration with the GBT monitor and control group in a series of meetings starting in late March 1995. The first tests took place in July 1995. This was the first "mission-critical" use of AIPS++, and so our ability to fulfill expectations was on trial. AIPS++ met all the specified goals in functionality. In addition, the combination of the Glish system and the plotting and analysis tools was found to provide an accommodating environment for debugging. To track down unexpected behavior in some of the data, the group running the tests (not from the AIPS++ group) were able to try different and unanticipated ways of plotting the data. These tests are continuing throughout the fall.

In synthesis support, we decided to adopt the Hamaker, Bregman, Sault formalism for as the basis for AIPS++ polarization calibration and imaging. A number of memos have been written on this approach. We are now embarking upon design of classes.

Glish has seen substantial enhancements and improvements. By agreement with the author of the package, Vern Paxson, we have assumed responsibility for distributing Glish. This is good for AIPS++ since Glish lies at the heart of our development strategy in both command line interface development and task control. The design of the support for task control within AIPS++ is now complete and we are starting on implementation. We made a number of substantial improvements to the Lattice and Image classes that will be vital for applications development. We completed a design for a generic filler program to load telescope data into AIPS++, and are now proceeding to implement the design. We designed and started to implement a tiled storage manager for the AIPS++ Table system. We started design and implementation of the Coordinate classes (by Wim Brouw at ATNF).

In visualization, AIPSView went through a number of alpha test phases and was released in version beta 1. In addition to the 2D display present in AIPSView, we have developed a prototype for 3D visual analysis based on the OpenGL and OpenInventor libraries.

In the system area, we participated in beta testing of the new Sun native code C++ compiler. As a result of the feedback that we gave, we are now able to adopt the compiler to some considerable advantage in speed of compilation and ease of use. We installed AIPS++ on an SGI PowerChallenge computer. We added an e-mail exploder archive. We can now do rebuilds of AIPS++ in parallel on a number of CPUs.

The Project center completed hiring of two new members in Socorro. These will bring skills in a number of areas: radio and optical synthesis, signal processing, parallel processing in C++, grand challenge computing, and numerical astrophysics.

N. SOCORRO COMPUTING

During most of the summer of 1995, a large-scale upgrade of the AOC computing facilities took place. The main aim of this upgrade was to improve computing facilities for visiting observers, but also local staff benefited from it. The improvement was threefold.

Four of the IBMs received new and faster disks. These are IBMs which are primarily used for large VLBA projects, in which AIPS task running times can be many hours, sometimes more than a day. Some of the most time-consuming tasks were limited in their speed of execution by I/O constraints. We hope that the new disks have improved that situation; we do not have any numbers on the performance improvement yet. The old disks were distributed among the public Sparc stations and AOC staff.

All public Sparc IPX workstations received an upgrade using the Weitek chip. This chip is faster than the original CPU by a factor 2. Experiences elsewhere with this Weitek chip indicate realistic performance improvements for AIPS tasks by a factor of 1.7.

Three Sparc 20s stations were added, two of which are dual processor machines, to our pool of public workstations. They replace two IPXs which are now being used for other purposes.

As a result, not only have reduction facilities for visitors improved, but we also expect a smaller demand for public workstation time from the local users. In parallel with the hardware upgrade, the operating system for most Sparc workstations was upgraded to Solaris 2.4.

A list of all public workstations and the rules for applying for time are now accessible via the NRAO home page. We plan to make the registration process available on the Web shortly.

Work continued on the VLA archive project. Currently all data from 1976 through 1983 and from 1990 to present have been converted; work on the 1989 data has just begun. The project's by-product – the archive catalog – has been available on the World Wide Web for many months now, and has become quite popular as evidenced by the one hundred queries received in an average working day.

The hardware upgrade of the VLA online system was partially concluded. The newly installed networking capabilities are expected to greatly improve the interaction between operators and the online system. Extensive tests were made to measure the performance and reliability of the new SCSI disks which are to replace the ancient Century disks. A carefully planned transition between the two systems will take place shortly. This transition is designed to take place with as little interference with VLA operations as possible, and will allow a rapid return to the old system should problems occur.

O. VLBA STATUS

During the third quarter of 1995 (period ending September 16, 1995), a total of 46 projects was correlated (36 VLBA, four tests, and six global). The scheduling committee recently increased the amount of observing and we are beginning to see the effects of this. The correlator latency (time between observation and correlation) recently increased from about 17 days to 28. This is due in part to a larger number of projects which cannot be correlated with a speed-up factor. In order to address the increased load, we have, from October 1, increased the correlator operation time to 24 hours a day, seven days a week. This will result in a 40 percent increase in the time available for astronomical correlation. In order to deal with the expected increase in data quantity, we have added a fourth VLBA scientist to the data scrutinizing team. This will keep our quality control at its present high level.

The handling of global projects is still not routine, although it is improving. The problems encountered range from the late arrival of tapes, the incompleteness of log information, and the need for clock searches to the need for an increased level of scrutinization. Improvements currently being implemented in the EVN will alleviate some of these problems shortly.

The correlator software upgrade is progressing at a steady pace and early tests have been encouraging. Until the upgrade is completed, we still cannot tackle the backlog of projects that contain source and/or frequency sub-arraying, have many short scans, or do not have synchronized tape changes.

Nature has tested the VLBA recently. The St. Croix antenna suffered a near miss by Hurricane Luis in August but was hit almost head on a few weeks later by Hurricane Marilyn. Luckily the antenna appears to have survived unscathed.

P. GREEN BANK TELESCOPE PROJECT

Antenna

Over the last quarter the visible construction activity has increased significantly at the Green Bank Telescope site. There are fabrication and erection activities underway in several areas on the ground as well as high in the air on the structure. Since the installation of the elevation shaft, completed in May, the first section of the box structure (B1) has been installed and welded. The erection of the B1 box sequence supplied sufficient stiffness to the shaft to allow removal of the temporary support scaffolding. Also, all eleven of the elevation wheel sections have now been installed in place below the shaft. Alignment and welding of the wheel are approaching completion. All six of the large W19 beams which attach the elevation wheel to the shaft have been installed and aligned, and welding is underway.

On the ground, trial erection of the box segments B2, B3, and B4 is close to completion. These segments will eventually be taken apart in large modules to be lifted into their place in the structure. Also on the ground, assembly of the back-up structure (BUS) trusses has begun. Six sections are complete and standing on the assembly pad where the entire BUS will be assembled and aligned prior to being lifted to the structure in modules. A seventh truss section is underway in the large assembly fixture. Many pieces of the feed arm structure have been fabricated and shipped to the site for storage until they are needed in the erection process.

The receiver room has been assembled and the feed turret, which will hold the Gregorian receivers and feeds, has been installed in the room. Interior finishing of the receiver room is underway. The actuator room has been outfitted with the equipment rack, the required unistrut, air conditioning, and wiring, and is ready for installation on the structure.

Approximately 800 of the total 2,000 panels have been manufactured and are stored at COMSAT/RSI's plant in Sterling, Virginia. Painting of the panels will begin soon. The subreflector back-up structure has been assembled and aligned at RSI. The subreflector panels are under production. Final alignment and testing of the completed subreflector is anticipated in November.

Open Loop Active Surface

In the software area, time was expended reviewing software written by a summer student which included a design of the master computer software and associated code.

A circuit which uses the actuator's LVDT's as position sensors is being developed. A circuit has been prototyped using an older instrumentation op-amp that was on hand. A newer instrumentation amplifier with superior specs is on order and will be used in the

circuit. There is a long delivery on this op-amp, so the final testing is on hold until the op-amp arrives. Confidence is high that the item will work as expected, so a printed circuit layout has been designed.

Closed Loop Active Surface

Instrument Optics – Engineering problems with the instrument base have been resolved and the first article has been built. The mirror, electronics, connectors, and optics have been installed on this unit and it is now undergoing mechanical and optical calibration. A new fixture, to facilitate measurement of the mechanical offsets between the fixed tooling ball and the mirror axes has been built and is being used for the calibration. Additional fixtures are being designed and built to define the true mirror axes to higher accuracy.

The decision has been made to proceed with this base design and the cover will conform to the base design. The drawings require another revision based on errors discovered while building the first article. When these revisions are made, the machine shop will start production. Extensive drawing revisions of the optical assembly have been started. When these drawings are approved, the machine shop can start production of these assemblies also. The machine shop is nearly through with production of all anodized parts for the mirror heads. These will be anodized in one lot.

140 Foot Telescope Demonstration – A modular system has been devised to facilitate use of the hydrostatic level over uneven ground. Preliminary runs have been made between ZY11-ZY12-ZY13. Closures have improved and accuracies of 25-50 microns seem reasonable. As soon as the weather permits, measurements will be made between ZY10-ZY11, and complete runs will be made at night.

Horizontal control surveys are complete and preliminary coordinates of each monument are now known with respect to the center of the spherical bearing. These will be checked against the model of the rotating structure as a function of hour angle and declination. The azimuth orientation of the monument Kelvin mountings have been measured. Following completion of the first article instrument calibration, systems tests will be conducted to point the instrument to fixed points on the structure. A CCD camera has been added for diagnostic work. With this camera we can see the beam location or look down the bore of the instrument.

Great progress has been made on the tracking software algorithm. We now have a ZY demonstration working that tracks a 3-D trajectory in sync with the site IRIG UTC time distribution. This allows any laser on any monument to track a point. Work will now concentrate on writing a ZIY program to take the hour angle and declination and convert it into 3-D trajectories for the retroreflectors on the 140 Foot Telescope.

Panel Setting Tool – The prototype tool has been modified to include suggested revisions. Work has started on the software interface between the CMT handheld computer and the dual axis inclinometer, digital indicators, and barcode reader.

Laser Locations – Drawings have been generated of the GBT site showing the ground laser locations. Work is underway on generating drawings showing the feed arm laser locations.

Servo

A conference was held to consolidate comments to the feed arm servo test procedure recently submitted by the contractor, PCD. PCD has accepted the comments submitted by NRAO and plans to update the test procedure to reflect them. A revised schedule for the feed arm servo test is being developed by PCD.

Using an accelerometer and low frequency spectrum analyzer, a few attempts have been made to measure the vibration modes and damping of the GBT. The few lowest vibration modes were found very close to the predicted values. The data on damping is not conclusive at this point, and more work is required in this area.

Electronics

Orders have been placed for all purchased components required to construct the second converter rack. Also, orders were placed for material needed to build the next five optical fiber driver and receiver modules (less optical links).

Construction has begun on the 1.6 GHz sampler filter module prototypes. Also, the noise source module has been installed in 140 Foot Telescope Cassegrain house.

Work continued on the final design of the multiplexed switching signals system.

One GBT prime focus temperature controller is completed with all functions tested. Fabrication of the other controller is completed and testing will commence soon. The design has been started of the dewar for prime focus receiver #2.

The machine shop is currently modifying the holography receiver and is scheduled to be finished by the middle of October.

On the K-band receiver the MCB interface and rack wiring were changed, four new cryogenic amplifiers were installed, and the dewar was fitted with a cold cathode tube vacuum gauge. The new MCB circuitry is now being tested, and should be completed shortly. It is expected that the receiver testing will be done by mid-October.

The failed LO amplifier from the X-band receiver was sent back to the vendor for repair. This is the second failure of the LO amplifier. We are now requesting quotes from other vendors for a spare amplifier.

The spectrometer correlator chips have undergone functional testing at low frequency. Over 63.5 percent of the chips passed this test. Some chips will be tested at full speed during October.

The software for testing the spectrometer samplers is about 80 percent complete. The only portion left is the code for reading in the data from the hardware. All other routines for the drop down menus and the FFT routines have been thoroughly tested. Print routines will also be added so that hard copies of the FFT's will be available.

The extension of the monitor and control ethernet from the 140 Foot Telescope to the Interferometer was installed. This allows the connection of the weather station SBC to the monitor and control ethernet at the 140 Foot Telescope. The ethernet was extended over fiber optic cable. Equipment was installed at the Interferometer 85-1 control room and the 140 Foot Telescope.

The round trip phase monitor testing continued this quarter. The unit was installed in the timing center rack and tested using OVLBI's MCB interface. Some problems were found, and the module was brought back to the lab for rework and further testing. It is expected that this will be complete by the end of October.

