NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

1 October 1993 - 31 December 1993

TABLE OF CONTENTS

A. TELESCOPE USAGE

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

	140 Foot	12 Meter	VLA/VLBA
Scheduled observing (hours)	1948.75	1877.50	1581.9
Scheduled maintenance and equipment changes	152.00	32.75	271.0
Scheduled tests and calibrations	35.75	213.50	299.5
Time lost	147.75	219.00	61.7
Actual observing	1801.00	1658.50	1520.2

B. 140 FOOT TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
A115	Aldcroft, T. (Stanford) Elvis, M. (CFA) Bechtold, J. (Arizona)	Observations at 650-975 MHz to determine limits on galactic absorber sizes at $z > 0.4$.
B609	Bania, T. (Boston) Rood, R. (Virginia) Balser, D. (Boston)	X-band measurements of the cosmic abundance of ^{3}He+.
B619	Brown, R. Frayer, D. (Virginia)	A 6 cm search for radio frequency transitions from metastable states of H_2.
E057	Elvis, M. (CFA) Laor, A. (Princeton) Lockman, F. J. Murphy, E. (Virginia) Wills, B. (Texas)	Accurate 21 cm column densities toward quasars with X-ray spectra.
F111	Frail, D. Beasley, A.	An OH search for masers in globular clusters.
F116	Frayer, D. (Virginia) Brown, R. Vanden Bout, P.	A search for redshifted CO emission from a sample of confirmed damped Lyman alpha absorption line systems.

No.	Observer(s)	Program
F117	Frail, D. Goss, W. M. Slysh, V. (Astro-Space Ctr., Moscow) Dubner, G. (IAR, Buenos Aires)	A search for shock-excited maser emission in the OH line.
G338	Gottlieb, C. (Harvard) Thaddeus, P. (CFA) McCarthy, M. (CFA)	13.3 GHz search for the HCCCS radical.
L290	Liszt, H. Lucas, R. (IRAM, Grenoble)	A survey at 6 cm of H_2CO absorption from local gas seen toward compact extragalactic continuum sources.
M347	Magnani, L. (Georgia) La Rosa, T. (NRC/MSFC) Shore, S. (GHRS/NASA) Hearty, T. (Georgia)	An H_2CO search for correlated velocity structure in MBM55 and L134N.
S378	Sizemore, W. Lockman, F. J. Maddalena, R.	Monitoring emissions from geostationary satellites at 10 GHz.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
A116	Arzoumanian, Z. (Princeton) Nice, D.	Observations at 550 MHz of the orbital fluctuations in the eclipsing pulsar binary PSR B1957+20.
B550	Backer, D. (Calif., Berkeley) Foster, R. (NRL) Sallmen, S. (Calif., Berkeley)	Measurements at 800 and 1400 MHz of the timing of an array of pulsars.
B559	Biggs, J. (Curtin Univ., Australia) Salter, C. (NAIC) Foster, R. (NRL)	Observations at 1420 MHz to monitor HI absorption spectra.
M368	McKinnon, M.	Timing the young pulsar PSR B1823-13.
M359	McKinnon, M.	A search at 800 MHz for pulsed emission from the companion of PSRB1820-11.
N011	Nice, D. Sayer, R. (Princeton) Taylor, J. (Princeton)	A 340-380 MHz survey of the northern sky for millisecond pulsars.
N013	Nice, D. Sayer, R. (Princeton) Taylor, J. (Princeton)	A search at 370 MHz for pulsed radio emission from X-ray pulsar 1E 2259+586.

No.	Observer(s)	Program
S377	Sayer, R. (Princeton) Nice, D. Taylor, J. (Princeton)	A pulsar search towards SNR G10.0-0.3.
T302	Taylor, J. (Princeton) Nice, D. Thorsett, S. (Caltech) Arzoumanian, Z. (Princeton)	Pulsar timing observations over the range of 780-820 and 1300-1350 MHz.

The following very long baseline interferometry programs were conducted.

No.	Observer(s)	Program
BP008	Porcas, et als.	0957+561 A,B: A direct test for 10^6 solar mass black holes.
GP013	Preuss, et als.	18 cm observations of the radio galaxy 3C 390.3.
GR004	Rupen, et als.	VLBI imaging of supernovae 1993J in M81.
GZ010	Zensus, et als.	Observations of the evolution of the parsec-scale structure of 3C 345.

C. 12 METER TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B594	Barnes, P. (CFA)	A search for CO emission from the Pluto-Charon system.
B597	Bergin, E. (Massachusetts) Goldsmith, P. (NAIC) Snell, R. (Massachusetts) Ungerechts, H. (Massachusetts)	Study of chemical structure and star formation in dense interstellar clouds.
B600	Barnes, P. (CFA) Lada, E. (Maryland) Myers, P. (CFA)	Isotopic spectroscopy of dense cores in L1030-55 clouds.
B605	Backer, D. (Calif., Berkeley) Wright, M. (Calif., Berkeley) Plambeck, R. (Calif., Berkeley) Welch, W. J. (Calif., Berkeley) Kellermann, K. Emerson, D. Carlstrom, J. (Calif., Berkeley) Padin, S. (Caltech) Moran, J. (CFA) Rogers, A. (Haystack)	VLBI observations of Sgr A* at λ 3 mm.

