NATIONAL RADIO ASTRONOMY OBSERVATORY

Quarterly Report

April 1, 1993 - June 30, 1993

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A. TELESCOPE USAGE

NRAO telescopes have been scheduled for research and maintenance in the following manner during the second quarter of 1993.

	140 Foot	12 Meter	VLA
Scheduled observing (hrs)	1946.25	1973.75	1707.2
Scheduled maintenance and equipment changes	150.25	21.25	240.5
Scheduled tests and calibrations	87.50	189.00	243.9
Time lost	76.50	162.75	71.7
Actual observing	1869.75	1811.00	1635.5

B. 140 FOOT TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B601	Bell, M. (Herzberg) Avery, L. (Herzberg) Watson, J. (Herzberg) MacLeod, J. (Herzberg)	Measurements at 18-24 GHz of MgNC hyperfine structure in TMC-1 and a search for MgNC, NaNC, KNC, CaNC in space.
C280	Codella, C. (Univ. Di Firenze) Felli, M. (Arcetri)	Three centimeter hydrogen radio recombination line observations of SFR's with H_2O masers.
H289	Heiles, C. (Calif., Berkeley) Levenson, N. (Calif., Berkeley) Reach, W. (NASA/GSFC) Koo, B-C. (Seoul National Univ.)	Twenty-one centimeter test observations of the warm ionized medium.
L271	Lockman, F. J. Savage, B. (Wisconsin)	A search at 1420.4 MHz for high-velocity HI toward QSOs.
L280	Lockman, F. J. Savage, B. (Wisconsin)	Search at 1420 MHz for high-velocity HI toward QSOs.
L283	Lo, K. Y. (Illinois) Norton, L. (Illinois)	Measurements at 1.42 GHz of the HI flux of dwarf irregular galaxies.
M347	Magnani, L. (Georgia) La Rosa, T. (NRC/MSFC) Shore, S. (GHRS/NASA)	A search at 4.83 GHz for correlated velocity structure in MBM 55 and L134N.

No.	Observer(s)	Program
M362	McKinnon, M.	Test of the instrumental polarization of telescope and operation of the spectral processor polarization observing mode at 1.6 GHz.
M365	Menten, K. (CFA)	A search for NH_2CH_2CN at 9072 MHz.
R251	Roberts, M. Hogg, D.	A search at 1420 MHz for HI in the SO galaxy NGC 3115.
T293	Turner, B. Rickard, L. J (NRL) Lanping, X. (Beijing)	A study of 2 cm H_2CO in low-latitude molecular clouds.
T313	Tifft, W. (Arizona)	A fundamental test at 1420 MHz for redshift variability.
T321	Turner, B.	Observations at 23.7 GHz of NH_3, C_3H_2, and HC_3N in Clemens-Barvainis objects.
T323	Thuan, T. (Virginia) Lipovetsky, V. (Spec. Astrophys. Obs., Russia) Pustilnik, S. (Spec. Astrophys. Obs., Russia)	1420 MHz HI content of a sampling of blue compact dwarf galaxies from the second Byurakan Survey.
T327	Thuan, T. (Virginia) Fouque, P. (Meudon) Schneider, S. (Massachusetts)	A 21 cm redshift survey of southern dwarf galaxies in ESO catalog.
T328	Turner, B.	Six centimeter H_2CO mapping of Clemens-Barvainis objects.
W280	Wootten, H. A.	Monitoring of H_2O masers in star-forming cores in Rho Oph.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
B550	Backer, D. (Calif., Berkeley) Sallmen, S. (Calif., Berkeley) Foster, R. (NRL)	Measurements at 800 and 1400 MHz of the timing of an array of pulsars.
B559	Biggs, J. (Curtin Univ., Australia) Salter, C. (NAIC) Foster, R. (NRL)	Observations at 1420 MHz to monitor pulsar HI absorption spectra.
S356	Biggs, J. (Curtin Univ., Australia) Salter, C. (NAIC) Foster, R. (NRL)	1420 MHz HI absorption observations of a complete sample of pulsars.

No.	Observer(s)	Program
T302	Taylor, J. (Princeton) Nice, D. (Princeton) Thorsett, S. (Caltech) Arzoumanian, Z. (Princeton) Shrauner, J. (Princeton) Wan, L. (Princeton) Sayer, R. (Princeton) Camilo, F. (Princeton)	Pulsar timing observations over the range 780-820 and 1300-1350 MHz.

C. 12 METER TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B556	Brown, R.	Study of CO in HI absorption cloud toward 3C 196.
B585	Balonek, T. (Colgate) Dent, W. (Massachusetts)	Study of the evolution of extragalactic radio sources at millimeter wavelengths.
B591	Baath, L. (Chalmers/Onsala) Wright, M. (Calif., Berkeley) Rogers, A. (Haystack) Emerson, D. Jewell, P.	Millimeter VLBI observations of compact radio sources.
B593	Buhl, D. (NASA/GSFC) Goldstein, J. (NASM) Chin, G. (NASA/GSFC)	Study of global winds in the mesosphere of Venus.
B594	Barnes, P. (CFA)	A search for CO emission from the Pluto-Charon system.
B596	Brown, R. Vanden Bout, P.	Study of CO emission in the IRAS F10214+4724.
B597	Bergin, E. (Massachusetts) Goldsmith, P. (Massachusetts) Snell, R. (Massachusetts) Ungerechts, H. (Massachusetts)	Study of the chemical structure and star formation in dense interstellar clouds.
B598	Black, J. (Arizona) Walker, C. (Texas) Bechtold, J. (Arizona) Aalto, S. (Chalmers/Onsala)	A search for CO and C at a redshift of $z \geq 2$.
B599	Burton, W. B. (Leiden) Liszt, H.	Study of inner-galaxy molecular gas distribution.

No.	Observer(s)	Program
B604	Burton, W. B. (Leiden)	Measurement of the CO in a cirrus cloud studied previously with extensive HI data.
C276	Clancy, R. T. (Colorado) Muhleman, D. (Caltech)	Study of microwave spectroscopy of the terrestrial planetary atmospheres.
C281	Carey, S. (RPI) Mead, K. (Union College) Kutner, M. (RPI)	A detailed investigation of the physical properties of arm and interarm clouds in the outer galaxy.
D179	Dickey, J. (Minnesota) Casoli, F. (Paris Obs.) Combes, F. (Paris Obs.) Kazes, I. (Paris Obs.)	Study of the turn-around radius of the Coma Cluster.
H284	Helfer, T. (Maryland) Blitz, L. (Maryland)	Study of the dense gas in galactic GMCs and in external galaxies.
H285	Hughes, D. (Oxford) Dunlop, J. (Liverpool)	Are the cores of lobe-dominated quasars the same as radio-quiet quasars?
K337	Kobulnicky, H. (Minnesota) Dickey, J. (Minnesota) Garwood, R.	Study of CO emission/absorption in the inner galaxy.
L279	Latter, W. Jewell, P.	A spectral bandscan of IRC+10216 in the 1.2 mm window.
L282	Lubowich, D. (Hofstra) Pasachoff, J. (Williams College)	Does deuterium exist in the galactic center?
L285	Liszt, H. Lucas, R. (IRAM)	CO absorption studies of BL Lac.
M350	Mizuno, D. (RPI) Kutner, M. (RPI) Verter, F. (NASA/GSFC)	Study of the response of GMCs in M31 to the spiral shock.
M363	Mangum, J. (Arizona) Martin, R. (Arizona)	Study of kinetic temperature in galactic nuclei.
M364	Mangum, J. (Arizona) Latter, W.	A derivation of the physical conditions in the Serpens molecular cloud.
R253	Rogers, C. (DRAO) Dewdney, P. (DRAO) Fich, M. (Waterloo Univ.)	A differential comparison of H_2 + CO photo-dissociation regions.

No.	Observer(s)	Program
R256	Radford, S. (IRAM) Solomon, P. (SUNY, Stony Brook) Downes, D. (IRAM)	Study of CO (3-2) in the primeval galaxy IRAS 10214+4724.
S357	Steffes, P. (Georgia Tech) DeBoer, D. (Georgia Tech)	A SETI search of nearby solar-type stars at the 203 GHz positronium hyperfine resonance.
S358	Salter, C. (NAIC) Sinha, R. (TIFR) Emerson, D. Jewell, P. Kerr, F. (Maryland)	Continuum observations of the galactic center at $\lambda 3$ mm.
S362	Sanders, D. (Hawaii) Mazzarella, J. (Caltech) Graham, J. (Calif., Berkeley) Chambers, K. (Hawaii)	CO observations of $1 < Z < 4$ radio galaxies.
S364	Snyder, L. (Illinois) Miao, Y. (Illinois) Kuan, Y. (Illinois)	A study of ethyl cyanide in Sgr B2.
S367	Sahai, R. (Chalmers/Onsala) Wootten, H. A. Wild, W. (ESO) Schwartz, H. (ESO)	Study of molecular lines in the compact planetary M1-16.
T310	Turner, B. Steimle, T. (Arizona State)	A confirmation of silylene (SiH_2) in IRC 10216.
T315	Turner, B.	Survey of SO^+ in warm molecular clouds as a diagnostic of dissociative shock chemistry.
T322	Turner, B.	A confirmation of some singly deuterated complex molecules.
T326	Thornley, M. (Maryland) Wilson, C. (McMaster Univ.)	Study of the molecular gas content of NGC 2403.
W330	Womack, M. (N. Arizona Univ.)	Interstellar ionization studies through observation of HCO^+ isotopes.
W331	Wilson, C. (McMaster Univ.) Walker, C. (Texas) Thornley, M. (Maryland)	Observations of the HII region NGC 595 in M33.