Monitor and Control

Work this quarter included modification of the control, monitor, and message libraries to allow processes and computers in the system to be started or restarted in any order. This was accomplished by having processes periodically test connections when operating and attempt re-connects when connections are lost. This work was completed and will go into alpha test in the next release.

The analysis of the imaging geometry of the subreflector ellipsoid was essentially completed, and a preliminary version of the results is now available at ftp://fits.cv.nrao.edu/pub/gbt_ellipsoid.tar.gz. The analysis of the Gregorian focus tracking algorithm, which will use results from the structural model, best-fitting paraboloid and ellipsoid analyses has been started.

Data Analysis

During September work continued on the 140 Foot Telescope integration tests. Test programs were written to test the performance of Glish and X11 events for real-time data display. Several astronomical source catalogs were written in FITS format for use during the October 140 Foot Telescope test runs. Work was done to access Fortran programs from Glish. In particular, the pulsar prediction program "tempo" and the IRAM "astro" program can now be executed from Glish. Results from these programs can be used in Glish scripts.

Future work will concentrate on support for the spectral processor used in spectral line observing. The current data reduction path using IRAF will be updated to use FITS binary tables.

Q. PERSONNEL

New Hires

P. Palmer	Visiting Scientist	07/01/95
P. Wilkinson	Visiting Scientist	07/12/95
A. Minter	Research Associate (non BR)	08/14/95
E. Schulman	Research Associate	08/28/95
A. Roy	Research Associate (non BR)	09/12/95
G. Taylor	Asst. Scientist, Socorro Operations	09/18/95

Terminations

E. Wilcots	Research Associate	07/20/95
P. Palmer	Visiting Scientist	07/31/95
K. Mead	Visiting Scientist	09/15/95

Change in Title

T. Bastian	to Scientist	07/01/95
S. Beland	to Sr. Scientific Prog. Analyst	07/01/95
D. Frail	to Associate Scientist	07/01/95
R. Norrod	to Deputy Project Mgr - NRAO Systems	07/01/95
M. Stennes	to Electronic Engineer I	07/01/95
T. Weadon	to Head/ Green Bank Electronics Division	07/01/95
A. Zensus	to Scientist	07/01/95

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VAN LANGEVELDE, H.J.; DIAMOND, P.J.; SCHLIZZI, R.T. VLBI Phase-Referencing Observations of the OH Masers in U Her and R LMi; Toward Parallax Distance Measurements.

VENTURI, T.; CASTALDINI, C.; COTTON, W.D.; FERETTI, L.; GIOVANNINI, G.; LARA, L.; MARCAIDE, J.M.; WEHRLE, A.E. VLBI Observations of a Complete Sample of Radiogalaxies. VI. The Two FR-I Radio Galaxies B2 0836+29 and 3C465.

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YUSEF-ZADEH, F.; MEHRINGER, D.M. An H2O Maser Near Sgr A East: Evidence for Active Massive Star Formation Near the Galactic Center.

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NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

October 1, 1995 - December 31, 1995

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A. TELESCOPE USAGE

The following telescopes have been scheduled for research and maintenance in the following manner during the fourth quarter of 1995.

	140 Foot	12 Meter	VLA	VLBA
Scheduled observing	1712.25	1747.50	1603.2	919.6
Scheduled maintenance and equipment changes	177.75	39.25	232.6	242.3
Scheduled tests and calibrations	194.00	337.75	317.2	431.8
Time lost	154.50	85.75	59.3	40.3
Actual observing	1557.75	1661.75	1543.9	879.3

B. 140 FOOT TELESCOPE OBSERVING PROGRAMS

The following continuum program was conducted during this quarter.

No.	Observer(s)	Program
D186	de Pater, I. (Calif., Berkeley) Heiles, C. (Calif., Berkeley) Maddalena, R. Wong, M. (Calif., Berkeley)	21 cm monitoring of the Comet-Jupiter crash.

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B638	Bell, M. (NRC, Herzberg) Feldman, P. (NRC, Herzberg) Kolbuszewski, M. (Steacie, NRC)	Observations to determine if there is a chemical link between C_3H_2 and the carriers of the diffuse interstellar bands.
B639	Balser, D. Lockman, F. J. McKinnon, M.	Observations of helium, hydrogen, and carbon radio recombination lines toward pulsars.
B642	Balser, D. Rood, R. (Virginia) Bania, T. (Boston)	Ionized helium measurements in galactic HII regions.
B643	Braatz, J. (Maryland) Wilson, A. (Maryland)	Monitoring of H_2O megamasers in active galaxies.

No.	Observer(s)	Program
B646	Breen, J. (Virginia) Murphy, E. (Virginia)	Measuring accurate N_H column densities toward clusters of galaxies observed with the ROSAT PSPC.
B655	Bates, N. (Franklin WV High School)	High velocity resolution HI spectra of several face-on galaxies.
F124	Frayer, D. (Toronto) Brown, R. Vanden Bout, P.	A 12-20 GHz survey of molecular oxygen at high redshift.
H293	Haynes, M. (Cornell) Hogg, D. Maddalena, R. Roberts, M.	Evaluating galactic HI envelopes and a search for faint companions.
L273	Lockman, F. J.	HI mapping of Ursa Major.
L308	Liszt, H. Lucas, R. (IRAM)	Observations of CH emission toward extragalactic continuum sources previously studied in OH.
M385	Murphy, E. (Virginia) Lockman, F. J.	The magnetic field in galactic HI.
T348	Thuan, T. (Virginia) Martin, J-F. (Meudon)	21 cm observations of the influence of local environment on the physical properties of dwarf galaxies.
T349	Taylor, G. (Caltech) Conway, J. (Onsala) Readhead, A. (Caltech)	Search for HI absorption in radio galaxies with compact symmetric structure on the pc-scale.
V083	van Zee, L. (Cornell) Haynes, M. (Cornell) Maddalena, R.	HI observations of galaxies with extended hydrogen envelopes.
W280	Wootten, H. A.	H_2O monitoring in star-forming cores in Rho Oph.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
A118	Arzoumanian, Z. (Cornell) Nice, D. Taylor, J. (Princeton) Taylor, H. (Princeton)	Bimonthly timing of 63 pulsars at 550, 810, and 1420 MHz.

No.	Observer(s)	Program
B617	Backer, D. (Calif., Berkeley) Sallmen, S. (Calif., Berkeley) Foster, R. (NRL) Matsakis, D. (NRL)	Pulsar timing array observations at 800 and 1395 MHz.
B644	Backer, D. (Calif., Berkeley) Zepka, A. (Calif., Berkeley) Sallmen, S. (Calif., Berkeley)	Pulsar flux density and pulse morphology observations at 3 GHz.
M386	McKinnon, M. Fisher, J. R.	A 1.3-1.8 GHz polarization model test and timing of young pulsar PSR B1823-13.

The following very long baseline programs were conducted.

No.	Observer(s)	Program
A120	Altunin, V. (JPL/Caltech) Migenes, V. (CSIRO) Slysh, V. (Lebedev)	OH masers VLBI survey.
BL022	Langston, G.	High resolution imaging of Einstein Ring MG1654+1346. 90 cm.
C293	Clark, T. (NASA/GSFC) Ryan, J. (NASA/GSFC) Gordon, D. (Hughes/STX) Himwich, W. (NVI, Inc.) Varney, D. (NVI, Inc.) Vandenberg, N. (NVI, Inc.)	140 Foot, 85-3, and 20-m Green Bank geodetic ties.

C. 12 METER TELESCOPE OBSERVING PROGRAMS

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
A129	Apponi, A. (Arizona State) Ziurys, L. (Arizona State)	Evaluating the nitrogen/oxygen chemical network: additional mapping of NO and N_2O in Sgr B2.
A130	Apponi, A. (Arizona State) Ziurys, L. (Arizona State)	Re-evaluating the interstellar $[HCO^+]/[HOC^+]$ abundance ratio.

No.	Observer(s)	Program
C296	Clancy, R. T. (Colorado) Sandor, B. (Colorado)	Mars dust storm observations.
C297	Cappa de Nico, C. (IAR) Carey, S. (Hanscom/AFGL) Kutner, M. Mead, K.	CO observations around NGC 6888.
D187	Dayal, A. (Arizona) Bieging, J. (Arizona)	CO observations of young planetary and proto-planetary nebulae.
E61	Evans, A. (Hawaii), Sanders, D. (Hawaii) Mazzarella, J. (Caltech)	CO (1→0) observations of powerful radio galaxies detected by IRAS.
G345	Gensheimer, P. (MPIR, Bonn)	Search for vibrationally excited SiC_2.
G346	Gensheimer, P. (MPIR, Bonn)	Search for the HCCNC isomer of HC_3N toward IRC+10216.
G347	Glenn, J. (Arizona) Walker, C. K. (Arizona)	Continuum polarimetry of protostellar dust cores.
G348	Guélin, M. (IRAM) Ziurys, L. (Arizona State) Apponi, A. (Arizona State)	Confirmation of circumstellar ^{26}AlF: testing nucleosynthesis in AGB stars.
H313	Hogg, D. Roberts, M. Bregman, J. (Michigan)	Study of the CO distribution in the Sa galaxy NGC 3623.
H314	Hogg, D.	A search for CO associated with stellar wind bubbles.
H315	Ho, P. (CFA) Martin, R. (Arizona) Turner, J. (UCLA) Yun, S. (CFA)	A big CO map of NGC 253.
H316	Hurt, R. (Calif., Riverside) Turner, J. (UCLA) Martin, R. (Arizona)	OTF mapping of the molecular gas in the starburst galaxy Maffei 2.
I16	Irvine, W. (Massachusetts) Ohishi, M. (Nobeyama) Hjalmarson, A. (Chalmers, Onsala) Dickens, J. (Massachusetts)	Study of the hydrogenation of interstellar molecules.

No.	Observer(s)	Program
I17	Irvine, W. (Massachusetts) Dickens, J. (Massachusetts) Ohishi, M. (Nobeyama) Ziurys, L. (Arizona State) Amano, T. (NRC, Herzberg)	Confirmation of interstellar H_2COH.
J129	Jewell, P. Walker, C. (Arizona)	A study of SiO masers in evolved stars — polarization properties.
K352	Kurtz, S. (Mexico/UNAM) Lizano, S. (Mexico/UNAM)	Study of molecular flows in high mass star-forming regions.
L302	Lo, K-Y. (Illinois) Ho, P. (CFA) Steidel, C. (MIT)	Study of the molecular gas content of z ~ 0.1 to 0.3 IRAS galaxies.
L313	Latter, W. (NASA/Ames) Charnley, S. (NASA/Ames)	Study of methanol in IRC+10216.
M395	Mangum, J. (Arizona) Latter, W. (NASA/Ames) McMullin, J. (Arizona)	A derivation of the physical conditions in the Serpens molecular cloud.
M397	Mangum, J. (Arizona) Emerson, D. Emerson, C. (Cambridge) Emerson, N. (Catalina Foothills HS)	Study of CO in the Pleides.
P175	Paglione, T. (Boston) Jackson, J. (Boston) Bolatto, A. (Boston)	Study of the dense gas in the galactic center.
P178	Phillips, R. (Haystack) Beasley, A. Dhawan, V. Bower, G. (Calif., Berkeley) Backer, D. (Calif., Berkeley) Wright, M. (Calif., Berkeley) Baath, L. (Chalmers, Onsala) Booth, R. (Chalmers, Onsala) Conway, J. (Chalmers, Onsala) Rantakyro, F. (Chalmers, Onsala) Wikland, T. (Chalmers, Onsala) Perlman, E. (NASA/GSFC) Carilli, C. (CFA) Doeleman, S. (Haystack)	Millimeter VLB network studies.