No.	Observer(s)	Program
B606	Balonek, T. (Colgate) Dent, W. (Massachusetts)	Study of the evolution of extragalactic radio sources at millimeter wavelengths.
B608	Butner, H. (NASA/Ames) Lada, E. (Maryland) Charnley, S. (NASA/Ames) Roberge, W. (Rensselaer)	Detection of Alfven waves by molecular spectroscopy.
C281	Carey, S. (Rensselaer) Mead, K. (Union College) Kutner, M. (Rensselaer)	A detailed investigation of the physical properties of arm and interarm clouds in the outer galaxy.
C283	Clancy, R. T. (Colorado) Sandor, B. (Colorado) Muhleman, D. (Caltech)	Microwave spectroscopy of terrestrial planetary atmospheres.
C285	Carey, S. (Rensselaer) Mead, K. (Union College) Kutner, M. (Rensselaer)	Study of cloud structure in the outer galaxy.
G334	Gensheimer, P. (Illinois)	A search for vibrationally excited SiC_2 in IRC+10216.
G339	Gensheimer, P. (Illinois)	Observations of the CO envelope around α Ori.
H290	Hollis, J. M. (NASA/GSFC) Jewell, P.	Identification of interstellar CH_2.
H291	Holdaway, M. Owen, F.	90 GHz continuum survey of potential MMA calibrators.
K340	Koo, B.-C. (Seoul National Univ.) Moon, D-S. (Seoul National Univ.) Heiles, C. (Calif., Berkeley) Seward, F. (CFA)	Molecular line study of a shocked gas in the W51 complex.
K342	Kutner, M. (Rensselaer) Crane, P. (ESO)	Study of CO in diffuse interstellar clouds.
L279	Latter, W. Jewell, P.	Study of a spectral bandscan of IRC+10216 in the 1.2 mm window.
L284	Liszt, H.	Study of J=1-0 CO emission toward extragalactic continuum sources.
L286	Latter, W. Walker, C. (Arizona) Maloney, P. (NASA/Ames)	Study of CO^+ and HCO^+ in NGC 7027 and M17.

No.	Observer(s)	Program
M340	Mizuno, D. (Rensselaer) Kutner, M. (Rensselaer) Verter, F. (NASA/GSFC)	Study of the response of GMCs in M31 to the spiral shock.
M357	Mangum, J. (Arizona) Latter, W.	A derivation of the physical conditions in the Serpens molecular cloud.
M367	Magnani, L. (Georgia) Hearty, T. (Georgia) LaRosa, T. (Alabama) Onello, J. (SUNY)	Study of the CO-H_2 conversion factor for translucent clouds.
P162	Pound, M. (Maryland) Blitz, L. (Maryland)	The continued search for proto-brown dwarfs.
S363	Steimle, T. (Arizona State) Turner, B. Saito, S. (Nagoya Univ.) Takano, S. (Nagoya Univ.)	Search for CaNC as a test of refractory element astrochemistry.
S365	Shepherd, D. (Wisconsin) Churchwell, E. (Wisconsin)	Study of molecular outflows associated with ultracompact HII regions.
S368	Steimle, T. (Arizona State) Turner, B.	Search for AlC in IRC 10216 as a test of chemical models of CSE and ISM refractory elements.
S371	Sanders, D. (Hawaii) Evans, A. (Hawaii) Mazzarella, J. (Caltech) Chambers, K. (Hawaii) Graham, J. (Calif., Berkeley)	CO observations of $2 < Z < 4$ radio galaxies.
T296	Turner, B. Amano, T. (NRC, Herzberg) Avery, L. (NRC, Herzberg) Feldman, P. (NRC, Herzberg)	A 2 mm spectral survey of Orion, SgrB2, W51M, and IRC 10216.
T324	Turner, B.	Study of the chemistry of the cirrus cores and of small galactic plane clouds: CS, C_3H_2 and HC_3N.
T329	Turner, B. Steimle, T. (Arizona State) Meerts, L. (Katholieke Univ., Neth.)	A search for circumstellar and interstellar NaCN.
W332	Wilkinson, D. (Princeton) Page, L. (Princeton)	Study of spectrum of CMBR anisotropy candidate.
Z105	Ziurys, L. (Arizona State) Yoder, T. (Arizona State) Apponi, A. (Arizona State) Pascarelle, S. (Arizona State)	A proposal to complete a 270-300 GHz spectral-line survey of Orion.

No.	Observer(s)	Program
Z107	Ziurys, L. (Arizona State) Apponi, A. (Arizona State) Anderson, M. (Arizona State) Steimle, T. (Arizona State)	A search for interstellar MgCN.
Z108	Ziurys, L. (Arizona State) Apponi, A. (Arizona State) Barclay, W. (Arizona State)	Confirmation of interstellar CaH.
Z109	Ziurys, L. (Arizona State) Apponi, A. (Arizona State) Brazier, C. (Phillips Lab, USAF)	A search for interstellar AlC.

D. THE VERY LARGE ARRAY

Fourth quarter 1993 was spent in the following configurations:

DnC	October 1 to October 25
D	October 25 to December 31

No.	Observer(s)	Program
AA158	Abada-Simon, M. (Paris Obs.) Lecacheux, A. (Paris Obs.) Dulk, G. (Colorado) Bastian, T. Bookbinder, J. (CFA)	Variations of AE aquarii at centimeter, millimeter, and submillimeter wavelengths. 1.3, 2, 3.6, 6 cm
AA161	Adler, D. Wakker, B. (Illinois) Westpfahl, D. (NMIMT)	ISM in NGC 628. 20 cm
AA163	Adler, D. Wakker, B. (Illinois) Westpfahl, D. (NMIMT)	Star formation, spiral structure, and HI in NGC 628. 20 cm line
AA165	Anantharamaiah, K. (Raman Institute) Zhao, J. (CFA) Goss, W. M. Viallefond, F. (Meudon) van Gorkom, J. (Columbia)	Galaxies detected in recombination lines. 1.3, 2 cm
AB456	Burke, B. (MIT) Hewitt, J. (MIT) Roberts, D. (Illinois)	Monitoring 0957+561 A,B. 3.6 cm
AB633	Burns, J. (NMSU) Perley, R. Gisler, G. (LANL)	Imaging the cluster radio halo in Abell 2255. 20, 90 cm

