NATIONAL RADIO ASTRONOMY OBSERVATORY

Quarterly Report

January 1 - March 31, 1993

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A. TELESCOPE USAGE

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

	140 Foot	12 Meter	VLA
Scheduled observing (hours)	1705.50	1791.50	1652.60
Scheduled maintenance and equipment changes	148.75	8.25	241.40
Scheduled tests and calibrations	237.75	360.25	251.00
Time lost	237.73	508.75	57.84
Actual observing	1467.75	1282.75	1594.80

B. 140 FOOT TELESCOPE

The following programs were conducted during this quarter.

No.	Observer(s)	Program
B533	Bell, M. (HIA, Ottawa) Seaquist, E. (Toronto)	Observations of H_2CO at 14.5 GHz to examine the dust lane and nuclear region of Centaurus A.
C279	Carignan, C. (U. Montreal) Demers, S. (U. Montreal) Westpfahl, D. (NMIMT) Fisher, J. R. Puche, D. (Harvard)	Observations to measure the HI content of dwarf spheroidals.
L271	Lockman, F. J. Savage, B. (Wisconsin)	Search at 1420.4 MHz for high-velocity HI toward QSO's.
L273	Lockman, F. J. Murphy, E. (Virginia)	HI mapping of Ursa Major.
L280	Lockman, F. J. Savage, B. (Wisconsin) Murphy, E. (Virginia)	Continued search at 1420 MHz for high-velocity HI toward QSO's.
M352	Moscadelli, L. (Bologna) Wilson, T. (MPIR, Bonn) Graham, D. (MPIR,Bonn) Mantovani, F. (Bologna) Catarzi, M. (Arcetri) Cohen, R. (Manchester) Baath, L. (Chalmers/Onsala) Menten, K. (CFA)	VLBI measurements of 12 GHz methanol masers using telescope G.

No.	Observer(s)	Program
M354	Malnendes, S. (Molecular Res. Inst.) McLean, A. (Molecular Res. Inst.) Thaddeus, P. (CFA) Vrtilek, J. (CFA) Gottlieb, C. (CFA) Turner, B.	A search at 18.8, 21.5, and 24.3 GHz for the cumulene, C_2H_6.
M356	Maddalena, R.	Continued 1420 MHz measurements of HI emission from the region of Orion.
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.
T321	Turner, B.	Observations at 18.2 and 23.7 GHz of NH_3 and HC_3N in Clemens-Barvainis objects.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
B550	Backer, D. (Calif., Berkeley) Foster, R. (NRL) Sallmen, S. (Calif., Berkeley)	Observations at 0.8 and 1.4 GHz of the timing of an array of pulsars.
L278	Lundgren, S. (Cornell) Cordes, J. (Cornell) Foster, R. (NRL) Nice, D. (Princeton) Ulmer, M. (Northwestern)	Simultaneous 800 and 1400 MHz radio and Gamma-ray observations of two pulsars.
M359	McKinnon, M.	A search at 800 MHz for pulsed emission from the companion of PSR B1820-11.
N12	Nice, D. (Princeton) Arzoumanian, Z. (Princeton) Sayer, R. (Princeton) Taylor, J. (Princeton)	A search at 800 MHz for radio pulsars coincident with EGRET gamma-ray point sources.
S356	Salter, C. (NAIC) Biggs, J. (Curtin Univ., Australia) Foster, R. (NRL)	HI-absorption observations at 1420 MHz 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 MHz and 1300-1350 MHz.
T320	Taylor, J. (Princeton) Nice, D. (Princeton) Sayer, R. (Princeton) Camilo, F. (Princeton)	A survey of the northern sky for millisecond pulsars at 1330 MHz.

C. 12 METER TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
A105	André, P. (CNRS, France) Loren, R. (unaffiliated) Wootten, H. A. Despois, D. (Bordeaux)	Study of mass and morphology of dense gas of the rho Ophiuchi cloud cores.
A112	Antonucci, R. (Calif., Santa Barbara) Barvainis, R. (Haystack)	Broadband, wide-field search for CO in cooling flows.
B585	Balonek, T. (Colgate) Dent., W. (Massachusetts)	Study of the evolution of extragalactic radio sources at millimeter wavelengths.
B586	Balonek, T. (Colgate)	Study of short time scale variability of extragalactic radio sources at millimeter and optical wavelengths.
B588	Bieging, J. (Arizona) Latter, W.	Further molecular line studies of S stars.
B590	Barvainis, R. (Haystack) Antonucci, R. (Calif., Santa Barbara) Coleman, P. (Leiden)	The "Cloverleaf": An excellent candidate for CO and CI emission from a quasar at $z \sim 2.5$.
B592	Brown, R. Vanden Bout, P.	Study of CO emission at high redshift.
B593	Buhl, D. (NASA/GSFC) Goldstein, J. (NASM) Chin, G. (NASA/GSFC)	Study of global winds in the mesosphere of Venus.

No.	Observer(s)	Program
C276	Clancy, R. T. (Colorado) Muhleman, D. (Caltech-OVRO)	Microwave spectroscopy of the terrestrial planetary atmospheres.
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.
D180	Digel, S. (CFA) de Geus, E. (Maryland)	Study of dense molecular gas beyond the optical disk of the Milky Way.
G331	Gensheimer, P. (Illinois) Likkel, L. (Illinois) Snyder, L. (Illinois)	Proposal for mapping SiC_2 in IRC+10216.
H286	Ho, P. (CFA) Szczepanski, J. (MIT) Ho, L. (Calif., Berkeley) Pahre, M. (Caltech)	Mapping of molecular cloud interactions with the galactic center.
L274	Latter, W. Maloney, P. (NASA/Ames)	Study of CO^+ and HCO^+ in photodissociation regions.
L275	LaRosa, T. (NASA/Marshall) Magnani, L. (Georgia) Shore, S. (NASA/Marshall)	A statistical study of turbulence in a molecular cloud without star formation.
M344	Moriarty-Schieven, G. (JPL) Wannier, P. (JPL) Tamura, M. (JPL) Keene, J. (Caltech)	Study of CS in proto-stellar cores.
M349	Mead, K. (Union College, NY) Carey, S. (RPI) Kutner, M. (RPI)	Sensitive survey of arm and interarm molecular clouds in the outer galaxy.
M353	Minh, Y. (Daeduk, Korea) Turner, B. Kim, K. (ChungNam, China) Irvine, W. (Massachusetts)	Study of the chemistry of cirrus cloud cores.
O42	Odenwald, S. (NRL) Lockman, F. J.	A CO survey of high-latitude, far-IR clouds.
P162	Pound, M. (Maryland) Blitz, L. (Maryland)	The continued search for proto-brown dwarfs.

No.	Observer(s)	Program
R252	Wilner, D. (Calif., Berkeley) Lee, Y. (Massachusetts) Reach, W. (NASA/GSFC) Pound, M. (Maryland)	Dense gas in high-latitude clouds: A multi-transitional study of CS excitation.
R253	Rogers, C. (DRAO) Dewdney, P. (DRAO) Fich, M. (Waterloo)	A differential comparison of H_2+CO photo-dissociation regions.
S349	Sage, L. (Nevada) Ziurys, L. (Arizona State)	A search for SiO emission from a sample of nearby galaxies.
T296	Turner, B. Amano, T. (NRC, Herzberg) Avery, L. (NRC, Herzberg) Feldman, P. (NRC, Herzberg)	A 2 mm spectral survey of Orion, Sgr B2, W51M, and IRC 10216.
T307	Turner, B. Rickard, L. (NRL) Lanping, X. (Beijing)	Completion of project T290: Are cirrus clouds different from galactic plane clouds?
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.
T319	Thatte, N. (Calif., Berkeley) Welch, W. J. (Calif., Berkeley)	Study of bipolar outflow in W43.
W318	Womack, M. (Northern Arizona)	Interstellar ionization studies through observations of HCO^+ isotopes.
Y11	Yu, T. (Calif., Berkeley) Welch, W. J. (Calif., Berkeley)	Study of rho Ophiuchi B1.
Z100	Ziurys, L. (Arizona State) Snyder, L. (Illinois) Hollis, J. M. (NASA/GSFC)	Confirmation of interstellar HNO: The 1.2 mm transition.
Z101	Ziurys, L. (Arizona State) Apponi, A. (Arizona State) Barclay, W. (Arizona State) Yoder, T. (Arizona State)	Confirmation of interstellar MgOH.
Z102	Ziurys, L. (Arizona State) Apponi, A. (Arizona State) Barclay, W. (Arizona State) Anderson, M. (Arizona State)	A search for interstellar CaH.

No.	Observer(s)	Program
Z104	Ziurys, L. (Arizona State) Apponi, A. (Arizona State)	A search for interstellar AlOH.

D. VERY LARGE ARRAY

First quarter 1993 was spent in the following configurations: BnA configuration from January 1 to February 18; A configuration from February 26 to March 31.