No.	Observer(s)	Program
	(continued)	
	Rogers, A. (Haystack) Junor, W. (New Mexico) Biretta, J. (STScI) Krichbaum, T. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Graham, D. (MPIR, Bonn) Zensus, J. A. Grewing, M. (IRAM) Lonsdale, C. J. (Haystack) Wardle, J. (Brandeis) Roberts, D. (Brandeis)	
R262	Richter, M. (Calif., Berkeley) Graham, J. (Calif., Berkeley) Tauber, J. (ESTEC)	Comparing HCO^+ and H_2 in molecular shocks.
R263	Roberts, M. Hogg, D.	Study of the distribution of the cool interstellar gas in asymmetric isolated galaxies.
S404	Sandor, B. (Colorado) Clancy, R. T. (Colorado)	Microwave spectroscopy of Earth's atmosphere.
S405	Shen, J. (Illinois) Lo, K-Y. (Illinois) Yun, M. (CFA) Turner, J. (UCLA) Ho, P. (CFA)	CO, HCN, and HCO^+ observations of M82 and NGC 2146.
T355	Turner, B.	The sulfur chemistry of translucent molecular clouds: a proposed search for H_2S.
T357	Turner, B.	A confirmation of silanone (H_2SiO).
T358	Tielens, A. (NASA/Ames) Irvine, W. (Massachusetts) Ohishi, M. (Nobeyama) Hjalmarson, A. (Chalmers, Onsala) Dickens, J. (Massachusetts)	Study of physical conditions and carbon budget around YSOs with ice bands.
V86	van Dishoeck, E. (Leiden) Mundy, L. (Maryland) McMullin, J. (Arizona) Blake, G. (Caltech) Evans, N. (Texas)	The youngest stellar regions: the evolution of chemical morphologies.

No.	Observer(s)	Program
V87	Verdes-Montenegro, L. (IAA, Spain) Yun, M. (CFA) Perea, J. (IAA, Spain) del Olmo, A. (IAA, Spain)	Study of the molecular component of Hickson groups.
W351	Wootten, H. A. Mangum, J. (Arizona)	Study of the origin of broad formaldehyde line emission in millimeter-bright low mass star-forming regions.
W357	Womack, M. (Penn State) Stern, A. (SW Research Inst., Texas)	Study of carbon chemistry in Kuiper disk comets.
W368	Woodney, L. (Maryland) A'Hearn, M. (Maryland) Samarasinha, N. (KPNO-NOAO) McMullin, J. (Arizona) Mundy, L. (Maryland)	Observations of comet C/1995 01 (Hale-Bopp).
Y17	Yu, T. (Calif., Berkeley)	Observations of OPHB1 in the J=1-0 ^{12}CO line.
Z128	Zhao, J.-H. (SA/IAA, Taiwan) Zhou, S. (Illinois) Ho, P. (CFA) Xia, X-Y. (Tianjing U.) Deng, Z. (Beijing Obs.)	Confirmation of CO detection at z = 0.58.
Z129	Zhou, S. (Illinois) Choi, M. (Texas) Evans, N. (Texas)	A $C^{18}O$ J = 2→1 survey of selected regions in Taurus.
Z130	Ziurys, L. (Arizona State) Apponi, A. (Arizona State) Allen, M. (Arizona State)	A search for FeF in IRC+10216.
Z131	Ziurys, L. (Arizona State) Apponi, A. (Arizona State)	A search for circumstellar $MgCH_3$: constraining Mg chemistry.

D. VERY LARGE ARRAY OBSERVING PROGRAMS

Fourth Quarter, 1995 was spent in the following configurations: BnA, October 1 to October 2; B, October 2 to December 31.

No.	Observer(s)	Program
AA181	Alexander, P. (Cambridge) Green, D. (Cambridge) Clemens, M. (Cambridge)	Star-formation history in interacting galaxies NGC 4490/ NGC 4485. 3.6 cm line
AA192	Abada-Simon, M. (Utrecht) Lasota, L. (Paris Obs) Chanmugam, G. (LSU) Frank, F. (LSU)	Search for radio emission from magnetic catacysmic variable RXJ051541+01. 6 cm
AA193	Anantharamaiah, K. (Raman Institute) Roy, A. (Raman Institute) Goss, W. M. Zhao, J.-H. (SA/IAA, Taiwan)	Recombination lines from external galaxies. 20 cm line
AA194	Antonucci, R. (Calif., Santa Barbara) Barvainis, R. (Haystack) Geller, R. (Calif., Santa Barbara)	Nature of the optical/ultraviolet emission in AGN. 1.3 cm
AB628	Becker, R. (Calif., Davis) Helfand, D. (Columbia) White, R. (STScI) Perley, R.	Survey of the north galactic cap. 20 cm
AB705	Burke, B. (MIT) Becker, D. (MIT) Lehar, J. (CFA) Hewitt, J. (MIT) Roberts, D. (Brandeis)	Time delay of the gravitational lens 0957+561. 3.6, 6 cm
AB740	Baum, S. (STScI) Colbert, E. (Maryland) O'Dea, C. (STScI) Pedlar, A. (Manchester)	Three archetypical Seyferts: MKN 6, NGC 3079, MKN 231. 6 cm
AB759	Browne, I. (Manchester) Wilkinson, P. (Manchester) Sykes, C.(Manchester)	Ring and halo in the gravitational lens B0218+357. 20 cm

No.	Observer(s)	Program
AB760	Browne, I. (Manchester) Wilkinson, P. (Manchester) Sykes, C. (Manchester) Muxlow, T. (Manchester) Jackson, N. (Manchester) Myers, S. (Caltech) Fassnacht, C. (Caltech) Readhead, A. (Caltech) Pearson, T. (Caltech) de Bruyn, A. (NFRA) Snellen, I. (Leiden)	Deep imaging of the new quadruple lensed system 1608+656. 1.3, 2, 3.6, 6, 20 cm
AB764	Bujarrabal, V. (Yebes Obs) Alcolea, J. (Yebes Obs)	Radio continuum observations of M1-92, the Minkowski's Footprint. 3.6, 6, 20 cm
AB766	Blundell, K. (Oxford) Rawlings, S. (Oxford) Lacy, M. (Oxford) Littlewood, C. (Oxford) Willott, C. (Oxford) Serjeant, S. (Oxford)	The evolution of radio quasars and their environments from z = 0.5-3. 3.6, 6, 20 cm
AB767	Bloemhof, E. (Arizona) Gwinn, C. (Calif., Santa Barbara) Danen, R. (Calif., Santa Barbara)	High spatial resolution observations of the LkH 101 wind. 1.3 cm
AC420	Carilli, C. (CFA) Rottgering, H. (Cambridge) Best, P. (Cambridge) Owen, F.	Two classic "alignment effect" high-z radio galaxies. 3.6, 6, 20 cm
AC429	Cowan, J. (Oklahoma) Branch, D. (Oklahoma)	Search for extragalactic intermediate age supernovae. 6 cm
AC437	Curiel, S. (CFA) Eiroa, C. (Madrid Obs) Canto, J. (Mexico/UNAM)	Circumstellar disk structures around very young stellar objects. 0.7, 1.3, 3.6 cm
AC441	Cotton, W. Swain, M. (Rochester) Bridle, A. Kassim, N. (NRL)	J2146+82 – large radio galaxy with misaligned outbursts? 90 cm

No.	Observer(s)	Program
AC442	Conner, S. (MIT) Garnavich, P. (CFA) Turner, E. (Princeton) Schechter, P. (CFA) Burke, B. (MIT)	New gravitational lens candidates from the MIT-Green Bank-VLA survey. 2 cm
AC443	Chernin, L. (Calif., Berkeley)	Water masers in protostellar outflows. 1.3 cm line
AC445	Clarke, T. (Toronto) Kronberg, P. (Toronto) Bohringer, H. (MPIfEP, Garching)	Polarization observations of radio sources through Abell clusters. 3.6, 20 cm
AC446	Chandler, C. Koerner, D. (JPL) Sargent, A. (Caltech)	Resolving disk structure in HH 24MMS. 0.7 cm
AC451	Carilli, C. (CFA) Womble, D. (San Diego State) Sargent, W. (Caltech)	HI 21 cm absorption towards 0959+682 by tidal debris in the M81 group. 20 cm line
AC452	Chen, H. (CFA) Zhao, J.-H. (SA/IAA, Taiwan)	Direct imaging of circumstellar disk around L1641N. 0.7, 1.3 cm
AD365	Duric, N. (New Mexico) Perley, R. Kassim, N. (NRL)	75 MHz observations of galactic supernova remnant W49B. 90 cm
AD369	Danner, R. (Caltech) Kulkarni, S. (Caltech)	Soft X-ray sources in high galactic latitude clouds. 6, 20 cm
AD370	Dallacasa, D. (NFRA) Feretti, L. (Bologna) Giovannini, G. (Bologna) Klein, U. (Bonn U.)	Probing the cluster magnetic field in Abell 119. 3.6, 6, 20 cm
AD372	DePree, C. (North Carolina)	Unusual source in NGC 6951. 2 cm
AE097	Eilek, J. (NMIMT) Loken, C. (New Mexico State) Owen, F.	The ends of type I radio tails. 90 cm
AF294	Frail, D. Kulkarni, S. (Caltech) Vasisht, G. (Caltech)	High resolution imaging of the soft gamma ray repeater SGR 1806-02: the second epoch. 6, 3.6 cm

No.	Observer(s)	Program
AF296	Fiebig, D. (Heidelberg Obs) Papkalla, R. (Heidelberg Obs)	Search for H_20 maser emission from protostellar disks. 1.3 cm line
AF297	Fey, A. (USNO) Kassim, N. (NRL)	Low frequency observations of the Cygnus region. 90 cm
AG448	Greenhill, L. (CFA) Henkel, C. (MPIR, Bonn)	Monitoring the acceleration of water megamaser features in NGC 4258. 1.3 cm line
AG449	Gizani, N. (Manchester) Leahy, J.P. (Manchester) Garrington, S. (Manchester) Perley, R.	Faraday rotation in Hercules A. 3.6, 20 cm
AG450	Green, D. (Cambridge) Cowan, J. (Oklahoma)	Search for young galactic SNRs: a follow up. 6 cm
AH492	Hjellming, R. Gehrz, R. (Minnesota) Seaquist, E. (Toronto) Taylor, A. R. (Calgary)	Image and light curve evolution of radio novae. 1.3, 2, 3.6, 6, 20 cm
AH551	Ho, L. (Calif., Berkeley) Van Dyk, S. (Calif., Berkeley)	Survey of nearby galactic nuclei. 3.6, 6 cm
AH556	Han, J. (Beijing Obs) Beck, R. (MPIR, Bonn) Berkhuijsen, E. (MPIR, Bonn)	Halo of M31. 20 cm
AH559	Ho, L. (Calif., Berkeley) Van Dyk, S. (Calif., Berkeley)	The nature of low luminosity active galactic nuclei. 3.6 cm
AH560	Hankins, T. (NMIMT) Moffett, D. (NMIMT) Shrauner, J. (Princeton) Taylor, J. (Princeton) Thorsett, S. (Princeton)	Search for strong pulses from PSR B1937+214. 6, 20, 90 cm
AH561	Henkel, C. (MPIR, Bonn) Gaume, R. (USNO) Fey, A. (USNO) Braatz, J. (Maryland) Wilson, A. (STScI)	Study of the H_20 masers in IC 1481. 1.3 cm line

No.	Observer(s)	Program
AH565	Herrnstein, J. (CFA) Blackman, E. (CFA) Moran, J. (CFA) Greenhill, L. (CFA) Diamond, P.	Polarmetric observations of the masing molecular disk in NGC 4258. 1.3 cm line
AH566	Ho, P. (CFA) Lo, K.-Y. (Illinois)	High velocity H_2O masers toward the galactic center. 1.3 cm line
AH567	Ho, P. (CFA) Wilner, D. (CFA)	Continuum mapping of HL Tau. 0.7 cm
AH568	Harvanek, M. (Colorado/JILA) Stocke, J. (Colorado/JILA)	Distant 3CR radio galaxies at z = 0.15-0.65. 20 cm
AJ250	Jackson, N. (Manchester) Bremer, M. (Leiden) Roland, J. (IAP, Paris)	Completion of an unbiased sample of radio sources. 6 cm
AK368	Kaufman, M. (Ohio State) Brinks, E. Elmegreen, B. (IBM) Elmegreen, D. (Vassar College) Struck-Marcell, C. (Iowa State)	Radio continuum observations of ocular and caustic galaxies. 20 cm
AK376	Kulkarni, S. (Caltech) Frail, D.	Search for the radio counterparts of gamma ray bursters.
AK403	deKoff, S. (STScI) Biretta, J. (STScI) Baum, S. (STScI) Sparks, W. (STScI) Miley, G. (Leiden) Macchetto, D. (STScI)	HST/VLA snap-shot survey of 3CR radio galaxies. 2, 3.6 cm
AK410	Knopp, G. (Hawaii) Chambers, K. (Hawaii)	High redshift radio galaxies – morphology and polarization. 6 cm
AK413	Kassim, N. (NRL) Perley, R. Erickson, W. (Maryland)	74 MHz observations of strong sources – large angular size objects. 90 cm
AK414	Kronberg, P. (Toronto) Allen, M. (Toronto)	High resolution radio spectral index studies of the nucleus of M82. 3.6 cm