No.	Observer(s)	Program
AB682	Beasley, A. Bastian, T. Ball, L. (Sydney) Wu, K. (Sydney)	A survey of magnetic cataclysmic variables. 3.6 cm
AB686	Braun, R. (NFRA) Walterbos, R. (NMSU) Henning, T. (New Mexico)	The periphery of Abell 1383. 20 cm line
AB688	Bosma, A. (Marseille Obs.) Freeman, K. (Mt. Stromlo) Athanassoula, E. (Marseille Obs.)	Low surface brightness giant spiral galaxies. 20 cm line
AB690	Broeils, A. (Cornell) Giovanelli, R. (Cornell) Haynes, M. (Cornell)	Invisible galaxies in a low latitude field. 20 cm line
AB693	Bastian, T. Nitta, N. (Lockheed) Hudson, H. (Cambridge) Gary, D. (Caltech) Kiplinger, A. (Colorado)	Solar flare imaging with high time resolution. 1.3, 2, 3.6, 6 cm
AC308	Condon, J. Cotton, W. Perley, R.	All sky survey. 20 cm
AC330	Clegg, A. (NRL) Johnston, K. (NRL)	Short time scale variability of interstellar OH masers. 20 cm line
AC348	Westpfahl, D. (NMIMT) Carilli, C. (Leiden) Tongue, T. (NMIMT) Holdaway, M. Zhao, J. (CFA) Rupen, M.	Polarimetry of barred spiral NGC 1365. 6, 20 cm
AC363	Curiel, S. (CFA) Rodriguez, L. (Mexico/UNAM) Eiroa, C. (Madrid Obs.) Canto, J. (Mexico/UNAM)	Radio continuum emission associated with YSOs. 3.6 cm
AC366	Cox, A. (Wisconsin) Sparke, L. (Wisconsin) van Moorsel, G.	Radio continuum emission in polar-ring galaxies. 6 cm
AD304	Dahlem, M. (STScI)	Star-forming regions in the inner disk of NGC 1792. 20 cm
AD313	Dickey, J. (Minnesota)	Orbiting cores in the Hercules cluster. 20 cm line

No.	Observer(s)	Program
AD324	De Pree, C. (North Carolina) Goss, W. M. Mehringer, D. (Illinois)	H92α and H66α radio recombination line observations of W49. 1.3, 3.6 cm line
AD326	Dahlem, M. (STScI) Dettmar, R.-J. (STScI) Hummel, E. (Royal Obs.) Lehnert, M. (Caltech) Heckman, T. (STScI)	Radio continuum of edge-on spiral galaxies with Hα emission in the halos. 6 cm
AF245	Frail, D. Kulkarni, S. (Caltech) Yusef-Zadeh, F. (Northwestern)	Determining the proper motions of non-thermal cometary nebulae. 3.6 cm
AF251	Felli, M. (Arcetri) Tofani, G. (Arcetri) Goldsmith, P. (NAIC) Olmi, L. (NAIC)	IR cluster in Cepheus B-S155 interface. 2, 3.6 cm
AF256	Fomalont, E. Kellermann, K. Partridge, R. B. (Haverford) Windhorst, R. (Arizona State)	The radio sky at microjansky levels. 3.6 cm
AF258	Florkowski, D. (USNO) Johnston, K. (NRL) de Vegt, C. (Hamberger Sternwarte)	Reference sources near radio stars. 6 cm
AG382	Goss, W. M. Schwarz, U. (Groningen/Kapteyn) Dubner, G. (IAR, Buenos Aires) Winkler, P. F. (Middlebury College)	Search for HI associated with Cas A. 20 cm line
AG393	Guedel, M. (Colorado/JILA) Schmitt, J. (MPIfEP, Garching) Benz, A. (ETH, Zurich) Elias, N. (USNO)	HD 129333: An analog of the infant sun. 3.6, 6, 20 cm
AG398	Green, D. (Cambridge) Cowan, J. (Oklahoma)	A search for young galactic SNRs. 3.6 cm
AH492	Hjellming, R. Gehrz, R. (Minnesota) Seaquist, E. (Toronto) Taylor, A. (Calgary)	Image and light curve evolution of the novae Puppis 1991 and Cygni 1992. 1.3, 2, 3.6, 6, 20 cm
AH493	Holdaway, M. Carilli, C. (Leiden) Rupen, M. Kollgaard, R. (Penn State)	Centaurus A. 90 cm

No.	Observer(s)	Program
AH496	Hollis, J. M. (NASA/GSFC) Van Buren, D. (Caltech) Vogel, S. (Maryland)	Probing the large-scale dynamical features of PN Abell 35. 6 cm
AH497	Hartmann, L. (CFA) Rodriguez, L. (Mexico/UNAM) Anglada, G. (Barcelona)	Radio continuum from new FU Orionis stars. 3.6 cm
AH500	Higdon, J. Ghigo, F.	HI observations at NGC 2793. 20 cm line
AI049	Ishizuki, S. (Tohoku U.) Ishii, T. (Tohoku U.)	Star formation in starburst and hotspot galaxies. 20 cm
AJ232	Jackson, J. (Boston) Kraemer, K. (Boston)	NH_3 in the NGC 6334 molecular cloud complex. 1.3 cm line
AK327	Kaufman, M. (Ohio State) Brinks, E. Elmegreen, B. (IBM) Elmegreen, D. (Vassar) Struck-Marcell, C. (Iowa State)	Ocular and caustic galaxies undergoing close tidal encounters. 20 cm line
AK331	Kobulnicky, H. (Minnesota) Dickey, J. (Minnesota) Conti, P. (Colorado)	Spectral index mapping of Wolf-Rayet galaxies. 2 cm
AK339	Koo, B.-C. (Seoul National U.) Ho, P. (CFA)	Ammonia line observations of protostellar object IRAS 19550+3248. 1.3 cm line
AK340	Kenny, H. (CMC, Kingston) Taylor, A. (Calgary) Seaquist, E. (Toronto)	Outburst flux measurements of the stellar jet source, CH Cygni. 2, 6, 20 cm
AK343	Kobulnicky, H. (Minnesota) Dickey, J. (Minnesota) Conti, P. (Colorado)	HI spectral mapping of Wolf-Rayet galaxies. 20 cm line
AK358	Kulkarni, S. (Caltech) Vasisht, G. (Caltech) Frail, D.	Monitoring SGR 1806-20 = SNR 10.0-0.3. 3.6, 6, 20 cm
AL294	Leone, F. (Catania, Italy) Trigilio, C. (Noto, Italy) Umana, G. (Noto, Italy)	Testing the proposed models for radio emission from CP stars. 1.3, 2, 6, 20 cm
AL295	Lim, J. (Caltech)	dM4e flare star MR Persei. 3.6, 6 cm
AL302	Lis, D. (Caltech) Menten, K. (CFA) Carlstrom, J. (Caltech) Zylka, R. (MPIR, Bonn)	Search for compact HII regions and H_2O masers in the GC dust ridge. 1.3 cm line