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 ρ-Oph cloud. 3.5 cm
AA149	Akujor, C. (Chalmers, Onsala) Booth, R. (Chalmers, Onsala) Garrington, S. (Manchester) Spencer, R. (Manchester) Ludke, E. (Manchester)	Depolarization in compact steep-spectrum sources. 6 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. 3.6, 20 cm
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
AB612	Biretta, J. (STScI) Owen, F.	Monitoring of proper motions in the M87 jet. 2 cm
AB628	Becker, R. (Calif., Davis) Helfand, D. (Columbia) White, R. (STScI) Perley, R.	Survey of the north galactic cap. 20 cm
AB666	Browne, I. (Manchester) Baldwin, J. (NOAO) Netzer, H. (Tel Aviv) Wills, B. (Texas) Wills, D. (Texas)	Structures for radio loud HST quasars. 20 cm

No.	Observer(s)	Program
AB667	Burke, B. (MIT) Becker, D. (MIT) Conner, S. (MIT) Avruch, M. (MIT) Fletcher, A. (MIT) Herold, L. (MIT) Turner, E. (Princeton) Ekers, R. (AT, Australia) Wright, A. (AT, Australia)	MG VLA gravitational lens search. 3.6 cm
AB669	Bookbinder, J. (CFA) Guedel, M. (Colorado) Saar, S. (CFA)	M dwarfs. 2, 3.6, 6, 20 cm
AB671	Beasley, A. Bastian, T.	Rotational modulation of O-B star microwave emission. 3.6, 6 cm
AC329	Cecil, G. (North Carolina) DePree, C. (North Carolina)	Nuclear outflow in NGC 6951. 6 cm
AC333	Cordova, F. (Penn State) Thompson, R. (Penn State)	Ultrasoft X-ray emitting active galactic nuclei. 6 cm
AC337	Clancy, T. (Colorado) Grossman, A. (Maryland) Muhleman, D. (Caltech)	Mapping seasonal variations of Mars water vapor. 1.3 cm
AC341	Curiel, S. (CFA) Rodriguez, L. (Mexico/UNAM) Moran, J. (CFA)	Radio monitoring of the Serpens radio jet. 2, 3.6, 6 cm
AC348	Carilli, C. Westpfahl, D. (NMIMT) Tongue, T. (NMIMT) Holdaway, M. Zhao, J. Rupen, M.	Polarimetry of barred spiral NGC 1365. 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
AC350	Carilli, C. Wrobel, J.	HI absorption towards MKN 231. 20 cm
AC351	Caganoff, S. (Melbourne) Tsvetanov, Z. (Johns Hopkins)	Radio morphology and extended emission line region in Seyfert galaxies. 6 cm

No.	Observer(s)	Program
AC360	Carlstrom, J. (Caltech) Phillips, T. (Caltech) Hills, R. (Cambridge) Lay, O. (Cambridge) Menten, K. (CFA)	Stellar 22 GHz water masers at the time of 321 MHz water maser observations. 1.3 cm
AD252	de Pater, I. (Calif., Berkeley)	Jupiter patrol. 20 cm
AD294	David, L. (CFA) Harris, D. (CFA)	NGC 5044 - Central dominant galaxy in a group with a cooling flow. 6 cm
AD297	Drake, S. (NASA/GSFC) Simon, T. (Hawaii) Linsky, J. (Colorado) Dempsey, B. (Colorado) White, N. (NASA/GSFC)	Search for radio emission from X-ray selected RS CVn candidates. 3.5 cm
AD298	Dwarakanath, K. Rupen, M.	Steep-spectrum sources. 3.6, 6, 20, 90 cm
AD299	Dey, A. (Calif., Berkeley) van Breugel, W. (LLNL)	3C 258--radio galaxy with aligned radio and optical structures. 3.6, 6, 20 cm
AD300	Drake, S. (NASA/GSFC) Linsky, J. (Colorado) Schmitt, J. (MPIfEP, Munich) Lim, J. (Caltech)	Selected magnetic Bp stars. 3.6 cm
AD304	Dahlem, M. (STScI)	Star-forming regions in the inner disk of NGC 1792. 20 cm
AD305	Dwarakanath, K. van Gorkom, J. (Columbia) Owen, F.	Neutral hydrogen in cooling flows of clusters of galaxies. 20 cm
AD307	Diamond, P. Frail, D. van Langevelde, H. (Leiden) Cordes, J. (Cornell)	The shape of the scattering disk of OH/IR stars at Galactic Center. 20 cm
AD310	de Pater, I. (Calif., Berkeley) Silva, A. (Calif., Berkeley) Lissauer, J. (SUNY) Showalter, M. (NASA/Ames) Graham, J. (Calif., Berkeley)	Saturn main ring system. 1.3, 2, 3.6 cm
AF217	Frail, D. Kulkarni, S. (Caltech) Thorsett, S. (Caltech)	Young pulsar in G5.4-1.2. 20 cm

No.	Observer(s)	Program
AF226	Feigelson, E. (Penn State) Hertz, P. (NRL) Kollgaard, R. (Penn State) Brinkmann, W. (MPIfEP, Munich) Voges, W. (MPIfEP, Munich)	Radio source contributors to the X-ray background. 3.5, 6 cm
AF231	Frail, D. Vasisht, G. (Caltech) Kulkarni, S. (Caltech)	Are PSR 1758-23 and SNR W28 physically associated? 3.6, 20 cm
AF235	Foster, R. (NRL) Backer, D. (Calif., Berkeley)	PSR 1951+32 in the CTB 80 supernova remnant. 20 cm
AF238	Fiebig, D. (Heidelberg) Menten, K. (CFA) Duschl, W. (Heidelberg) Tscharnuter, W. (Heidelberg)	Water maser outbursts in Fu Orionis star RNO 1B. 1.3 cm
AF243	Foster, R. (NRL) Tavani, M. (Princeton) Frail, D.	Search for pulsed emission from LSI +61 303. 20 cm
AF244	Frail, D. Cordes, J. (Cornell) Harrison, P. (Manchester)	Search for pulsar wind nebulae. 3.6 cm
AF245	Frail, D. Kulkarni, S. (Caltech) Yusef-Zadeh, F. (Northwestern)	Determining the proper motions of non-thermal cometary nebulae. 3.6 cm
AG357	Ge, J. (Brandeis) Taylor, G. (Caltech) Owen, F.	Large Faraday rotations in cooling flow cluster A1795. 2 cm
AG363	Greenhill, L. (CFA)	Continuum emission associated with the IC10 water megamaser. 1.3 cm
AG364	Grossman, A. (Maryland) Muhleman, D. (Caltech)	Saturn's atmosphere. 20 cm
AG371	Grossman, A. (Maryland) Muhleman, D. (Caltech)	Polarized emission from Titan's surface. 3.5 cm
AG373	Guedel, M. (Colorado) Dempsey, R. (Colorado) Linsky, J. (Colorado)	Flares on RS CVN's observed with the VLA and ROSAT: V772 Her. 3.6, 6, 20 cm
AG374	Guedel, M. (Colorado) Schmitt, J. (MPIfEP, Munich)	Alpha CrB: A totally eclipsing radio binary? 3.6 cm

No.	Observer(s)	Program
AG375	Guedel, M. (Colorado) Elias, N. (USNO) Lim, J. (Caltech)	Radio characteristics of selected PELA-like objects. 2, 3.6, 6, 20 cm
AG377	Guedel, M. (Colorado) Schmitt, J. (MPIfEP, Garching) Benz, A. (ETH, Zurich)	X-ray-flux-limited sample of G main-sequence stars. 3.6 cm
AG381	Golub, L. (CFA) Bastian, T. Koutchmy, S. (CNRS, France) Zirker, J. (NOAO)	Microwave, soft X-ray and optical fluctuations of coronal bright points. 6, 20 cm
AG382	Goss, W. M. Schwarz, U. (Groningen/Kapteyn) Dubner, G. (IAFE, Buenos Aires) Winkler, F. (Middlebury)	Search for HI associated with Cas A. 20 cm
AH390	Hjellming, R. Gehrz, R. (Minnesota) Taylor, A. (Calgary) Seaquist, E. (Toronto)	Monitoring radio novae. 3.6, 6, 20 cm
AH424	Han, X. (NMIMT) Hjellming, R.	The radio remnant of the 1989 outburst of V404 Cyg. 3.6, 6 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
AH477	Hewitt, J. (MIT) Katz, C. (MIT) Turner, E. (Princeton)	Gravitational lens MG0414+0534. 1.3, 2, 3.6, 6, 20 cm
AH478	Hewitt, J. (MIT) Ellithorpe, J. (MIT) Moore, C. (MIT) Turner, E. (Princeton)	Monitoring gravitational lens MG0414+0534. 2 cm
AH485	Hankins, T. (NMIMT) Moffett, D. (NMIMT)	Crab pulsar "giant pulses." 3.6, 6, 20 cm
AH486	Healy, K. (NMIMT) Hankins, T. (NMIMT)	Pulsar radio halos. 90 cm
AH487	Higdon, J.	Continuum emission from the Cartwheel ring galaxy. 3.6 cm

