NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

1 January 1992 - 31 March 1992

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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 1992.

	140-Foot	12 Meter	VLA
Scheduled observing (hrs)	1931.25	1906.75	1632.9
Scheduled maintenance and equipment changes	151.25	4.00	245.4
Scheduled tests and calibrations	77.50	247.50	296.0
Time lost	147.25	474.00	70.2
Actual observing	1784.00	1432.75	1562.7

B. 140-FOOT TELESCOPE

The following continuum programs were conducted during this quarter.

No.	Observer(s)	Program
W289	Wilkinson, D. (Princeton) Page, L. (Princeton) Wollack, E. (Princeton)	Anisotropy of cosmic microwave radiation at 26-36 GHz.

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
A108	Albert, E. (USNA) Danly, L. (STScI) Roberts, B. (USNA)	Observations of HI to map clouds in the Galactic Halo.
C272	Claussen, M. (NRL) Rickard, L. J (NRL) Yun, J. L. (Boston) Clemens, D. (Boston)	Observations at 22 GHz of water masers associated with Bok Globules.
H279	Haynes, M. (Cornell) Giovanelli, R. (Cornell) Wegner, G. (Dartmouth) Salzer, J. (Wesleyan) daCosta, L. (CNpq, Brazil) Freudling, W. (ESO)	Observations of HI to study the deviations from Hubble flow in a sample of Sc galaxies.
K332	Kalenskii, S. (Lebedev) Val'tts, I. (Lebedev) Slysh, V. (Lebedev)	Search at 28.3 GHz for methanol 4_0-3_1E masers.

No.	Observer(s)	Program
L260	Littleton, J. (West Virginia) Gallagher, J. (Wisconsin) Hunter, D. (Lowell Obs.) Matthews, L. (Wisconsin)	HI survey of low surface brightness galaxies.
L265	Lewis, B. M. (NAIC)	Search at 22 GHz for water masers from southern Mira variables.
M331	Matsakis, D. (USNO) McCarthy, D. (USNO)	Observations at 22 GHz of water masers.
M334	McGonagle, D. (Massachusetts) Irvine, W. (Massachusetts) Ohishi, M. (Nobeyama) Saito, S. (Nagoya) Yamamoto, S. (Nagoya)	Search at 21.223 GHz for the HCCN radical in interstellar clouds.
M341	Menten, K. (CFA) Reid, M. (CFA)	Observations of 6.6 GHz methanol masers.
T295	Turner, B.	Search at 310 GHz for OD in TMC-1 and L183.
T300	Thuan, T. (Virginia) Lipovetsky, V. (Special Astrophysical Ob., USSR) Pustilnik, S. (Special Astrophysical Ob., USSR)	Measurements of HI in a complete sample of blue compact dwarf galaxies.
W280	Wootten, H. A.	H_2O monitoring in star forming cores in Rho Oph.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
B550	Backer, D. (Berkeley) Van Hook, S. (Berkeley) Foster, R. (NRL) Sallmen, S. (Berkeley)	Measurements at 800 and 1330 MHz of the timing of an array of pulsars.
B559	Biggs, J. (NASA/GSFC) Salter, C. Foster, R. (NRL)	Observations at 1420 MHz to monitor pulsar HI absorption spectra.
F105	Foster, R. (NRL) Fiedler, R. (NRL) Cordes, J. (Cornell)	Observations at 800-840 and 1330 MHz to obtain the dynamic spectra of strong radio pulsars.
K333	Kulkarni, S. (Caltech) Phillips, J. (Caltech) Vasisht, G. (Caltech)	Multi-frequency observations at 800 and 1330 MHz of PSR 1829-10.

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.

The following very long baseline programs were conducted and the stations used are coded as follows.

A	-	Arecibo 300 m	Lm	-	Medicina 32 m
B	-	Effelsburg	No	-	Noto, Sicily 32 m
G	-	Green Bank 140 ft	O	-	Owens Valley 130 ft
Jb	-	Jodrell Bank 250 ft	R	-	Crimea USSR 30 m
Ki	-	Haystack 46 m	Sn	-	Onsala 20 m
Km	-	Haystack 120 ft	T	-	Torun, Poland 15 m
Jn	-	Merlin Array	VLBA	-	All available VLBA 25 m
Jm	-	Jodrell Bank 76 m	Wn	-	Westerbork n = 1-14x26 m
Lb	-	Bologna 25 m	Yn	-	Socorro n = 1-27x25 m

No.	Observer(s)	Program
GB13	Kus, A. (Onsala) Booth, R. (Onsala) Wilkinson, P. (Manchester)	3.6 cm observations of cores of steep spectrum compact QSO 3C 380, second epoch, with telescopes B, Sn, Lm, G, and VLBA.
GC7	Campbell, R. (CFA) Corey, B. (Haystack) Shapiro, I. (CFA) Falco, E. (CFA)	Observations at 6 cm of the gravitationally lensed images of 0957+561, with telescopes B, Lm, Ki, G, FD, LA, KT, and Y_{27}.
GC8	Cawthorne, T. (CFA) Roberts, D. (Brandeis) Wardle, J. (Brandeis) Ge, J-P. (Brandeis) Gabuzda, D. (Calgary)	Polarization observations at 6 cm of three quasars having prominent milliarcsecond scale jets, with telescopes Lm, B, W_{14}, Ki, G, Y_{27}, PT, KP, LA, FD, NL, BR, and OV.
GG7	Giovannini, G. (Bologna) Comoretto, G. (Arcetri) Feretti, L. (Bologna) Venturi, T. (Bologna) Wehrle, A. (JPL)	Observations at 6 cm of three low luminosity (FR-I) radio galaxies, with telescopes Jb, Wn, B, Sn, Lm, No, Km, G, Y_{27}, and VLBA.

No.	Observer(s)	Program
GG8	Ghosh, T. (NFRA) Rao, A. P. (TIFR)	Observations at 50 cm of extragalactic sources to map the distribution of interstellar scattering at low latitudes, with telescopes B, Jb, Wn, T, Lm, G, O, and VLBA.
GG9	Gabuzda, D. (Calgary) Cawthorne, T. (CFA)	Polarization-sensitive observations at 6 cm of a complete sample of 1 Jy BL Lac objects, with telescopes Lm, B, W_{14}, Km, G, Y_{27}, NL, BR, and OV.
GL4	Lestrade, J. F. (Meudon/JPL) Phillips, R. (Haystack) Gabuzda, D. (Calgary) Preston, R. (JPL)	Phased-referenced observations at 6 cm of RS CVn stars for HIPPARCOS, with telescopes Lm, B, Km, G, Y_{27}, and O.
GP9	Patnaik, A. (Manchester) Browne, I. (Manchester) Porcas, R.	Observations at 6 cm of three small separation gravitational lens systems, with telescopes Jn, Jb, Wn, B, Lb, No, Sn, Y_{27}, G, A, and VLBA.
GR2/3	Roberts, D. (Brandeis) Brown, L. (Brandeis) Ochs, M. (Brandeis) Wardle, J. (Brandeis)	Dual-wavelength linear polarization observations at 3.6 and 6 cm of the properties of 3C 273, with telescopes B, Lm, Jb, W_{14}, No, Sn, Ki, G, Y_{27}, and VLBA.
GV7	Venturi, T. (Bologna) Pearson, T. (Caltech)	Observations at 6 cm of the morphological evolution of the superluminal radio sources 3C 216 and 1642+690, with telescopes B, Wn, Sn, Jb, Lm, No, Ki, G, Y_{27}, O, and VLBA.
GV8	Vermeulen, R. (Caltech) Conway, J. (Caltech) Hough, D. (Trinity College) Readhead, A. (Caltech)	3.6 cm mapping of double-lobed quasar cores 3C 175 and 3C 181, with telescopes B, Lb, No, Km, G, Y_{27}, and VLBA.
GX2	Readhead, A. (Caltech) Wilkinson, P. (Manchester) Xu, W. (Caltech) Polatidis, A. (Manchester) Pearson, T. (Caltech) Lawrence, C. (Caltech) Herbig, T. (Caltech)	A large scale VLBI snapshot survey at 6 cm (part 2), with telescopes Lb, Sn, Wn, G, Km, O, Y_{27}, and VLBA.
GX3	Xu, W. (Caltech) Readhead, A. (Caltech) Conway, J. (Caltech) Unwin, S. (Caltech) Wilkinson, P. (Manchester) Polatidis, A. (Manchester)	Observations at 50 cm to study a possible new class of active galaxy with S-shaped symmetric structure, with telescopes B, Jb, Lb, No, Sn, Wn, Km, G, and VLBA.
UAH7	Porcas, R. Akujor, C. (Onsala)	Observations at 4.991 GHz to monitor the quasar 3C 279, with telescopes Ki, B, G, Y_1, Wn, Sn, Jm, No, Lm, and VLBA.