No.	Observer(s)	Program
AL304	Levine, D. (UCLA/IPAC) Taylor, G. (Caltech) Morris, M. (UCLA) Schulman, E. (Michigan)	Search for H_2O masers toward the galactic center. 1.3 cm line
AL305	Lim, J. (Caltech) White, S. (Maryland)	Search for radio emission from precataclysmic binaries. 3.6 cm
AL309	Lang, K. (Tufts) Willson, R. (Tufts) Kile, J. (Tufts)	VLA-Yohkoh SXT observations of dynamic structures on the sun. 20, 90 cm
AM402	Marcha, M. (Manchester) Browne, I. (Manchester) Laing, R. (Cambridge)	Polarization structure and flow speed in low luminosity jets. 6 cm
AM416	Mundy, L. (Maryland) McMullin, J. (Maryland)	Puzzling spectral index of emission from YSO NGC 1333 IRS 4A. 1.3 cm
AM419	Mirabel, I. F. (CNRS, France) Duc, P. (CNRS, France) Brinks, E.	HI in the merger Arp 105. 20 cm line
AM423	Mundy, L. (Maryland) Grossman, A. (Maryland) White, S. (Maryland)	T Tauri star RY Tau. 1.3, 2, 3.6, 6 cm
AM424	Moore, E. (Boston) Gottesman, S. (Florida)	HI observations of the barred spiral galaxy NGC 3319. 20 cm line
AM426	McMahon, P. (MIT) van Gorkom, J. (Columbia) Richter, O.-G. (STScI) Ferguson, H. (Cambridge)	A complete volume-limited HI survey of the Hydra I cluster. 20 cm line
AM428	Mirabel, I. F. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Central source and jets in GRS 1758-258. 6 cm
AM431	Martin-Pintado, J. (Yebes Obs.) Gaume, R. (NRL) Johnston, K. (NRL)	The physical properties of the molecular outflow in CRL 618. 1.3 cm line
AN062	Nordgren, T. (Cornell) Chengalur, J. (Cornell) Salpeter, E. (Cornell) Terzian, Y. (Cornell)	HI morphology and orbital kinematics of galaxy pairs. 20 cm line
AO117	Olling, R. (Columbia) Rupen, M. van Gorkom, J. (Columbia)	The edge-on dwarf galaxy NGC 5023. 20 cm line

No.	Observer(s)	Program
AP255	Puche, D. (CFA) Westpfahl, D. (NMIMT)	HI mapping of grand design spirals M51 and M83. 20 cm line
AP264	Puche, D. (CFA) Westpfahl, D. (NMIMT)	High resolution HI study of IZW18. 20 cm line
AP270	Pedlar, A. (Manchester) Kukula, M. (Manchester) Mundell, C. (Manchester) Meaburn, J. (Manchester) Baum, S. (STScI)	Neutral hydrogen in NGC 5033 and NGC 4051. 20 cm line
AP274	Pantoja, C. (Oklahoma) Altschuler, D. (NAIC) Eder, J. (NAIC)	Spectroscopy of an optically obscured galaxy. 21 cm line
AP275	Phookun, B. (Maryland) Mundy, L. (Maryland)	D-array observations of NGC 3162, an interacting one-armed spiral. 20 cm line
AP276	Pedlar, A. (Manchester) Mundell, C. (Manchester)	Continuum and HI observations of NGC 3281. 20 cm line
AR291	Roberts, D. (Illinois) Crutcher, R. (Illinois) Troland, T. (Kentucky) Goss, W. M.	HI Zeeman observations of W3. 20 cm line
AR294	Riley, J. (Cambridge) Alexander, P. (Cambridge) Pooley, G. (Cambridge) Scheuer, P. (Cambridge) Laing, R. (Cambridge)	A study of FRII radio galaxies of intermediate power. 3.6 cm
AR295	Rawlings, S. (Oxford U.) Saunders, R. (Cambridge) Cotter, G. (Cambridge) Lacy, M. (Oxford U.) Baldwin, J. (Cambridge)	Giant radio galaxies at high redshift. 3.6, 6 cm
AR296	Rupen, M. Knapp, J. (Princeton) Gunn, J. (Princeton) Olling, R. (Columbia) van Gorkom, J. (Columbia)	The velocity dispersion of the HI in face-on galaxies. 20 cm line
AR297	Roberts, D. (Illinois) Crutcher, R. (Illinois) Troland, T. (Kentucky)	VLA HI Zeeman obervations of NGC 6334 and M17. 20 cm line