No.	Observer(s)	Program
AJ221	Jacobson, A. (Los Alamos) Erickson, W. (Maryland) Mercier, C. (Paris)	Geoplasma dynamics. 90 cm
AJ222	Johnston, K. (NRL) Claussen, M. Bowers, P. (NRL)	Water masers of IK Tau. 1.3 cm
AJ226	Junor, W. Saikia, D. (TIFR) Salter, C. (NAIC) Ghosh, T. (NFRA)	0042+672 - A steep-spectrum Crab look-alike? 20 cm
AK307	Kronberg, P. (Toronto)	3 C9 — a single-image gravitational lens. 2, 3.6, 6 cm
AK317	Kassim, N. (NRL) Perley, R. Erickson, W. (Maryland) Dwarakanath, K. Taylor, G. (Caltech)	75 MHz imaging: the weaker sources. 90 cm
AK320	Kronberg, P. (Toronto)	Further sample of highly redshifted quasars. 3.6, 6 cm
AK322	Kronberg, P. (Toronto) Perley, R. Dyer, C. (Toronto)	Polarization symmetry-breaking in quasar jets. 3.6 cm
AK324	Kollgaard, R. (Penn State) Feigelson, E. (Penn State) Laurent-Muehleisen, S. (Penn State) Chester, M. (Penn State) Brinkmann, W. (MPIfEP, Munich) Hertz, P. (NRL)	Optically quiet quasars. 1.3, 2, 3.6, 6, 20 cm
AK326	Kundu, M. (Maryland) Strong, K. (Lockheed) Kane, S. (Calif., Berkeley) Pick, M. (Meudon) White, S. (Maryland) Gopalswamy, N. (Maryland)	Flaring bright points. 20, 90 cm
AL150	Lestrade, J. (Meudon) Preston, R. (JPL)	Statistical properties of RSCVn stars. 6 cm
AL251	Langston, G.	Tracking variability of gravitational lens 2016+112. 3.5, 6 cm
AL252	Ledlow, M. (New Mexico) Owen, F.	Radio galaxies in rich clusters. 20 cm

No.	Observer(s)	Program
AL279	Lim, J. (Caltech) White, S. (Maryland) Phillips, R. (Haystack)	A test for the evolution of stellar coronae. 2, 3.6, 6, 20 cm
AL283	Lozinskaya, T. (Sternberg, Moscow) Purton, C. (Hawaii) Dewdney, P. (DRAO)	Stellar wind of WR142. 2, 6 cm
AL287	Lonsdale, C. (IPAC, Pasadena) 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
AL292	Langston, G.	Gravitational lens MG1654+1346. 2, 6, 20 cm
AM360	McMullin, J. (Maryland) Mundy, L. (Maryland)	Survey of young stellar objects. 1.3, 2, 3.5 cm
AM364	Morganti, R. (CNR, Bologna) Parma, P. (CNR, Bologna) Fanti, R. (CNR, Bologna) de Ruiter, H. (CNR, Bologna) Capetti, A. (Torino)	Polarization study of B2 radio galaxies. 6 cm
AM374	Mehringer, D. (Chicago) Palmer, P. (Chicago) Goss, W. M. Yusef-Zadeh, F. (Northwestern)	W51 — the ultracompact H II regions. 1.3, 2, 3.6, 20 cm
AM378	Migenes, V. (AT, Australia) Bowers, P. (NRL) Cohen, R. (Manchester) Shepherd, M. (Caltech)	High resolution and sensitivity maps of OH maser shells. 20 cm
AM379	Mirabel, F. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Gamma ray sources 1E1740.7-2942 and GRS1758-258. 6, 20 cm
AM382	Muhleman, D. (Caltech) Butler, B. (Caltech) Slade, M. (JPL)	Radar imaging of Mars. 3.6 cm
AM384	Mulchaey, J. (STScI) Wilson, A. (STScI)	Comparison of Seyfert I/Seyfert II emission in S0 and E hosts. 3.6, 20 cm
AM386	Mehringer, D. (Chicago) Palmer, P. (Chicago) Goss, W. M.	OH and H_2O masers in Sgr D. 20 cm

No.	Observer(s)	Program
AM387	Mehringer, D. (Chicago) Palmer, P. (Chicago) Goss, W. M.	Sgr B2. 6 cm
AM389	McKinnon, M. Thorsett, S. (Caltech) Taylor, J. (Princeton)	Orbit determination and mass of PSR B1820-11. 20 cm HTRP
AM392	Moore, C. (MIT) Hewitt, J. (MIT) Turner, E. (Princeton)	Gravitational lensing in MG2120+1327. 2, 6 cm
AM394	Mundy, L. (Maryland) McMullin, J. (Maryland) Blake, G. (Caltech) Sandell, G. (JCMT)	NGC 1333 IRAS 4: centimeter wavelength emission from dust? 3.6, 6 cm
AM396	Melia, F. (Arizona) Olszewski, E. (Arizona) Yusef-Zadeh, F. (Northwestern)	Radio sources in three nearby dwarf spheroidal galaxies. 3.6, 6, 20 cm
AM399	Mirabel, I. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Monitoring 1E1740.7-2942 and GRS1758-258. 6 cm
AM401	Minter, A. (Iowa) Spangler, S. (Iowa)	Faraday rotation measurements to study plasma turbulence in the ISM. 20 cm
AM404	Muhleman, D. (Caltech) Butler, B. (Caltech) Slade, M. (JPL) Haldemann, A. (Caltech)	Venus radar map — eta Regio. 3.6 cm
AN058	Navarro, J. (Caltech) Kulkarni, S. (Caltech) Vasisht, G. (Caltech) Tanaka, Y. (ISAS, Japan) Nagase, F. (ISAS, Japan) Frail, D. Strom, R. (NFRA)	Monitoring quiescent LMXBs. 20 cm
AN059	Nonino, M. (Trieste Obs) Fanti, C. (CNR, Bologna) Fanti, R. (CNR, Bologna)	Radio mapping of Markarian 315. 6, 20 cm
AO111	Owen, F. Lavery, R. (DTM/Carnegie) Henry, P. (Hawaii)	Gravitational lens candidate in an Abell cluster. 2, 3.6 cm
AO114	O'Dea, C. (STScI) Jackson, J. (Boston)	Search for molecular absorption in GPS radio sources. 1.3, 2, 20 cm

No.	Observer(s)	Program
AP237	Phillips, J. (Caltech) Frail, D. Thorsett, S. (Caltech)	Search for asteroids and planetesimals around pulsars. 20 cm
AP243	Patnaik, A. (Manchester) Browne, I. (Manchester) King, L. (Manchester) Walsh, D. (Manchester) Wilkinson, P. (Manchester)	Monitoring the smallest lens 0218+357. 2, 3.6 cm
AP255	Puche, D. (CFA) Westpfahl, D. (NMIMT)	HI mapping of grand design spirals M51 and M83. 20 cm
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
AP259	Purcell, W. (Northwestern) Yusef-Zadeh, F. (Northwestern)	Extended emission near pulsars PSR 1952+29 and PSR 1913+16. 3.6, 20 cm
AP260	Pahre, M. (Caltech) Ho, P. (CFA)	HII regions and hot molecular cloud cores in W51. 1.3 cm
AP261	Palmer, P. (Chicago) Mehringer, D. (Chicago) Yusef-Zadeh, F. (Northwestern) Goss, W. M.	OH maser in the Sgr B1. 20 cm
AQ009	Quirrenbach, A. (NRL) Edelson, R. (NASA/GSFC) Madejski, G. (NASA/GSFC) Witzel, A. (MPIR, Bonn) Bregman, J. (Michigan)	Monitoring BL Lacertae objects OJ287 and Mkn 421. 3.6, 6, 20 cm
AR275	Rhee, G. (New Mexico State) Roland, J. (IAP, Paris) Webb, J. (New South Wales)	High redshift radio galaxies. 6, 20 cm
AR282	Rawlings, S. (Oxford) Lacy, M. (Oxford) Riley, J. (Cambridge) Waldram, E. (Cambridge) Warner, P. (Cambridge)	Approximately 10 MHz peaked radio sources: a new population of high-redshift galaxies. 3.6 cm
AR283	Reid, M. (CFA) Menten, K. (CFA)	OH masers and the galactic magnetic field. 20 cm

No.	Observer(s)	Program
AR284	Ridgway, S. (Hawaii) Chambers, K. (Hawaii) Stockton, A. (Hawaii)	Nature of low radio luminosity z ~ 1 quasars. 6 cm
AR287	Rigler, M. (Hawaii) Lilly, S. (Toronto) Chambers, K. (Hawaii)	High redshift radio galaxies. 6 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
AR292	Roberts, D. (Illinois) Yusef-Zadeh, F. (Northwestern) Goss, W. M.	H92α observations of high velocity gas in Sag A West. 3.6 cm
AR300	Ratner, M. (CFA) Bartel, N. (CFA) Lestrade, J. (Meudon) Lebach, D. (CFA) Shapiro, I. (CFA)	Reference sources near HR 5110. 3.6 cm
AS333	Sramek, R. Weiler, K. (NRL) Van Dyk, S. (NRL) Panagia, N. (STScI)	Statistical properties of radio supernovae. 2, 6 cm
AS450	Sahai, R. (JPL) Claussen, M.	Time variation of the enigmatic radio source in IRC+10216. 1.3, 2, 3.6 cm
AS479	Swain, M. (Rochester) Bridle, A. Baum, S. (STScI)	3C 353. 3.6 cm
AS484	Salter, C. (Arecibo) Junor, W. Bignell, R. C. Saikia, D. (TIFR)	Optically thick planetary nebulae. 90 cm
AS485	Schachter, J. (CFA) Elvis, M. (CFA) Stocke, J. (Colorado) Perlman, E. (Colorado)	New, bright BL Lacs in the Einstein slew survey. 6 cm
AS488	Seaquist, E. (Toronto) Odegard, N. (NASA/GSFC)	Synchrotron emitting wind in NGC 4194. 20 cm
AS490	Stocke, J. (Colorado) Perlman, E. (Colorado)	The most highly core-dominated BL Lacs. 20 cm