No.	Observer(s)	Program
UAH8	Migenes, V. (Manchester) Alef, W. (MPIR, Bonn)	112 MHz bandwidth test observations at 6 cm, with telescopes B, Jb, No, Lb, Sn, Ki, Wn, G, and Y_{27}.

C. 12 METER TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
A110	André, P. (CNRS, France) Cabrit, S. (Grenoble) Lada, C. (CFA)	A correlation between molecular outflow energetics and circumstellar disk mass?
B568	Buhl, D. (NASA/GSFC) Goldstein, J. (NASM) Chin, G. (NASA/GSFC)	Observations of the mesospheric winds on Venus.
B571	Bieging, J. (Arizona) Latter, W.	A survey of S stars for mass loss.
B572	Black, J. (Arizona) Aalto, S. (Onsala)	Study of molecular line emission in merging and interacting galaxies.
B573	Butner, H. (NASA/Ames) Lada, E. (CFA) Charnley, S. (NASA/Ames) Roberge, W. (Rensselaer)	Detection of Alfven waves by molecular spectroscopy.
C273	Clancy, R. T. (Colorado) Muhleman, D. (Caltech)	Microwave spectroscopy of the terrestrial mesosphere.
D170	Dickinson, D. (Lockheed) Jewell, P.	A search for SiO masers in OH/IR stars.
G321	Gordon, M. Martin-Pintado, J. (Yebes)	Monitoring program for the RRL maser in MWC 349.
H280	Hogg, D.	A search for CO in compact planetary nebulae.
H281	Ho, P. (CFA) Szczepanski, J. (MIT) Ho, L. (Berkeley)	Study of molecular clouds interacting with the galactic center.
L263	Latter, W. Maloney, P. (NASA/Ames)	Study of CO^+ and HCO^+ in photodissociation regions.
L267	Lada, E. (CFA)	Study of the effects of core structure on star formation efficiency.

No.	Observer(s)	Program
M326	Magnani, L. (Georgia) LaRosa, T. (Alabama) Lada, E. (CFA)	A survey of CS emission in translucent clouds.
M332	Mundy, L. (Maryland) Salter, M. (Maryland) Mangum, J. (Texas) Wootten, H. A.	Temperature study of circumstellar gas around YSOs.
M333	Magnani, L. (Georgia) Onello, J. (SUNY) Venezia, V. (SUNY)	CO observations at the edge of MBM16.
M335	Meixner, M. (Berkeley) Welch, W. J. (Berkeley) Hawkins, G. (Caltech)	Study of the geometry of mass loss in evolved stars.
M336	Moriarty-Schieven, G. (JPL) Wannier, P. (JPL)	NGC 2071 and L723: Multilobed outflows?
M339	Martin, R. (Arizona) Ho, P. (CFA) Turner, J. (UCLA)	CO and ^{13}CO J = 2-1 emission from HII regions in the spiral arms of IC 342 and the nucleus of M83.
M340	Mizuno, D. (Rensselaer) Kutner, M. (Rensselaer) Verter, F. (NASA/GSFC)	Study of the response of GMCs in M31 to the spiral shock.
P159	Pound, M. (Maryland) Blitz, L. (Maryland)	The continued search for proto-brown dwarfs.
S345	Snyder, L. (Illinois) Hollis, J. M. (NASA/GSFC) Ziurys, L. (Arizona State) Kuan, Y. (Illinois)	A proposed search for new interstellar nitroxyl sources.
S347	Sage, L. (MPIR, Bonn) Cox, P. (Marseille) Brouillet, N. (MPIR, Bonn) Westpfahl, D. (NMIMT)	CO observations of the anomalous spiral galaxy N4258.
S348	Spangler, S. (Iowa) Fix, J. (Iowa)	Study of the application of radio astronomical techniques to the measurement of the earth's ozone layer.
T303	Turner, B.	Search for SO^+ in the shocked source IC 443G.
T307	Turner, B. Rickard, L. J (NRL) Xu, L. (Beijing Obs.)	Are cirrus clouds different from galactic plane clouds?

No.	Observer(s)	Program
T314	Turner, B.	Study of cirrus cloud structures.
W184	Wootten, H. A. Wannier, P. (JPL)	CO observations of Nova Cygni.
W301	Wannier, P. (JPL) Moriarty-Schieven, G. (JPL) Tamura, M. (JPL) Keene, J. (Caltech)	Temperature study of circumstellar gas in YSOs using methanol.
W307	Wilner, D. (Berkeley) Forster, R. (Berkeley) Welch, J. (Berkeley)	Study of molecular environment of an ultracompact HII region.
W308	Williams, J. (Berkeley) Blitz, L. (Maryland)	Comparison of the Rosette and Maddalena clouds at CS (2-1).
W310	Wootten, H. A. Loren, R. (unaffiliated) André, P. (CNRS, France)	Are oxygen-rich grain mantles responsible for sulfur oxide and SiO enhancements?
W315	Wilson, C. (Maryland) Thornley, M. (Maryland)	Continued studies of M33.
W317	Wootten, H. A. Sahai, R. (Onsala)	CO observations of circumstellar envelopes.
Z91	Ziurys, L. (Arizona State)	A renewed study of interstellar $HCNH^+$.
Z96	Ziurys, L. (Arizona State) Barclay, W. (Arizona State) Anderson, M. (Arizona State)	A renewed search for interstellar CaOH.
Z97	Ziurys, L. (Arizona State) Barclay, W. (Arizona State) Anderson, M. (Arizona State)	A search for interstellar MgOH.

D. VERY LARGE ARRAY

This quarter was spent in the following configurations:

B	configuration:	from January 01 to January 20
CnB	configuration:	January 20 to February 29
C	configuration:	February 29 to March 31

No.	Observer(s)	Program
AA123	André, P. (CNRS, France) Feigelson, E. (Penn State) Leous, J. (Penn State) Montmerle, T. (CNRS, France)	Circular polarization from magnetic star S1 in ρOph cloud. 3.8 cm.
AA133	Alexander, P. (Cambridge) Blundell, K. (Cambridge) Pooley, G. (Cambridge) Riley, J. (Cambridge) Liu, R. (Cambridge)	ENLRs and asymmetries in radio sources. 3.8, 6, 20 cm.
AA134	Antonucci, R. (Calif., Santa Barbara) Freedman, R. (Calif., Santa Barbara) Coleman, P. (Groningen/Kapteyn) Barvainis, R. (Haystack) Geller, R. (Calif., Santa Barbara)	Primeval galaxy/quasar search. 6 cm.
AA137	André, P. (CNRS, France)	Young stellar objects in ρOph A. 2, 6 cm.
AA138	André, P. (CNRS, France) Gudel, M. (Colorado)	Young magnetic B stars in Taurus-Auriga. 3.8 cm.
AA141	Andre, P. (CNRS, France) Mutel, R. (Iowa) Phillips, R. (Haystack)	Polarization and spectral properties of 2 magnetized YSO's. 2, 3.5, 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. (Haystack) Hewitt, J. (MIT) Roberts, D. (Brandeis)	Monitoring 0957+561 A,B. 6 cm.
AB607	Benz, A. (ETH, Zurich) Gudel, M. (ETH, Zurich) Schmitt, M. (MPIEP, Munchen)	Monitoring the quiescent radio emission of UV Cet. 2, 3.8, 6 cm.
AB608	Biretta, J. Perley, R.	Search for superluminal motion in kiloparsec scale jets: 3C 273, 3C 279. 2, 6 cm line.
AB623	Burns, J. (New Mexico State) Brown, D. (New Mexico State) Olowin, R. (St. Mary's College)	Parkes sources in rich southern clusters. 20 cm.
AB625	Brown, R. Holdaway, M.	Ionized hydrogen at galactic center: H138β. 6 cm line.