No.	Observer(s)	Program
AR304	Rudolph, A. (NASA/Ames) de Geus, E. (Maryland) Brand, J. (Arcetri) Wouterloot, J. (Cologne)	Outer galaxy, massive, star-forming clouds. 3.6 cm
AS333	Sramek, R. Weiler, K. (NRL) van der Hulst, J. (Groningen/Kapteyn) Panagia, N. (STScI)	Statistical properties of radio supernovae. 2, 6 cm
AS503	Strom, R. (NFRA) Johnston, H. (Utrecht) Verbunt, F. (Utrecht) Aschenbach, B. (MPIPA, Munich)	An X-ray knot associated with the Vela SNR. 6, 20 cm
AS510	Swain, M. (Rochester) Bridle, A. Baum, S. (STScI)	Additional 8 GHz imaging of radio galaxy 3C 353. 3.6 cm
AS515	Schiminovich, D. (Columbia) van Gorkom, J. (Columbia)	HI observations of shell galaxies. 20 cm line
AS517	Strauss, M. (Princeton) Szomoru, A. (Groningen/Kapteyn) van Gorkom, J. (Columbia)	HI observations of galaxies in the Bootes void. 20 cm line
AS518	Stocke, J. (Colorado) Carilli, C. (Leiden) Urry, M. (STScI) Donahue, M. (DTM/Carnegie) Shull, J. (Colorado)	HI imaging of a low redshift Lyman alpha forest cloud. 20 cm line
AS520	Saunders, W. (Oxford U.) Rowan-Robinson, M. (Queen Mary) Maddox, S. (Cambridge) Pedlar, A. (Manchester) Smoker, J. (Manchester)	IRAS galaxies behind the Milky Way. 6 cm
AT154	Thorsett, S. (Caltech) Taylor, J. (Princeton) McKinnon, M. Hankins, T. (NMIMT) Stinebring, D. (Oberlin)	Timing fast pulsars at the VLA. 6, 20, 90 cm
AU055	Uson, J. Goss, W. M.	Observations of ^{3}He in the galactic HII region W43. 3.6 cm line
AV206	van Moorsel, G. Oosterloo, T. (Bologna)	HI observations of two compact groups of galaxies. 20 cm line

No.	Observer(s)	Program
AW343	Westpfahl, D. (NMIMT) Puche, D. (CFA)	Is dark matter absent from the smallest dwarf galaxies? 20 cm line
AW346	Wilcots, E. Miller, B. (Washington) Hodge, P. (Washington)	NGC 2537 and Ho I. 6 cm
AW350	Wills, B. (Texas) Shastri, P. (Calif., Berkeley)	Core variability in lobe-dominated quasars. 3.6 cm
AW355	Wood, D. Strom, K. (Massachusetts)	HI photodissociation regions in L1641. 20 cm line
AW358	Westpfahl, D. (NMIMT) Puche, D. (CFA)	High-resolution HI mapping of NGC 3938. 20 cm line
AW362	White, S. (Maryland)	The stellar activity cycle on active stars. 3.6, 6, 20 cm
AW370	White, S. (Maryland) Gary, D. (Caltech) Kundu, M. (Maryland)	Large-scale features in the sun's atmosphere. 6, 20, 90 cm
AY055	Yun, M. (Caltech) McIntyre, V. (CFA)	Galaxy-scale gaseous collisions and ring galaxies. 20 cm line
AY060	Yusef-Zadeh, F. (Northwestern) Roberts, D. (Illinois) Zhao, J. (CFA) Goss, W. M.	Recombination line measurements of non-circular moving gas at the galactic center.
AZ063	Zijlstra, A. (ESO) Pottasch, S. (Groningen/Kapteyn)	Resolving the optical-radio flux discrepancy of planetary nebulae. 3.6, 6 cm
AZ065	van Zee, L. (Cornell) Broeils, A. (Cornell) Haynes, M. (Cornell) Salzer, J. (Wesleyan)	HI mapping of extreme M(H)/L galaxies. 20 cm line

E. VERY LONG BASELINE ARRAY

No.	Observer(s)	Program
BB022	Backer, D. (Calif.,Berkeley) Wright, M. (Calif.,Berkeley) Plambeck, R. (Calif.,Berkeley) Kellermann, K. Emerson, D. Carlstrom, J. (Caltech) Padin, S. (Caltech) Moran, J. (CFA) Rogers, A. (Haystack)	VLBI observations of Sgr A* at 3 mm wavelength. 0.3 cm

No.	Observer(s)	Program
BC026	Campbell, R. (CFA) Shapiro, I. (CFA) Ratner, M. (CFA) Bartel, N. (CFA) Cappalio, R. (Haystack)	Pulsar parallax determinations.
BG020	Gwinn, C. (Calif., Santa Barbara) Greenhill, L. (CFA) Antonucci, R. (Calif., Santa Barbara) Barvainis, R. (Haystack)	Weighing a hidden Seyfert nucleus - NGC 1068. 1.3 cm
BL002	Lestrade, J. F. (JPL/Meudon) Jones, D. (JPL) Preston, R. (JPL) Phillips, R. (Haystack)	Radio star astrometry for HIPPARCOS tie-in. 3.6 cm
BM030	Marscher, A. (Boston) Moore, E. (Boston) Wehrle, A. (Caltech) Xu, W. (Caltech)	Mk II observations of 3C 273 and 3C 279, coordinated with other bands.
BP008	Porcas, R. (MPIR, Bonn) Garrett, M. (Manchester) Wilkinson, P. (Manchester) Walsh, D. (Manchester)	0957+561A,B: a direct test for 10^6 solar mass black holes. 3.6 cm
BP011	Preston, R. (JPL) Costa, M. (W. Australia) King, E. (Tasmania) Jauncey, D. (ATNF) Jones, D. (JPL)	Monitoring the nucleus of Centaurus A. 3.6 cm
BT007	Thakkar, D. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Vermeulen, R. (Caltech)	Nuclei of low-luminosity radio galaxies. 6.18 cm
GL009	Lestrade, J. F. (JPL/Meudon) Phillips, R. (Haystack) Jones, D. (JPL) Preston, R. (JPL)	Astrometric observations of stars to tie in HIPPARCOS. 3.6 cm
GM015	Marcaide, J. (Valencia, Spain) Elosegui, P. (CFA) Alberdi, A. (IAP, Granada) Guirado, J. (IAP, Granada) Ratner, M. (CFA) Shapiro, I. (CFA)	Absolute kinematics of radio source components: 0716+71. 3.6 cm