No.	Observer(s)	Program
AS497	Saikia, D. (TIFR) Thomasson, P. (Manchester)	Compact sources from the S4 survey. 15 GHz
AS498	Surdej, J. (Liege) Kellermann, K. Haubold, H. (UN) Kayser, R. (Hamburg Obs) Retty, M. (IAP, Paris) Refsdal, S. (Hamburg Obs)	Clover-leaf gravitational lens H1413+117. 2, 3.6 cm
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. (Onsala) Sevenster, M. (Leiden)	OH/IR stars: 1612 MHz survey of galactic plane. 18 cm
AT144	Taylor, G. (Caltech) Ge, J. (Brandeis) Owen, F. Baum, S. (STScI) O'Dea, C. (STScI)	Faraday rotation in cooling flow clusters. 3.6 cm
AT145	Thorsett, S. (Caltech) Taylor, J. (Princeton) McKinnon, M. Hankins, T. (NMIMT) Stinebring, D. (Oberlin)	Timing fast pulsars. 6, 20, 90 cm
AT147	Thorsett, S. (Caltech) Kulkarni, S. (Caltech) Readhead, A. (Caltech) Thakkar, D. (Caltech) Vermeulen, R. (Caltech) Frail, D.	Calibrators around three millisecond pulsars. 3.6 cm
AT148	Tongue, T. (NMIMT) Carilli, C. Westpfahl, D. (NMIMT) Puche, D. (CFA)	Low-frequency continuum of Homberg II. 90 cm
AV193	van der Hucht, K. (Utrecht) Williams, P. (Royal Obs) Spoelstra, T. (NFRA)	Wolf-Rayet object WR125. 2, 6, 20 cm

No.	Observer(s)	Program
AV201	Vasisht, G. (Caltech) Kulkarni, S. (Caltech) Frail, D.	Proper motion measurements of PSR 1800-21. 20 cm
AV203	Van Dyk, S. (NRL) Weiler, K. (NRL) Sramek, R. Schlegel, E. (NASA/GSFC) Filippenko, A. (Calif., Berkeley) Panagia, N. (STScI)	Search for Type IIpec Supernovae. 6, 20 cm
AV204	van Breugel, W. (LLNL) Sutherland, W. (Calif., Berkeley) Heckman, T. (Johns Hopkins) Lehnert, M. (Johns Hopkins)	Southern quasar survey. 20 cm
AW230	Wrobel, J. Unger, S. (RGO)	International monitoring of the Seyfert NGC 5548. 3.6 cm
AW305	Wannier, P. (JPL) Andersson, B. (JPL) Moriarty-Schieven, G. (JPL) Federman, S. (Toledo)	Warm OH around molecular clouds. 20 cm
AW330	Wills, B. (Texas) Shastri, P. (Calif., Berkeley)	Core variability in lobe dominated quasars. 3.6 cm
AW335	Wootten, H. A. Mangum, J. (Arizona)	NGC 1333: dense gas accreting onto a binary protostar. 1.3 cm
AW339	Wilson, A. (STScI) Ulvestad, J. (JPL)	High resolution images of NGC 1068. 1.3 cm
AW340	Womble, D. (Calif., San Diego) Dickey, J. (Minnesota) Kazes, I. (Paris) Carilli, C.	Quasar galaxy pair 0248+430. 20 cm
AW341	Womble, D. (Calif., San Diego) Carilli, C. Sargent, W. (Caltech) Yun, M. (CFA)	Search for HI absorption towards Q0959+6827. 20 cm
AW343	Westpfahl, D. (NMIMT) Puche, D. (CFA)	The smallest dwarf galaxies. 20 cm
AW345	Wood, D.	G5.89-0.39: A bipolar outflow of ionized gas? 1.3, 2, 3.6 cm

No.	Observer(s)	Program
AW347	Wood, D. Kulkarni, S. (Caltech)	Radio spectrum of G2.4+1.4. 20, 90 cm
AW348	Wolszczan, A. (Penn State) Frail, D.	Further astrometric observations of PSR 1257+12. 20 cm
AW349	White, S. (Maryland) Mundy, L. (Maryland) Grossman, A. (Maryland) Beasley, A.	Mass loss in young stars. 3.5 cm
AZ056	Zhao, J. Goss, W. M. Anantharamaiah, K. (Raman Institute)	Radio recombination lines from starburst nuclei of nearby galaxies. 3.6 cm
AZ060	Zhao, J. Goss, W. M.	Flux variations of Sgr A* and the GCT. 1.3, 3.6 cm

E. VERY LONG BASELINE ARRAY

No.	Observer(s)	Program
BC020	Campbell, R. (CFA) Shapiro, I. (CFA) Ratner, M. (CFA) Bartel, N. (York) Cappallo, R. (Haystack) Whitney, A. (Haystack) Cannon, W. (ISTS) Petrachenko, W. (GSC) Eubanks, T. (USNO)	Pulsar parallaxes. 13 cm
BD003	Diamond, P. Beasley, A.	Proper motion of the OH and H_2O masers in W43(OH). 1.3, 18 cm line
BD011	Desai, K. (Calif., Santa Barbara) Diamond, P. Gwinn, C. (Calif., Santa Barbara)	OH masers in W49N. 20 cm
BG011	Greenhill, L. (CFA) Moran, J. (CFA) Reid, M. (CFA) Argon, A. (CFA)	Refining the water maser proper motions in M33/IC 133. 1.3 cm

No.	Observer(s)	Program
BJ002	Jones, D. (JPL) Jauncey, D. (AT, Australia) Preston, R. (JPL) Reynolds, J. (AT, Australia) Murphy, D. (JPL) Tzioumis, A. (AT, Australia) Meier, D. (JPL)	Einstein ring PKS 1830-211. 1.3 cm
BJ005	Junor, W. McHardy, I. (Southampton) Mantovani, F. (CNR, Bologna)	Short time scale variations in 3C 273. 1.3, 3.6, 6 cm
BL001	Lestrade, J. (Meudon) Jones, D. (JPL) Preston, R. (JPL) Phillips, R. (Haystack) Gabuzda, D. (Calgary)	Astrometry of 12 radio stars. 3.6 cm
BL002	Lestrade, J. (Meudon) Jones, D. (JPL) Preston, R. (JPL) Phillips, R. (Haystack)	Radio star astrometry for HIPPARCOS tie in. 3.6 cm
BL003	Lonsdale, C. (Haystack) Barvainis, R. (Haystack)	Radio quiet QSOs. 3.6 cm
BM007	Menten, K. (CFA) Reid, M. (CFA) Pratap, P. (CFA) Moran, J. (CFA)	Methanol masers. 7 mm
BR007	Roberts, D. (Brandeis) Wardle, J. (Brandeis) Ochs, M. (Brandeis) Brown, L. (Connecticut) Moellenbrock, G. (Brandeis)	Superluminal quasars 3C 273 and 3C 345. 3.6, 6 cm
BV006	Vermeulen, R. (Caltech)	Rapid structure variable 0642+449. 6 cm
BW003	Wrobel, J. Bridle, A. Walker, R. C.	Parsec-scale structure of the twin-jet source M84. 3.6, 6 cm
BW008	Walker, R. C. Fomalont, E.	VLBA baselines. 3.6 cm
BX001	Xu, W. (Caltech) Readhead, A. (Caltech) Pearson, T. (Caltech) Wilkinson, P. (Manchester) Polatidis, A. (Manchester)	A very small gravitational lens candidate. 2, 3.6 cm

No.	Observer(s)	Program
GB015	Bloom, S. (Boston) Marscher, A. (Boston) Gear, G. (Royal Obs)	Strong millimeter sources. 1.3, 3.6 cm
GG014	Gurvits, L. (Arecibo) Schilizzi, R. (NFRA) Kellermann, K. Barthel, P. (Groningen/Kapteyn) Pauliny-Toth, I. (MPIR, Bonn) Kardashev, N. (Lebedev) Popov, M. (Lebedev)	Quasars with z > 3. 6 cm
GG015	Giovannini, G. (CNR, Bologna) Feretti, L. (CNR, Bologna) Venturi, T. (CNR, Bologna) Marcaide, J. (IdA, Spain) Wehrle, A. (IPAC)	Two FR-1 radio galaxies: 3C 31 and 3C 264. 6 cm
GG018	Gabuzda, D. (Calgary) Wehrle, A. (IPAC)	Structure of 3C 279. 3.6 cm
GK007	Kollgaard, R. (Penn State) Feigelson, E. (Penn State) Laurent-Muehleisen (Penn State) Gabuzda, D. (Calgary)	X-ray selected BL Lac objects. 6 cm
GL009	Lestrade, J. (Meudon) Phillips, R. (Haystack) Jones, D. (JPL) Preston, R. (JPL)	Astrometric observations of stars to tie in HIPPARCOS. 3.6, 6 cm
GM012	Mantovani, F. (CNR, Bologna) Bondi, M. (CNR, Bologna) Junor, W. Padrielli, L. (CNR, Bologna)	Structures of steep-spectrum low frequency variables. 18 cm
GO001	O'Dea, C. (STScI) Biretta, J. (STScI)	Archetype FR-1 NGC 1265. 6 cm
GP012	Pauliny-Toth, I. (MPIR, Bonn) Unwin, S. (Caltech) Wehrle, A. (IPAC) Zensus, A. Nicolson, G. (Hartebeesthoek)	Monitoring of quasar 3C 454.3. 1.3, 3.6 cm