No.	Observer(s)	Program
Y12	Yamamoto, S. (Nagoya Univ.) Saito, S. (Nagoya Univ.) Ohishi, M. (Nobeyama) Irvine, W. (Massachusetts) McGonagle, D. (Massachusetts)	Search for interstellar CH_2N.
Z102	Ziurys, L. (Arizona State) Apponi, A. (Arizona State) Barclay, W. (Arizona State) Anderson, M. (Arizona State)	A search for interstellar CaH.
Z106	Ziurys, L. (Arizona State) Allen, M. (Arizona State) Apponi, A. (Arizona State)	A search for interstellar MgF and CaF.

D. VERY LARGE ARRAY

The second quarter was spent in the following configurations: B configuration from April 1 to May 10; CnB configuration from May 10 to June 7; and B configuration from June 7 to June 30.

No.	Observer(s)	Program
AA123	Andre, P. (CNRS, France) Feigelson, E. (Penn State) Leous, J. (Penn State) Montmerle, T. (CNRS, France)	Monitoring the polarization from the magnetic star S1 in the p-Oph cloud.
AA150	Alexander, P. (Cambridge) Leahy, J. (Manchester) Eales, S. (Toronto) Rawlings, S. (Oxford) Allington-Smith, J. (Durham)	Survey of DRAGNs at high redshift. 20 cm
AA155	Athreya, R. (TIFR) Kapahi, V. (TIFR) Subrahmanya, C. (TIFR) van Breugel, W. (LLNL) McCarthy, P. (Carnegie)	High-redshift radio galaxies from Molonglo 1 Jy sample. 6 cm
AA157	Afflerbach, A. (Wisconsin) Churchwell, E. (Wisconsin)	H109α emission toward selected UC HII regions. 6 cm line
AB414	Becker, R. (Calif., Davis) White, R. (STScI)	Monitoring radio stars HD193793 and P Cygni. 2, 6 cm
AB456	Burke, B. (MIT) Hewitt, J. (MIT) Roberts, D. (Brandeis)	Monitoring 0957+561 A,B. 6 cm

No.	Observer(s)	Program
AB628	Becker, R. (Calif., Davis) Helfand, D. (Columbia) White, R. (STScI)	Survey of the north galactic cap. 20 cm
AB633	Burns, J. (New Mexico State) Perley, R. Gisler, G. (Los Alamos)	Imaging the cluster radio halo in Abell 2255. 90 cm
AB665	Brown, A. (Colorado) Bromage, G. (Rutherford-Appleton Lab) Ambruster, C. (Villanova)	Monitoring HD197890 (Speedy Mic) during ROSAT observation. 3.6, 6, 20 cm
AB669	Bookbinder, J. (CFA) Guedel, M. (Colorado) Saar, S. (CFA)	M dwarfs during ROSAT observations. 2, 3.6, 6, 20 cm
AB673	Baudry, A. (Bordeaux) Menten, K. (CFA)	High-excitation OH lines in W3(OH). 1.3 cm line
AB676	Baum, S. (STScI) O'Dea, C. (STScI) Gallimore, J. (Maryland)	Superwinds in edge-on Seyferts. 6 cm
AB681	Brown, A. (Colorado) Butler, J. (Armagh Obs.) Linsky, J. (Colorado) Guedel, M. (Colorado) Ambruster, C. (Villanova)	Flare stars Gl 867 A and B. 3.6, 6, 20 cm
AC316	Carilli, C. Owen, F. Harris, D. (CFA)	Polarimetric imaging of two high-redshift radio galaxies. 3.6, 6, 20 cm
AC331	Cordes, J. (Cornell) Hankins, T. (NMIMT) Moffett, D. (NMIMT) Romani, R. (Stanford)	Polarization of two southern gamma-ray pulsars. 6, 20 cm
AC337	Clancy, R. T. (Colorado) Grossman, A. (Maryland) Muhleman, D. (Caltech)	Mapping seasonal variations of Mars water vapor. 1.3 cm line
AC343	Carignan, C. (Montreal) Freeman, K. (Mt. Stromlo)	HI kinematics of LSB spirals NGC 24 and NGC 45. 20 cm line
AC345	Condon, J. Helou, G. (IPAC) Sanders, D. (Hawaii) Soifer, B. (Caltech)	The extended IRAS bright galaxy sample. 20 cm

No.	Observer(s)	Program
AC347	Cordes, J. (Cornell) Lundgren, S. (Cornell) Romani, R. (Stanford)	A ram-pressure driven pulsar nebula. 6, 20 cm
AC348	Carilli, C. Westpfahl, D. (NMIMT) Tongue, T. (NMIMT) Holdaway, M. Zhao, J.-H. Rupen, M.	Polarimetry of barred spiral NGC 1365. 6, 20, 90 cm
AC349	Camilo, F. (Princeton) Arzoumanian, Z. (Princeton) Nice, D. (Princeton) Taylor, J. (Princeton)	Search for a companion pulsar to PSR B2303+46. 90 cm
AC351	Caganoff, S. (Melbourne) Tsvetanov, Z. (Johns Hopkins)	Radio morphology and extended emission line region in Seyfert galaxies. 6 cm
AC354	Clancy, R. T. (Colorado) Grossman, A. (Maryland) Muhleman, D. (Caltech)	Mapping seasonal variations of Mars water vapor. 1.3 cm line
AC357	Cox, A. (Wisconsin) Sparke, L. (Wisconsin) van Moorsel, G. Sackett, P. (Princeton)	High-resolution neutral hydrogen observations of polar-ring galaxies. 20 cm line
AC360	Carlstrom, J. (Caltech) Phillips, T. (Caltech) Hills, R. (Cambridge) Lay, O. (Cambridge) Menten, K. (CFA)	321 and 22 GHz water masers. 1.3 cm line
AD279	Dickel, J. (Illinois) Mufson, S. (Indiana) Wood, C. (Indiana)	High-resolution polarimetry of the SNR Kesteven 69. 6 cm
AD298	Dwarakanath, K. Rupen, M.	Steep-spectrum sources. 3.6, 6, 20, 90 cm
AD301	Drake, S. (NASA/GSFC) White, N. (NASA/GSFC) Linsky, J. (Colorado) Dempsey, R. (Colorado) Simon, T. (Hawaii)	RS CVn binary stars in support of ROSAT observations. 3.6, 20 cm
AD304	Dahlem, M. (STScI)	Star-forming regions in the inner disk of NGC 1792. 20 cm

No.	Observer(s)	Program
AD306	Dwarakanath, K.	Search for recombination lines from the warm ionized medium. 90 cm line
AD308	DePree, C. (North Carolina) Rupen, M. Carilli, C.	Search for synchrotron halos of edge-on galaxies. 90 cm
AD309	Dwarakanath, K. Bagri, D.	Small-scale polarization structure in the diffuse galactic emission. 90 cm
AD313	Dickey, J. (Minnesota)	Orbiting cores in the Hercules cluster. 20 cm line
AD314	Doyle, L. (NASA/Ames) Vikramsingh, R. (NASA/Ames)	Stellar mass loss in young sun-type stars. 1.3, 2, 3.5, 6, 20 cm
AD315	Duric, N. (New Mexico) Goss, W. M. Viallefond, F. (Meudon) Lacey, C. (New Mexico) Gordon, S. (CFA)	Survey of SNRs in nine nearby galaxies. 6 cm line
AD316	Dubner, G. (IAFE, Buenos Aires) Giacani, E. (IAFE, Buenos Aires) Goss, W. M. Winkler, F. (Middlebury)	Four small-diameter galactic SNRs. 20, 90 cm
AD317	Dahlem, M. (STScI) Bomans, D. (Bonn)	Peculiar gas kinematics in NGC 1792. 20 cm line
AD320	Drake, S. (NASA/GSFC) Bookbinder, J. (CFA) Linsky, J. (Colorado)	A survey of the "non-magnetic" CP stars. 3.6 cm
AD321	de Pater, I. (Calif., Berkeley) Grossman, A. (Maryland)	Jupiter - south equatorial belt activity. 2 cm
AE092	Eder, J. (NAIC)	HI in the gas-rich SO galaxy NGC 252. 20 cm line
AF227	Fey, A. (NRL) Gaume, R. (NRL) Claussen, M. Nedoluha, G. (NRL) Johnston, K. (NRL)	"Cometary" HII regions. 6 cm
AF241	Feretti, L. (CNR, Bologna) Andernach, H. (IAP, Canarias) Giovannini, G. (CNR, Bologna) Perley, R.	Jets in 3C 31 and 3C 449. 3.6, 6, 20 cm

No.	Observer(s)	Program
AF245	Frail, D. Kulkarni, S. (Caltech) Yusef-Zadeh, F. (Northwestern)	Determining the proper motions of non-thermal cometary nebulae. 3.6 cm
AF247	Fruchter, A. (Calif., Berkeley) Thorsett, S. (Caltech) Goss, W. M.	Survey for continuum radiation from two rich globular clusters. 20 cm
AF249	Frail, D. Whiteoak, J. (Sydney) Goss, W. M.	Radio imaging around young pulsars. 20, 90 cm
AF250	Fruchter, A. (Calif., Berkeley) Thorsett, S. (Caltech)	Timing observations of the eclipsing pulsar PSR B1718-19. 20 cm
AG340	Goss, W. M. Wood, D.	Sickle (G0.18-0.04) and Pistol (G0.15-0.05). 3.6 cm line
AG343	Giovannini, G. (CNR, Bologna) Feretti, L. (CNR, Bologna) Boehringer, H. (MPIfEP, Garching) Schwarz, R. (MPIfEP, Garching)	Halo sources in A2255 and A2319. 20, 90 cm
AG344	Giovannini, G. (CNR, Bologna) Feretti, L. (CNR, Bologna) Boehringer, H. (MPIfEP, Garching) Schwarz, R. (MPIfEP, Garching)	Cluster radio halo candidates. 20, 90 cm
AG363	Greenhill, L. (CFA)	Continuum emission associated with the IC 10 water megamaser. 1.3 cm
AG372	Grossman, A. (Maryland) Muhleman, D. (Caltech)	Saturn's atmosphere. 3.5, 6 cm
AG378	Gwinn, C. (Calif., Santa Barbara) McKinnon, M. Desai, K. (Calif., Santa Barbara)	Scatter broadening of pulses from young pulsars. 20, 90 cm
AG379	Gopalswamy, N. (Maryland) Schmahl, E. (Maryland) Kundu, M. (Maryland) Sawant, H. (BSA-INPE)	Radio microbursts. 20, 90 cm
AG383	Goss, W. M. Slysh, V. (IKI, Moscow) Frail, D.	OH(1720 MHz) near the SNR W28. 18 cm line