No.	Observer(s)	Program
GM017	Marcaide, J. (Valencia, Spain) Ros, E. (Valencia, Spain) Alberdi, A. (IAA, Granada) Guirado, J. (IAA, Granada) Rius, A. (IAA, Granada) Shapiro, P. (CFA) Whitney, A. (Haystack) Perez, E. (Canarias, Spain) Krichbaum, A. (MPIR, Bonn) Schilizzi, G. (NFRA) Elosegui, P. (CFA) Mantovani, F. (Bologna, Italy) Rogers, A.E.E. (Haystack) Witzel, A. (MPIR, Bonn) Davis, R. (Manchester) de Bruyn, G. (NFRA) Diamond, P. Jones, D. (JPL) Preston, R. (JPL) Trigilio, C. (Bologna, Italy) Zensus, J. A.	SN1993J: Distance to M81. 3.6 cm
GM019	Mantovani, F. (CNR, Bologna) Junor, W. (unaffiliated) Cotton, W. Padrielli, L. (IAR, Bologna)	A new component in steep spectrum source 2147+145. 18 cm
GP013	Preuss, E. (MPIR, Bonn) Alef, W. (MPIR, Bonn) Kellermann, K. Wu, S. (Beijing Obs.)	Radio galaxy 3C 390.3 at 18 cm. 18 cm
GR004	Rupen, M. Bartel, N. (CFA) Conway, J. Beasley, A. Sramek, R. Romney, J. Bietenholz, M. (York U.) Weiler, K. (NRL) van Dyk, S. (NRL) Panagia, N. (STScI) Cannon, W. (York U.) Altunin, V. (JPL) Davis, R. (Manchester) Graham, D. (MPIR, Bonn) Jones, D. (JPL) Popelar, J. (Ottawa) Rius, A. (IAA, Granada) Venturi, T. (Bologna)	Supernova 1993J in M81. 2, 3.6, 6, 4 cm

No.	Observer(s)	Program
GZ010	Zensus, J. A. Leppanen, K. (Helsinki) Unwin, S (Caltech) Wehrle, A. (JPl/IPAC)	Evolution of the parsec-scale structure of 3C 345. 3.6 cm single 19 antenna VLBI

F. SCIENTIFIC HIGHLIGHTS

Green Bank

Several stellar OH maser sources were detected during a survey of all globular clusters north of -42 degrees declination with the 140 Foot Telescope. One maser of particular interest is from a Mira variable in the metal-rich globular M107. This is the first radio detection of an evolved star in a globular cluster. It will be valuable for studying stellar evolution in low metalicity environments and will allow us to measure the distance and proper motion of the globular cluster.

Investigators: D. Frail and T. Beasley (NRAO)

Tucson

Sodium cyanide (NaCN), the first molecule containing Na, has been discovered in the outer envelope of the IRC 10216 circumstellar shell. Four transitions in the 3 and 2 mm regions have been seen. Together with the earlier discovered MgNC, and several compounds of Si, it appears that a rich gas-phase refractory-element chemistry occurs in the outer envelope and provides perhaps the dominant source of these elements seen in gas-phase in the ISM. The fractional abundance of NaCN varies from $6x10^{-9}$ to $1x10^{-7}$ depending on whether its distribution corresponds to that of HC_3N (outer plus intermediate envelope) or to HC_7N (outer envelope only). Such large fractions are unlikely to be formed by slow radiative-association reactions as has been suggested; unknown but faster gas-phase processes are indicated. The fraction of cosmic Na in the form of NaCN appears to be several percent, so that significant amounts of Na escape incorporation into grains in the inner envelope, somewhat higher than the corresponding fraction of Mg, and much higher than the fraction (<0.002) for Si. If IRC 10216 is typical of mass-losing systems, relative abundances of Na and Si as observed in the diffuse ISM are consistent with rates of ejection in the gas phase from CSEs.

Investigators: B. Turner (NRAO), T. Steimle (Arizona State), and L. Meerks (Katholieke Univ., Netherlands)

Socorro

Soft Gamma Repeater Is Linked to Supernova Remnant — Using archival data sets from VLA observations, the soft gamma-ray repeater SGR 1806-20 was shown to be coincident (within the error box of the gamma-ray observations) with the supernova remnant G10.0-0.3. Following publication of this result, SGR 1806-20 entered a new period of activity. New VLA observations then showed the supernova remnant to have a morphology suggestive of a plerion, or pulsar-powered SNR, and refined the likely position of the pulsar. These later results were published in an IAU circular in October. Shortly thereafter, satellite observations revealed a "new" X-ray source appearing at the same time as a gamma-ray burst from this region. The X-ray emission came from the position of the VLA-observed radio source. This identification of a soft gamma-ray repeater with a plerion is highly significant for constraining models of SGRs.

Investigators: S. Kulkarni (Caltech) and D. Frail (NRAO)

VLA Reveals New Details of Galactic Merger — The VLA has been used in C and D configurations to observe the galactic merger remnant NGC 7252, the "Atoms for Peace" galaxy, in conjunction with optical and X-ray observations. The VLA observations of this late-stage merger remnant revealed that the atomic hydrogen is located exclusively in the outer, tidal regions, with none in the central portion. The detailed imaging of HI in the tidal tails is providing important new constraints on numerical simulations of the system, and may explain some of the peculiar kinematics of this system. The observed lack of neutral atomic

hydrogen in the main body of the remnant, along with the presence of warm and hot ionized gas and a "post-starburst" spectrum in that region, has suggested efficient, ongoing conversion of HI into other phases.

Investigators: J. Hibbard (Columbia), P. Guhathakurta (Princeton), J. van Gorkom (Columbia), and F. Schweizer (Carnegie Institution)

VLBA Measures Size of Galactic Center Source Sgr A* — Observations with five stations of the VLBA at 7mm wavelength have provided an upper limit of 0.4 milliarcseconds, or 3.3 Astronomical Units, for the diameter of the Galactic Center source Sagittarius A*, believed to be at the dynamical center of the Milky Way. This upper limit on the diameter leads, under current models, to an upper limit of 1.5 x 10^6 solar masses for the black hole at the center of this object. The small size and the large radio luminosity of this object add to the evidence that the underlying body of Sagittarius A* is a massive black hole.