No.	Observer(s)	Program
AB626	Beck, S. (Tel Aviv U.) Ho, P. (CFA) Turner, J. (UCLA)	NGC 5253. 3.8, 6 cm.
AB630	Brown, A. (Colorado) Bromage, G. (Rutherford) Jeffries, R. (Birmingham)	Two young coronally active dwarfs from ROSAT WFC All-Sky Survey. 3.8 cm.
AB640	Braun, R. (NFRA) Fabian, A. (Cambridge)	Molecular gas in galaxy clusters: OH. 20 cm line.
AC295	Churchwell, E. (Wisconsin) Kurtz, S. (Wisconsin) Guilloteau, S. (IRAM) Zavagno, A. (Marseille Obs.) Wood, D.	Statistics of UC HII regions. 3.8 cm.
AC298	Caganoff, S. (Johns Hopkins) Armus, L. (Johns Hopkins) Ford, H. (Johns Hopkins)	Polarimetry of the emission line loops in NGC 3079. 3.8, 6 cm.
AC310	Cowan, J. (Oklahoma) Branch, D. (Oklahoma) Roberts, D. (Oklahoma)	Supernovae 1957D and 1950B in M83. 20 cm.
AC317	Chanmugam, G. (LSU) Mason, P. (LSU) Fisher, P. (LSU)	Magnetic cataclysmic variable star BY Cam. 3.8, 6, 20 cm.
AC318	Cesaroni, R. (Arcetri) Hofner, P. (Wisconsin) Walmsley, C. M. (MPIR, Bonn) Churchwell, E. (Wisconsin) Kurtz, S. (Wisconsin)	Hot NH_3 toward ultracompact HII regions. 1.3 cm line.
AC320	Cote, S. (Mt. Stromlo) Carignan, C. (Montreal) Freeman, K. (Mt. Stromlo)	HI kinematics of dwarf irregulars in Sculptor and Centaurus groups. 20 cm line.
AC322	Chernin, L. (CFA) Masson, C. (CFA)	Neutral wind from L1448C. 20 cm line.
AC323	Curiel, S. (CFA) Rodriguez, L. (Mexico/UNAM)	Emission associated with HH 12. 2, 6 cm.
AD276	Dey, A. (Berkeley) van Breugel, W. (Lawrence Livermore)	Nearby galaxies with blue continuum. 6 cm.

No.	Observer(s)	Program
AD277	Diamond, P. Frail, D. Cordes, J. (Cornell) van Langevelde, H. (Leiden)	OH/IR stars at the Galactic Center. 20 cm.
AD278	Deich, W. (Caltech) Kulkarni, S. (Caltech) Thorsett, S. (Caltech) Middleditch, J. (Los Alamos) Frail, D.	Deep pulse searches towards globular clusters. 20 cm.
AD281	de Pater, I. (Berkeley)	Jupiter's spectrum at long wavelengths. 20, 90 cm.
AD288	Drake, S. (NASA/GSFC) Linsky, J. (Colorado) Stewart, R. (CSIRO) Bastian, T.	Magnetic BP stars. 3.8 cm.
AD290	Drake, S. (NASA/GSFC) White, N. (NASA/GSFC) Florkowski, D. (USNO) Linsky, J. (Colorado)	ROSAT/VLA observations of four Algol binaries. 3.8, 20 cm.
AE083	Elias, N. (USNO)	Detection of chromospherically active variables. 3.8 cm.
AE084	Erickson, W. (Maryland) Grossman, A. (Maryland) Douglas, J. (Texas)	Scintillation by Jupiter's magnetosphere. 90 cm.
AE085	Engels, D. (Hamburger Sternwarte) Winnberg, A. (Onsala) Lindqvist, M. (Onsala) Walmsley, C. M. (MPIR, Bonn)	Water masers in circumstellar shells. 1.3 cm line.
AE087	Elias, N. (USNO) Florkowski, D. (USNO)	Detection experiment for the stars of the MarkIII astrometric catalog. 3.8 cm.
AF217	Frail, D. Kulkarni, S. (Caltech) Thorsett, S. (Caltech)	Young pulsar in G5.4-1.2. 20 cm.
AF220	Frail, D. Kassim, N. (NRL) Weiler, K. (NRL) Dwarakanath, K.	Further studies of two PSR-SNR associations. 90 cm line.
AF222	Leone, F. (Catania) Umana, G. (IdR, Bologna)	Survey of radio emitting magnetic chemically peculiar stars. 6 cm.

No.	Observer(s)	Program
AF223	Fiebig, D. (MPIR, Bonn) Duschl, W. (Heidelberg Obs) Menten, K. (CFA) Tscharnuter, W. (Heidelberg Obs.)	H_2O maser outbursts in FU Ori objects. 1.3 cm line.
AF224	Navarro, J. (Caltech) Kulkarni, S. (Caltech) de Bruyn, G. (NFRA) Frail, D.	Millisecond pulsar candidate. 20 cm.
AF225	Frail, D. Wolszczan, A. (Arecibo)	Search for extended emission around PSR 1257+12. 3.8, 20 cm.
AG333	Gomez, Y. (Mexico/UNAM) Moran, J. (CFA) Rodriguez, L. (Mexico/UNAM)	Planetary NGC 6302 proper motion. 3.8 cm.
AG335	Gudel, M. (ETH, Zurich) Lim, J. (Macquarie)	K stars. 3.8 cm.
AG347	Grossman, A. (Maryland) Muhleman, D. (Caltech)	The radio light-curve of Titan. 3.8 cm.
AG348	Guedel, M. (Colorado) Skinner, S. (Colorado) Linsky, J. (Colorado) Brown, A. (Colorado) Fuerst, E. (MPIR, Bonn)	Decimeter-to-millimeter spectra of six bright RS CVn binaries. 1.3, 2, 3.8, 6, 20 cm.
AG350	Ge, J-P. (Brandeis) Owen, F.	Polarimetry of NGC 1275. 3.8 cm.
AH390	Hjellming, R. Gehrz, R. (Minnesota) Taylor, A. (Calgary) Seaquist, E. (Toronto)	Monitoring radio novae. 3.8, 6, 20 cm.
AH424	Han, X. (NMIMT) Hjellming, R.	The radio remnant of the 1989 outburst of V404 Cyg. 3.8, 6 cm.
AH433	Hummel, C. (MPIR, Bonn) Quirrenbach, A. (USNO)	Kiloparsec-scale structure of the peculiar S5 quasar 0153+744. 20 cm.
AH437	Hewitt, J. (MIT) Turner, E. (Princeton) Chen, G. (MIT) Angelus, A. (MIT)	Monitoring the "Einstein Ring" gravitation lens MG1131+0456. 3.8, 6 cm.
AH448	Hollis, J. M. (NASA/GSFC) Yusef-Zadeh, F. (Northwestern)	R Aquarii Core. 3.8 cm.