No.	Observer(s)	Program
AK416	Keane, M. (KPNO-NOAO)	Deep, multi-frequency imaging of PKS 2349-014. 2, 3.6, 6, 20 cm
AK417	Koerner, D. (JPL) Chandler, C. Sargent, A. (Caltech)	Radial structure and dust properties of circumstellar disks. 0.7, 1.3, 3.6 cm
AK418	Koerner, D. (JPL) Jensen, E. (Wisconsin) Mathieu, R. (Wisconsin)	Circumstellar disks in the pre-main sequence binary environment. 0.7, 1.3, 3.6 cm
AK419	Keane, M. (KPNO-NOAO)	A new sample of southern compact groups. 20 cm
AK420	Kollgaard, R. (Penn State) Ghisellini, G. (Torino) Maraschi, M. (Genova U.) Pesce, J. (STScI) Sambruna, R. (STScI) Urry, C. (STScI)	Multifrequency monitoring of blazars. 1.3, 2, 3.6, 6, 20 cm
AL353	Ludke, E. (UFSM, Brazil)	Faraday effect in CSS sources. 1.3 cm
AL364	Leitch, E. (Caltech) Myers, S. (Caltech) Readhead, A. (Caltech)	Point source contaminants in the OVRO microwave background fields. 0.7, 1.3, 2, 3.6 cm
AL366	Lacy, M. (Oxford) Blundell, K. (Oxford)	A search for remnant hotspots in radio-quiet quasar E1821+643. 90 cm
AL367	Lehnert, M. (LLNL) Gregg, M. (LLNL)	High resolution observations of many highly polarized sources. 6 cm
AL368	Lara, L. (Bologna) Cotton, W. Feretti, L. (Bologna) Giovannini, G. (Bologna) Marcaide, J. (Valencia) Venturi, T. (Bologna)	Large angular size radio sources from the NRAO VLA Sky Survey. 6, 20 cm
AL369	Lopez, J. (Mexico/UNAM) Vazquez, R. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM)	Imaging of the remarkable planetary nebula KjPn 8. 3.6, 6 cm
AL381	Lundgren, S. (NRL)	Candidate for EGRET source 2EG0431+2910. 6 cm
AL382	Lestrade, J.-F. (Meudon)	Search for emission from 51 Peg. 3.6 cm

No.	Observer(s)	Program
AM490	Muxlow, T. (Manchester) Pedlar, A. (Manchester) Wilkinson, P. (Manchester) Axon, D. (STScI)	Combined 5 GHz VLA-MERLIN image of starburst activity in M82. 6 cm
AM499	Morrison, G. (New Mexico) Owen, F.	Imaging the two most extreme Butcher-Oemler clusters. 20 cm
AM500	Marti, J. (Barcelona) Paredes, J. (Barcelona) Peracaula, M. (Barcelona)	The Cygnus X-3 extended radio emission. 3.6, 6 cm
AM502	Muhleman, D. (Caltech) Grossman, A. (Maryland) Slade, M. (JPL) Butler, B.	Titan polarization and mapping radar measurements. 3.6 cm line
AM503	Moffett, D. (NMIMT) Hankins, T. (NMIMT)	Crab pulsar polarization at high radio frequencies. 3.6, 6, 20 cm
AM504	McHardy, I. (Southampton) Lehto, H. (Turku) Newsam, A. (Southampton)	Cosmic soft X-ray background and sub-millijansky radio sources: are they the same? 20 cm
AM505	Molnar, L. (Iowa) Fix, J. (Iowa) Dunn, D. (Iowa)	Thermal emission of Saturn's rings at Saturn equinox. 0.7, 2 cm
AM507	Mundell, C. (Manchester) Pedlar, A. (Manchester) Meaburn, J. (Manchester) Kukula, M. (Liverpool JMU) Axon, D. (STScI)	B Configuration observations of HI in NGC 3227. 20 cm line
AO123	O'Donaghue, A. (St. Lawrence U.) Eilek, J. (NMIMT) Owen, F.	Examining the morphological and dynamical basis for FRI/FRII boundary. 6 cm
AP296	Preston, R. (JPL) Folkner, W. (JPL)	Earth based observation of Galileo probe for Jupiter wind estimation. 3.6 cm
AP302	Pooley, G. (Cambridge) Hardcastle, M. (Cambridge) Alexander, P. (Cambridge) Riley, J. (Cambridge)	Jets in nearby FRI radio galaxies. 3.6, 20 cm

No.	Observer(s)	Program
AP325	Prins, S. (Amsterdam) Magnier, E. (Amsterdam) Fox, D. (MIT) Lewin, W. (MIT) van Paradijs, J. (Amsterdam)	Observations of SNRs in M31. 90 cm
AP326	Perley, R. Kronberg, P. (Toronto) Reid, R. (Toronto) Dyer, C. (Toronto) Roser, H.-J. (MPIA, Heidelberg)	Southern candidates for gravitational lensing of radio jets. 3.6 cm
AP327	de Pater, I. (Calif., Berkeley) Grossman, A. (Maryland)	Jupiter at the time of the Galileo probe entry. 2, 3.6, 6, 20 cm
AR334	Roser, H.-J. (MPIA, Heidelberg) Perley, R. Meisenheimer, K. (Royal Obs)	High frequency mapping of the jet of 3C 273. 0.7, 1.3, 2, 3.6, 6 cm
AR335	Rawlings, S. (Oxford) Lacy, M. (Oxford) Blundell, K. (Oxford) Serjeant, S. (Oxford)	An HST sample of quasars at $0.5 < z < 0.7$. 3.6, 6, 20 cm
AS516	Shaver, P. (ESO) Wall, J. (RGO) Kellermann, K.	Accurate positions of unidentified flat-spectrum Parkes sources. 3.6 cm
AS561	Stockton, A. (Hawaii) Ridgeway, S. (Hawaii)	Radio-optical survey of a complete z ~1 3CR sample of galaxies. 6 cm
AS566	Saripalli, L. (NAO, Japan) Patnaik, A. (MPIR, Bonn)	Study of a sample of flat-spectrum radio galaxies. 20 cm
AS568	Sramek, R. Weiler, K. (NRL) Van Dyk, S. (Calif., Berkeley) Panagia, N. (STScI)	Properties of radio supernovae. 1.3, 2, 3.6, 6, 20 cm
AS569	Skinner, S. (Colorado/JILA) Nagase, F. (ISAS, Japan) Itoh, M. (ISAS, Japan)	The unusual Wolf-Rayet star WR 147. 1.3, 2, 3.6, 6, 20 cm
AS571	Strelnitski, V. (NMIMT) Goss, W. M. DePree, C. (North Carolina)	High resolution imaging of G34.26+0.15 in H52α. 0.7, 1.3 cm line

No.	Observer(s)	Program
AS572	Saikia, D. (NCRA, India)	Mildly active galaxies with nuclear radio rings and spirals. 2, 3.6 cm
AS573	Saikia, D. (NCRA, India) Jeyakumar, S. (NCRA, India) Thomasson, P. (Manchester)	Three highly distorted compact steep-spectrum radio galaxies. 2, 3.6 cm
AS574	Seaquist, E. (Toronto)	A possible protogalaxy. 3.6 cm
AS575	Simon, L. (Iowa) Higdon, J. (CSIRO)	Ring galaxy Arp 141. 20 cm line
AT184	Thorsett, S. (Princeton) Taylor, J. (Princeton) McKinnon, M. Hankins, T. (NMIMT) Stinebring, D. (Oberlin College)	Timing fast pulsars at the VLA. 6, 20, 90 cm
AT185	Thornley, M. (Maryland) Mundy, L. (Maryland)	Cold gas on sub-kiloparsec scales in nearby flocculent galaxies. 20 cm line
AV219	Vine, S. (Cambridge) Thomson, R. (Cambridge) Gilmore, G. (Cambridge) Lewis, J. (RGO) Wyse, R. (Johns Hopkins) Higdon, J. (CSIRO)	HI velocity field mapping of bulgeless, edge-on disk galaxies. 20 cm line
AW404	Wilcots, E. (Wisconsin) Hodge, P. (Washington)	HI study of nearby irregular IC 1613. 20 cm line
AW417	Willner, S. (CFA)	Structure of HII regions in M33. 6 cm
AW419	Watson, A. (Lowell Obs) Cox, A. (Wisconsin) Wilcots, E. (Wisconsin)	Sub-arcsecond imaging of nuclear starbursts. 2, 6 cm
AW420	Wannier, P. (JPL) Stapelfeldt, K. (JPL) Sahai, R. (JPL) Koerner, D. (JPL) Werner, M. (JPL) Trauger, J. (JPL)	Protostellar disks in bright HII regions. 3.6 cm
AW421	Wallin, J. (George Mason) Higdon, J. (CSIRO)	HI observations of two interacting ring galaxies. 20 cm line

No.	Observer(s)	Program
AW422	Wilner, D. (CFA) Dickel, H. (Illinois) Welch, W. J. (Calif., Berkeley)	Line and continuum mapping of W49A North. 0.7 cm line
AW423	Willson, R. (Tufts) Lang, K. (Tufts) Kile, J. (Tufts) Gelfreikh, G. (Pulkovo Obs) Bogod, V. (Pulkovo Obs)	Collaborative VLA observations of the sun. 6, 20, 90 cm
AY072	Young, L. (Illinois) Lo, K.-Y. (Illinois),	HI in the dwarf irregular galaxy Leo A. 20 cm line
AZ074	van Zee, L. (Cornell) Haynes, M. (Cornell) Salzer, J. (Wesleyan U.) Westpfahl, D. (NMIMT)	HI in the star forming regions in IZw18. 20 cm line
AZ075	Zhang, Q. (CFA) Ho, P. (CFA)	Contracting molecular cloud cores. 1.3 cm line

E. VERY LONG BASELINE ARRAY OBSERVING PROGRAMS

No.	Observer(s)	Program
BA011	Alberdi, A. (ESA, Spain) Lara, L. (Bologna) Marcaide, J. (Valencia) Kemball, A. Patnaik, A. (MPIR, Bonn) Porcas, R. (MPIR, Bonn) Pauliny-Toth, I. (MPIR, Bonn)	Polarization sensitive VLBI measurements of 3C 454.3 and 3C 395. 2, 3.6 cm
BA012	Alberdi, A. (ESA, Spain) Marcaide, J. (Valencia) Marscher, A. (Boston) Gomez, J. (Boston) Kemball, A.	Dual polarization observations of the superluminal 4C 29.25. 1.3, 2 cm
BA014	Aaron, S. (Brandeis) Wardle, J. (Brandeis) Roberts, D. (Brandeis)	Polarization and spectral index mapping of the CSS quasar 3C 309.1. 2, 3.6 cm

No.	Observer(s)	Program
BB043	Beasley, A. Bastian, T. Niell, A. (Haystack)	High-frequency VLBA observations of AE Aqr. 1.3 cm with phased VLA
BB045	Benz, A. (SFIT, ETH) Conway, J. (Chalmers, Onsala) Alef, W. (MPIR, Bonn) Gudel, M. (SFIT, ETH)	VLBA observations of nearby dMe stars. 3.6 cm with phased VLA
BB048	Bondi, M. (Manchester) Dallacasa, D. (NFRA) Marcha, M. (Lisbon) Stanghellini, C. (CNR/IRA-Frascati)	Flat spectrum radio galaxies. 6 cm
BB049	Beasley, A. Bastian, T.	Orbital monitoring of HR 1099 and UX ARi. 3.6 cm
BB052	Bartel, N. (York U.) Sorathia, B. (York U.) Bietenholz, M. (York U.) Carilli, C. (CFA) Diamond, P.	Nuclear jet and counterjet in Cygnus A. 1.3, 6 cm
BB054	Bower, G. (Calif., Berkeley) Backer, D. (Calif., Berkeley)	Multi-frequency polarimetry of 3C 454.3. 1.3, 3.6 cm
BC046	Claussen, M. Braatz, J. (Maryland) Diamond, P. Wilson, A. (STScI) Henkel, C. (MPIR, Bonn)	Water masers in the elliptical galaxy NGC 1052. 1.3 cm with phased VLA
BC047	Coles, B. (Calif., San Diego) Grall, R. (Calif., San Diego) Klinglesmith, M. (Calif., San Diego)	Interplanetary scintillation measurements of the solar wind speed. 2, 3.6 cm