No.	Observer(s)	Program
GS007	Stanghellini, C. (CNR, Bologna) O'Dea, C. (STScI) Baum, S. (STScI) Fanti, R. (CNR, Bologna) Fanti, C. (CNR, Bologna) Dallacasa, D. (CNR, Bologna)	Gigahertz peaked spectrum radio sources. 6, 18 cm
GW007	Wilkinson, P. (Manchester) Henstock, D. (Manchester) Browne, I. (Manchester) Patnaik, A. (Manchester) Vermeulen, R. (Caltech) Taylor, G. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Cohen, M. (Caltech)	Survey of flat spectrum sources. 6 cm
GW008	Wehrle, A. (IPAC) Unwin, S. (Caltech) Abraham, Z. (Sao Paulo) Carrara, E. (Sao Paulo) Urry, C. (STScI) Madejski, G. (NASA-GSFC)	3C 279. 1.3, 6 cm
GX004	Xu, W. (Caltech) Conway, J. Unwin, S. (Caltech) Readhead, A. (Caltech) Pearson, T. (Caltech) Wilkinson, P. (Manchester) Polatidis, A. (Manchester)	Compact steep spectrum double and triple sources. 3.6 cm
GZ010	Zensus, A. Leppanen, K. Unwin, S. (Caltech) Wehrle, A. (IPAC)	Evolution of the parsec-scale structure of 3C 345. 1.3, 6 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

No.	Observer(s)	Program
UH002	Hewitt, J. (MIT) Cappallo, R. (Haystack) Corey, B. (Haystack) Ellithorpe, J. (MIT) Lestrade, J. (Meudon) Lonsdale, C. (Haystack) Niell, A. (Haystack) Phillips, R. (Haystack) Preston, R. (JPL)	Astrometric observations of the dMe stars AD Leo, YZ CMi, and Ev Lac. 3.6 cm
UL004	Lebach, D. (Harvard) Bartel, N. (CFA) Ratner, M. (CFA) Shapiro, I. (CFA)	Stellar astrometry for the NASA/Stanford gravity probe-B. 3.6 cm

F. SCIENTIFIC HIGHLIGHTS

Green Bank

Temporal Variations of Pulsar Dispersion Measures. The 140 Foot Telescope and the spectral processor have been used to monitor the time variability of the dispersion measure (DM) in the direction of four pulsars. The variations result from a changing line-of-sight through the interstellar medium owing to the peculiar motion of the pulsar with respect to the sun. The observed variations are inconsistent with the results from diffractive scattering studies. Contrary to expectations, the physical mechanism or the driving force responsible for DM variations appears to be distinct from that which causes diffractive scattering.

Investigators: D. C. Backer, S. Hama, S. van Hook (all UC, Berkeley) and R. S. Foster (NRL)

Socorro

Expansion Rate Measured for Remnant of Supernova 1006. The remnant of Supernova 1006 A.D. was observed with the VLA and the results compared to VLA observations made in 1983-84. By digitally subtracting the earlier map from the recent map, a clear expansion signature was revealed. The expansion was measured at about 3 arcseconds, implying an expansion rate of 0.04 percent per year, though there is evidence for variations around the remnant's shell. This measurement provides constraints for physical models of the remnant's expansion. SN 1006 is the last remnant of a prominent supernova of the past millennium to have its expansion measured in the radio region of the spectrum.

Investigators: D. A. Moffett (NMIMT), W. M. Goss (NRAO), and S. P. Reynolds (NC State)

VLA Observations Reveal Irregularities in Plasmasphere. A series of observations with the VLA has revealed irregularities in the total electron content of Earth's plasmasphere at altitudes from about 1,000 to 6,000 miles. Using unresolved radio sources as back-illumination for the geoplasma, researchers discovered previously unknown variations of about 10 percent in total electron content. The irregularities are aligned with the Earth's magnetic field lines and are co-rotating with the Earth. Because of their altitude and their co-rotation with the Earth, these irregularities have not been detected by

observation of satellite beacons. These newly discovered plasmaspheric structures may coincide with the inferred but previously undetected ducts through which the VLF signals known as whistlers propagate from one hemisphere to the other.

Investigators: A. R. Jacobson (Los Alamos) and W. C. Erickson (Tasmania)

Chaotic Motion Revealed in Dwarf Irregular Galaxies. VLA observations of neutral atomic hydrogen in nine dwarf irregular galaxies have produced the surprising result that only two galaxies in the sample showed evidence of rotation in the HI gas system. The other galaxies exhibited chaotic motion, rather than rotation, in their HI gas. This lack of rotational support should, presumably, lead to collapse of the gas and star formation on a relatively short time scale. However, these galaxies do not exhibit evidence of active star formation and have low metal abundances, thus limiting the number of star formation episodes they could have undergone. The existence at the present time of this HI gas with no rotational support presents a puzzle whose resolution would lead to a better understanding of the factors controlling star formation and the evolution of galaxies.

Investigators: K. Y. Lo (Illinois) and W.L.W. Sargent and K. Young (Caltech)

Tucson

Structure of the z = 2.286 CO Emission Region. Observations were made with the new 2 mm receiver of the redshifted CO(4-3) line in the protogalaxy IRAS F10214+4724. The objective of these observations was to compare the line brightness as seen by the 12 Meter Telescope with the same line as seen by the IRAM 30 meter telescope and to use that comparison to infer the size of the CO emission region. Both telescopes see a broad pedestal of CO emission superposed on which is a narrow line component brighter on the 30 meter than it is on the 12 Meter. Apparently the CO emission region can be characterized as a compact, relatively quiescent CO core embedded in a spatially extended region of molecular gas that is so kinematically broad as to be suggestive of infall or outflow.

Investigators: R. L. Brown and P. A. Vanden Bout

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

A three-stage demonstration amplifier covering the 60-80 GHz band and using TRW AlInAs/GaInAs/InP HFET's has been built and tested. The noise temperature at 70 GHz was 47 K, demonstrating that the performance of HFET receivers is now competitive with SIS receivers in the 3-mm wavelength atmospheric window.

A prototype of the 40-50 GHz amplifiers for the VLA Q-band receivers has been designed, and testing will begin soon. All the following amplifiers are being developed for GBT receivers.

Noise temperature measurements on the "SH series" prototype amplifier indicate a T_{LO} = 3.5 K with T_{AV} = 5.2 K across the 2.6-3.95 GHz band. Improvements in the noise performance near the band edges are possible with modifications to the input network. A pre-production amplifier which incorporates this modification is currently being fabricated. This amplifier is also being considered as an IF amplifier for SIS receivers.

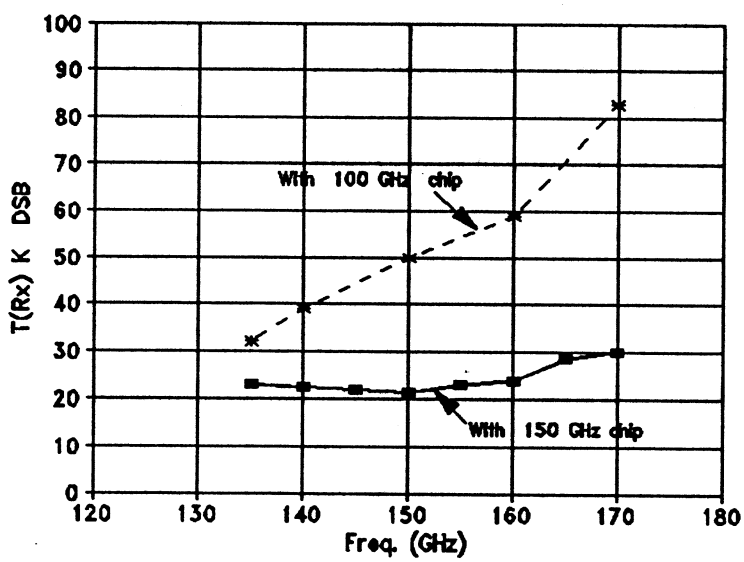
A design is under way for the 3.95-5.85 GHz amplifier. This amplifier is also being considered as an IF amplifier for SIS receivers.

Requirements of good input match for the 680-920 MHz amplifier forced a reconsideration of the initial design plan. The result is a hybrid amplifier design which incorporates a balanced first stage (for low noise performance and good input match) followed by a conventional two-stage amplifier. The core of the balanced design is the Lange-type quadrature coupler. A test coupler was designed, fabricated, and evaluated at room and cryogenic temperatures. The test coupler performed satisfactory. Based on the coupler design, a single-stage prototype balanced amplifier was designed and is currently being fabricated.

Although the performance of the "KL series" (18-22 GHz) and "KH series" (22-26 GHz) amplifiers proved satisfactory, the input network was redesigned to reduce the assembly time. The revised design is currently being incorporated into the mechanical drawings for this amplifier. This was done in anticipation of future needs for this amplifier series.