No.	Observer(s)	Program
AJ200	Jacobson, A. (Los Alamos) Erickson, W. (Maryland) Mercier, C. (Paris Obs.)	Ionospheric dynamics. 90 cm.
AJ215	Jaffe, W. (Leiden) McNamara, B. (Groningen/Kapteyn)	Neutral hydrogen in cooling flow clusters. 20 cm line.
AK283	Katgert, P. (Leiden) de Ruiter, H. (Bologna)	Power and redshift dependence of quasar radio morphology. 20 cm.
AK285	Koo, B. (CFA) Yun, M. (CFA) Ho, P. (CFA) Kumar, P. (NCAR) Heiles, C. (Berkeley)	Structure of HII region G5.48-0.24. 6, 20 cm.
AK286	Kapahi, V. (TIFR) Athreya, R. (TIFR) Subrahmanya, C. (TIFR) McCarthy, P. (Carnegie Obs.) van Breugel, W. (Lawrence Livermore)	Molonglo radio galaxies. 6 cm.
AK287	Kundu, M. (Maryland) White, S. (Maryland) Gopalswamy, N. (Maryland) Lin, R. (Berkeley)	Solar flares. 2, 3.8, 6 cm.
AK299	Knezek, P. (Massachusetts) Schneider, S. (Massachusetts)	Vertical gas motions in low surface brightness giants. 20 cm line.
AL247	Lang, K. (Tufts) Willson, R. (Tufts) Kile, J. (Tufts)	Solar corona. 20, 90 cm.
AL249	Longley, D. (Manchester) Pedlar, A. (Manchester) Hummel, E. (Royal Obs.) van der Hulst, J. (Groningen/Kapteyn)	Compact flat spectrum core sources in spiral nuclei. 2, 3.8 cm.
AL251	Langston, G.	Gravitational lens 2016+112. 3.8, 6 cm.
AL252	Ledlow, M. (New Mexico) Owen, F.	Radio galaxies in rich clusters. 20 cm.
AL257	Lacy, M. (Cambridge) Warner, P. (Cambridge)	The highest redshift giant radio galaxy. 20 cm.

No.	Observer(s)	Program
AL262	Lehnert, M. (Johns Hopkins) Baum, S. (STScI) O'Dea, C. (STScI) Armus, L. (Johns Hopkins) Caganoff, S. (Johns Hopkins)	Galactic superwinds: 3 starburst galaxies. 6, 20 cm.
AL263	Li, G. (Toronto) Seaquist, E. (Toronto)	Distributions of HI in SO galaxies. 20 cm line.
AM345	Mirabel, I. (CNRS, France) Rodriguez, L. (Mexico/UNAM) Cordier, B. (CNRS, France) Paul, J. (CNRS, France) Lebrun, F. (CNRS, France)	1E 1740.7-2942. 3.8, 6, 20 cm.
AM349	Mundy, L. (Maryland) Salter, M. (Maryland) Grossman, A. (Maryland)	Dust emission from circumstellar disks. 1.3, 2, 3.8 cm.
AM351	Mulchaey, J. (Maryland) Mushotzky, R. (NASA/GSFC)	Galaxy-IGM interactions. 3.8 cm.
AM353	Moffett, D. (NMIMT) Goss, W. M. Reynolds, S. (N. C. State)	SN 1006 - expansion. 20 cm.
AM358	Moore, E. (Florida) Gottesman, S. (Florida)	HI observations of the barred spiral galaxies NGC 1398 and NGC 1784. 20 cm line.
AM364	Morganti, R. (IdR, Bologna) Parma, P. (IdR, Bologna) Fanti, R. (IdR, Bologna) de Ruiter, H. (IdR, Bologna) Capetti, A. (IdF, Torino)	Polarization study of B2 radio galaxies. 6 cm.
AN057	Neininger, N. (MPIR, Bonn) Horellou, C. (Meudon) Beck, R. (MPIR, Bonn)	Detailed magnetic field structure of M51. 20 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.
AO108	Odewahn, S. (Minnesota)	HI in the Magellanic type galaxy NGC 4618. 20 cm line.

No.	Observer(s)	Program
AP206	Phookun, B. (Maryland) Mundy, L. (Maryland)	NGC 4254 and NGC 4654: HI observations of one-armed spiral galaxies. 20 cm line.
AP213	Pedlar, A. (Manchester) Longley, D. (Manchester) Anantharamaiah, K. (Raman Institute) van Gorkom, J. (Columbia) Goss, W. M.	168α lines from galactic center. 20 cm line.
AP217	Puche, D. Westpfahl, D. (NMIMT) Brinks, E.	Nearby dwarf galaxies. 20 cm line.
AP225	Phookun, B. (Maryland) Mundy, L. (Maryland)	NGC 5713, NGC 3162, and NGC 3675: HI observations of one-armed spiral galaxies. 20 cm line.
AR243	Roberts, D. (Oklahoma) Taylor, G. (Arcetri)	Absorption distance determination to galactic-plane variables. 20 cm line.
AR252	Reynolds, S. (N. C. State)	Supernova remnants. 6 cm.
AR253	Roberts, D. (Oklahoma) Yusef-Zadeh, F. (Northwestern)	High velocity ionized gas in Sgr A. 3.8 cm line.
AR260	Richter, O. (STScI) Sackett, P. (Pittsburgh) Sparke, L. (Wisconsin)	Polar ring galaxy NGC 5122. 20 cm line.
AR261	Rowan-Robinson, M. (Queen Mary) Sopp, H. (Queen Mary) Lawrence, A. (Queen Mary) McMahon, R. (Cambridge) Broadhurst, T. (Royal Obs.)	Search for high redshift infrared galaxies. 6 cm.
AR263	Rudolph, A. (Maryland) de Geus, E. (Maryland) Brand, J. (Arcetri) Wouterloot, J. (Koln)	Outer galaxy massive star forming clouds. 3.8, 6 cm.
AR268	Rodriguez, L. (Mexico/UNAM) Curiel, S. (CFA)	Radio monitoring of the outburst in SVS13. 3.8, 6 cm.
AS333	Sramek, R. Weiler, K. (NRL) van Dyk, S. (NRL) Panagia, N. (STScI)	Statistical properties of radio supernovae. 2, 6 cm.
AS438	Sparks, W. (STScI) Macchetto, F. (STScI) Miley, G. (Leiden)	3C 66B: a double stranded optical jet. 1.3 cm.

No.	Observer(s)	Program
AS450	Sahai, R. (Onsala) Claussen, M. (NRL)	Time variation of the enigmatic radio source in IRC+10216. 1.3, 2, 3.8 cm.
AS452	Schachter, J. (CFA) Elvis, M. (CFA) Stocke, J. (Colorado) Perlman, E. (Colorado) Morris, S. (Carnegie Obs.)	BL Lacs from Einstein slew survey. 6 cm.
AS453	Smith, B. (Texas)	HI in "ripple" galaxy NGC 2782. 20 cm line.
AS457	Sahai, R. (Onsala) Claussen, M. (NRL) Luttermoser, D. (Iowa State) Brown, A. (Colorado)	Carbon star V Hydrae. 2, 3.8 cm.
AS460	Sanbonmatsu, K. (Columbia) Helfand, D. (Columbia)	Kinematic distance determination for SNR G27.4+0.0. 20 cm line.
AS465	Sarazin, C. (Virginia) O'Dea, C. (STScI) Baum, S. (STScI)	Radio imaging of the complex X-ray source 2A 0335+096. 3.8, 20 cm.
AT110	Torrelles, J. (IAA, Andalucia) Rodriguez, L. (Mexico/UNAM) Canto, J. (Mexico/UNAM) Ho, P. (CFA) Gomez, J. (CFA)	Ammonia observations of protoplanetary disks. 1.3 cm line.
AT114	Taylor, A. (Calgary) Dougherty, S. (Calgary)	Monitoring of radio variable Be stars. 3.8 cm.
AT118	Thorsett, S. (Caltech) Taylor, J. (Princeton) McKinnon, M. (NMIMT)	Binary pulsar timing measurements: pulsars not accessible to Arecibo. 20, 90 cm.
AT126	Taylor, G. (Arcetri) Hu, E. (Hawaii)	Quasar and Lyman-α companion in 1033+137. 3.8 cm.
AT127	Thorsett, S. (Caltech) Taylor, J. (Princeton) Hankins, T. (NMIMT) Stinebring, D. (Oberlin)	Timing fast pulsars. 6, 20, 90 cm.
AT131	Thorsett, S. (Caltech) McKinnon, M. (NMIMT) Taylor, J. (Princeton)	Binary pulsar timing. 20, 90 cm.
AT134	Taylor, A. (Calgary) Dougherty, S. (Calgary)	Monitoring of radio variable Be stars. 3.8 cm.