No.	Observer(s)	Program
AH390	Hjellming, R. Gehrz, R. (Minnesota) Taylor, A. (Calgary) Seaquist, E. (Toronto)	Monitoring radio novae. 3.6, 6, 20 cm
AH437	Hewitt, J. (MIT) Turner, E. (Princeton) Chen, G. (MIT) Angelus, A. (MIT)	Monitoring the "Einstein Ring" gravitation lens MG1131+0456. 3.5, 6 cm
AH478	Hewitt, J. (MIT) Ellithorpe, J. (MIT) Moore, C. (MIT) Turner, E. (Princeton)	Monitoring gravitational lens MG0414+0534. 2 cm
AH481	Habbal, S. (CFA) Esser, R. (CFA) Karovska, M. (CFA) Gonzalez, R. (CFA)	Source region of the solar wind--observations with SPARTAN 201. 3.6, 6, 20 cm
AH482	Hughes, V. (Queens) Ungerechts, H. (Massachusetts)	An anomalous galactic feature at l=80. 3.6 cm
AH483	Hofner, P. (Wisconsin) Cesaroni, R. (Arcetri) Churchwell, E. (Wisconsin) Kurtz, S. (Wisconsin) Walmsley, C. (MPIR, Bonn)	Hot ammonia toward ultracompact HII regions. 1.3 cm line
AH485	Hankins, T. (NMIMT) Moffett, D. (NMIMT)	Crab pulsar "giant pulses." 3.6, 6, 20 cm
AH488	Henning, P. (NFRA) Mulchaey, J. (Maryland) Davis, D. (NASA/GSFC) Keel, W. (Alabama) Condon, J.	Galaxy-intragroup medium interactions as revealed by HI. 20 cm line
AH491	Hutchings, J. (DRAO) Eales, S. (Toronto) Myers, S. (Caltech) Gower, A. (Victoria)	X-ray luminous clusters at redshift 0.2 to 0.4. 6, 20 cm
AH492	Hjellming, R. Gehrz, R. (Minnesota) Seaquist, E. (Toronto) Taylor, A. (Calgary)	Image and light curve evolution of the novae Puppis 1991 and Cygni 1992. 1.3, 2, 3.6, 6, 20 cm

No.	Observer(s)	Program
AH493	Holdaway, M. Carilli, C. Rupen, M. Kollgaard, R. (Penn State)	Cen A. 90 cm
AI046	Irwin, J. (Queens)	HI observations of the edge-on galaxy NGC 3044. 20 cm line
AI047	Impey, C. (Arizona) Foltz, C. (MMTO) Hooper, E. (Arizona)	The radio properties of optically selected QSOs. 3.5 cm
AI048	Ivison, R. (Toronto) Seaquist, E. (Toronto) Hughes, D. (Oxford) Bode, M. (John Moores Univ.) Schwarz, H. (ESO, Chile) Bang, M. (John Moores Univ.)	Multi-frequency observations of symbiotic stars: the centimeter and millimeter continuum. 1.3, 2, 3.6, 6, 20 cm
AK298	Kellermann, K. Sramek, R. Green, R. (KPNO) Schmidt, M. (Caltech) Shaffer, D. (Interferometrics)	Measurement of radio structures of quasars in BQS sample. 6 cm
AK309	Kronberg, P. (Toronto) Glendenning, B. Sramek, R.	Monitoring SNR candidates in M82. 1.3, 2 cm
AK319	Katz-Stone, D. (Minnesota) Rudnick, L. (Minnesota)	Three-frequency mapping of FR 1 radio galaxy 3C 449. 20, 90 cm
AK320	Kronberg, P. (Toronto)	Further sample of highly redshifted quasars. 3.6, 6 cm
AK326	Kundu, M. (Maryland) Strong, K. (Lockheed) Kane, S. (Calif., Berkeley) Pick, M. (Meudon) Gopalswamy, N. (Maryland) White, S. (Maryland)	Flaring bright points. 20, 90 cm
AK329	Kurtz, S. (Wisconsin) Churchwell, E. (Wisconsin) Hofner, P. (Wisconsin) Wood, D.	The IRAS 18032-2032 complex--an absorption distance. 1.3, 3.6, 20 cm line

No.	Observer(s)	Program
AK335	Kapahi, V. (TIFR) Athreya, R. (TIFR) Subrahmanya, C. (TIFR) McCarthy, P. (Carnegie) van Breugel, W. (LLNL)	The Molonglo 1-Jy sample. 6, 20 cm
AK338	Kenny, H. (Canadian Military Univ.) Taylor, A. (Calgary)	Monitoring CH Cygni outburst. 2, 6, 20 cm
AL150	Lestrade, J. (JPL/Meudon) Preston, R. (JPL)	Statistical properties of RSCVn stars. 6 cm
AL276	Laurent-Muehleisen, S. (Penn State) Kollgaard, R. (Penn State) Feigelson, E. (Penn State)	Jet morphology of X-ray selected BL Lacertae objects. 6, 20 cm
AL280	Ludke, E. (Manchester) Conway, R. (Manchester) Garrington, S. (Manchester)	Faraday rotation in sources with depolarization asymmetries. 3.6 cm
AL285	Lang, K. (Tufts) Willson, R. (Tufts) Kile, J. (Tufts)	Solar microbursts. 20, 90 cm
AL287	Lonsdale, C. (Haystack) Beichman, C. (IPAC, Pasadena) Van Buren, D. (IPAC, Pasadena) Smith, H. (Calif., San Diego) Soifer, B. (Caltech) Neugebauer, G. (Caltech) Wolstencroft, R. (Royal Obs.)	Protogalaxies in the IRAS faint source survey. 20 cm
AL288	Langston, G.	Tracking variability of lens 2016+112. 2, 6 cm
AL289	Lazio, T. (Cornell) Cordes, J. (Cornell)	Angular broadening in the galactic anticenter. 6, 20 cm
AL297	Lacy, M. (Oxford) Rawlings, S. (Oxford) Warner, P. (Cambridge)	Search for cluster halo sources at high redshift. 3.6, 20 cm
AL301	Lim, J. (Caltech) Bieging, J. (Arizona)	Survey for nonthermal radio emission from OB and Wolf-Rayet stars. 3, 6, 20 cm
AL302	Lis, D. (Caltech) Menten, K. (CFA) Carlstrom, J. (Caltech) Zylka, R. (MPIR, Bonn)	Search for compact HII regions and H_2O masers in the GC dust ridge. 3.6 cm line

No.	Observer(s)	Program
AL303	Lehto, H. (Turku) Andernach, H. (IAC, Tenerife) Aragon-Salamanca, A. (Durham) Bower, R. (MPIfEP, Garching)	X-ray detected gravitational lens. 3.6 cm
AM397	Molnar, L. (Iowa) Niermann, S. (Iowa) Kniffen, D. (Hampden-Sydney) Mattox, J. (NASA/GSFC)	Radio counterparts of EGRET gamma ray point sources. 3.5, 20 cm
AM398	Masson, C. (CFA)	Distances to planetary nebulae BD+30 3639 and NGC 6572. 2, 6 cm
AM399	Mirabel, I. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Monitoring 1E1740.7-2942 and GRS1758-258. 6 cm
AM402	Marcha, M. (Manchester) Browne, I. (Manchester) Laing, R. (RGO)	Polarization structure and flow speed in low luminosity jets. 20 cm
AM409	Minter, A. (Iowa) Spangler, S. (Iowa)	Faraday rotation measurements to study plasma turbulence in the ISM. 20 cm
AM414	Megeath, S. (MPIR, Bonn) Wilson, T. (MPIR, Bonn)	Dense young clusters in S184 and DR22. 2, 6, 20 cm
AM416	Mundy, L. (Maryland) McMullin, J. (Maryland)	Puzzling spectral index of emission from a YSO. 1.3 cm
AM417	Marshall, J. (Cambridge) Lasenby, A. (Cambridge) Yusef-Zadeh, F. (Northwestern)	High-velocity gas in the galactic center. 20 cm line
AO113	Oren, A. (Calif., San Diego) Wolfe, A. (Calif., San Diego)	Faraday rotation mapping of 3C 196. 2 cm
AO117	Olling, R. (Columbia) Rupen, M. van Gorkom, J. (Columbia)	The edge-on dwarf galaxy NGC 5023. 20 cm line
AP238	Palmer, P. (Chicago) Gonatas, D. (Pennsylvania)	Recombination lines in Mon R2. 3.6, 6, 20 cm line
AP250	Papadopoulos, P. (Toronto) Seaquist, E. (Toronto) Wrobel, J. Binette, L. (Toronto)	Extended radio emission from radio quiet quasars. 6 cm