No.	Observer(s)	Program
BC048	Clark, T. (NASA/GSFC) Ryan, J. (NASA/GSFC) Ma, C. (NASA/GSFC) Vandenberg, N. (Interferometrics) Gipson, J. (Interferometrics) Himwich, W. (Interferometrics) MacMillan, D. (Interferometrics) Potash, R. (Interferometrics) Gordon, D. (NASA/GSFC) Neill, A. (Haystack) Corey, B. (Haystack) Rogers, A. (Haystack) Eubanks, T. (USNO) Fomalont, E. Walker, R.C.	Revised:NASA space geodesy program observations for June-December, 1995. 3.6 cm
BC051	Cotton, W. Feretti, L. (Bologna) Giovannini, G. (Bologna) Lara, L. (Bologna) Ventura, T. (Bologna) Marcaide, J. (Valencia)	VLBA polarization observations of NGC 315. 6 cm with phased VLA
BD023	Denn, G. (Iowa) Mutel, R. (Iowa)	Monitoring BL Lac, with polarization. 1.3, 2, 3.6 cm
BD027	Diamond, P. Kemball, A.	Multi-epoch observations of stellar SiO masers. 0.7 cm with single VLA antenna
BE006	Eubanks, T. (USNO) Archinal, B. (USNO) Beasley, A. Fomalont, E. Walker, R. C. Napier, P.	Two centimeter astrometric survey; proof of concept. 3.6 cm
BF012	Fey, A. (USNO) Johnston, K. (USNO) Fomalont, E. Eubanks, M. (USNO)	Astrometric observations for the radio reference frame. 3.6 cm
BF016	Frail, D. van Langevelde, H. (NFRA)	Extragalactic scattering in galaxy/quasar pairs. 18, 90 cm

No.	Observer(s)	Program
BG015	Greenhill, L. (CFA) Diamond, P. Gwinn, C. (Calif., Santa Barbara) Moran, J. (CFA)	Tracing the dynamics of a protoplanetary disk. 1.3 cm
BG041	Geldzahler, B. (George Mason) Kafatos, B. (George Mason) Hollis, J.M. (NASA/GSFC) Bradshaw, C. (George Mason) Pedelty, J. (NASA/GSFC)	High resolution observations of the symbiotic star R Aqr. 6 cm with phased VLA
BG045	Greenhill, L. (CFA) Moran, J. (CFA) Danchi, W. (Calif., Berkeley) Bester, M. (Calif., Berkeley)	Snapshot survey of SiO maser stars at maximum and minimum luminosity. 0.7 cm with singleVLA antenna
BG046	Greenhill, L. (CFA) Braatz, J. (Maryland) Wilson, A. (STScI) Moran, J. (CFA) Herrnstein, J. (CFA) Claussen, M.	The water maser in the Seyfert NGC 1386. 1.3 cm with phased VLA
BG047	Greenhill, L. (CFA) Koekemoer, A. (Mt. Stromlo) Gwinn, C. (Calif., Santa Barbara) Moran, J. (CFA) Herrnstein, J. (CFA) Henkel, C. (MPIR, Bonn) van Breugel, W. (LLNL) Dey, A. (LLNL)	Ultraluminous water maser emission in an early-type galaxy at 100 Mpc. 1.3 cm with phased VLA
BH010	Hewitt, J. (MIT) Haarsma, D. (MIT) Katz, C. (MIT) Moore, C. (MIT) Trotter, C. (MIT)	Gravitational lens monitoring with the VLBA. 3.6, 18 cm
BH012	Hough, D. (Trinity U.) Zensus, J. A. Porcas, R. (MPIR, Bonn)	The lobe-dominated superluminal 3C 263. 2, 3.6, 6 cm
BJ020	Junor, B. (New Mexico) Biretta, J. (STScI) Wardle, J. (Brandeis)	VLBA 6, 4 cm polarimetry of Vir A.

No.	Observer(s)	Program
BK034	Krichbaum, T. (MPIR, Bonn) Britzen, S. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Zensus, J. A.	Monitoring of 0528+134 after a millimeter outburst. 1.3 cm
BK036	Kemball, A.	Polarization survey. 0.7 cm
BK037	Kellermann, K. Zensus, J. A. Cohen, M. (Caltech) Vermeulen, R. (Caltech)	Monitoring superluminal sources. 2 cm
BL020	Ludke, E. (UFSM, Brazil) Sanghera, H. (NFRA) Cotton, W.	Resolving Faraday effects in CSS jets. 6 cm
BL022	Langston, G.	High resolution imaging of Einstein Ring MG1654+1346. 90 cm with Green Bank
BL024	Lazio, T. (Cornell) Cordes, J. (Cornell)	Search for angular broadening in the galactic anticenter. 90 cm with phased VLA
BL026	Lobanov, A. (Lebedev) Zensus, J. A.	Relativistic shocks and transition zones in 3C 273. 1.3, 2, 3.6, 6 cm
BL030	Lonsdale, C. (Haystack) Barthel, P. (Groningen/Kapteyn)	Resolving the interaction edge of 3C 205 south. 6 cm with phased VLA
BM047	Marscher, A. (Boston) Gomez, J. (Boston) Wehrle, A. (JPL) Georganopoulos, M. (Boston)	Coordinated multi-band observations of blazars. 1.3 cm
BP026	Phillips, R. (Haystack) Deeney, B. (Colorado/JILA) Lestrade, J.-F. (Paris Obs)	WTT star polarization synthesis. 3.6, 6 cm with phased VLA
BR035	Rioja, M. (NFRA) Porcas, R. (MPIR, Bonn)	VLBA astrometry on the quasar pair 1038+528 A and B. 3.6 cm
BS019	Sjouwerman, L. (Chalmers, Onsala) Diamond, P. van Langevelde, H. (NFRA) Winnberg, A. (Chalmers, Onsala) Habing, H. (Leiden) Lindqvist, M. (Leiden)	Stellar proper motions in galactic center from SiO and H_20 masers. 1.3 cm with phased VLA

No.	Observer(s)	Program
BT018	Thakkar, D. (Caltech) Vermeulen, R. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech)	Morphology and proper motions of the radio cores in FR I galaxies. 6 cm with phased VLA
BT019	Tingay, S. (Mt. Stromlo) Jauncey, D. (CSIRO) Reynolds, J. (CSIRO) Tzioumis, A. (CSIRO) Preston, R. (JPL) Jones, D. (JPL) Murphy, D. (JPL) Meier, D. (JPL) Lovell, J. (Tasmania) McCulloch, P. (Tasmania) Costa, M. (West Australia)	Sub-parsec scale structure of Centaurus A at the SVLBI frequency. 1.3 cm
BU006	Ulvestad, J. (JPL) Wrobel, J.	Continuum imaging of the Seyfert 1/Starburst Galaxy Mrk 231. 6, 18 cm
BV014	Vermeulen, R. (Caltech)	Nature of the low-frequency compact emission from 3C 84. 18, 90 cm
BV016	Vermeulen, R. (Caltech) Readhead, A. (Caltech) Walker, R. C. Romney, J. Kellermann, K. Dhawan, V. Benson, J. Backer, D. (Calif., Berkeley) Alef, W. (MPIR, Bonn)	Probing the accretion region in 3C 84. 1.3, 2, 3.6, 6 cm with single VLA antenna
BV017	Venturi, T. (Bologna) Cotton, W. Feretti, L. (Bologna) Giovannini, G. (Bologna) Lara, L. (Bologna) Marcaide, J. (Valencia)	Proper motion monitoring in two FRI radio galaxies. 3.6 6, 18 cm with single VLA antenna
BW019	Wilkinson, P. (Manchester) Browne, I. (Manchester) Jackson, N. (Manchester) Myers, S. (Caltech) Readhead, T. (Caltech) de Bruyn, G. (NFRA)	Testing CLASS gravitational lens candidates with the VLBA. 3.6, 6, 18 cm

No.	Observer(s)	Program
BZ017	Zensus, J. A. Lobanov, A. (Lebedev) Leppanen, K. (Helsinki)	Monitoring the parsec-scale jet structure of 3C 345. 1.3, 2, 3.6, 6 cm
GM025	Marcaide, J. (Valencia) Ros, E. (Valencia) Alberdi, A. (ESA, Spain) Diamond, P. Shapiro, I. (CFA) Guirado, J. (JPL) Preston, R. (JPL) Jones, D. (JPL) Witzel, A. (MPIR, Bonn) Krichbaum, T. (MPIR, Bonn) Schilizzi, R. (NFRA) Mantovani, F. (Bologna) Trigilio, C. (Bologna) Whitney, A. (Haystack)	Radio-shell expansion in SN 1993J. 13, 18 cm with phased VLA
GR012	Rupen, M. Bartel, N. (York U.) Beasley, A. Conway, J. (Chalmers, Onsala) Bietenholz, M. (York U.) Sorathia, B. (York U.) Graham, D. (MPIR, Bonn) Venturi, T. (Bologna) Umana, G. (Bologna) Rius, A. (Barcelona) Altunin, V. (JPL) Jones, D. (JPL)	VLBI imaging of supernova 1993J in M81. 3.6, 6, 18 cm with phased VLA

F. SCIENCE HIGHLIGHTS

Green Bank

The evolved star, U Equ, has a very peculiar optical spectrum indicating an unusual circumstellar environment. It is known to have OH and H_2O maser emission with a profile structure that suggests an outflow velocity of only 2.5 km/s. Recent observations of OH and H_2O masers with the 140 Foot indicate that the emission has changed in intensity and character over the last ten years. The H_2O maser has developed an additional spectral feature and the OH profile exhibits changes on a time scale of months. The velocity spread of emission has increased. The characteristics of U Equ probably

result from the combination of a warm, evolved, star surrounded by a cold oxygen-rich shell with a disk/(bipolar) shell geometry. Regular monitoring of the star in the H_2O and OH lines is now underway at the 140 Foot to search for signs of acceleration in the cold shell.

Investigators: C. Barnbaum (NRAO), A. Omont (Institut d' Astrophysique de Paris), M. Morris (UCLA)

Socorro

Sequence of VLBI Images Shows Expansion of SN1993J – Using the VLA, the VLBA, and European telescopes, an international VLBI team has made a sequence of images of Supernova 1993J in M81. The high-resolution sequence shows the expansion over a one-year period. While the expansion is symmetrical, the radio emission is clearly stronger on one side of the shell. So far, no protrusions such as those seen resulting from instabilities in older supernova events have developed. The images also show that the debris shell has not begun decelerating due to interaction with circumstellar material. The angular expansion rate measured with the VLBI images, combined with expansion speed measured by optical spectroscopy, should provide a refined value for the distance to M81, about 11 million light-years away.

Investigators: J. Marcaide and E. Ros (U. Valencia, Spain): A. Alberdi (Special Laboratory for Astrophysics and Fundamental Physics of Madrid, and Institute of Astrophysics at Andalucia, Spain); P. Diamond (NRAO); I. Shapiro (CFA); J. Guirado, D. Jones and R. Preston (JPL); T. Krichbaum and A. Witzel (MPI R); F. Mantovani (Bologna); A. Rius (Special Laboratory for Astrophysics and Fundamental Physics, Madrid and the Center for Advanced Studies at Blanes, Spain); R. Schilizzi (Joint Institute for VLBI in Europe and Leiden); C. Trigilio (Noto); and A. Whitney (Haystack)

Observations Show Collapsing Envelope Around Protostar – The VLA and the DSN 70-meter telescope were used to make 22 GHz spectral-line maps of CCS toward the core of B335, a young protostellar region. The resulting high-resolution channel maps image the collapsing envelope around the protostar. The velocity structure supports the evidence for inside-out collapse and the high-velocity features are consistent with accretion onto a rotating central disk. The CCS emission is asymmetric and clumpy, implying that the physical conditions of the region are not spherically symmetric and that the infall of gas onto the circumstellar disk may be episodic.

Investigators: T. *Velusamy, T.B.H. Kuiper and W.D. Langer (JPL)*

G. PUBLICATIONS

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

H. CHARLOTTESVILLE ELECTRONICS

Amplifier Development, Design and Production

A total of 18 amplifiers was delivered this quarter. Work on the 290-395 MHz amplifier prototype was completed Work has begun on the balanced version. The new PC-based HFET test station was completed.