No.	Observer(s)	Program
AT137	Taylor, C. (Minnesota) Brinks, E. Skillman, E. (Minnesota)	High resolution study of intergalactic HI clouds. 20 cm line.
AU044	Umana, G. (IdR, Bologna) Trigilio, C. (IdR, Bologna) Hjellming, R. Catalano, S. (Catania) Frasca, A. (IdR, Bologna)	Algol-type systems: RZ Cas. 1.3, 2, 3.8, 6, 20 cm.
AU046	Uson, J. Bagri, D. Cornwell, T.	Absorption in galaxies/QSOs at z=3.3. 90 cm line.
AU047	Uson, J. Bagri, D. Cornwell, T.	Two Zel'dovich pancakes. 90 cm line.
AV190	van Moorsel, G. (ESO, Garching) Sparke, L. (Wisconsin) Schwarz, U. (Groningen)	HI study of the peculiar galaxy NGC 3718. 20 cm line.
AV191	Viallefond, F. (Meudon) Lequeux, J. (Meudon)	Small-scale structure in the extinction in M33 HII regions. 3.8 cm.
AV193	van der Hucht, K. (Utrecht) Williams, P. (Royal Obs.) Spoelstra, T. (NFRA)	Wolf-Rayet object WR125. 2, 6, 20 cm.
AV194	van Breugel, W. (Lawrence Livermore) McCarthy, P. (Carnegie Obs.) Kapahi, V. (GMRT, Pune)	Distant radio galaxy studies in the southern hemisphere. 3.8 cm.
AW297	Wallin, J. (NRL) Higdon, J. (Texas) Appleton, P. (Iowa State)	Ring galaxy AM1354-250 continuum. 6 cm.
AW298	Wallin, J. (NRL) Higdon, J. (Texas) Appleton, P. (Iowa State)	Ring galaxy AM1354-250 HI. 20 cm line.
AW302	Weisberg, J. (Carleton) Frail, D. Johnston, S. (CSIRO) Cordes, J. (Cornell)	HI absorption toward pulsars in the inner galaxy. 20 cm line.
AW304	Waldron, W. (ARC)	Radio/X-ray comparison of early-type stars. 3.8 cm.

No.	Observer(s)	Program
AW305	Wannier, P. (JPL) Andersson, B. (JPL) Moriarty-Schieven, G. (JPL) Federman, S. (Toledo)	Warm OH around molecular clouds. 20 cm line.
AW306	Wannier, P. (JPL) Andersson, B. (JPL) Moriarty-Schieven, G. (JPL)	Warm HI around molecular clouds. 20 cm line.
AW311	Wallace, B. (Calgary) Taylor, A. (Calgary) Goss, W. M. Normandeau, M. (Calgary)	Search for new SNRs. 6, 20 cm.
AW322	Winkler, P. (Middlebury) Dubner, G. (IAFE, Argentina) Goss, W. M.	Radio imaging of the new optical SNR G203.2-12.3. 20 cm.
AY043	Yusef-Zadeh, F. (Northwestern)	High-resolution mosaic of the Sgr A complex. 3.8 cm.
AY045	Yin, Q. Heeschen, D.	Supernovae in MKN 297. 3.8, 6, 20 cm.
AZ044	Zhao, J-H. Ekers, R. (Australia Telescope) Goss, W. M. Lo, K. (Illinois) Narayan, R. (CFA)	Flux density variations in Sgr A. 3.8, 6, 20 cm.
AZ052	Zhao, J-H. Goss, W. M. Lo, K. (Illinois) Ekers, R. (Australia Telescope)	Galactic center at 1.3 and 3.6 cm. 1.3, 3.8 cm.
AZ053	Zhao, J. Carilli, C. Anantharamaiah, K. (Raman Institute) van Gorkom, J. (Columbia)	Seyfert NGC 1068. 6, 20, 90 cm.
AZ056	Zhao, J. Goss, W. M. Anantharamaiah, K. (Raman Institute)	Radio recombination lines from starburst nuclei of nearby galáxies. 3.8 cm line.

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)	Astrometry of dMe stars. 3.6 cm.

E. VERY LONG BASELINE ARRAY

No.	Observer(s)	Program
BG005	Giovannini, G. (IdR, Bologna) Cotton, W. Feretti, L. (IdR, Bologna) Marcaide, J. (IAA, Andalucia) Venturi, T. (IdR, Bologna) Wehrle, A. (JPL) Vermeulen, R. (Caltech)	Five radio galaxies. 3.8, 18 cm.
BZ001	Zhang, Y. (Boston) Marscher, A. (Boston)	Spectral investigation of a complete sample of compact doubles. 1.3, 3.8, 20 cm.

F. SCIENTIFIC HIGHLIGHTS

Green Bank

The list of known 6.7 GHz methanol masers has been expanded from about 80 to 200. An extremely strong spectral line, whose existence was unknown less than a year ago, has now been demonstrated to be widespread throughout the Galaxy. The main remaining piece of information is the spatial distribution of the various velocity components within a single spectral feature. This information awaits VLBI observations, which have been scheduled for April 1992.

Investigators: K. M. Menten and M. J. Reid (CFA)

Socorro

Andromeda Central Source

A radio source recently detected by the VLA at the center of M31 is the weakest known nuclear source thus far observed in any galaxy. The unresolved radio source with a flux density of 28 ± 5 microjansky coincides with the M31 optical stellar nucleus and with a variable Einstein X-ray source. It is only 1/300 as luminous as the Galactic Center source Sgr A and 1/5 as luminous as Sgr A*. The A configuration, 3.6 cm observation makes it unlikely that the detection is due to broad scale emission or a number of small weak sources. If it is not a weak analogue of Sgr A or Sgr A* it could possibly be similar

to the two transient sources that have been observed in the vicinity of Sgr A since 1975. In the same field of view an upper limit of 15 μJy has been determined for the flux density from the remnant of supernova 1885A in M31.

Investigators: P.C. Crane, NRAO; J. R. Dickel, University of Illinois; and J. J. Cowan, University of Oklahoma

Magnetic Field in Z = 0.395 Galaxy

VLA observations have been used to suggest that the rotation measure distribution along the radio jet of the quasar PKS 1229-021 (Z=1.038) is due to the magnetic field reversals in an intervening spiral galaxy disk at Z = 0.395. Rotation measure maps made from the 7-frequency, A and B configuration observations clearly display a quasi-oscillatory pattern along the length of the quasar jet. Combined with the known optical absorption spectrum of the quasar, the observations suggest the presence of an intervening spiral galaxy whose orientation, inclination, and magnetic field can be modelled to match the observations. The resultant magnetic field strength is of order 1-4 μG.

Investigators: P. P. Kronberg, MPIRA, Germany; J. J. Perry, IOA Cambridge, UK; and E.L.H. Zukowsky, University of Toronto

Tucson

"A Giant Molecular Cloud in the Making?" A study is underway with the 12 Meter Telescope that may illuminate the path by which a giant molecular cloud, the birthplace of stars, is itself formed. Using the J = 1-0 ^{12}CO and ^{13}CO molecules, the investigators are mapping the structure of Maddalena's cloud, a large, cold molecular cloud devoid of star formation. As a comparison, they are also mapping a more typical molecular cloud, the Rosette. The investigators have also made CS observations of CO clumps in Maddalena and the Rosette molecular cloud at the 12 meter, in addition to higher transition CO studies at other telescopes. Although the mass spectrum of clumps in Maddalena's cloud appears no different from that measured for the Rosette and other molecular clouds, the physical conditions of the clumps are apparently quite different. CS emission is very weak, if observable in Maddalena, and CO(3-2)/^{13}CO(1-0) ratios are relatively low. The Rosette molecular cloud shows prominent CS emission and strong, often self-absorbed CO(3-2) lines. Maddalena's cloud may be a GMC "in the making," i.e., one step before star formation. The observations suggest that although the structure of the clumps as an ensemble appears very quickly, the clumps themselves must become denser before the onset of star formation.