No.	Observer(s)	Program
AP251	Pedlar, A. (Manchester) Axon, D. (Manchester) Baum, S. (STScI) O'Dea, C. (STScI) Unger, S. (RGO)	HI in NGC 4151. 20 cm line
AP255	Puche, D. (CFA) Westpfahl, D. (NMIMT)	HI mapping of grand design spirals M51 and M83. 20 cm line
AP256	Palmer, D. (NASA/GSFC) Schaefer, B. (NASA/GSFC) Cline, T. (NASA/GSFC) Hurley, K. (Calif., Berkeley) Laros, J. (Los Alamos) Fishman, G. (NASA/MSFC) Kouveliotou, C. (NASA/MSFC)	Gamma ray burster radio counterparts--deep searches. 3.5, 20 cm
AP258	Peng, Y. (Maryland) Vogel, S. (Maryland)	A collapsing core in Sgr B2. 1.3 cm line
AP267	Petrosian, A. (Byurakan Obs.) Krishna, G. (TIFR)	"Blue-compact-dwarf galaxies" from the Byurakan surveys. 3.6, 6, 20 cm
AP268	Phillips, R. (Haystack) Lonsdale, C. (Haystack)	Rotational modulation of emission from HDE 283572. 3.5, 6, 18 cm
AR268	Rodriguez, L. (Mexico/UNAM) Curiel, S. (CFA)	Radio monitoring of the outburst in SVS13. 3.6, 6 cm
AR278	Rodriguez, L. (Mexico/UNAM) Canto, J. (Mexico/UNAM) Raga, A. (Manchester) Noriega-Crespo, A. (Washington) Reipurth, B. (ESO)	HH1-2 region. 6 cm
AR279	Roettiger, K. (New Mexico State) Burns, J. (New Mexico State) Loken, C. (New Mexico State) Owen, F.	Steep spectrum radio sources in rich clusters. 20, 90 cm
AR290	Rowan-Robinson, M. (Queen Mary) Lawrence, A. (Queen Mary) Oliver, S. (Queen Mary) McMahon, R. (Cambridge)	Search for high-redshift infrared galaxies. 20 cm
AR296	Rupen, M. Knapp, J. (Princeton) Gunn, J. (Princeton) Olling, R. (Columbia) van Gorkom, J. (Columbia)	The velocity dispersion of the HI in face-on galaxies. 20 cm line

No.	Observer(s)	Program
AR297	Roberts, D. (Illinois) Crutcher, R. (Illinois) Troland, T. (Kentucky)	HI Zeeman observations of NGC 6334 and M17. 20 cm line
AS333	Sramek, R. Weiler, K. (NRL) van Dyk, S. (NRL) Panagia, N. (STScI)	Statistical properties of radio supernovae. 2, 6 cm
AS450	Sahai, R. (Chalmers/Onsala) Claussen, M.	Time variation of the enigmatic radio source in IRC+10216. 1.3, 2, 3.6 cm
AS483	Smale, A. (NASA/GSFC) Corcoran, M. (NASA/GSFC) Drake, S. (NASA/GSFC)	Cygnus X-3 and the Cyg OB2 association. 2, 3.6, 6, 20 cm
AS484	Salter, C. (NAIC) Junor, B. Bignell, R. C. Saikia, D. (TIFR)	Optically thick planetary nebulae. 6 cm
AS488	Seaquist, E. (Toronto) Odegard, N. (GSC/GSFC)	Synchrotron emitting wind in NGC 4194. 6 cm
AS500	Sparke, L. (Wisconsin) Cox, A. (Wisconsin) Sackett, P. (Princeton) Richter, O. (STScI)	Polar-ring galaxy NGC 5122. 20 cm line
AS501	Seaquist, E. (Toronto) Ivison, R. (Toronto) Hughes, D. (Oxford) Evans, A. (Keele)	An OH and H_2O maser survey of symbiotic stars. 1.3, 18 cm line
AS502	Schindler, S. (Calif., Santa Cruz) van Gorkom, J. (Columbia)	The evolution of galaxy clusters. 20, 90 cm
AS503	Strom, R. (NFRA) Johnston, H. (Utrecht) Verbunt, F. (Utrecht) Aschenbach, B. (MPIfEP, Garching)	An X-ray knot associated with the Vela SNR. 20 cm
AS507	Sage, L. (Nevada) Spight, L. (Nevada) Higdon, J. Huchtmeier, W. (MPIR, Bonn) Schultz, A. (STScI)	Atomic gas and sequential star formation in Arp 147. 20 cm line

No.	Observer(s)	Program
AT134	Taylor, A. (Calgary) Dougherty, S. (Calgary)	Monitoring of radio variable Be stars. 3.6 cm
AT143	te Lintel Hekkert, P. (Mt. Stromlo) Habing, H. (Leiden) Blommaert, J. (Leiden) Dejonghe, H. (Gent) Rich, M. (Columbia) Winnberg, A. (Chalmers/Onsala)	OH/IR stars: 1612 MHz survey of galactic plane. 18 cm line
AT145	Thorsett, S. (Caltech) Taylor, J. (Princeton) McKinnon, M. Hankins, T. (NMIMT) Stinebring, D. (Oberlin)	Timing fast pulsars. 6, 18, 90 cm
AT149	Thuan, T. (Virginia) Condon, J. Dennefeld, M. (Paris) Boller, T. (MPIfEP, Garching)	ROSAT/IRAS galaxies. 20 cm
AT151	Taylor, C. (Minnesota) Brinks, E.	HII galaxy/companion systems at high resolution. 20 cm line
AU053	Umana, G. (CNR, Bologna) Trigilio, C. (CNR, Bologna) Hjellming, R. Catalano, S. (Catania) Frasca, A. (Catania)	Radio survey of algol-type binary systems.
AV193	van der Hucht, K. (Utrecht) Williams, P. (Utrecht) Spoelstra, T. (NFRA)	Wolf-Rayet object WR125. 2, 6, 20 cm
AV205	van der Werf, P. (MPIfEP, Garching)	Imaging of the starburst nucleus in M83. 2 cm
AW230	Wrobel, J. Unger, S. (RGO)	International monitoring of the Seyfert NGC 5548. 3.5 cm
AW312	Wilson, C. (Maryland) Skillman, E. (Minnesota)	Atomic hydrogen clouds in the irregular galaxy NGC 6822. 20 cm line
AW325	Waller, W. (NASA/GSFC) Westpfahl, D. (NMIMT) Puche, D. (CFA) Wilcots, E.	HI morphology and kinematics of NGC 1569. 20 cm line
AW330	Wills, B. (Texas) Shastri, P. (Calif., Berkeley)	Core variability in lobe dominated quasars. 3.6 cm

No.	Observer(s)	Program
AW344	White, S. (Maryland) Lim, J. (Caltech)	Nonthermal emission due to episodic mass loss from RS CVn binaries. 20, 90 cm
AW349	White, S. (Maryland)	T Tauri Stars.
AW361	White, S. (Maryland) Aschwanden, M. (Maryland)	The magetic field configuration in the solar corona. 20, 90 cm
AW362	White, S. (Maryland)	The stellar activity cycle on active stars. 3.6, 6, 20 cm
AW363	White, S. (Maryland)	A field of extended sources surrounding a head-tail source in Lacertae. 6, 20 cm
AY052	Yang, H. (Minnesota) Skillman, E. (Minnesota)	Evolution of an SNR in giant HII region. 3.6, 20 cm
AY053	Yin, Q.-F. Heeschen, D.	Supernova activity in Mkn 297. 2, 3.6, 6, 20 cm
AZ060	Zhao, J.-H. Goss, W. M.	Galactic center transient at two years of age. 3.5, 6, 20 cm

E. VERY LONG BASELINE ARRAY

No.	Observer(s)	Program
BB006	Beasley, A. Giampapa, M. (NSO) Hjellming, R.	Orbital monitoring of close-binary systems. 13, 4 cm
BB009	Baath, L. (Chalmers/Onsala) Inoue, M. (Nobeyama) Rogers, A. (Haystack) Wright, M. (Calif., Berkeley) Padin, S. (Owens Valley) Sandell, G. (JCMT) Witzel, A. (MPIR) Lerner, M. (Chalmers/Onsala) Rantakyro, F. (Chalmers/Onsala) Akujor, C. (Chalmers/Onsala) Backer, D. (Owens Valley) Booth, R. (Chalmers/Onsala) Carlstrom, J. (Calif., Berkeley) Dickman, R. (NSF) Emerson, D. Hirabayashi, H. (Nobeyama) Hodges, M. (Owens Valley) Jewell, P.	

No.	Observer(s)	Program
continued:		
	Legg, T. (NRC) Moran, J. (CFA) Morimoto, M. (Nobeyama) Plambeck, R. (Calif., Berkeley) Nyman, L. (SEST) Predmore, C. (Massachusetts) Whitney, A. (Haystack) Woody, D. (Owens Valley) Whyborn, N. (SEST)	Millimeter VLBI observations of compact radio sources. 3, 1.3 mm
BB012	Baath, L. (Chalmers/Onsala) Lerner, M. (Chalmers/Onsala) Rantakyro, F. (Chalmers/Onsala) Akujor, C. (Chalmers/Onsala) Booth, R. (Chalmers/Onsala)	The Onsala high-frequency VLBI study. 7 mm
BC011	Claussen, M. Benson, J. Nedoluka, G. (NRL) Johnston, K. (NRL)	Multi-frequency SiO maser observations of W Hya. 7 mm
BC015	Conway, J.	Observations of the nucleus of 3C 219. 18, 3.6 cm
BC025	Conway, J. Romney, J. Rupen, M. Beasley, A.	HI absorption against 3C 84.
BD002	Diamond, P. Kemball, A. (Rhodes) Benson, J. Junor, W. Zensus, J. A.	Monitoring the structure of SiO masers with the VLBA. 7 mm
BK003	Kellermann, K. Zensus, J. A. Cohen, M. (Caltech)	Nucleus of NGC 5128
BL002	Lestrade, J. (Meudon) Jones, D. (JPL) Preston, R. (JPL) Phillips, R. (Haystack)	Radio star astrometry for HIPPARCOS tie in. 3.6 cm
BM007	Menten, D. (CFA) Reid, M. (CFA) Pratap, P. (CFA) Moran, J. (CFA)	Methanol masers. 7 mm