A prototype of the 60-90 GHz amplifier has been developed. A laboratory receiver with this amplifier demonstrate noise temperature of less than 75 K from 60-89 GHz and less than 55 K from 78-86 GHz, which is about the same as th

best SIS mixer receivers in this frequency range. The prototype version will be further evaluated in the VLBA 80-90 GHz receiver. A production version of this amplifier with improved performance is under development.

Superconducting (SIS) Millimeter-Wave Mixer Development

For the new 8-channel 3-mm receiver, we have developed a new six-wire SIS bias-T with internal protective resistors for use with an L-band IF. In addition to protective series resistors, a 50-ohm resistor is connected across the SIS junction to ground. It is hoped that this bias-T will reduce the number of mixer failures due to static electricity.

Also for the 8-channel 3-mm receiver, six dual backshort drive mechanisms have been completed.

Work continues on a new tunerless SIS mixer design, initially for 200-300 GHz. This design will be compatible with both the UVa and JPL fabrication processes. If successful, this mixer design will be incorporated into the planned single-chip image separation mixer.

During this quarter we have assembled and tested, or repaired, 10 SIS mixers, and mounted and DC-tested 19 SIS chips from 7 UVa wafers.

Electromagnetic Support

The Central Development Laboratory is developing a circular polarizer for the new 18-26 GHz VLA receiver. This component consists of a broadband 90 degree differential phase shifter followed by an orthomode transition.

A prototype phase shifter has been fabricated and tested. The measured differential phase shift between 19 GHz and 25.6 GHz is $86.3 \pm 3.5°$. A slightly longer phase shifter to give a mean phase differential of 90 degrees is being fabricated.

A K-band orthomode junction to be used in conjunction with the wideband phase shifter is under development. Prototypes of the symmetric and antisymmetric ports and the associated test fixtures were fabricated to evaluate the junction performance. A return loss of 25 dB in both ports from 18 to 26.5 GHz was demonstrated. A production model of the full junction is currently undergoing fabrication at the Green Bank Shop.

GBT Spectrometer

During the last quarter, construction of the GBT spectrometer continued. The system is almost complete, with bins, power supplies, and cooling fans mounted in place. Bin backplanes have been wirewrapped, but some re-work is required because of physical obstruction between some of the wirewrap coax cables and signal cable connectors.

All control cards in the system except the Long Term Accumulator (LTA) have been wirewrapped and tested. More than one-half of the high-speed multi-layer cards have been tested and are awaiting installation. All parts for the construction of the system have been ordered and received with the exception of the LTA memory modules.

The design and construction of the LTA card test fixture was completed during the quarter, but the unit has not yet been tested.

Construction of a frame decoder for the Russian Radioastron OVLBI satellite was completed during this quarter. The unit has been tested and is now ready for shipment to Russia. The decoder is almost identical to that used in the NRAO Green Bank Earth Station and will be provided to the Russian Astro Space Center for testing of the Russian Radioastron ground support system.

Spectrum Management

During November 4-18, an NRAO staff member spent two weeks as an IUCAF representative at the World Radiocommunication Conference in Geneva. Although there is severe competition for spectrum in many areas, radio astronomers at the conference were successful in getting approval for a number of new footnotes to the radio regulations. These will increase the protection of radio astronomy, and include, for example, one urging administrations to take all practicable steps to protect observations of the recently discovered line of methanol in the 6650-6675.2 MHz band. Other activities in the general area of interference protection include discussions with Motorola engineers on tests of emission levels from satellites of the Iridium series in the 1610.6-1613.8 MHz OH-line band. The first of which will be launched in the latter half of 1996, and Motorola will cooperate with NRAO staff at Green Bank and Socorro in tests using NRAO telescopes.

I. GREEN BANK ELECTRONICS DIVISION

GBT Development

Servo System

We have been working closely with the Comsat/RSI servo division on the GBT Servo system. We are monitoring their progress, working out technical details, and reviewing their test procedures and documentation. The areas of focus this past quarter have been the Feed Arm Servo system and the Auto-Stow protocol/implementation for both the azimuth/elevation and the feed arm systems. The factory tests for both of these areas is scheduled to take place January 15-26, 1996.

Spectrometer

The latest wafer run is complete. 63.6 percent of the chips passed the wafer probe test. A few chips were tested to 160 MHz and passed. Some correlator and memory cards have been tested with good results. The LTA prototype is being wire-wrapped. We also received and have now tested all of the wire wrap control cards (with the exception of the LTA). More than half of the multi-layer correlator cards have been tested. Both spectrometer racks have been constructed, and back plane installation and power wiring should occur in the next month.

IF/Converter Racks

Construction and testing of the prototype 1.6 GHz filter module were completed, and construction of the remaining seven modules started. The construction of the 100 MHz filter module prototype has started. All MCB interface modules for the IF/converter racks have been built and partially tested.

Receivers

Construction is continuing on Prime Focus Receiver #1. Design work started on Prime Focus Receiver #2 earlier this quarter. Design and fabrication of the OMT for this receiver is scheduled to begin first quarter of 1996.

The X, Ku, and K-band receivers are actively being used on the 140 Foot Telescope. This is proving to be invaluable giving us opportunities to tune and refine these receivers to be world class.

Active Surface

A technical review of the Active Surface computer interface with proposed protocols took place this quarter. The software to control the actuators and interface with the Monitor and Control system is being designed and tested.

Site Operations

Routine maintenance, repair, and installation support was supplied to the 140 Foot, the 85-1/2/3, USNO 20 Meter, and the OVLBI earth-station telescopes.

J. TUCSON ELECTRONICS

Fiber Optic Link between VLBA Antenna and 12 Meter

During the past quarter, a fiber-optic link has been established between the VLBA antenna and the 12 Meter Telescope. The objective here is to facilitate the millimeter-wave VLBI observations that are now regularly scheduled. Reference and IF signals are exchanged between the two sites so making the set-up of VLBI experiments far easier than in the past.

8-Beam 1.3 mm SIS Receiver

Although this receiver is now complete and was tested on the telescope in December 1995, some unsolved problems remain. The most serious of these is that receiver noise temperatures are several K higher than expected. Tests continue in order to understand the reasons for this.

On the positive side, the eight-beams are well formed and the efficiency of the beams is correct. The rotator for tracking parallactic angle is now operational.

4-Beam Dual-Polarization 3 mm Receiver

Progress on this receiver has been slower than hoped for owing to the pressure of other work. A crossed grid polarization diplexer designed to work at 4 K has been built and has yet to be tested. A cooled tripler has been tested and has given good results over the frequency range of interest. The cryogenic enclosure has been fabricated, but has yet to be tested.

K. SOCORRO ELECTRONICS

VLA 1.3 - 1.7 GHz Receiver Improvements

Prototypes of a new Walsh-function phase switching scheme in the 200 MHz output of the F2 first local oscillator successfully removed the out-of-band signals which were imaged to appear in-band. The scheme also greatly reduces the 1400 MHz spurious signal in L-band. This method replaces the previously planned frequency converter F15 with a much less expensive system. We expect to complete all antennas next quarter.

VLA Upgrade Prototype Front End

Development work proceeds on a front end covering the full bandwidth of the waveguide in the frequency range of 18 GHz to 26.5 GHz. The design includes three sub-band system temperature monitors for estimating atmospheric phase variations. A polarizer consisting of a waveguide phase shift section and an OMT section are under development by the Central Development Lab. Other components have been selected and ordered. Assembly will start in the first quarter of 1996.

VLA 40 - 50 GHz Receivers

The last of the 13 front ends was installed on antenna 20 this quarter in time for the 1995/1996 winter atmosphere. This installation phase of the project is complete. The division system engineer is assisting scientific staff and the E&S Division with holographic and other measurements to improve aperture efficiency with surface adjustments and subreflector positioning.

New VLA Correlator Controller

A new project plan was developed. Work on hardware and software progresses. The optical fiber link and serial I/O Subsystems will be tested in April.

VLA Antenna B-Rack Shields and Optical Fibers

Shields with optical fibers have been installed in all 28 antennas. The project is complete. However, tests indicated shielding effectiveness is about 15 dB at P-band instead of the expected 35 dB. Leakage paths will be located and corrected.

VLA T4/T5 Baseband Filter/Driver Upgrade

Investigations of poor antenna passbands resulted in the discovery of T4 baseband filter problems. Over the last 17 years, carbon composition resistors within the T4s have changed resistance as much as 50 percent and have also become reactive. All of the 115 T4 modules have been tested and repaired within the past year. Most passbands now are within 0.25 dB of the average. Some T5 driver modules are being upgraded to achieve the overall 0.25 dB passband specification.

VLA Wye Cable

A section of wye multipair cable in the vicinity of the antenna assembly building was replaced to eliminate excessive noise and leakage which impaired reliable wireline monitor and control of antennas on the west arm.

VLA Virtual Instrument Recorder (VIR)

This system is being developed to replace the eight channel Digital Data Tap which uses an eight channel Analog Recorder. The Analog Recorder has reached the end of its repairable life. This older system required engineers or technicians to travel to the VLA Site to set-up and retrieve the data. We are in the process of implementing hardware and software to provide AOC access to on-line VLA site monitoring and data recording using a graphical interface. This system will provide simultaneous multichannel and multiuser capability. It was installed at the VLA for beta testing, and should be functional next quarter.

GPS Receivers

The effort to develop a universal interface to connect any brand/model GPS receiver to the VLBA station computer without software changes encountered unexpected setbacks. The VME computer requires faster response than the interface can provide, and the Trak GPS computes GPS-station clock time offsets in a manner incompatible with the Odetics receivers. Another manufacturer has not yet delivered a compatible receiver.

VLBA Correlator

Five ASIC chips have failed since the new cooling units came online May 16, which translates to about 0.7 chips per month, compared to a rate of 2 chips per month prior to the increased cooling.

We received 861 of the 1000 new ASICs being provided by LSI Logic. Approximately 800 of these have been installed in FFT cards since 14 December. One of the new chips has failed and it failed in the first 24 hours. The remaining 139 chips were received in late December.

Problems were found and fixed in the 2K FFT Trig Table and in the Pulsar Model Tracking Firmware.

Work continues on cleaning up the Fractional Sample Time Correction serial interface to eliminate slight occasional errors that show up in system tests.

VLBA Data Acquisition and Playback

Progress has been made with the "barrel roll" problem in the formatter. A firmware fix is in place which cleared the problem in tests. Work continues to identify and fix a related firmware problem. Tests are being carried out on samples of Ampex tape, to determine if it can be used with the VLBA recording system. Two headstacks have been ordered from Penny & Giles. These will be tested to determine if Penny & Giles could be a second source of headstacks. Tests will continue to determine the highest relative humidity (RH) which avoids excessive headstack wear. Design continues on methods to deliver lower RH air to the headstack area.

VLBA Weather Stations

Nearly all site weather stations have new power supplies to improve the reliability of the TSL dew point temperature sensors. The remaining sites will have new supplies installed in January.

Interference Protection

Tests of a cellular phone (domestic public cellular radio telecommunications service) showed emissions at the second harmonic to be 1 milliwatt, which exceeds standards given in 47CFR Paragraph 22.907. Since the harmonic is in the 1150-1750 MHz band used by the VLA and VLBA, there is concern about interference from the hand-held mobile cellular radios when used in close proximity to the radio telescopes. Additional information has been requested from the Equipment Authorization Division of the FCC. Further tests are planned.

A cable between pad W8 of the VLA and the control building has been installed to permit direct monitoring of interfering signals entering the P band and L band sidelobes (73-75 MHz, 300-345 MHz, and 1155-1734 MHz) of the antenna at W8. A test performed with a time domain reflectometer shows the cable has no discontinuities. A test of cable attenuation shows the cable losses are equal to or less than design calculations. The first interference data from this system are planned to be presented at the URSI National Radio Science Meeting in January.

Problems with the AIPS reduction of VLBA monitor data taken this past summer have slowed the presentation of interference information from the VLBA sites. A second test better suited for AIPS has been executed but not yet reduced.

The frequency calibration of X and P band interference information from the VLA was found to be skewed during AIPS reduction. The reduction routine now has been modified interference plots for P band, X band, and other VLA bands are expected to join L band interference plots on the Web during the next quarter.