Superconducting (SIS) Millimeter-Wave Mixer Development

We have now received from UVa the first wafer of SIS mixers for 130-170 GHz. Hitherto, our 2-mm receivers have used SIS chips designed for 100 GHz. The improvement in receiver noise temperature is apparent from the figure.



These SIS mixers were originally designed with a single mechanical tuner, whose specific function was to tune out the inductance of the series array of junctions. During initial evaluation of this design, it was found that the presence of a second tuner allowed the mixer to be tuned for (reactive) image rejection. As a result, all the 2-mm mixers at present in use on the 12 Meter Telescope have two mechanical tuners. A future wafer of 2-mm SIS mixers from UVa will contain the first experimental tunerless 2-mm mixers.

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 bias-circuit instability, which is believed to be remediable in a new design.

During this quarter, we have built (or rebuilt) and tested a total of 7 SIS mixers and 10 frequency multipliers.

Electromagnetic Support

A K-band feed covering the 22 to 26.5 GHz range for the GBT was fabricated and measured. The horn has excellent symmetry of the E- and H-plane patterns. The copolar pattern has a taper between -12.6 dB and 13.5 dB at the edge of the GBT subreflector. The worst cross-polarization is -27.0 dB. The measured input return loss is better than 24 dB in the frequency range of interest.

A quadridged orthomode transducer minus the coax probes was designed, fabricated, and measured. The small end of the transducer has an impedance of 50 ohms. This is the prototype of the OMT for the C-band GBT receiver. The measured return loss is better than 25 dB in the band of interest.

A feed for the 12 to 15.4 GHz band for the GBT was designed and drawings were sent to the Green Bank shop.

Waveguide components for testing the throat section of the GBT L-band feed were designed and drawings made.

A memo on the polarization characteristics of the GBT was written and distributed.

A feed to cover the 40 to 50 GHz range for the VLA was designed.

I. GREEN BANK ELECTRONICS

Green Bank Telescope

In the open loop active surface, progress was made both with the actuators and actuator control system. Specifically, for the actuators:

- Wear problems, discovered by NRAO during life testing, were resolved both in the actuator and the actuator drive motor. Both these problems have been resolved and retrofits will be made by the vendors on the 1900 already manufactured units.

- All LVDT's have been received and almost 1000 have been extensively tested by NRAO.

- A retrofit to the actuators to eliminate the RFI from the actuators has been extensively tested and parts ordered. The actuator vendor will install this when he does the retrofits mentioned above.

In the control system area,

- A mock up of one-eighth of the active surface control room was designed and built as an aid to mechanical layout and design, and electrical and software development and testing.

- Actuator power supplies have been evaluated.

- All commercial control modules have been received.

- Progress on NRAO designed electronics has been made with the design of two boards during the quarter.

The work in the servo area consists of monitoring the progress and reviewing the work of the servo contractor, RSI/PCD. During the past quarter a meeting was held at their facility to review comments on the hardware design, and on control computer (CCU and SCU) software specifications. A dynamics report has been received and reviewed.

Work on receiver monitor and control electronics continues. The unit for the K-band receiver is complete, and design is in progress for three other receivers. Also a prototype controller for an air-knife, whose function it is to keep the feed apertures clear, has been completed.

A straw man design for a digital continuum receiver has been completed and circulated for comment. Work has begun on component selection.

Systems engineering for the GBT received some attention this quarter with the definition of dependencies between all of the tasks in the antenna construction project and in the receiver/backend efforts. A scheme to track and focus attention on critical dependencies and interfaces between hardware and software subsystems was developed utilizing computer-based CPM, PERT, and DBMS tools.

Site Computing Infrastructure

A fair amount of effort was expended this quarter installing various upgrades to site computing equipment purchased at the end of 1992. Among the more significant upgrades are a new laser printer, memory upgrades to all workstations, and increased mass storage. Also, the capabilities of the site network were extended in the lab as well as in the warehouse; a print server and laser printer were added on the first floor of the lab.

VLBA

Modifications to several baseband converters were completed, fulfilling our commitment to the VLBA project.

Operations

Support was provided as required to the 140 Foot Telescope, the Interferometer telescopes, the 40 Foot Telescope, and the laboratory.

New Projects

Work was begun on three new projects. First, the technical specifications for a new Navy VLBI antenna were prepared for inclusion in the request for proposal for bids. Second, preliminary work was initiated for the development of the Technical and Management Plan for upgrading and operation of the 140 Foot Telescope for use in the High Resolution Microwave Survey (HRMS) program circa 1995. In addition, an engineer and a technician were hired and began work at the US Naval Observatory for the design and implementation of the new Ultra-High Precision Clock System to be installed and operated at Green Bank over the next one to two years.

J. SOCORRO ELECTRONICS

1.3 - 1.7 GHz Receiver Improvements

The VLA now has 25 antennas operating with the new style front-ends. All front-ends funded through 1992 have been completed and all remaining parts have been ordered with 1993 funds. The entire VLA L-band upgrade will be completed in the third quarter of 1993.

40 - 50 GHz Receivers

All critical components for the receiver addition to nine VLA antennas are ordered. Dewar drawings are in the VLA machine shop for use in the fabrication stage. The new test equipment necessary for construction and testing has been received.

Tipping Radiometer at Mauna Kea

Data taken since August 1992 at the VLBA station will provide data to correlate atmospheric characteristics there with data from a duplicate instrument near the summit.

VLA Spectral Ripple

Laboratory tests of waveguide devices suspected of causing the spectral ripple were suspended after little progress. The 20 mm waveguide on antenna 27 was rebuilt and the rotary joints in antennas 1 and 3 were replaced, resulting in some improvement.

Cathodic Protection of Waveguide

Efforts over the past several years to improve anode bed efficiency resulted in better cathodic protection from electrolytic corrosion. Measurements of waveguide-to-soil voltage potential at all VLA manholes showed adequate protection.

Manhole Replacement

Preparation of materials and elevation surveys began for replacing more collapsing concrete manholes with steel culverts. Ten VLA waveguide manholes will be replaced this summer.

VLA Wye Monitor

In March, three 25-pair cable sections replaced old buried 19-pair cables at the control building, providing 25 continuous pairs to each of the VLA arms. We also completed interfaces to the correlator and computer UPSs. Interfaces to the site power generators and to the correlator air conditioner will be completed next quarter. The Wye Monitor provides the VLA operator with voice phrase alarms detailing "antenna number," "arm," and "problem." Operators interface via a touchscreen, bringing up windows for detailed information on monitored systems. Next quarter there will be 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. Requirements for the VME array processor card have been defined and quotes requested. Two VME prototyping cards are ordered. Several interfaces to the correlator prototype are planned by the end of the year.

Optical Fiber in VLA Antennas

An investigation is underway for 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. A prototype system is being tested on the VLA M/C bench and mechanical and electronic modifications are being designed. This will be tested on three or four antennas which have B-rack shields to measure the reduction of RFI.

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 NRAO's informal network have concentrated on major radar installations (NEXRAD), several military systems, and harmonic emissions from TV transmitters. NRAO also participated in the National Academy of Sciences Committee on Radio Frequencies (CORF) efforts to support Arecibo's petition to establish an FCC radio coordination zone for Puerto Rico

and to advise the FCC on proposed regulations for sharing the 1612 MHz radio astronomy band with the Mobile Satellite Service (MSS).

K. TUCSON ELECTRONICS

260-300 GHz SIS Receiver Set Completed

The 260-300 GHz, dual-polarization SIS mixer pair was completed and installed in the 1 mm cryostat earlier this year. The completion of this receiver set is the culmination of a program to construct state-of-the-art SIS receivers covering all the atmospheric pass bands between 68 and 300 GHz. The 12 Meter Telescope has five receiver bands covering 70-90 GHz, 90-116 GHz, 130-170 GHz, 200-260 GHz, and now 260-300 GHz, all with dual polarizations. At times this year, all ten mixers have been simultaneously cold to 4 K and available for use on the telescope. These receivers each have closed-cycle cryogenics, and each can be tuned single sideband with > 20 dB image rejection. Image rejection is achieved through backshort tuning with the 2 mm and 3 mm receivers, and quasi-optically with the 1 mm receivers. The receiver development project is a collaboration between the Central Development Laboratory and the Tucson staff. The high frequency receiver will next be scheduled in the late autumn.

Dish Surface Improvements

In mid-March the antenna surface panels were reset, producing a significant improvement in dish surface accuracy. The aperture efficiency at 230 GHz was increased to 30 percent, and a significant increase in the antenna temperature of small-diameter sources was immediately apparent. This resetting successfully removed some aberrations in the dish surface that had been introduced a few years ago during some unavoidable repair work to the antenna backup structure. An error-correcting subreflector had been in use in the interim which partially corrected the distortions. It is believed that the primary surface of the dish is now significantly better than at any time in the past.