No.	Observer(s)	Program
BM011	Moran, J. (CFA) Rodriguez, L. (Mexico/UNAM) Vazquez-Semademi, E. (Mexico/UNAM)	NGC 6334B: scale of turbulent scatterers. 1.3, 2, 3.6, 6 cm
BP012	Preston, R. (JPL) Moellenbrock, G. (Brandeis) Zensus, J. A. Linfield, R. (JPL) Roberts, D. (Brandeis) Gurvits, L. (Lebedev) Hirabayashi, H. (ISAS) Jauncey, D. (CSIRO) Schilizzi, R. (NFRA)	22-GHz VLBI survey in support of the VSOP and radio astronomy missions. 1.3 cm
BR002	Rendong, N. (Beijing) Gabuzda, D. (Calgary) Kameno, S. (Nobeyama) Inoue, M. (Nobeyama)	VLBI polarimetry of the high rotation measure source 3C 119. 4 cm
BR005	Russell, J. (ARC) Fey, A. (NRL) Johnston, K. (NRL)	Astrometric survey for the radio/optical reference frame. 3.6 cm
BR018	Rupen, M. Conway, J. Sramek, R. Romney, J. Bartel, N. (York) Weiler, K. (NRL) van Dyk, S. (NRL) Panagia, N. (STScI)	Imaging of SN 1993J in M81. 1.3, 2, 3.6 cm
BS004	Sanders, W. (New Mexico) Fomalont, E.	Trigonometric parallax of radio stars. 20 cm
BS007	Shaffer, D. (Interferometrics) Potash, R. (Interferometrics) Clark, T. (NASA/GSFC) Ma, C. (NASA/GSFC) Niell, A. (Haystack) Corey, B. (Haystack) Walker, R. C. Junor, W.	Use of phase delay to reduce measurement error. 13, 3.6 cm
BS009	Shaffer, D. (Interferometrics) Potash, R. (Interferometrics) Ma, C. (NASA/GSFC) Niell, A. (Haystack)	Geodetic source survey. 3.6 cm

No.	Observer(s)	Program
BT003	Thorsett, S. (Caltech) Dewey, R. (JPL) Frail, D. Kukarni, S. (Caltech) Thakkar, D. (Caltech) Vermeulen, R. (Caltech)	Calibrators around three millisecond pulsars. 18 cm
BT004	Thakkar D. (Caltech) Kulkarni, S. (Caltech) Readhead, A. (Caltech) Thorsett, S. (Caltech) Vermeulen, R. (Caltech) Frail, D.	Parallax measurement of nearby pulsars. 18 cm
BT007	Thakkar, D. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Vermeulen, R. (Caltech)	Nuclei of low-luminosity radio galaxies. 18, 6 cm
GA009	Alberdi, A. (IAA, Granada) Marcaide, J. (Valencia) Pauliny-Toth, I. (MPIR, Bonn) Cawthorne, T. (Lancashire) Elosegui, P. (CFA)	Absolute kinematics and polarization observations of 3C 454.3. 3.6 cm
GA010	Alef, W. (MPIR, Bonn) Preuss, E.(MPIR, Bonn) Kellermann, K. Shengyin, W. (Beijing)	Observations of the radio galaxy 3C 390.3. 1.3 cm
GJ005	Junor, W. Biretta, J. (STScI) Reid, M. (CFA) Muxlow, T.(NRAL, Manchester) Spencer, R.(NRAL, Manchester)	Spectral index imaging of the M87 jet. 18 cm
GC012	Conway, J. Wilkinson, P. (Manchester) Unwin, S. (Caltech) Xu, W. (Caltech)	Advance speeds in compact triples 0710+439 and 2352+495. 6 cm
GD002	Davis, R. (Manchester) Muxlow, T. (Manchester) Unwin, S. (Caltech)	3C 273. 18 cm
GD004	Desai, K. (Calif., Santa Barbara) Gwinn, C. (Calif., Santa Barbara) Diamond, P.	OH masers in W49N. 18 cm

No.	Observer(s)	Program
GG017	Garrett, M. (Manchester) Polatidis, A. (Manchester) Patnaik, A. (Manchester)	Flat spectrum radio sources > 500 mJy. 1.3 cm
GG020	Guirado, J. (IAA, Granada) Marcaide, J. (Valencia) Elosegui, P. (CFA) Alberdi, A. (IAA, Granada)	Phase-referenced motion of a component in 4C 39.25. 3.6 cm
GK008	Krichbaum, T. (MPIR, Bonn) Standke, K. (MPIR, Bonn) Steffen, W. (MPIR, Bonn) Britzen, S. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Zensus, J. A.	Motion along curved paths in the jet of 1803+78. 1.3 cm
GK010	Krichbaum, T. (MPIR, Bonn) Britzen, S. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Muxlow, T. (Manchester) Schalinski, C. (IRAM) Matveyenko, L. (Space Research Inst.) Zensus, J. A.	Bent jet of 1803+78. 18 cm
GP012	Pauliny-Toth, I. (MPIR, Bonn) Unwin, S. (Caltech) Wehrle, A. (IPAC, Pasadena) Zensus, J. A. Nicolson, G. (Hartebeesthoek)	Monitoring of quasar 3C 454.3. 1.3 cm
GV011	Vermeulen, R. (Caltech) Xu, W. (Caltech) Cohen, M. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Taylor, G. (Caltech) Wilkinson, P. (Manchester) Polatidis, A. (Manchester)	Snapshot survey of superluminal motion. 6 cm
GW010	Wilkinson, P. (Manchester) Henstock, D. (Manchester) Browne, I. (Manchester) Patnaik, A. (Manchester) Readhead, A. (Caltech) Taylor, G. (Caltech) Pearson, T. (Caltech) Vermeulen, R. (Caltech) Cohen, M. (Caltech)	Snapshot survey of flat-spectrum sources. 6 cm

No.	Observer(s)	Program
GZ010	Zensus, J. A. Leppanen, K. (Metsahovi Radio Res. Station) Unwin, S. (Caltech) Wehrle, A. (IPAC, Pasadena)	Evolution of the parsec-scale structure of 3C 345. 1.3, 6 cm
MAH004	Marcaide, J. (Valencia) Alberdi, A. (CSIC, Granada) Guirado, J. (CSIC, Granada) Rius, A. (CSIC, Granada) Witzel, A. (MPIR, Bonn) Krichbaum, T. (MPIR, Bonn) Perez, E. (IAP, Canarias) Shapiro, I. (CFA) Elosegui, P. (CFA) Rogers, A. (Haystack) de Bruyn, G. (NFRA) Schilizzi, R. (NFRA) Baath, L. (Chalmers/Onsala) Booth, R. (Chalmers/Onsala) Davis, R. (Manchester) Diamond, P. Jones, D. (JPL) Mantovani, F. (IdR, Italy) Preston, R. (JPL) Ronnang, B. (Chalmers/Onsala) Trigilio, C. (IdR, Italy) Zensus, J. A.	Supernova 1993J. 1.3 cm
RD093	Clark, T. (NASA/GSFC) Ryan, J. (NASA/GSFC) Ma, C. (NASA/GSFC) Himwich, W. (Interferometrics) Vandenberg, N. (Interferometrics)	Improved measurements of vertical coordinates and earth rotation. 3.6 cm

F. SCIENTIFIC HIGHLIGHTS

Green Bank

Recombination lines from the diffuse ionized gas associated with galactic "chimney" structures have been measured to determine the ionization of helium in this component of the ISM. It is found that the He+/H+ ratio is typically between 1 percent and 2 percent, implying that the warm ionized medium is ionized by a diffuse UV radiation field and not by nearby OB stars. In most directions the C+ line is as strong as the He+ line.

Investigators: C. Heiles, N. Levinson (Calif., Berkeley), W. Reach (NASA/GSFC), and B.-C. Koo (U. Korea, Seoul).

Socorro

VLA, VLBA Monitor Expanding Shell of Supernova 1993J - Supernova 1993J, the brightest optical supernova visible in the northern hemisphere since 1937, was discovered on March 28. The discovery was announced informally by e-mail early on March 30 and VLA observation began that evening. There was no detection on the first day owing to the thick shell of ionized gas that surrounds the stellar progenitor. However, by April 1 the ejecta had passed far enough through the circumstellar shell that the VLA could detect radio radiation at 1.3 cm. Since then, the VLA has monitored the supernova almost daily, yielding numerous data points in five bands to define the early radio light curve. The VLA subsequently detected the supernova at 2, 3.6, and 6 cm, and by mid-June at 20 cm. Because of the brightness of its radio emission and its relative closeness at around 3.3 Mpc, SN 1993J is an ideal candidate for VLBI observations, and the VLBA first observed it on April 26, at 1.3 cm. Subsequent VLBA observations were made on May 16 and June 26, at 1.3, 2, 3.6 and 6 cm. These VLBI observations involved the full VLBA, together with a variety of antennas from the DSN and the EVN, as well as various independent observatories, for a total of between 14 and 17 antennas. The VLA also is being used in phased-array mode as part of another VLBI network monitoring the supernova. Continuing VLBI observations are planned at intervals of six weeks as long as the supernova is visible, in order to produce a "movie" of its expanding shell. The light curves of this supernova already are providing a crucial test for models of the progenitor star and its evolution prior to the explosion. The large quantity of radio data, along with that from other wavelengths, will likely make this supernova a watershed event in understanding these objects.

Investigators for the VLA monitoring program: S. Van Dyk, H.-A. Nguyen, and K. Weiler (NRL); R. Sramek and M.P. Rupen (NRAO); and N. Panagia (STScI).