Investigators: J. Williams, Berkeley and L. Blitz, Maryland

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

The production of 1.2-1.8 GHz, 12-18 GHz, 26-36 GHz and 38-45 GHz amplifiers continued. A summary of amplifier deliveries in this quarter is given in the table below:

FREQUENCY BANDS	NUMBER OF AMPLIFIERS
1.2-1.8	16
12-18	3
26-36	3
38-45	4
Grand Total	26

A design of the 8-10 GHz amplifier has been completed, and a prototype is under construction. Designs of the 18-22 GHz and the 22-26.5 GHz amplifiers are in progress. A test fixture for evaluation of a Cuflon microstrip and waveguide-to-microstrip transition in the 60-90 GHz band has been designed and is under construction. A new set of dewar transition lines has been tested at room temperature and cryogenic testing will begin soon.

Superconducting (SIS) Millimeter-Wave Mixer Development

The first fixed-tuned SIS mixers for the 200-300 GHz band have been tested. These are usable over a 50-60 GHz range whose location within the 200-300 GHz band depends on the integrated tuning elements of the particular mixer. The receiver noise temperature is 50-60 K over most of the band. The present version of this mixer can exhibit instability in the lower part of the frequency range unless the bias voltage and LO power are adjusted in the right sequence; this may make computer-controlled tuning difficult. We are now designing a modified version of this mixer which should have improved bandwidth, and not exhibit the tuning idiosyncrasy described above. It is planned eventually to use this mixer in the 8-beam 230 GHz receiver and in the 270-300 GHz receiver.

Work has started on four SIS receiver modules ("rockets") for 270-300 GHz. It is hoped these will be ready in time for installation during the 1992 summer shutdown.

A new set of SIS mixers containing small chip and integrated (tunerless) designs specifically for the 130-170 GHz bands is now being fabricated at UVA. At present, the 2-mm mixers on the 12-m telescope have junctions with integrated tuners designed for 100 GHz. This accounts for the rapid increase of receiver noise temperature with frequency. The new devices designed for 150 GHz should cure this.

Polystyrene foam supported mylar vacuum windows appear to be working satisfactorily on all the SIS receivers on the 12-m telescope. Recently, however, the gas used in manufacturing extruded polystyrene foam was changed from a chloro-fluorocarbon (freon) to a hydro-chloro-fluorocarbon less damaging to the ionosphere. The millimeter-wave loss of the new polystyrene foam was too high to use in vacuum windows. We have measured the loss of many other materials as possible substitutes, and have found only one which may be suitable. That is expanded polystyrene (as opposed to extruded) which is made from small styrene beads. It is not yet known whether the inhomogeneity in dielectric constant resulting from the expanded bead structure of this material will cause unacceptable scattering of a millimeter-wave beam. Also, this material may have unacceptable outgasing characteristics. We are continuing this investigation.

Work continues on a new, more versatile, SIS mixer test set based on a closed-cycle JT refrigerator. The new test set will allow us to measure the conversion loss and noise of new experimental mixers of various sizes and configurations (including 4 K feed horns and lenses, if desired) which will not fit in our present small liquid helium test cryostats.

We have completed a study of three approximations to Tucker's theory of SIS mixers. The results show that an approximation slightly less extreme than the usual three-frequency approximation is acceptable for most SIS mixer design work. This is an important result, especially for designing tunerless mixers, as use of the approximate method can reduce the computational effort needed to design a mixer from hours on a large computer using a full analysis to minutes on a desktop

machine. This work has been possible as a result of Stafford Withington's visit, from Cambridge, during the summer of 1991, when he installed his full SIS mixer analysis program on the Charlottesville Polaris computer. Our results were presented at the 1992 Space Terahertz Technology Symposium.

During this quarter we have built (or rebuilt) and tested a total of 11 SIS mixers operating from 68-300 GHz. In addition, we have built and tested 6 frequency multipliers, including 4 experimental triplers using experimental three-dimensional electron gas varactor diodes being developed at UVA. Such multipliers may play an important role in the local oscillator chain on the Millimeter Array.

OVLBI Earth Station Project

Work continued during the quarter on the detailed design phase, with progress in the various subsystems described in the following paragraphs.

In the optics system, additional testing of the FSS prototype was carried out, showing good bandwidth in the required transmission and reflection bands, but slightly higher losses than expected. The performance is adequate, but further improvement may be possible in the final version. Refinement of the other optical elements continued. The mirror and feed designs are nearly finalized, and fabrication is due to begin during the next quarter.

In the two-way timing system, work during this quarter concentrated on prototyping of the uplink portion, which includes all the microwave components. In addition, further study of the algorithms for processing of the downlink phase detector results was done, and a report was issued.

The main development computer (an 80486/33 PC) was received and installed, and benchmarks were run to determine key operating system performance measures on this faster platform. Two real-time programming experts from the AOC in Socorro visited Green Bank during the quarter to provide consulting. An overall review of the software effort was conducted, dividing it into system level, VLBA code porting, and new code development segments. The required manpower for each was estimated. It became clear that a larger effort than originally planned (1 FTE) would be needed in order to complete the project on time, so efforts were begun near the end of the quarter to recruit an additional staff member. Considerable progress was made in porting some of the required VLBA control code to UNIX; decisions were made on methods of handling the operating system differences in the remaining code. A version of the MCB driver compatible with the VLBA code was developed and tested.

For the wideband data system, design of the prototype Costas demodulator was completed and prototype construction was started. A design report was prepared in draft form. Design of the decoder was started. Construction of the two VLBA recorders continued at the contractor's plant. At the end of the quarter, delivery was still expected on the scheduled date of April 15.

A team from NASA visited Green Bank in January for an informal review of the project. This included a tour of the site, demonstrations of hardware, and presentations by members of the development team.

The project manager visited JPL in March for a series of coordination meetings. Informal agreements were reached on various interfaces, and information on signal processing techniques was exchanged. The Russian transponder for Radioastron (laboratory model) was on hand, and some tests on it were conducted.

Electromagnetic Support

Input VSWR of the GBT profile horn prototype feed was measured and found to be better than 35 dB in the frequency range of interest. In an attempt to reduce the length of the feed, three different tapers of shorter lengths were machined, and the input VSWR of two of them was found to be more than satisfactory.

The design of a wideband linear taper horn was completed. This horn design will be used in the 3.95-5.85 GHz and 5.85-8.20 GHz bands of the GBT and a prototype was made in the K_u band.

The aperture efficiency of the GBT was calculated at L-band using the measured feed patterns of the prototype feed.

A VLBA 43 GHz feed was modified with an attachment at the aperture to be used on the VLA antenna to measure its efficiency. The far-field patterns and input VSWR of this feed were also measured.

I. GREEN BANK ELECTRONICS

Green Bank Telescope

Receivers

Design of the 18-26.5 GHz receiver started during this period. A block diagram design was developed for a four-feed, cooled receiver. Two feeds will operate from 18 to 22 GHz and two from 22 to 26.5 GHz. Approximately 80 percent of the microwave components have been selected and placed on order. Monitor and control functions have been specified.

A decision was made to purchase the waveguide polarizer to be used in the prime focus 680-920 MHz receiver. The order has been placed, sharing non-recurring engineering costs with the NAIC Arecibo Observatory group who are also interested in this device.

Control testing of the commercial local oscillator synthesizer was completed satisfactorily. Design of the remaining portions of the LO system is proceeding.

A prototype quadridged OMT operating near 5 GHz was constructed and tested. The design was obtained by scaling, to the extent possible, a unit used on the 140-foot and VLBA antennas. This prototype served as a test bed to evaluate problems expected in the fabrication, as well as the electrical performance. Tests indicate that satisfactory performance over the 1.5:1 desired bandwidth could be achieved, but problems with tolerances and physical dimensions lead to the conclusion that this design was impractical. Utilization of a finite-element analysis package allowed the production of an improved design, and fabrication of a new prototype is now beginning.

Certain components common to all receivers have been selected and are being purchased. Examples include cryogenic temperature sensors, hermetic multipin connectors for use on the vacuum dewars, and receiver printed circuit boards.