The success of this resetting project derives from a number of improvements in NRAO's techniques of surface measurement and adjustment. The process involves several steps. Holography data is taken from a 38 GHz signal provided by the LES8 satellite. Several improvements have been made to the holography receiver to make it more sensitive and more stable. Data-acquisition has also been improved immensely. We can now obtain a 4 degree-square, continuously scanned, 129 by 129 point holography map in about 1 hour 45 minutes. In previous years a map one-quarter this size took nearly a week to obtain! The holography map can be reduced within minutes and the data supplied to a panel-fitting program that fits for optimum screw settings. This program makes use of a finite-element analysis of the behavior of the panels under screw tension at various points of the panels. A mechanical sensor jig is then placed in the dish, supported on ball bearings at the center and at the edge of the dish. Armed with the predictions of the panel-fitting program, the "screw-turners" use a real-time computer display that differences the setting goals for each panel and the current readouts from the sensors to achieve best adjustment of each panel. A full iteration of holography, fit predictions, and panel adjustments now can be made in 24 hours.

Analysis of the remaining residuals in the surface fits suggest that there is yet more room for improvement. We plan to have another iteration during the summer shutdown period.

L. AIPS

The 15APR93 version of AIPS will be released fairly soon, but it will be delayed until full support for Sun's new operating system is available in AIPS. This system is called Solaris and is based on the Bell System V flavor of Unix rather than Sun's traditional Berkeley Unix systems. This is a major change, but should be made easier by the work already done to port AIPS to Hewlett Packard's Unix system, which is also Bell-based. Other system-type changes include modification of the tape handling routines to support a wider variety of tape devices, handling end-of-information, and other conditions more

precisely. The ability to put all messages from tasks (from any AIPS computer) into a special message window on the user's workstation screen has been added recently. Better control over message suppression was also added.

Most of the effort in the AIPS package has been put into VLBI-related calibration and imaging software. A substantial subroutine package has been developed to make AIPS' functions more modular and more accessible to programmers. During 1993 Q1, this package was substantially debugged and had numerous functions added including self calibration, faster in-core imaging, point models with corrections for the W term, bandwidth smearing, and frequency errors, round clean boxes, image interpolation and re-gridding and polarization-coherent re-referencing of fringe phase, delays, and rates. An imaging process similar to Jodrell Bank's difference mapping (an iterative self-calibration and imaging) was coded using this package in a task called SCMAP. Baseline-based VLB fringe fitting is now available in AIPS using tasks BLING and BLAPP. The antenna-based fringe fitting task FRING can now handle larger amounts of data in each fit. The new task CLPLT is used to plot VLB closure phases rather than VBPLT, but VBPLT can now plot a variety of new parameters. Division of compressed uv data by models was corrected, and the speed of MX, CALIB, UVSUB, and FRING was improved by enabling gridded model computation methods wherever possible.

New task PASTE inserts (or adds) sub-images into portions of another image. A completely revised version of the task GAL to fits models of galaxy velocity fields was released. A draft of a proposed FITS standard for the description of coordinates was released for comment via the world-wide FITS-exploder and network news. In particular, it provides a detailed description of a large number of projections of spherical coordinates onto the image plane.

M. AIPS++

Although the progress in the high-level design has been slower than hoped, significant progress has been made. A meeting is planned in Socorro in May to review the parts of the design relating to the processing of observing data and its subsequent calibration. Work on the high-level design has emphasized the need for fundamental astronomical coordinate systems to be approached rigorously.

We made good progress on the infrastructure. The coding standards have been finalized, and the development of a standard for documentation in the code is nearly complete. From this programmer documentation a prototype documentation extractor can be produced. There is basic functionality in the mathematics classes; work is in progress to develop the basic linear algebra capability with a rich suite of matrix operations. The basic table classes which will be used for data storage and retrieval are also progressing well. Work has just begun 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 an enhanced dependency analysis. Work on FITS is still in progress. The basic tools for gridding, weighting, and Fourier transforming of data have now been fully integrated into the AIPS++ system using the basic mathematics classes.

The "keyword=value" command line interface from the original prototype is now functional, again using the new string classes. It was decided to use Khoros as a graphical front-end for the development phase at least. This provides a graphical network user interface, plus some basic image display capabilities that will be essential for debugging.

N. SOCORRO COMPUTING

In the VLA online systems area, preparations are underway to support observing strategies necessary for the L-band all-sky survey. Understanding the requirements and preparing for the survey will continue to take much of the online group's time in the next quarter as well.

The team of engineers and programmers involved in the VLA correlator controller upgrade project completed specification of requirements for the first equipment procurement this quarter, and the procurement process was begun. Planning and development will continue throughout the next several months.

In January 1993, the network link from the AOC to the Internet was upgraded to full T1 speed, and in March a T1 link to the VLA site was ordered. Installation is expected in May. The VLA online systems group is enhancing the software on the near-real-time imaging system to take advantage of this increased capacity and allow real-time data filling at the AOC. A portion of the bandwidth of this line will be set aside for voice lines, which will provide considerable savings on telephone costs.

As a result of the proliferation of new computers, most of the older systems are being shut down. These systems are expensive to maintain and no longer provide enough computing capabilities relative to the newer systems to justify the effort needed to maintain them. In early 1993, the 11/750 at the VLA site, OUTBAX, was turned off, and in March one of the Convexes was shut down. The other will most likely be kept running until late 1993, and the remaining VMS MicroVAX-II will be kept for the foreseeable future.

During this quarter, steps were taken to reduce NRAO's need for 9-track tape drives by changing the medium for duplication of VLA data to Exabyte. This increases the number of loading devices available at the AOC, and it is also faster to fill from Exabyte — whether on the local system or over the network — than from a Convex 9-track tape drive. Since all visitor workstations at the AOC are equipped with Exabyte drives, visitors can load data directly onto their reserved system. To date the change appears to have been quite successful.

The archive tape project has now begun actively copying tapes at the AOC. Initially we will be recovering some of the most recent tapes for recycling purposes. After that, copying of the older tapes will begin. During the translation process, the header information is extracted and built into a database, which astronomers will in the future be able to use to find archival data of scientific interest to them.

Installation of an Uninterruptible Power Supply (UPS) in the AOC computer room is essentially complete. This will provide continuous power primarily for VLBA monitor and control operations at the AOC, and will also support the general-purpose Solbourne and the high-performance NFS server which provides software to the Sun workstations.

O. VERY LONG BASELINE ARRAY

Sites and Antennas

The eight continental sites are essentially complete. The St. Croix antenna has been in use for several months using a dial-up telephone connection for monitor and control. An Internet connection is still not in place because of delays by the Puerto Rico Telephone Company in installing a leased line from the St. Croix VLBA site to the CRACIN Network equipment in San Juan. Other work needed to complete the site included some rework of the antenna paint by the antenna contractor and preparation of a hurricane survival plan.

The installation of all NRAO-supplied equipment was completed at the Mauna Kea site by the end of March 1993. First radio signals were received on 27 February 1993. Equipment installation was delayed by three weeks by a major ice storm in early January. Ice falling from the quadruped and apex structures damaged 16 reflector panels. They were replaced with spare panels. The site should be available for astronomy in late April 1993.

Electronics

With the exception of the 43 GHz receiver on the St. Croix antenna, all antennas had all nine receivers installed by the end of March. The only major piece of new equipment needed to complete the electronics systems at the sites is the new injected-pulse phase calibration system. This system was installed on three antennas by the end of the quarter and should be available on the remaining antennas in the middle of the year.

Tape Recorders and Tapes

All data acquisition tape recorders have been built. All sites but one now have two tape recorders. The remaining site will have its recorders installed by May 1993. Thirteen of the eventual twenty-four data playback recorders are now on-line on the correlator. Of the remaining eleven units, five are complete and in operation on the Haystack correlator and the remainder are due to be completed by Haystack by the end of May 1993.

After intensive work at Haystack the decision was made to use thin (16 microns) tape for VLBA operations. A retrofit program for the recorders and playback drives is in process to ensure that the thin tape can be used without damage. Half (450 reels) of the total tape supply has been ordered from two vendors (Sony and 3M). The 3M tape has been received and is being transferred to glass reels. The order for the second half of the tape supply should be placed by July 1993.

Correlator

As the VLBA construction project ends, the correlator too is nearing completion. About half of the playback interface's operating modes — a set described by an irregular four-dimensional volume of 332 cells, each with as many as 32 sub-cells — have been validated. The fractional-sample correction and spectral-averaging capabilities were recently brought into full operation. The hardware components of the pulsar gate and the self-test facility were also checked out and await completion of the supporting software.

Starting at the end of December 1992, two major efforts were mounted to achieve first scientific results with the correlator. Both revealed serious residual bugs, about evenly divided between hardware and software, which were detected in the scientific runs either because they occur only at relatively heavier correlator loading or through close scrutiny of the results. All problems so discovered have now been corrected (including the capabilities mentioned above), and all functional elements required to extract scientifically usable data are believed to be operational. A third "first science" effort is underway at the end of the quarter.

Such astronomical testing will continue as the main correlator activity through the end of March, possibly requiring another test observation after the February/March Network session. If the major remaining problems are overcome, then, beginning in April, further test observations and some already approved internal VLBA observations will be scheduled. They will be recorded on the first increment of the VLBA's main procurement of thin tape, planned to be ready for use at that time. The correlator's playback drive complement is planned to reach 19 and to be upgraded for thin-tape operation by mid-April. Processing of these observations will be the first scheduled "production" correlation. The results will be evaluated carefully as they represent first extension of testing from specialized test observations to include normal observational cases. The programs will be restricted to the simplest and best-established modes — including both continuum observations and wideband spectroscopy, in single or parallel polarizations. An important element at this stage will be intercomparison of results with those obtained with the Mark III correlator.