Investigators for the VLBA monitoring program: M. Rupen (NRAO); N. Bartel (York Univ.); J. Conway, A. Beasley, R. Sramek, J. Romney (NRAO); M. Bietenholz (York Univ.); K. Weiler, S. van Dyk (NRL); N. Panagia (STScI); M. Titus (Haystack); W. Cannon (ICS); J. Popelar (Ottawa); D. Graham (MPIR); T. Venturi (Inst. de Rad.); R. Davis (NRAL); A. Rius (DSN); V. Altunin and D. Jones (JPL)

Investigators using the VLA in phased-array mode: J. Marcaide (Valencia); A. Alberdi, J. Guirado, and A. Rius (CISC, Granada); A. Witzel and T. Krichbaum (MPIR, Bonn); E. Perez (IAP, Canarias); I. Shapiro and P. Elosegui (CFA); A. Rogers (Haystack); G. de Bruyn and R. Schilizzi (NFRA); L. Baath and R. Booth (Onsala); R. Davis (Manchester); P. Diamond (NRAO); D. Jones (JPL); F. Mantovani (IdR, Italy); R Preston (JPL); B. Ronnang (Onsala); C. Trigilio (IdR, Italy); and A. Zensus (NRAO)

Binary Pulsar May Have a Planetary Companion - The VLA and the 140 Foot Telescope at Green Bank have been used to make regular timing observations of the pulsar B1620-26 in the globular cluster M4. This millisecond pulsar has a binary companion of approximately 0.3 solar mass. In 1993, D.C. Backer recognized a varying acceleration, or jerk, on the pulsar, and suggested that it might be caused by the presence of a planetary companion in the system. The VLA and 140 Foot timing observations, made between 1989 and 1993, yield data consistent with the effect of either a planet in an orbit at approximately 10 AU or a star in an orbit at approximately 50 AU. Thus, this pulsar is likely to be either the first pulsar found in a triple stellar system or part of the first binary star system found with a planet.

Investigators: S. Thorsett (Caltech and OVRO) and Z. Arzoumanian and J. Taylor (Princeton)

Tucson

The CO Tully-Fisher Relation and the Turn-Around Radius of the Coma Cluster - Investigators are using 12 Meter Telescope observations of CO emission to measure the distances to galaxies. The technique is based on the Tully-Fisher relation which describes the correlation of galaxy rotational velocity, as indicated by spectral line width, and optical or near-IR luminosity. Heretofore, this relation has been based largely on 21 cm HI observations. The investigators believe that CO observations, now possible with the sensitive new receivers at the 12 Meter, offer some advantages over HI observations. In particular, the distribution of CO more closely follows the luminous matter and is less susceptible to warps and stripping than

is the HI, which is located at larger galaxy radii. The investigators are using this technique to measure the gravitational perturbation of a supercluster by a rich cluster. Specifically, they hope to measure the "turn-around radius" of the Coma cluster, within which galaxies are falling toward the cluster, thus departing from the smooth Hubble expansion.

Investigators: J. M. Dickey (Minnesota), F. Casoli, F. Combes, and I. Kazes (Paris Observatory).

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. CENTRAL DEVELOPMENT LABORATORY

Amplifier Development, Design, and Production

The development of the 40-50 GHz amplifier has been completed and seven amplifiers have been built and tested. The minimum noise temperature in the band is about 30 K, the average noise for 10 GHz bandwidth is about 40 K, and the maximum noise temperature is less than 50 K for all the amplifiers.

After a successful demonstration last quarter of the 60-80 GHz amplifier using TRW AlInAs/GaInAs/InP devices, the evaluation of millimeter-wave HFET's from other manufacturers continued this quarter.

The prototype for the 680-920 MHz balanced amplifier has been evaluated. The measurements are as follows:

Frequency Range:	680-920 MHz	600-1000 MHz
Noise Temperature:	3.6 ± 0.1 K	4.0 ± 0.5 K
Gain:	17.0 ± 0.7 dB	16.3 ± 1.4 dB
Input Match:	≤ -18 dB	≤ -18 dB
Output Match:	≤ -25 dB	≤ -23 dB

Although the electrical performance of the prototype amplifier is satisfactory, a reduction in the physical size was needed. A pre-production design has been completed and is currently being machined. Due to the use of a more compact quadrature coupler, the overall size of the amplifier has been reduced significantly. This amplifier, together with scaled versions, will be used on the GBT from 290 MHz to 1200 MHz.

The electrical design of a 3.95-6.0 GHz amplifier has been completed and is currently in the drafting stage. This amplifier will be used on the GBT and is being considered as an IF amplifier for SIS receivers.

The "SH series" prototype was completed and evaluated. This amplifier was used in preliminary tests for evaluating an SIS mixer having an IF frequency of 2.9-3.9 GHz. However, since emphasis is now placed on the 3.95-6.0 GHz band for the IF, further development of this amplifier will be postponed until next year.

The revised design of the "KH series" 22-26 GHz amplifier has been completed and is currently in the production stage.

Superconducting (SIS) Millimeter-Wave Mixer Development

We have completed a new, more versatile, SIS mixer test set. This allows us finally to measure mixer parameters (as opposed to overall receiver characteristics) with the mixer attached to the same 4 K feed horn, lens, etc., used in the receivers

on the 12 Meter Telescope. This was not possible with our old liquid helium test cryostats because of their small size. The new test set uses a closed-cycle JT stage attached to a standard 1020 refrigerator.

In the past year, there have been several reports of intermittent "bias instability" in SIS receivers at the 12 Meter Telescope. Considerable effort has been spent trying to locate the cause. A number of feed-through filters have been found cracked, which, according to the manufacturer, was a common difficulty with that design. An improved filter is now being retrofitted to all 20 receiver inserts. We also found in one insert a short-circuit to ground where the bias wires were epoxied to a 4 K copper heatsink. This was apparently a result of differential expansion between the epoxy and the metal. A new heatsink, in which the bias wires are attached to an anodized aluminum plate by a more flexible adhesive, is being evaluated.

Work continues on development of better tunerless SIS mixers for operation to 360 GHz. The performance of the 200-300 GHz design degrades rapidly above ~280 GHz, and, because of its very small circuit dimensions, it is not suitable for scaling to higher frequencies. Also, the present design can suffer from low-frequency instability, which is believed to be remediable in a new design.

We have been assisting the UVa physics department in designing an SIS receiver for 585 GHz using SIS devices to be made in the UVa EE department. This project is funded by the Army, and it is hoped that a successful outcome will inspire them to continue funding for the UVa SIS facility. Technically, the project is expected to benefit our normal millimeter-wave work (*i.e.*, up to ~360 GHz) through the exploration of new, better controlled, SIS fabrication techniques and approaches to mount design suitable for the shorter wavelength. A new, very simple waveguide mount has been designed using the HP High Frequency Structure Simulator program.

During this quarter, we have built (or rebuilt) and tested a total of seven SIS mixers and four complete SIS receiver inserts.

Electromagnetic Support

The K_u-band feed covering the 12 to 15.4 GHz range for the GBT was fabricated and its radiation patterns were measured. The taper at the edge of the subreflector varies between -12.8 dB and -13.5 dB. The worst cross-polarization is -28 dB. The measured input return loss is better than 21.7 dB in the band of interest.

A circular-to-rectangular transition for measuring the GBT L-band feed was designed and drawings made.

An 86 GHz septum polarizer, which was scaled from a 43 GHz polarizer, was modeled and analyzed using the HFSS software.

A feed for the 8 to 10 GHz band for the GBT was designed, and drawings were sent to the Green Bank shop.

A feed to cover the 40 to 50 GHz feed for the VLA was fabricated and measurements performed. The taper at the edge of the subreflector varies between -11.5 dB and -14.5 dB. The input return loss is better than 25 dB above 41.4 GHz and at 40 GHz is 19 dB.

A quadridged orthomode transducer without the probes, covering the 3.95 to 5.85 GHz range, was designed. This is a slightly better design compared to an earlier version.

I. GREEN BANK ELECTRONICS

Green Bank Telescope

Finishing touches are being placed on the 18-26 GHz Green Bank Telescope (GBT) receiver. Many of the components required for the Prime Focus receiver were received and tested or ordered. Cryogenic lines were fabricated and tested. Block diagrams and functions lists were prepared for the monitor and control interface. The design for the 800 MHz horn was completed and preliminary drawings were submitted to the Shop for material ordering.

Progress was made with the actuators and actuator control system for the open loop active surface effort. Negotiations continue with the actuator motor vendors with the goal of defining a mutually agreeable schedule for task completion. In the control system area, work on NRAO designed electronics continues. A system to monitor and control power supplies has been built and tested. Watchdog timers and interfaces to the emergency stop system were designed, built, and tested. A chassis to house the electronics is under construction. A board which interfaces actuator cables to motor drive and LVDT read-out modules, and provides transient suppression, was designed and fabricated. A considerable effort was expended learning C++ software development techniques.

Servo system efforts consisted of monitoring the progress and reviewing the work of the servo contractor, RSI/PCD. During the past quarter, meetings were held at their facility to review the software design for both the SCCU (loop closing computer) and the OCU (operator interface). Their software effort is satisfactory, and NRAO's comments have been well received. RSI/PCD has recently revamped its schedule to take into account its production capabilities and the slip in the overall telescope schedule. The new schedule calls for factory sell-off in February, 1994, approximately five months later than on the previous schedule.

The monitor and control electronics for the K-band receiver is complete, and design is in progress for three other receivers.

Work on the Digital Continuum receiver continues. A system which gives the capability of programming field programmable gates arrays has been specified and requisitioned. A VME card capable of carrying pin grid array logic as well as DIP packaged logic has been ordered.

Operations

Support was provided as required to the telescopes and lab. Test equipment storage was moved to the basement level to make space for the consolidation of all OVLBI electronics work in one room of the Janksy lab. Support to the 140 Foot and Interferometer telescopes was routine. The 40 Foot Telescope had minor repairs accomplished and was tweaked primarily for the first of two summer sessions of Learning to Investigate the Universe (LITU).

Navy Hawaii Telescope Hardware Installation

A new receiver and VLBA backend were installed in the Navy Kokee Park telescope on the Island of Kauai, Hawaii. Equipment placement, cable runs, initial checkout, and testing were completed in just three weeks. Shortly after the NRAO team returned to Green Bank, the telescope was used successfully in its first attempt at VLBI operations.

National Radio Quiet Zone

Sixty applications for fixed, non-government transmitters within the Quiet Zone were processed during the quarter.

The National Weather Service (NWS) monitor was installed temporarily at the 40 Foot Telescope facility to measure signal levels from the NWS Integrated Flood and Warning System (IFLOWS). After analysis of the signal strength data, two transmitters were relocated within the Quiet Zone to reduce interference.