Feeds and Optics

The linear taper prototype feed was designed for the Gregorian focus, and operates over the 12 to 18 GHz frequency range. Fabrication is 95 percent complete and testing will begin shortly. Fabrication drawings are being produced for prime focus feed prototypes. Preliminary investigations into developing a lightweight construction technique for the large feeds were performed, and this work continues.

Our antenna analysis software was used to further investigate the antenna cross-polarization performance. It appears that the feed locations designated in the receiver plan provides satisfactory performance. Currently, the effects of gravitational deformations predicted for the LORAL structural design are being analyzed.

Antenna Interface

Continued discussions with RSI concerning the prime focus boom and service area led to the construction of a simple full-scale mock-up of that area. Various procedures for loading a receiver into the focus-rotation mount were evaluated, and a workable procedure developed.

A design for a feed rotator to be installed on the receiver turret is being developed. The design is approximately 50 percent complete, with a goal that a working model will be assembled and under test by the end of the year.

Active Surface

Electronics to be provided to the actuator manufacturer for testing production actuators was completed.

Hardware and software to control 11 actuators in a brassboard test of many active surface concepts was designed, built, and tested. A one-axis test in the lab yielded a mean positioning accuracy, as measured by the LVDT, of 0.7 mils.

The design of several small subsystems required for the final system has begun. These included interfaces to the emergency stop and to the emergency generator, as well as a master oscillator to which all LVDT's will be locked.

Preliminary drawings were completed to convey NRAO's concepts for the active surface control room and actuator grouping to RSI.

Investigation of lightning protection and RFI suppression techniques for the active surface have begun.

Autocollimator Pointing

Improvement of the autocollimator test set continues. Pointing stability has been enhanced by temperature controlling the pipe through which the laser passes. Initially control was manual. Stability measurements of less than 1" are now common; some intervals are up to 2", peak to peak. This has justified active closed-loop control of the pipe temperature which is in progress.

A specification has been written for the precision steerable mirror systems required by the autocollimator system.

Laser Ranging

Three camera systems have been produced and tested. Software for the control and data analysis of a three camera system has been written and is being debugged. Minor hardware problems have been found and are being investigated.

140 Foot Telescope Cassegrain Receiver Upgrade

Construction of hardware for the second local oscillator has been completed. This unit will require a few weeks of shakedown before being considered complete. The upgrade requires several HEMT amplifiers to cover the 5 to 18 GHz range. These are being developed and constructed at the Central Development Lab.

Navy Operations

Construction and test of modules for the Hawaii S/X receiver continues. The dewar has been assembled and almost completely tested. Work on the feed is about 60 percent complete. Approximately 45 percent of the other modules have been built and tested.

J. SOCORRO ELECTRONICS

RFI Improvements

The sensitivity of the 327 MHz and 75 MHz systems will be limited partly by radio-frequency interference locally generated at each antenna. Modifications to various modules to reduce this interference and increase the instantaneous usable bandwidth were investigated. A modification to allow the monitor and control system to free run eliminated most of the coherent RFI between antennas. However, the remainder still limits use of the 327 MHz system, so enclosing the radiating components with RFI shields is necessary.

Four RFI enclosures for the vertex mounted "B" racks were purchased. These RFI enclosures eliminated the remaining antenna-generated interference at 327 MHz. There is still some locally generated RFI noticeable at 75 MHz. An in-house design for the remaining 24 RFI enclosure is complete. This quarter five more enclosures were installed, for a total of 12 antenna outfittings. The remaining enclosures will be constructed and installed as funding permits.

1.3-1.7 GHz T_{sys} Improvements

Presently twelve VLA antennas have the improved (30 K vs 55 K T_{sys}) VLBA style L-band receivers installed. Three more of the new front-end systems are now in the assembly process. With 1992 funds, we expect to install ten new front-end systems in 1992 and two more in early 1993. If 1993 funding permits, we could build ten more in 1993.

1.3-1.7 GHz RFI Improvements

The VLA receiver frequency conversion design contains an image response such that external signals in the 1710-1850 fixed microwave band appear in VLA data in the 1490-1350 MHz range. A 1785 MHz bandwidth filter in all 20 cm receivers has adequately suppressed the worst interference at 1415 MHz. However, increased VLA observing at 1350-1365 MHz and increased priority of USFS radio links at 1830 and 1849 MHz caused a serious loss of spectral line observing. The U.S. Forest Service could no longer turn off their links at our request. Therefore, we successfully tested the addition of 1200-1730 MHz bandpass filters in three antennas in October 1991. With fifty more filters purchased in January 1992, we have outfitted nine more antennas this quarter and will complete outfitting all antennas in April 1992.

K. TUCSON ELECTRONICS

200-270 GHz SIS Receiver Sideband Filter

Single sideband filters have been installed on the two polarization channels of the 1-mm SIS receiver. These are Martin-Puplett polarizing interferometers which are independently adjusted to the required frequency. The image is terminated in a cold load on the 4 K station inside the dewar. The filters have over 20 dB of rejection at mid-band when tuned using a signal source at the image frequency. At present there is no on-line frequency source, but one will be developed for this purpose. Setting the filter is currently done by interpolation from a calibration table and generally yields mid-band rejection in excess of 15 dB. Lab measurements show that the image termination has an apparent temperature of about 27 K at 230 GHz, and the loss in the optics is a few percent. Single sideband temperatures are close to twice the double sideband temperatures as the mixers are optimized for the given signal sideband when the image filter has been set. Two double sideband modes are available. In the first, the path difference through the filters is configured to be zero. In the second double sideband mode, the sideband filters are completely removed from the signal path, giving noise temperatures a few degrees lower.

Progress on New 2 mm SIS Receiver

In March, the Tucson receiver group completed the new 2 mm SIS receiver. First tests of the receiver on the telescope were encouraging. If further tests during the next few weeks continue to go well, we will schedule a few "guinea pig" observers to use the receiver in late May and June. We expect the receiver to be available as a standard instrument this autumn.

We have not yet evaluated the receiver over the entire 130 to 170 GHz tuning range. At the J = 3-2 CS frequency near 147 GHz, the receiver noise temperatures are ~80 K (DSB). Through tuning of the backshorts, we were able to achieve a single sideband tuning with better than 15 dB image rejection. We do not yet know what the image rejection will be at other frequencies in the band. As with our other SIS receivers, this is a dual polarization receiver in a 4 K, closed-cycle cryostat. The SIS mixers were developed by the Central Development Laboratory in Charlottesville.

L. AIPS

The 15APR92 release of AIPS is nearly complete and we are preparing to start distribution at the end of April. The most significant changes to AIPS were in the area of handling inter-cpu communication for sharing data, tape drives and displays among work stations. The "typical" AIPS site, now has several workstations running AIPS, but fewer tape drives and graphics display devices. These resources are now shared between users in a more elegant manner. Several improvements to the AIPS workstation "TV" program XAS have also been made.

Experimentation with VLBI observations of polarized radio sources as shown that the basic changes were required for calibration of these observations. An ellipticity-orientation polarization model was added to the AIPS calibration software. New AIPS tasks were created to display and test calibration VLBI data. Improvement of VLBI data reduction software remains the top priority for AIPS.

Several bugs have been fixed in the 15APR92 release of AIPS, particularly in the area of processing compressed UV-data. It is believed that all UV-data can now be calibrated and de-convolved in compressed format. Minor improvements were also made to various data display tasks.

M. SOCORRO COMPUTING

In the online computer systems area, work was continued with PGPLOT and the VLA Standard Command Package to better tailor them to the realtime environment at the VLA. These packages provide the basis for both realtime and historical data display using the online system. The SPARCstation that is intended to provide realtime access to VLA data was moved to the site; data was successfully filled into AIPS and ISIS. Work continues to resolve various problems uncovered during these tests and to make the system more robust. We are identifying other applications that will benefit from the near-realtime connection to the observing system.

The format of data provided by the observing system from a pointing run has been transformed to aid in the understanding of VLA pointing errors. Much of the work done in this area also lays the necessary groundwork to provide the "referenced pointing" scheme that will be necessary if the VLA is to be used at wavelengths shorter than 1 cm.