Computer-controlled monitoring with a scanning radio receiver and a tape recorder may have identified a frequently strong intermittent interfering source in the band 1429 - 1435 MHz. Further tests are planned to verify the findings before mitigation negotiations begin. The scanning monitoring system, now that it is fully operational, is expected to help identify interfering signal sources in P and L bands.

L. COMPUTING AND AIPS

General

The long-term outlook for computing at NRAO remains similar to that described in previous quarterly reports, with our current data reduction facilities moving towards obsolescence more rapidly than they are being replaced.

Computing security issues were significant this quarter due to break-ins which occurred in Green Bank and Charlottesville. Thanks to the efforts of various staff members, both intrusions were detected relatively early (less than 48 hours after the weekend break-in Green Bank, and about 8 hours after the intrusion in Charlottesville). The root cause of the break-ins was almost certainly due to compromise of external users' passwords, by way of password "sniffers" running at non-NRAO sites. Other, more subtle methods were also used to compromise our systems and gain root access. The steps taken to deal with the break-ins and reduce our vulnerability caused more disruption than anyone would have liked (such as delaying NRAO outgoing e-mail for about two days), and other lingering effects (such as difficulties in some types of inter-site file transfers). We have taken steps to insure that known security holes have been closed (applying various software and hardware updates at all NRAO sites, and eliminating more subtle vulnerabilities due to various types of public accounts). We are also taking steps to review our overall security posture at NRAO. The challenge is to balance the need to provide convenient access to NRAO computing facilities to our many legitimate outside users while at the same time preventing unauthorized hackers from gaining access to our systems and potentially causing serious problems. As long as our systems are available for access through the Internet, we will remain vulnerable at some level. The goal is to minimize the number of break-ins and intrusions while still providing convenient access to our user community.

During December, the remainder of 1995 RE funds were combined with unused travel funds, and amounts from various other accounts to meet several critical needs in computing at NRAO. In Charlottesville, a large amount of additional disk storage (> 30 GBytes) was purchased, to meet the needs of visiting and staff scientists, as well as to provide additional storage for results from the VLA D-Array survey. In Green Bank, three new single-user workstations were purchased, to meet needs for additional workstations in Green Bank and also help upgrade obsolete workstations. In Socorro, two high-end workstations were purchased to augment the publicly available machines in Socorro. The new machines (Sun Sparc Ultra 1 model 170e's) have an AIPS benchmark well over 6.5, making those machines the fastest workstations at NRAO, with the exception of a DEC Alpha machine on loan from Digital Equipment Corp. (NRAO remains extremely grateful to DEC for that machine!) In Tucson, a small project was undertaken to provide high speed mass storage on removable magneto-optical drives to meet the needs of 12 Meter observers.

Increasing the network bandwidth to Green Bank remains an on-going issue. Initial cost estimates are rather high, but alternative solutions are being vigorously pursued. One promising possibility would allow us to create a dedicated network among NRAO sites, including high-speed links to all the major sites, with costs only slightly above current costs.

Negotiations with the National Center for Supercomputing Applications in Illinois (NCSA) are underway to try and develop a working partnership between NCSA and NRAO. This partnership will provide high-end computing facilities to NRAO users with scientific and technical problems which are beyond present or anticipated NRAO computing facilities. If the various problems that beset remote use of computing facilities can be resolved, the facilities at NCSA will provide our users (visitors and staff) with large improvements for some scientific problems. Initially, expected uses of NCSA will include installation of AIPS for tests on certain large problems, and use of the NCSA facilities for running various finite-element modeling for the Green Bank Telescope. To date, NCSA has been extremely cooperative and encouraging, which bodes well for this effort.

VLA Archiving

The VLA re-archiving project, which reformats and copies all VLA data onto Exabyte tape, made reasonable progress. Currently, all data from 1976 through 1983 and from 1990 to present have been re-archived. Work on the 1989 data is progressing reasonably well, but has met with some delay due to poor quality nine-track tapes. We are studying alternative methods which allow faster handling of the problematic tapes we are encountering. We have made promising tests using one of the old Telex tape drives connected to a PC. The new VLA database, which is being created automatically during the re-archiving, is directly accessible via the NRAO home page and offers standard search facilities.

Visitor Support

In order to facilitate planning for scientists visiting Socorro, we have created a "Socorro Visitor's Information Package" on the Socorro, VLA, and VLBA pages of the NRAO World Wide Web site. The first item concerns a list of public workstations at the AOC in Socorro and rules and guidelines by which they are assigned to visitors. The Visitor's Registration Form asks for all the information that is needed to book a stay in Socorro, including reserving a workstation. Coming soon will be a third item in the package which will allow a prospective visitor to look at current and future workstation bookings at the AOC.

VLA Online

With the availability of 7 mm receivers at the VLA, pointing has become an important issue. The current state of reference pointing is described in "Some Issues for Q Band Observing" which is available on the web. Some improvements planned for the near future include: (a) Remove the restriction which limits pointing offset analysis to one subarray at a time. This will simplify the scheduling of pointing scans when multiple subarrays are used and allow the operations group more freedom in scheduling pointing runs. (b) Allow "second order" reference pointing . This would remove residual inter-band pointing errors that remain after correcting for the pointing offset determined at longer wavelengths. It is not clear that the increased complexity of such a procedure is warranted except in the most demanding observations. We expect to have capabilities (a) and (b) available by April of 1996.

Maintenance Software

Now that lack of funding has prevented NRAO from purchasing a commercial maintenance software product, we have started to improve and enhance our current Ingres-based version of MAINT. This is done in close collaboration with frequent MAINT users, especially those at the VLA site.

The new AIPS programming position has been filled, and the new hire will start in March, in Charlottesville. The emphasis for this position will be to support the NASA-funded space VLBI related parts of AIPS. This is especially important with the launch of VSOP due in September of this year.

The first release of AIPS under a "GNU General Public License" rather than a "user agreement" took place on August 18. The source code and full binary forms for a variety of architectures are found through anonymous ftp in directory aips/15JUL95 (and below) on the computer known as baboon.cv.nrao.edu. Since then, 154 sites have copied some or all of AIPS to their machines. Tape copies of AIPS are also available, currently without a media charge. So far 51 copies have been shipped on tape to 32 sites. To provide more information on AIPS use, and to provide data which will allow us to set priorities, a registration system has been established. Although the AIPS code is now free and mostly anonymous, help with installation and use of AIPS requires a site "registration" which is also at no charge to institutions engaging in research in astronomy. To date, 70 of the 186 non-NRAO sites have registered the 15JUL95 release, indicating that they expect to run it on 485 computers. These include 163 Sun4, 167 Solaris, 47 PC (Linux), 39 DEC Alpha, 27 HP, 20 SGI, 13 IBM, 4 DEC Ultrix, 2 Sun3, 2 PC (Linux Elf), and 1 Convex systems.

The new edition of the CookBook neared completion during the quarter. Out-of-date chapters on analysis, advanced subjects (POPS, remote use, programming), exiting, and the handling of problems were revised to reflect modern conditions and capabilities. A brand new chapter on single-dish data in AIPS was written. The new index plus the table of contents and all references to these chapters were kept current. The only chapter that has not been modernized is the Glossary, which is rather dated but still very useful. All chapters of the CookBook are made available via the World Wide Web. Users can fetch the new chapters as they are actually completed by fetching the files via the WWW (or via anonymous ftp). AIPS is at WWW URL http://www.cv.nrao.edu/aips/.

A number of changes of general interest were made. When users enter a gripe, the text is now sent by e-mail to a number of accounts. This makes the gripe system available to non-NRAO sites and should improve the reaction time to many of the gripes. The remote use of magnetic tapes and, particularly, pseudo-tape disk files caused a glaring hole in computer security which has been repaired at the cost of forcing remote sites to be registered with the site providing the remote "tape" service. Remote users of compute servers will soon be able to interact with their data using AIPS display tools running on their desktop computer using a new provision for "guest" display accounts. A "garbage collector" has been written for POPS, the user input language of AIPS. This has been needed for 25 years and not only reclaims wasted space but allows the user to pick up new system verbs, adverbs, and procedures while retaining all adverb values and procedures.

Of interest both to VLA and to VLBA, the new task CPASS determines the spectral bandpass calibration with polynomial fits rather than channel-by-channel averages. This should enhance the flexibility and signal-to-noise ratios in that calibration process. Fringe-rate imaging may now be applied to VLA data with FRMAP to find the areas of emission prior to using more standard imaging techniques. FITLD applies a correction for the correlator's saturation effect in VLBA self spectra. Serious errors in position angles plotted by PCNTR and fit by IMFIT, JMFIT, and SAD were corrected. The handling of noise and error estimates in the fitting routines was also improved.

Support for single-dish data reduction in AIPS was enhanced by a significant number of (individually) small corrections and improvements. The new task SDMOD may be used to generate model single-dish data or subtract a model from real data. OTFUV was corrected to read 12 Meter on-the-fly data on all computer architectures.

M. AIPS++

In Single Dish processing, the Charlottesville-based group continues to work closely with the GBT on providing AIPS++ software for single dish processing. The most important goal is to allow use of AIPS++ single dish data analysis

processing by a first user on the NRAO 140 Foot Telescope in June 1996. In addition, the ATNF has decided to use AIPS++ to support an HI survey using a 13-feed multi-beam system on the Parkes telescope, scheduled for August 1996.

We have developed an extension to Glish, called Glishtk, that allows construction of a Tk-widget based GUI from inside Glish. It gives the ability to design and implement a GUI from the Glish command line and has led to a design for the AIPS++ GUI. This design will be implemented over the next few months using Glishtk and the Tasking classes.

Excellent progress has been made on designing and implementing the Measures Classes. All of the system, apart from high-precision VLBI support, should be available by April 1996. Much of the coding has been done now, but a redesign of the interface is underway partly in response to comments by others and partly as a result of experience in implementing the classes.

A design and implementation for synthesis calibration and imaging based upon the Measurement Equation for a Generic Interferometer has been developed. Development is proceeding on various fronts. One important goal will be to allow support of the commissioning of the new WSRT on-line control system, TMS, expected to commence in August 1996. Another is an early test of the AIPS++ GUI mentioned above by implementing a general imaging and self-calibration task. This will be made available to users for testing and use.

In Visualization and Image Analysis, the NCSA group has worked on the graphics capabilities in AIPS++. Currently for the GBT tests, we use a Glish client, gplot1d, that calls a commercial widget, Xrt/Graph. A tentative plan was to replace this at some point with classes developed at Fermilab. A better option is to instead use a Motif-based widget for the Caltech PGPLOT library that is widely used in Astronomy.

In Infrastructure, the Table system continues to evolve and grow towards completion. A modification of the Table system was agreed to, designed, and implemented, all within a few weeks. Similar changes to the AIPS++ library are expected to occur repeatedly in the future as applications needs come to drive the Project.

In Documentation, we have resolved our staffing problem mentioned in the last Quarterly report, and a large number of changes are now in progress. AIPS++ has adopted the Free Software Foundation's gnats program to track bug reports and change requests.

In the System area, we have implemented automated testing whereby the entire test suite is run weekly and the results monitored. The goal is to catch problems with the Library early on. We are now working towards rectifying existing problems. We have also implemented registration of template specializations, and are in the process of implementing shared libraries, something that will be vital to reduce the typical size of executables.

In Management, a major push was made during the last quarter to formulate development plans for various key areas of the Project. A development plan is essentially a detailed time-line with deliverables, responsibilities and requirements on other parts of the Project all laid out clearly. This is a vital discipline for a project as diverse and complex as AIPS++, serving not only to aid in management but also in ensuring that all members of the Project are aware of goals and activities. We also implemented a formal scheme for managing substantial changes to the system, involving a proposal, request for comments, and decision date.

N. GREEN BANK TELESCOPE PROJECT

Antenna

Construction activity has moved ahead at the Green Bank Telescope site over the last quarter, although at a slightly slower pace owing to a couple of factors. First, the derrick crane went out of service in October due to a broken sheave (pulley wheel around which the cable is wrapped). This was not an easy fix for COMSAT RSI, which involved engineering design, special parts order and significant disassembly/installation/re-assembly effort over about two months. Fortunately, work was able to proceed using the traveling cranes on the ground. More recently, the second factor affecting progress has been the Green Bank winter weather.