A new AOR AR3000 receiver was purchased and placed into operation for interference monitoring and offending transmitter location over the range of 100 kHz to 2.03 GHz. The addition of this receiver provides a permanent fixed capability and a permanent mobile capability with an older, existing receiver.

The NRAO Green Bank interference officer attended the FAA/DOD Eastern Region Spectrum Users Conference. The interagency relationship and communications efficiency was improved through attendance at that meeting and other on-site meetings.

J. SOCORRO ELECTRONICS

1.3 - 1.7 GHz Receiver Improvements

The VLA now has all 27 antennas in the array operating with the new style front-ends. We will complete all construction, including the 28th annenna and two spare front ends, in the third quarter of 1993.

40 - 50 GHz Receivers

All critical components for the receiver addition to ten VLA antennas have been received. The VLA machine shop has fabricated parts to complete two receivers. We are assembling and testing the first receiver. One manufacturer has supplied cooled isolators that appear useable. We will proceed with these until a second manufacturer succeeds in suppling an improved version.

VLA Waveguide

Efforts continue to improve anode bed efficiency for more reliable cathodic protection of the wye waveguide from electrolytic corrosion. Continuing measurements of waveguide-to-soil voltage potentials at all waveguide manholes show adequate protection. The cryogenics/waveguide group replaced and rebuilt the azimuth and elevation rotary joints on three antennas and reworked all 20 mm waveguide on one antenna. Nine waveguide manholes have been replaced with steel culverts this year, leaving one more to do next quarter.

VLA Wye Monitor

The Wye Monitor provides the VLA Operator with voice phrase alarms detailing "antenna number," "arm," "generator," "UPS," "HVAC," "problem," etc. Operators interface via a touchscreen, bringing up windows for detailed information on monitored systems. This quarter we completed interfaces to the site power generators. Next quarter we expect to complete the interface to the correlator air conditioner and to a full backup system ready to go "online" should a failure occur.

New VLA Correlator Controller

The current correlator controller consists of a wire wrapped 16-bit slice microprocessor, a Modcomp computer, and a FPS-AP120B array processor. A single VME computer will replace the above equipment, which is nearing the end of its repairable life. We received the VME array processor card and began testing and designing the interface. Two VME prototyping cards are in use. We plan to have several interfaces to the correlator prototyped by the end of the year.

Optical Fiber in VLA Antennas

We are investigating the use of optical fiber cables to distribute digital control and monitor signals from the antenna buffer to the data sets in the VLA antennas. Fibers will replace the twisted pair cables which radiate RFI. We are testing a prototype system on the VLA M/C bench and designing mechanical and electronic modifications. We intend to test this on three or four antennas which have B-rack shields to measure the reduction of RFI.

VLBA Recorders

A Data Acquisition Rack (DAR) was installed at the VLA to replace the MKIII formatter and the HP computer that controlled the formatter. The video converters will remain for use in pulsar experiments. Use of the DAR and the VLBA tape recorder will parallel operation at the VLBA as closely as possible.

Modifications to VLBA tape drives to permit use of "thin" 16 micron tape have been completed at 9 sites; St. Croix is scheduled for July. The longer thin tape permits less frequent tape changes. During the thin tape upgrade, a bar code reader was added to each drive to read the tape VSN (volume serial number) during tape loading.

Nearly 400 thin tapes have been transferred to Acrometal "self-packing" reels and a supply shipped to the VLBA sites for use in observing. An accelerated life test on a sample of thin tapes was concluded. A second test with the new tapes and reels is being devised to provide input for the procurement of additional tapes and reels in October.

A replacement input module for the VLBA formatter has been installed at two VLBA sites, Pie Town and Los Alamos. The new design, called the "Digital Switch" module, includes counters that permit verification of PCAL on every input channel during observing.

Relative humidity sensors at each VLBA site have been interfaced with the station computer so that the computer room environment can be monitored. Data from the sensors will advise of any changes necessary to meet RH limitations for tape recorder operation.

Seventeen Playback Drives have now been installed at the VLBA Correlator. The 18th drive is at the AOC and will be in place soon. The remaining 6 drives are presently being used at the Haystack Correlator, and are expected to be installed at the AOC later this year.

Installation of the second tape drive at the Hancock site completed the outfitting of VLBA sites with tape recorders. Each site now has two recorders.

VLBI/MKII

The RCA VCRs used for MKII data collection at the VLA have been replaced with Panasonic VCRs as parts are no longer available for the RCA machines, and since the Panasonic VCRs have proven more reliable.

MKII data acquisition equipment was transferred to the VLBA Mauna Kea site to complete a reconfiguration of the seven MKII-equipped VLBA sites. The MKII sites are now Mauna Kea, Saint Croix, Hancock, North Liberty, Owens Valley, Brewster, and Pie Town.

Interference

Efforts continue, at a low level, to identify, control and mitigate local sources of RFI, such as digital (microprocessor) devices and radio devices. Frequency coordination efforts through the National Science Foundation Spectrum Management Office and our informal network have concentrated on major radar installations (NEXRAD), several military systems, and harmonic emissions from TV transmitters. Motorola's IRIDIUM Satellite Communications Division has requested that NRAO measure and provide the near- and far-sidelobe envelope patterns of VLA and VLBA antennas. The patterns will assist the Mobile Satellite Service (MSS) in complying with proposed FCC regulations for adjacent band interference in the 1610.6-1613.8 MHz radio astronomy band. We will test a proposed measurement procedure in July and anticipate conducting measurements in August and September.

K. TUCSON ELECTRONICS

During this quarter, work in the receiver area has concentrated on the upgrade of both our 1.2 mm receiver and the 8-beam system. The present PC control of our receivers will be phased out over the next year and receiver control will be integrated into the monitor-and-control system. The upgraded 1.2 mm receiver will be the first receiver to be controlled via the telescope Ethernet system; this work is well underway.

An unexpectedly heavy maintenance load due to problems with the existing receivers has delayed progress on the 8-beam system. The 4K dewar has been checked and one channel of the system has been constructed and checked. Both the optics and the receiver noise temperature were satisfactory and work is now progressing on the rest of the system.

The 3 mm receiver and 2 mm receiver will be unchanged for the coming observing season.

L. AIPS

The 15APR93 release of "Classic AIPS" has been replaced with a 15JUL93 release which we expect to occur approximately on the nominal date. The delay is due primarily to the addition of support for Sun's new operating system, Solaris. For this addition, most routines written in C in AIPS were revised to meet the ANSI standard for the C language and many were revised to conform to basic Posix standards. In this way, we actually reduced the number of host-specific routines while increasing those that apply to all UNIX systems. The system procedure files were also revised to be more portable, general, and reliable. With help from other institutions, our support for Hewlett Packard, DEC, and Cray systems was improved. The television server XAS was brought up to the standards of MIT Release 4 of X Windows, and the message server was made more reliable and transparently fast.

In anticipation of upcoming major VLA surveys, two new tasks were added. The first (WFCLN) does wide-field, wide-band image deconvolution taking into account frequency effects (in source spectral index, single-dish primary beam, erroneous center frequencies) while using an improved weighting scheme. The second (OHGEO) regrids the images to correct the geometry to be normal to the phase center and to correct effects of the variation of the primary antenna gain over the observed bandpass. Another new and useful task (DTSUM) provides matrix and other listings summarizing the contents of visibility data sets. Several data manipulation tasks were added. These are BLWUP to blow up an image by pixel replication, IMTXT to convert an image into a text form useful for non-AIPS programs, MULIF to add or increase an IF axis in a data set, UV2MS to append single-source visibility data correctly in a multi-source visibility file, and SPECR to regrid a visibility data set in frequency using an FFT interpolation method. A new canned procedure VLBA may be used to do a quick, but detailed examination of data coming from the VLBA Correlator.

The most serious bugs which we corrected were in the "gridded FFT" method of computing source models. The method did not work when there were both rotations and shifts. The AIPS test suite called DDT is being changed to test for this and assure future reliability. Baseline-based fringe fitting received numerous improvements and corrections. The standard fringe-fitting task was corrected to allow division by a clean component model and changes were made to allow such models to be used more easily in normal gain calibration. Task ANCAL which applies user-supplied, antenna-based calibrations to the data was overhauled and the general FITS reader FITLD was corrected for a number of problems including failure to catch parts of non-AIPS headers. UVPLT and other tasks were corrected to stop them from plotting every point twice. The AIPS tasks to convert plots and images to Postscript were generalized in the grey level of overlay lines (LWPLA) and in the handling of color lookup tables (TVCPS). Finally, a new verb TVPHLAME was added to do flame-like pseudo coloring on AIPS' TV displays.

M. AIPS++

In May there was a design review meeting in Socorro to review the parts of the design relating to the processing of observing data and it's subsequent calibration. Although significant progress was made, we did not get as far as we had initially

hoped, mainly due to a manpower change. Nevertheless, it is now probable that coding in this area will begin in July. During the review, work began in the classes to support coordinates and units.

Good progress continues on the infrastructure. Coding standards have been finalized, including a standard for documentation in the code. From this, programmer documentation can be produced using a prototype documentation extractor, which is now fully implemented. The basic table classes, which will be used for data storage and retrieval, are also progressing well. Work continues on the development of a full-blown data management system to replace the simple I/O capabilities which are currently used. The code management system has had significant improvements, including improved capabilities for individual programmers to develop code in their own environment. Work on FITS is progressing well. The prototype FITS classes will need to be more fully integrated into the rest of the AIPS++ environment, making greater use of the table and mathematics classes. There has been significant progress on the design of a general command line interface. More effort in this area is expected in the next six months.

The AIPS++ steering committee met following the design workshop in Socorro. In general, the members are happy with the progress. All participating observatories agree that we should continue the cooperative working arrangements for another two years.

N. SOCORRO COMPUTING

In the VLA online systems area, work continued to add the necessary support for the upcoming all-sky surveys. Further development was also done on the new VLA correlator controller software.