A test was successfully concluded to show that the memory capacity of the online computers could be quadrupled by a simple chip replacement. We now have sufficient chips on hand to upgrade all the memory boards and will carry out the modifications in the next month. The added memory will allow us to more easily accommodate the software needed to support ethernet-based networking.

At the Array Operations Center in Socorro, new equipment from the Array Computing procurement was successfully installed this quarter. An Auspex NS/5000 high-performance NFS server was formally accepted at the beginning of March.

This server provides the operating system and a large number of other programs, including AIPS, to the 24 existing Sun workstations and 23 new Sun SPARCstation IPXs which were accepted in late March. Two of the new SPARCstations are designated as reservable by visitors, and two more have been ordered. This will bring the total number of midsize public workstations to six.

Proposals for Visualization Systems are still under evaluation due to the variety and complexity of the software involved. A Request for Proposal was issued in early March for high-performance UNIX workstations.

Two of the three vacant scientific programming positions were filled, and the programmers began work, early in 1992. One has already completed the task of making substantial improvements to the software for the MANN measuring engine, while the other will be heavily involved for several months in the VLA archive tape copying project. An offer was made for the third position in late March; this position is committed to aips++ development until at least the end of 1993.

N. VLBA PROJECT

Antennas and Site Preparation

The first eight VLBA stations are operational: Pie Town, NM; Kitt Peak, AZ; Los Alamos, NM; Fort Davis, TX; North Liberty, IA; Brewster, WA; Owens Valley, CA; and Hancock, NH. At St. Croix, VI, the final outfitting is underway, with operability scheduled for June, 1992. At Mauna Kea, HI a mild winter allowed antenna assembly to progress unimpeded. Outfitting of the Mauna Kea antenna is scheduled to start in September, 1992 and to be completed before the year's end.

Electronics

The last Data Acquisition rack has been completed this quarter. The final rack set, for the antenna at Mauna Kea, has been shipped to Socorro for testing before shipment to Hawaii.

Four front ends for 43 GHz and six for 14 GHz remain to be completed. With the exception of two spare units, all other front ends have been completed. Approximately 20 converter modules, mostly for spares, remain to be wired, and should be completed during the coming quarter.

The final electronic modules to be constructed will be a set of two pulse calibration systems for each antenna, which will add the capability of calibrating time delays in the electronics. The design of the Pulse Generator module for this system is now complete and the prototype is ready for testing.

Retrofitting of some early modules is now in progress, and this work should be completed by about the third quarter of the year. All of the eight antennas which have been outfitted to date now have a full complement of eight Baseband Converter modules. Outfitting of the ninth antenna, at St. Croix, is now under way.

The construction group at Charlottesville will be reduced by one person at the end of March, and the remaining staff should be able to complete all construction to meet the outfitting schedules.

Data Recording

Recorder production in the third Haystack Observatory production run of eleven units, through serial #32, continues through the second quarter of 1992 because of a temporary shortage of headstacks from Metrum, plus a hold on shipments until Haystack completes a retrofit of mechanical upgrades resulting from their tape transport characterization studies. These changes are designed to allow thin tape to be utilized at full speed without damage. The fourth (and last) Haystack production run of 11 recorders is well underway. A final eight additional recorders, now mostly completed, are under construction at the AOC.

Before the purchase of the major VLBA supply of tape in late 1992, an accelerated life test of a significant sample of thin tapes from two manufacturers is being performed, to determine any wear or performance degradation from field usage and shipping. This test involves repeated weekly shipping and multiple wind tests at each destination, which are most of the operable VLBA sites, the AOC, and Haystack Observatory. At Haystack the tape edges are examined for any evidence of damage after each cycle. Using Federal Express shipping, the tapes are cycled weekly, which is four to eight times more frequent than is expected for VLBA astronomy operations. The accelerated life test is in addition to the observational test program using thin tapes mixed into VLBI and JPL/GSFC Network tapes supplied to selected VLBI observatories.

Monitor and Control

During first quarter 1992 enhancements to the on-line software system continued. Hardware checks now produce more meaningful information about equipment not performing as specified. Preliminary groundwork has been done for new modules not yet added to the system, including the switchable pulse calibration module and the pulse calibration extractors being installed in the formatters.

A network communications backup has been made and is currently being implemented.

The Monitor and Control group has taken over the code for producing correlator (and other) logs from the monitor data returned by the station computers. This code had been developed by the array operations group for some time.

Work is progressing toward inserting relevant log data into the Ingres database. Trial database logs have been given to the Charlottesville correlator group to see if they can be converted into the relevant quantities for the correlator.

A general purpose listing/plotting program for engineering data extracted from the station monitor data has been written to display the engineering data for benefit of the engineers and technicians. It has, however, been delayed in being generally available because of system problems with the graphics software package we are using.

Correlator

System-level checkout of the correlator continued, at a steady but exceedingly slow pace, throughout the quarter. Almost the entire effort in this area was focussed on the playback interface and the input stage of the correlator's FFT modules. Comprehensive tests and computer simulations were designed to evaluate the combined performance of the delay tracking, deformatting, data segmentation, and fringe rotation processes, and to verify the complex timing relationships among them. All five of the VLBA formatter's (de-)multiplexing modes have now been validated for Nyquist-sampled data, segmented for transforms of 512 or fewer points; a single over-sampled mode has also been proven. These tests are fundamental to ensuring correct performance of the entire correlator system, and will be extended to cover the special cases for high spectral resolution, and other over-sampled modes.

Many aspects of this area of the system are controlled by tables in ROM or RAM, and had been operating with preliminary, ad hoc versions of the tables. Final versions were developed for two of the most important such tables, the playback speed control and fringe-rotator functions. Elsewhere in the correlator, an experimental FFT "twiddle factor" table was developed, and shown in initial tests to suppress the spurious image lines previously seen in highly correlated spectra.

A new test fixture was placed in service in the final week of the quarter. It acquires up to 262,144 two-bit data samples from the output of the sampler in a VLBA D-rack. The samples can then be Fourier transformed off-line and the resulting spectrum compared with that obtained when data of identical statistical properties are passed instead to the VLBA formatter, and thence to the correlator's playback interface, either directly or via a recording. Initial tests with the new fixture showed excellent agreement between the two results.

Integration of all correlator operations under control of the real-time system was completed, and indeed all the tests described above were conducted totally under computer control. As a side-effect, some parts of the real-time control software

have now been exercised thoroughly and brought into a robust state. However, most of the software still awaits further progress in hardware checkout before serious testing under operational conditions can begin.

Data Processing

During the last quarter much progress was made on debugging the analysis software for single baseline, multi-IF VLBI/VLBA data. Three subtle bugs were uncovered and fixed in the fringe-fitting software. Numerous small enhancements were made to various routines to add versatility to the VLBA analysis path. Users now have more ways of examining their data.

A VLBI software workshop was held in March. Much of the discussion centered around improving the current software, and setting priorities for the development to be performed over the next 6 months. The writing of diagnostics for the debug of the VLBA correlator is planned to start shortly. This includes the ability to compare the VLBA Correlator results with astrometric AIPS fringe-fitting software with that obtained from the Haystack Correlator on the same data sets.

O. PERSONNEL

New Hires

Benett, A.	Scientific Programming Analyst	01/06/92
Roberts, T.	Scientific Programming Analyst	01/06/92
Rupen, M.	Research Associate	01/13/92
Conway, J.	Research Associate	01/13/92
Beland, S.	Scientific Programming Analyst	01/03/92

Staff Changes

Campbell, J.	to Electronics Engineer/Special Projects	01/01/92
Brundage, W.	to Head/VLA Electronics	01/01/92
Havlen, R.	to Special Assistant/Education and Public Relations	01/01/92
Romero, T.	to Acting Head/Observatory Services	02/01/92
Hunt, G.	to Deputy Assistant Director/Software Development (transfer to Charlottesville)	

Retirement

Crews, J. F.	Head/Green Bank Telescope Services	03/31/92

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