Investigators: D. Backer (Berkeley), J. Zensus and K. Kellermann (NRAO), J. Moran (CFA), and K. Y. Lo (Illinois)

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 telesopes during the reporting period.

H. CENTRAL DEVELOPMENT LABORATORY

Amplifier Development, Design and Production

During this quarter, an additional four 680-920 MHz amplifiers were delivered to Green Bank for use in the GBT prime focus receiver.

Two prototype 3.95-5.85 GHz amplifiers have been developed and tested. These were designed for the GBT Gregorian receiver, and production units will be delivered to Green Bank. The two prototype units are being evaluated by the Smithsonian (SAO) as IF amplifiers for the Submillimeter Array SIS mixers.

A new PC-based amplifier test station is being assembled for production testing of all amplifiers to 26.5 GHz.

Production of 26-36, 38-45, and 40-50 GHz amplifiers, as well as evaluation of millimeter-wave InP HFET's, continued. Several 38-45 GHz and 40-50 GHz amplifiers, modified to accommodate new InP devices, exhibited noise performance of about 10 K at 40 GHz.

A new version of the 72-92 GHz amplifier using InP devices is under development for evaluation of the VLBA at 86 GHz and also for a 12 Meter continuum receiver.

86 GHz VLBA Receiver

Long-delivery RF components, available from commercial suppliers, to build two VLBA receivers covering 72-92 GHz have been ordered. The feeds, polarizers, cal couplers, and cryogenic HFET low-noise amplifiers will be built by the CDL. Some testing of parts is already in progress and an outline mechanical design of the complete receiver is under way.

Superconducting (SIS) Millimeter-Wave Mixer Development

Modifications to the DC wiring in the twelve receiver inserts for 130-170, 200-260, and 260-300 GHz have been completed. The feed-through filters and 4 K wiring heatsinks have been replaced with new more reliable designs. The eight receiver modules for 68-90 and 90-116 GHz still remain to be modified.

Work continues on the design of an improved tunerless SIS mixer for the 200-300 GHz band.

Instrumentation of the new SIS mixer test dewar is now complete. This includes mixer and amplifier bias supplies, temperature and vacuum monitors, and a specially modified low static coaxial switch which allows the IF amplifier input to be connected to a 4 K cold load, a 20 K hot load, open- and short-circuit terminations, and to the mixer under test.

Initial tests on a new broadband vacuum window using a new proprietary microporous PTFE material to support a plastic film vacuum barrier have been successfully conducted. This design appears to have even lower loss than the expanded polystyrene/plastic film windows now in use.

During this quarter, a total of three SIS mixers, five SIS receiver inserts, and three frequency multipliers have been built (or rebuilt) and tested.

Electromagnetic Support

The coaxial region of the 3.95-5.85 GHz orthomode transducer was further analyzed and optimum locations for the orthogonal probes were identified. A prototype based on this design had return loss between 12 and 15 dB. More work on improving the design is being done.

Further study on tertiary reflectors for the purposes of beam switching and pointing corrections for the GBT was carried out.

The analysis of the effects of deformation on the GBT elevation structure due to gravity (Model 95, Rev B) was started.

GBT Spectrometer

Prototypes of the correlator chip intended for use in the GBT spectrometer were completed in December 1993. These chips showed problems in two areas: low yield and not working to the specified clock rate.

Of two wafers to be packaged, the first had 4 fully functional chips and the second had 9 good chips (there are 54 chip sites on a wafer). This represents yields of 7 percent and 16 percent.

Chips from both wafers failed at clock rates above 72 MHz instead of the specified 100 MHz. The chip design was simulated using a SPICE simulator to a worst case process/worst case environment rate of 130 MHz. No explanation of either the low yield or the low clock rate exists as of yet.

A test fixture for the correlator chip was constructed during the last quarter. This test fixture was used during the initial testing of the chip prototypes.

The chip test fixture was also used as a sampler test bed. The 2 GHz sampler breadboard was tested by using a correlator chip to correlate every 16th sample. A frequency response curve was run with this setup with results showing a 6 dB roll-off between 1750 MHz and 2000 MHz.

A breadboard of one of the GBT spectrometer circuit cards was made and tested to prove out the design techniques for 125 MHz logic. The card was tested successfully in December.

OVLBI Support

During the past quarter, activity on the demodulator module of the OVLBI ground station has principally been concerned with the clock recovery for the two binary waveforms demodulated from the IF signal by the Costas loop. It was decided to try to use one of the recently developed clock recovery IC's now available, since this held promise of a quicker and more reliable solution than one development of the required circuitry using discrete components. A particularly important requirement is that the two detected waveforms should be retimed to a common clock. A trial system using two AT&T T7032 IC's showed

unacceptably large variations in the relative delays of the reclocked output signals. A second attempt using AD 805 IC's looks much more promising and is under test as the quarter closes.

I. GREEN BANK ELECTRONICS

140 Foot Operations

The spectral processor is being upgraded by the addition of memory to the accumulator section, replacement of the control computer, and new control software. The memory is being increased by a factor of four to give enhanced time resolution in pulsar studies. The changes required to the digital hardware circuitry were completed this quarter. Portions of the new control software were demonstrated to the GBT Advisory Committee in October. Completion of the new software has been slowed by the high user demand for the spectral processor.

The source of a severe interference problem encountered during a 400 MHz pulsar program was identified as handheld communication transmitters used at the GBT construction site. This is the first confirmed instance of interference at the 140 Foot being generated at the GBT site. Available filters were inserted in the receiver as a temporary fix. Filters for permanent inclusion have been ordered. At the same time, components were selected and ordered to change the 300-1000 MHz receiver to single down-conversion with a variable first LO, which should make it less susceptable to out-of-band interference. Band reject filters were also procurred for the 892-898 MHz band used by airphones on commercial airliners, which have caused a significant amount of interference.

Eighteen receiver changes were scheduled and completed this quarter.