Continued debugging and development will proceed in parallel toward two complementary goals. Validation of additional correlator capabilities (including narrowband spectroscopy, cross-polarization, and pulsar gating) will determine how fast internal VLBA observations can ramp up to full operation. Enhancement of processing efficiency, on the other hand, will be essential to taking over the correlation of large pre-scheduled global Network sessions. Both efforts have been impacted seriously by the recent departure of an experienced member of the correlator software team. It is expected that recently reassigned programmers and anticipated new hires will require several months of familiarization before they can contribute with full effect.

Throughout this process, Network observations will continue to be correlated at the Mark III correlators at Haystack and in Bonn, for several reasons. The non-VLBA telescopes included in Network sessions cannot be rescheduled easily if errors in correlation are discovered after tapes are released. The Mark III recordings produced at most such stations lack the features of the VLBA format which facilitate robust playback. NRAO's capability to fill its database from SNAP-type logs is incomplete, although work is now in progress to define an extension for VLBA observations made using Mark 3 systems.

To cover the need for correlation of VLBI astronomical processing until the VLBA correlator becomes fully operational, NRAO has contracted with Haystack for six months of correlator operation starting July 1, 1993, when NSF-supported correlation at Haystack ceases. During this six-month period, NRAO will be both correlating on the VLBA correlator and sending selected tapes to Haystack for correlation. The cost of this contract is $160,000 for six months' operation at 215 hours per month. By mid-year, we hope to have developed enough confidence in the correlator's performance, and to have advanced its support for non-VLBA recordings and logs sufficiently, that the September and November Network sessions can be processed. The transfer of correlation operations from Haystack Observatory to the VLBA is to be completed by the end of 1993.

P. GREEN BANK TELESCOPE PROJECT

Antenna

Design. The Green Bank Telescope (GBT) structural design model was finalized by the design contractor and is now under review and verification at NRAO. In addition, the optimization of the structural geometry by NRAO is proceeding.

Also during the report period, the antenna contractor continued development of plans and procedures for fabrication, trial erection, and final erection of the elevation rotating structure. The analysis of the rotating structure model was carried on to ensure the design meets performance and stress requirements. The detailed joint design and analysis proceeded. The contractor continued detailing the manufacturing drawings for numerous components including the azimuth cable wrap, alidade equipment rooms and azimuth encoder mechanisms. Numerous other component design drawings were released for manufacturing. The subreflector drawing package has been submitted to NRAO for review, as has been the final dynamic analysis report. The contractor also continued the detailed servo system software development.

Fabrication and Construction. The azimuth track installation and grouting was completed during this period. Shoring towers were installed throughout the foundation area to support the alidade structure during the early construction phase. The assembly of alidade Level 1 was completed and Level 2 was begun. Eight of the 16 wheel assemblies were received at the site and set in place on the track. The remaining wheel assemblies were being completed and prepared for shipping to the site. Four whiffle beams are in place on two corners and one corner weldment has been set and connected to the alidade. Welding of the bolted-up structure began near the pintle tower area.

The contractor completed the electrical assembly and checkout of the derrick crane which will be used during the GBT erection. Welder training and qualification testing continued at the site. Fabrication and painting of the alidade towers, alidade access platforms and stair towers proceeded.

Active Surface and Pointing (Closed Loop)

During the report period, work focused on software improvements aimed at increasing the data rate of the metrology system. These efforts are now largely complete, and within the next month it is expected that the system will be acquiring data at the rate of five targets per second for each of the three rangefinders.

Work has started on a calibration range in the basement of the old 300 Foot Telescope control room. This will be used to calibrate the zero point of each rangefinder, and also to establish the pointing of each instrument.

Active Surface (Open Loop)

Measurements of the actuators showed evidence of excessive RFI. The program to reduce the RFI to acceptable levels continues. Purchase orders for most of the required parts have been placed.

Cyclic testing of the actuators for over 1,000 hours, since June 1992, has helped identify a problem in the actuator motors. Disassembled motors showed excessive commutator wear. NRAO worked with the motor vendor to identify and solve the cause of the wear, and motor production is again underway.

A search for possible vendors of power supplies for the actuator motors has resulted in the availability of two power supplies for testing in Green Bank. Tests are now underway.

A program to construct a representative part of the actuator control room to evaluate both packaging and electrical prototypes continues. Two prototype actuator control racks were completed during February. A mock up of part of the control room is 95 percent complete.

Disassembly of several actuators has identified a wear problem in one of the gears. The manufacturer has solved the problem and is making the correction to all units.

Measurements of the resistance of the LVDTs (the actuator position feedback devices) versus temperature were made to determine their suitability as a temperature sensor. The results were quite positive, implying that separate temperature transducers on the back of the dish are not necessary. The design of a 1 kHz reference for the actuator LVDT's and of the motor power wiring is in progress.

Efforts in the servo development consist of monitoring the progress of RSI's Precision Control Division (PCD). During February, Central Control Unit (CCU) and Subreflector Control Unit (SCU) software control requirement documents were reviewed. Also, a meeting was held at RSI/PCD to review progress in dynamic analysis, hardware, and software areas.

Electronics

LO and IF System. The LO and test tone routers have been assembled on the LO rack and integrated with their Monitor/Control interface. The system has been debugged, tested, and found to operate as expected. Several minor design errors were identified and corrected. Additional testing is required to check the operation of the VLBA phase cal generator, which is included in the router assembly.

The IF router is a system to be located in the receiver room that will select which receiver IF signals are sent off the telescope. The IF router components have been selected and ordered. Components for optical fiber drivers were also selected and ordered. These systems will form part of the IF distribution system of the telescope, and assembly and testing will occur later this year.

Receivers. Testing of the 18-26.5 GHz receiver began during this period. An image noise problem caused by amplifiers with high out-of-band noise was identified and filters that will eliminate this are being constructed. Testing of this receiver continues.

Construction, procurement, and component testing continues on the prime focus receiver. Development of a cooled 680-920 MHz HFET amplifier has progressed to the prototype stage. Microwave components for the 12-15.4 GHz receiver have been ordered or are under construction. A thermal transition and vacuum window assembly has been assembled and tested. Fabrication of other dewar parts continues.

Microwave components for the 8-10 GHz receiver have been ordered.

Feeds. Assembly of the full-scale 1.15-1.73 GHz feed horn is 50 percent complete. Fabrication of the ring-loaded throat section is underway. Some of the remaining fabrication work must be sent to an outside shop because the sizes involved exceeded capacities of machines in the NRAO shops.

Three of the four feeds required for the 18-26.5 GHz receiver have been completed. The fourth is being fabricated.

Drawings for the 12-15.4 GHz feed horn have been completed and will shortly be submitted for fabrication.

Miscellaneous. Initial load tests of the Gregorian feed rotator were encouraging, but a wear problem was encountered. The cause of this is being investigated, and tests will continue.

Components for the cryogenic refrigerator power supplies were ordered. Assembly will occur later this year.

Monitor and Control

Prime Focus Prototype. The prime focus prototype was finished. The graphical user interface will need an approach that is application specific to minimize duplication of effort (see below). C++ works well in the VxWorks environment and will reduce the effort required. It should be possible to write code-generators for Ethernet communication from interface specifications given in terms of C++ classes. Designs conceived at a higher level, including the integration of modules implemented by different programmers, were implemented with minimum trouble.

Graphical User Interface. The plan for graphical user interfaces is to create a library of components which may be combined to form various views needed to implement the interfaces. A component includes the display, state information, and the device interface under one definition. This will allow NRAO to quickly generate user interfaces once a fairly complete library of Components is available. It has been decided to use Motif for the displays.

System Architecture. The architecture has been divided into four parts: control, antenna, electronics, and date. Work has begun on the control architecture, specifically the nature of the components.

Project Management. In accordance with requests of the GBT Advisory Committee, the schedule has been modified to reflect the completion of a basic system as described in GBT Memo #94, and an emulation of the GBT on the 140 Foot Telescope.

Tasks. Work has begun on the following modules:

- RPC++ - a remote procedure call class
- H316 - an interface between the antenna personality module and the 140 Foot servo computer
- 140 Foot Personality - a module which performs the lowest level calls to the servo system
- Panel Components - the display and state information portions of the user-interface Components.

Q. PERSONNEL

New Hires

Bottomly, T.	Sr. Scientific Programming Analyst	01/05
Brandt, J.	Sr. Scientific Programming Analyst	01/07
Kesteven, M.	Visiting Scientist	01/22

Terminations

Ravindra, D.	Visiting Electronics Engineer I	01/06
Hudson, R.	Electronics Engineer I	01/18
delGiudice, W.	Mechanical Engineer I, Special Project	02/12*
Levin, B.	Electronic Engineer I	02/26*
Gonzalez, R.	Scientific Programming Analyst	02/26

* Reduction in force

Changes in Status

Hogg, D.	return to Scientific Staff from Acting Asst. Director, Green Bank	02/15

Promotions

Lockman, F. J.	to Scientist, Assistant Director, Green Bank	02/15

APPENDIX A

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