With the completion of the VLBA computing procurement, the computing environment at the Array Operations Center has stabilized. Minor improvements this spring included the addition of another 2 gigabytes of disk space on each of the three high-end IBM RS/6000's which previously had only 3 gigabytes available for data. As well, the new Solitaire image recorder installed at the AOC is now supported by AIPS and is available to visiting observers.

A T1 link to the VLA site was installed in May, providing approximately 1 megabit/sec bandwidth for data. This is a considerable improvement over the previous 14.4 kilobit connection. In addition to better response and throughput for interactive traffic and file transfers, it will allow us to do real-time filling of VLA data to computers at the AOC. This is an expansion of the near-real-time visualization capabilities already in place at the VLA site.

A new initiative is underway at the AOC, and at other NRAO sites, to provide networked online documentation to the NRAO user community. The goal is to allow easy access to PostScript files of various NRAO manuals, memos, and general information, which are then viewed or printed at remote locations. Early tests have been encouraging, and during the next few months we will continue to bring more documents into the system, and to do substantially more testing. We anticipate that this will ultimately make it much easier for users of NRAO instruments and facilities to obtain up-to-date information.

O. VERY LONG BASELINE ARRAY PROJECT

Project Management

The formal VLBA construction project is now effectively complete. No personnel remain on the construction payroll. The remaining funds in the construction budget are planned for the purchase, by the end of 1993, of the second half of the operational magnetic tape supply and for the completion of various retrofit programs.

Sites and Antennas

The last antenna, on Mauna Kea in Hawaii, was declared operational in May. Continued testing at the highest observing frequency, 43 GHz, has shown that several antennas have anomalous gain curves at this frequency. Testing is continuing to understand and correct this problem.

Electronics

All antennas are now operational with all nine receivers. The only significant piece of hardware still to be installed at each antenna is the circuit board in the formatter needed to extract phase calibration signals.

Tape Recorders and Tapes

Approximately half of the total operational supply of glass reels and thin magnetic tapes was received during the quarter. Several problems with both the reels and tapes were experienced, but these have now been overcome and the tape is being used at most sites. Haystack Observatory completed the production of recorders and playback drives.

Correlator

Confidence in the correlator grows as the level of remaining bugs diminishes. Although the "first science" milestone has not yet been passed, the correlator is being operated by the correlator operators for three hours every night. This enables development and testing of correlator operations independently of the continuing investigation of problems in correlation. Currently only test jobs are scheduled, but we plan to shift into initial production correlation as soon as feasible. A typical eight-station, 1-hour observing run takes about 0.5 hours to correlate and 0.75 hours to process in AIPS through to fringe fitting (on a Sparcstation IPX).

Operations

Although the VLBA correlator is not in production, observations on the array continue. In July, about 50 percent of the available time was scheduled, mainly on time-critical observations such as monitoring projects. This current observing is consuming our pool of about 420 thin tapes since we are now using thin tapes on all stations. The goal is to get as much experience as possible with thin tape operation before making the final procurement of the remaining thin tapes (about 580) in the last quarter of 1993.

P. GREEN BANK TELESCOPE PROJECT

Antenna

Schedule - The antenna contractor, Radiation Systems, Inc., has submitted a revised master program schedule reflecting a delay in delivery of the Green Bank Telescope (GBT) until December 31, 1995. The requested delay has resulted from difficulties in completing the antenna design, particularly the elevation structure design. AUI/NRAO is reviewing the requested delay and assessing the overall project impact, and has requested a recovery schedule from the contractor.

Design - The antenna contractor completed detailing of the azimuth cable wrap drawings and released a number of drawings for fabrication, including: alidade equipment room support structure, alidade access support bracing, loading platform support structure, loading platform, manlift mast support structure, elevation drive level access, and stairs, platforms, gratings and finish changes. Development of the plans and procedures for the fabrication, trial erection and final erection of the elevation rotating structure continued. Analysis of the rotating structure FEM model continued. Joint design review also continued and fatigue testing of sample joints was begun at Texas A&M. An analysis of the elevation bearing split was completed (the bearing is so large that it must be split for shipping).

Fabrication/Construction - The first shipment of panel fixtures was received by the antenna contractor. The first fixture table was completed and set-up was begun for fixture checkout. Also, the first panel tool was received and set up for checking. The chassis and all boards for the central control unit were received. All Az/El drive cabinets were completed. One cabinet was undergoing testing and burn-in.

At the construction site, the azimuth track, which was completed during the last report period, has been measured and has proven to be level within ± 0.0125 inches, which is within the specified tolerance. The assembly of the alidade is complete through Level 2. Level 3 was close to bolt-up completion. All sixteen wheels were in place on the track. One wheel is slightly out of tolerance and will be removed for re-machining later this year. All whiffle beams and corner weldments are in place. Welding of the bolted-up structure continued. Shipment of the structural components for alidade levels 4 through 7 continued.

Active Surface and Pointing (Closed Loop)

The calibration range in the basement of the 300 Foot Telescope control building, constructed over the last several months, has been fully occupied and the calibration work is proceeding according to schedule.

Development of the production laser detector is complete. Development of the production laser units is underway. The fourth axis for the Green Bank numerically controlled mill, which will be used in the production of the rangefinders, has been received and is expected to be brought fully on-line soon.

Quotes for the 2400 retroreflectors required for the telescope surface were received in order. Request for approval to place the order was sent to the National Science Foundation.

Software development continues in the acoustic thermometry area.

A landmark was reached when the ability was demonstrated to operate the lasers from Sun computers. A Sun system, rather than a PC system, will be used for the laser operation.

Procurement is underway to obtain the RF oscillator assembly, a critical component in the laser rangefinder. Prototype development of the oscillator assembly has recently shown that the specification is attainable.

Active Surface and Pointing (Open Loop)

A subsystem to monitor and control various parts of the active surface control system has been designed and was being tested. The system includes power supply monitoring and control, actuator temperature monitor circuits, watchdog timers, and emergency stop interfaces. A board which interfaces actuator cables to motor drive and LVDT read-out modules, and provides transient suppression was designed and fabricated.

The software effort continued up the C++ learning curve.

Servo

Effort in this area consisted of monitoring the progress of the servo contractor RSI/PCD. During this period, a review of the software for the Operator Control Unit was attended. The design appeared well conceived and adequate for its intended purpose. Several changes to the proposed layout of information on the screen were requested by NRAO.

RSI/PCD has recently revamped its schedule to take into account its production capabilities and the slippage in the overall telescope schedule. The new schedule calls for factory sell-off in February 1994.

Monitor and Control

RPC Classes - Work on the original set of public domain RPC++ classes was abandoned because of the number of compiler-specific (GNU) dependencies in the code. Instead, an alternate RPC++ class implementation which has less features (namely it requires the client serialize the procedure arguments), but compiles readily under our production compiler (CenterLine), will be used. The classes have been enhanced to handle either TCP or UDP, and to work under Sun or VxWorks.

GUI (Graphic User Interface) - Approximately half of a GUI editor for creating telescope control and monitor windows was finished. Work was begun on classes for computing signal transformations for feedback to the user.

Antenna and Pointing - Initial discussions of interfaces between monitor and control and pointing have begun.

140 Foot Telescope Test - Initial coordination meetings for testing GBT monitor and control software on the 140 Foot Telescope were begun. A draft definition of the experiment was written.

Electronics

LO and IF System - Work continued on the IF components which will be located in the Receiver Room. Drawings for the IF Router and Fiber Driver module have been submitted to the shop and fabrication has begun. Delivery of some of the purchased components is behind schedule; attempts are being made to expedite delivery from the vendors. Preliminary design of the M/C interface for the IF Router and Fiber Driver modules is complete. Extensive testing of an optical fiber microwave link was completed, and its performance is judged acceptable.

Work continued to complete the design of the IF system. This includes the 1-8 GHz Converter, search for a synthesizer for the system second LO, and selection of filters and other components.

Receivers - Assembly of the first prime focus receiver continued, and assembly of the 12-15.4 and 8-10 GHz gregorian receivers began. Delivery of the waveguide polarizers for the latter two receivers is behind schedule, but assembly and wiring of the receivers has proceeded. Cryogenic HEMT amplifiers for the 12-15.4 and 8-10 GHz receivers have been delivered.

Both feeds for the 12-15.4 GHz receiver have been fabricated and tested, and the 8-10 GHz feed is ready for testing.

An experimental OMT was sent to an outside firm to be dip-brazed, to gain experience with this assembly process. The unit turned out well. It appears that the final OMT's being designed for the 3.95-5.85 GHz and 1.15-1.73 GHz receivers could be dip-brazed successfully. Work on the 3.95-5.85 GHz OMT, including continued HFSS modeling and generation of fabrication drawings, is underway.

Miscellaneous - NRAO staff continues to monitor progress for the NASA-SERC correlator chip. Delivery of prototype chips now appears to be possible in October. Iteration of the spectrometer architecture design continued. Construction of test fixtures for testing of the chips has begun. Investigation of possible ways to build 2 GHz samplers using available comparator chips also begun. Investigation of possible bandpass filters for use preceding the samplers was carried out and some candidates were ordered for evaluation.

Linearity tests were done on V/F converters being considered for use in the continuum detector modules. Software tools needed to program the backend processors was acquired and are being studied.

Q. PERSONNEL

New Hires

Smith, C.	Librarian - Socorro	04/01/93
Haynes, M.	Visiting Scientist	06/01/93
Rowen, B.	Scientific Programmer	06/15/93

Terminations

Balonek, T.	Visiting Scientist	04/02/93
Stidstone, R.	Chief Engineer, VLBA Antennas	04/30/93
Valente, M.	Electronics Engineer II	05/14/93
Seielstad, G.	Scientist	05/31/93
Haynes, M.	Visiting Scientist	06/30/93
Junor, W.	Assistant Scientist, Socorro Operations	06/30/93
Lagoyda, J.	Librarian, Socorro	05/31/93

Other

Kellermann, K.	Return from Leave of Absence	04/03/93
Langston, G.	Transfer from Charlottesville to Green Bank	04/16/93

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