In spite of these hindrances, obvious progress has been accomplished. On the structure, the elevation wheel has been completed and sixteen counterweight boxes (out of 22 total) have been installed on the wheel. The boxes are approximately 14 ft x 8 ft x 8 ft and weigh about 25,000 pounds each empty, so installation is not trivial. Ultimately, the boxes will be filled with concrete to counterbalance the structure with a weight of approximately 2 million pounds. Also, the front center truss of the rotating box has been put into place, following completion of the rotating box trial erection on the ground. All eight elevation gear reducers have been installed. All access lighting on the alidade is now in place and working. In addition, the lower elevation cable wrap junction box has been installed and the cables have been pulled from level one.

On the ground, work has continued on the back-up structure (BUS) trial erection. The R_0 truss (center truss) from hoop 15 to 33 is in place. The R_{1R} and R_{1L} (ribs 1 right and 1 left of center) trusses are in place from hoop 27 to 33, and R_{2R} and R_{2L} are in place from hoop 15 to 33. For reference, there are 57 ribs total (the center rib plus 28 right and left). This is a major part of the current site work and will continue into the summer. Disassembly of the BUS and installation on the structure is scheduled for next fall. And, eight concrete foundation pads have been built to support the trial erection of the upper feed arm scheduled for next quarter.

Fabrication and assembly of the subreflector (an ellipsoid 7.55 m x 7.95 m) is proceeding at COMSAT RSI's Sterling, Virginia plant. Twenty-eight of the 40 panels have been fabricated and measured and are being installed on the subreflector back-up structure. The assembled unit is scheduled to be shipped to Green Bank in February. In addition, fabrication, measuring and painting of the 2,000 main reflector panels continues at Sterling. At the Dallas plant, the GBT feed arm servo hardware is undergoing system integration. The system will be ready for in-house tests in late January and shipment to the site in February.

The next quarter promises to be exciting as the box structure and horizontal feed arm erection continues, the trial erection of the back-up structure progresses, and the marriage of the upper feed arm, subreflector and servo system occurs.

Open Loop Active Surface

Most of the software work this period centered around the Intelligent I/O Processors (IIOP's). A second IIOP interface has been added to the VME chassis. The software in the slave has been modified to work with an array of IIOP's. The detailed configuration of the system has been defined and programmed into the system. Several control modules were integrated into the system to test the IIOP code with real hardware. In addition, test code was enhanced to test these modifications. The enhancement is now fully tested.

Some timing tests of the enhanced slave code (handling 25 percent of the actuators) were done. The maximum time through 560 position loops is 5.2ms, or an average of 9.2μs per axis. The longest RPC service call takes almost 19ms.

Two printed circuit boards, power supply peak detector, and room temperature monitor have both been calibrated and installed in the control chassis.

NRAO has received the op-amps required for our LVDT temperature monitor circuit. A prototype has been built, and we are in the process of evaluating the circuit. The purpose of this circuit is to use the DC resistance of LVDT's as an indication of temperature.

Closed Loop Active Surface

140 Foot Telescope Demonstration

The first experiments using laser ZP10 (the best unit) on the 140 Foot Telescope monuments revealed a pointing problem. After checking the calibration procedures, data entries and calculations, and trying the system on various monuments, we went back to the calibration lab and started checking the mirror mechanics. Autocollimator measurements identified two errors in the mirror system. The encoders showed a maximum error of about 50 counts in 180 degrees. The forks on the elevation assembly of two units that were inspected showed them to be off axis by 45-60 seconds.

The laser mirror pointing problems have been traced to the encoders. ZP10 has been modified to use ROD 500 encoders, and this unit will be calibrated and tested during early December. Problems with the two axes not being orthogonal have been traced to the bearing retainer rings. This is a much simpler problem than errors in the milling of the fork as originally feared. A temporary cover has been placed over the four monuments in order to leave the instruments in place. The model of the 140 Foot Telescope motions will be a priority in December. Software development effort is being exclusively dedicated to a ZIY program for the 140 Foot Telescope demonstration.

Panel Setting Tool

The tool was demonstrated to COMSAT RSI. Modifications and suggestions are being incorporated into the software and hardware. Effort is underway to correct the distance readings for tilt on the dish and field calibration procedures. Measurements are being made to determine if the instrument can be used as a check on the tilt of the actuators.

Software

Problems with the Bancom IRIG interrupt service routine have been resolved. Version 1.41 of the ZY program was released and is being tested. This version includes a number of changes in the pointing calibration algorithms, IRIG time sync, moving target tracking, and sets a standard for device memory, I/O locations, interrupt levels, and DMA channels. A prototype ZIY program is being developed to run the 140 Foot Telescope experiment. Plans are also being developed to attempt to interface to the GBT weather station.

Servo

Presently, the feed arm servo hardware is undergoing system integration, and will be ready for in-house tests early in 1996. A revised Factory Test Procedure has been received and is being reviewed.

NRAO is defining several operational scenarios involving the servo and developing a best guess of the detailed procedure required to effect the scenario. Following contractor reviews, the procedures will then be run in conjunction with the factory test.

Work is also continuing on the interface between the NRAO monitor and control system and the servo system. Code is being developed in-house and tested against a simulator.

Electronics

Prime Focus Receiver

The design of Dewar #2 is in progress. A model of the dewar was placed in the FE Box to determine the size, spacing and mounting. The cryogenic refrigerator has been selected and ordered. Shop drawings for construction of the dewar are underway. Investigation into what components are required for Band #5 has been started. In addition, a study of what kind of IF cables are required for the prime focus IF cable started, as well as how cables from prime focus FX to the receiver room should be installed at the receiver room cable entrance panel.

Prime Focus Temperature Controllers

The control circuit for the GBT temperature controller was redesigned to eliminate the pulse transformers and the RCA zero-crossing semiconductor. Instead, a motorola zero-crossing SCR driver is used. This chip simplifies the design. Fabrication of two of these models will begin next month. The circuit board for the control circuit and the digital control was drawn on AUTOCAD and a negative is being made. The fabrication and testing of these circuits should be completed next summer.

Analog/Sampler/Filter Modules

The drawings for the driver board used in 1.6 GHz Sampler Filter and 100 MHz Converter/Filter modules were completed and are now being fabricated by an outside shop. Also, the drawings for the 100 MHz converter/filter module were completed and are now being fabricated in-house. The analog filter rack wiring diagrams were begun.

The SQL detector video amp and 4-way divider/amplifier modules for new Converter modules have been built. Also, fabrication of the semi-rigid cables for the new Converter modules have been started.

Construction of the MCB interface module for the Analog Rack is finished. Also, we tested the MCB interface modules for Converter Rack B, and Analog Rack and started construction of a third MCB interface module.

The 1.6 GHz Sampler Filter module prototypes units were constructed, tested and evaluated.

Converter Rack A for output spur tests using the 140 Foot Telescope spectral processor has been set up.

Switching Signals

We are in the process of entering the first logic card into Or Cad to control the data flow of the multiplexed digital signals.

Spectrometer

During the period the back planes for the digital rack were received from the wire wrap company. Some of the wire wrap work on these back planes was not acceptable and will require some re-work. The main problem was a failure to anticipate that the large number of wire wrap coax cables would cover up some of the connectors. NRAO has also received and tested all of the wire wrap control cards with the exception of the LTA.

More than half of the multi-layer correlators cards have been tested. All of the correlator chips received so far from the last wafer run have now been installed into these correlator cards. No correlator chip failures were encountered during the correlator card testing. Three memory cards have been tested so far. Both spectrometer racks have been constructed and back plane installation and power wiring was started.

LO Reference Distribution System

Additional rework of the new RTPM was necessary to make it electrically compatible with OVLBI's RTPM. The rework, testing, and installation was completed this quarter.

X-Band Receiver

The new refrigerator was installed and the system was cooled. The receiver's SIB failed on 11/14/95, possibly caused by a water leak. The SIB was replaced in late November, but the 15 K and the 50 K monitors are not reading correctly (30 K and 58 K, respectively). The voltages going into the MCB interface are acceptable. The investigation will continue until the problem is solved.

K-Band Receiver

The new cold cathode gauge tube remote monitor was wired into the MCB interface so that data can be logged. The software will be modified as needed to scale the data properly. Also, during the B638 observing program, an instability in the receiver hardware was identified. The 300 K receiver components were taken to the lab and the unstable behavior was duplicated. The problem appears to be due to broken coax cables (aluminum). This testing will continue until the issue is resolved.

Similar to the X-band MCB problem, the 15 K and 50 K monitors are reading 25 and 60 K. The voltages here also are acceptable as they enter the MCB box. A new LO scheme that will make the use of frequency switching more effective in removing receiver instabilities was developed.

S-Band Receiver

Electrical design of the S-band receiver began this period.

L-Band Receiver

Work on the L-Band receiver continued including revision of OMT drawings and mechanical drawings.

Cryogenic GBT Activities

K-band: A problem was discovered with the cold cathode tube not reading. The controller was tested and found broken. The replacement tested OK.

X-band: The refrigerator was removed while cold. The displacers were found frozen to the cylinder walls, indicating water vapor was present. The entire system was evacuated (compressor and helium lines) and recharged and the charcoal trap was replaced. Further, a leak in the compressor was found and fixed.

Monitor and Control

The end of this period saw the release of a new version of the GBT monitor and control software at the 140 Foot Telescope. Release 2.0 includes the registries which are used for logging monitor information and the spectral processor. This release has a number of characteristics about it that make it, for the first time, mature enough for release to outside users. First, it is the first release of the Spectral Processor with no interim code and the list of enhancements and bugs fixes is completed. Second, the release was linked to the latest versions of the libraries, so it has important functionality such as the use of the message system which provides the sending of all messages from all processes to one user window, independent files for representing each GUI window in the console, compatibility with Glish 2.5.0.6d, the first use of config files for storing equipment setup information between invocations, the ability to start or restart processes or computers in any order, and all Sun processes run on Solaris.

Concerning antenna control a general finite state machine library was implemented in order to emulate actual states of hardware devices associated with the GBT during simulation. This library was used to code multiple state machines with interdependencies in the A140 program. The A140 program serves two functions. First, it is a GBT-to-140 Honeywell-316 protocol converter for use on the 140 Foot Telescope, and second it is used as a testbed for M&C antenna development. Also, the depth of control of the antenna was expanded to include stow/unstow, receiver selection, and optics mode selection.

Work continued on the analysis of the Gregorian focus tracking algorithm, which combines the results from the structural model, best-fitting paraboloid and ellipsoid analyses to produce the required trajectory of the subreflector mounting as a function of elevation angle.

Work on the updates for the receiver software continues: the enhancement for switching signals is finished and work continues on the registries and porting the work done on the X-band receiver to K- and Ku-band receivers. Work on the console rewrite began again as the receivers neared completion.

Work was completed for allowing Glish scripts to access telescope monitor points, and work has started and is near completion for a new Spectral Processor data monitor based on PV-Wave for displaying intensity plots of pulsar data as they are generated.

Work continued on coordination of prime focus, subreflector, feed boom turret and main dish. A focus-tracking module was added, which is the beginnings of the actual focus tracking module (algorithms based on the structural model are not yet included, just the control architecture). In preparation for testing, a SCCU network interface manual is being prepared to document, in detail, the meaning of the status information reported by the SCCU.

Data Analysis

The AIPS++ single-dish data analysis development for the GBT continued. A draft of a "AIPS++ Single Dish Development Plan" document was completed and released to the AIPS++/GBT Working Group for comment. The plan includes target dates for development milestones spanning the next eight months. It also attempts to define a minimal requirement set for a functional single-dish analysis package that could be released for trial use to 140 Foot Telescope observers. This draft is under review.

A small prototype GUI interface to Glish is nearing release for trials. This utilizes a public domain library, Tk widgets, as building blocks for the GUI. A GUI for the "gbtlogfiller" is expected soon as a demonstration tool and for trials.

A proposal for a unified Help system for use in conjuction with Glish functions is being prepared.

O. PERSONNEL

New Hires

J. Wiseman	Research Associate	October 1, 1995
J. Ford	Electronic Engineer I	October 1, 1995
X. Yang	Assistant Scientist - Research Support	November 13, 1995
J. Mangum	Assistant Scientist - Tucson Operations	December 13, 1995

Terminations

J. Higdon	Research Associate	October 18, 1995
C. Chandler	Research Associate	November 16, 1995
G. Fuller	Research Associate	November 30, 1995
P. Jewell	Scientist - Tucson Operations	December 31, 1995

Change in Title

A. Beasley	to Assistant Scientist - Socorro Operations	October 1, 1995

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