GBT Development

Construction of the GBT 8-10 GHz and 12-15.4 GHz front-ends was completed this quarter, and testing is underway. Assembly of the first prime-focus front-end continues. The receiver room IF rack assembly was completed, and testing of the IF router and first optical driver module began. Laboratory control programs for the above front-ends and the IF rack were completed and debugged. Generation of fabrication drawings for the 3.95-5.85 GHz and 1.15-1.73 GHz front-ends continued, and fabrication and assembly of portions of these systems is underway. Design, procurement, and assembly work on the revised prototype feed rotator and controller is about 90 percent complete. A first-article power supply assembly for the turret front-ends was constructed and evaluated and the remaining seven units are under construction. Rack frames for the receiver room fixed racks were fabricated.

Work on electronics for the open-loop active surface continued. Fabrication of interface boards with transient protection proceeded, and in-house assembly of the Actuator Room control panels began.

Development of the continuum backend continued. Most of the components for the digital section have been received. Major portions of the Xilinx implementation have been designed and simulated. A test program running under VXworks has been written, and learning of tools and techniques to be used for production of the final real-time code continues.

Problems have been encountered with the design or fabrication of the 1024 lag correlator chips, which will impact the new spectrometer construction project. The situation is under review.

Site Operations

A plan has been produced, and is being implemented, for a site-wide optical fiber installation. This includes installation of a buried multi-cell conduit, and single-mode and multimode optical fiber cables to the major buildings and antennas. In conjunction, site timing equipment will be consolidated at the Interferometer control building from which time-of-day and frequency reference signals will be distributed. The majority of materials for the conduit installation and some major components for the timing center have been ordered. We expect to begin the site work in spring 1994.

Maintenance, repair, and installation support was supplied to the 140 Foot, Interferometer, and site computer facilities. Work continues on construction of new S/X receivers for the support of USNO operations.

During this quarter, 36 NRQZ transmitter applications were received, for 164 different frequencies, at 143 separate locations.

J. TUCSON ELECTRONICS

1 mm Receiver Upgrade

The 1 mm SIS receiver has been upgraded and expanded. It was reinstalled on the telescope in mid-November and is working well. This receiver package provides complete tuning coverage from 200 to 300 GHz in two bands. The receivers are dual-polarization and use a quasi-optical image sideband suppression system.

Enhancements made to the receiver during the summer and fall include the following:

- The 260-300 GHz mixer set was installed in the cryostat. One can switch between the 200-265 GHz and 260-300 GHz mixers in a few minutes.

- Independent local oscillators for the two polarizations have been installed. One can now observe at two different frequencies simultaneously, albeit in only one polarization each. The two frequencies must be within the tuning range of a given mixer set. For example, one could observe ^{13}CO (220 GHz) and ^{12}CO (230 GHz) simultaneously in the low frequency band, or HCN (266 GHz) and HCO+ (268 GHz) simultaneously in the high frequency band. Note that this mode of observing is advantageous primarily to reduce telescope movement overhead losses or to achieve good cross calibration. Observations of weak signals from single lines are still best done with both polarizations tuned to the same frequency.

- A number of other technical enhancements were incorporated, including a new high-capacity refrigerator system, a new on-board computer system, and new X Windows-based receiver tuning software. Other enhancements, particularly concerning the quasi-optical single sideband system, will follow in the coming months.

K. SOCORRO ELECTRONICS

VLA 1.3 - 1.7 GHz Receiver Improvements

All 28 VLA antennas now have the new improved front-ends. Two additional spare front-ends will be completed in 1994.

VLA 40 - 50 GHz Receivers

All critical components for the addition of 40-50 GHz receivers to ten VLA antennas have been received. The VLA machine shop has fabricated parts to complete ten receivers. Five receivers have been assembled and tested, and four of them have been installed on antennas. The fifth will be installed in early January. The second manufacturer of an improved cooled isolator provided a new quote, but with poorer performance and higher cost. Therefore we will not purchase and retrofit the new isolators. It is expected that nine VLA antennas will be outfitted by April 1994.

VLA Waveguide

Efforts continue to improve anode bed efficiency for more reliable cathodic protection of the wye waveguide from electrolytic corrosion. The cryogenics/waveguide group installed new watering systems on the anode beds at E1 and W2 and rebuilt

the azimuth and elevation rotary joints on antennas 14 and 6. The waveguide manhole at AW9 was replaced with a steel culvert this quarter. Twenty-five culverts are on hand for installation in 1994.

VLA Wye Monitor

The wye monitor provides the VLA operator with voice alarms detailing "antenna number," "arm," "generator," "UPS," "HVAC," "problem," etc. Operators interface via a touchscreen, bringing up windows for detailed information on monitored systems. Next quarter we expect to include "the correlator air conditioner alarm." This will complete the project.

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 began. The VME array processor card was received and testing and designing the interface. Two VME prototyping cards are in use. We plan to have several interfaces to the correlator prototyped by the end of 1994.

VLA Antenna B-Rack Shields and Optical Fiber

The VLA machine shop completed the metal work, except for the panels, for twenty B-rack shields. These will be assembled and installed at the beginning of March. Optical fibers will replace the twisted pair cables, which radiate RFI in spite of filters, at the penetration of the B-rack shields. These cables distribute digital control and monitor signals from the antenna buffer to the data sets in the VLA antennas. A prototype system was tested on the bench, the mechanical and electronic modifications were designed, and four units were assembled. All shield installations will include the optical fibers.

VLBA Recorders and Playback Drives

In December, 450 thin tapes were ordered, with delivery scheduled in March. All playback drives at the AOC and all recorders at antenna sites and the AOC have tape vacuum levels set to eliminate tape shuttling between uses of thick and thin tapes. Much effort on the correlator playback drives and interfaces improved the data quality and reliability. In January new firmware in the recorders, playback drives, and formatter also will improve reliability.

VLBI/MKII

The MKII correlator developed an unrepairable problem in November, so it was permanently shut down and will go to government surplus. Support for the the MKII formatter/recorder systems at Mauna Kea, Saint Croix, Hancock, North Liberty, Owens Valley, Brewster, Pie Town, and VLA will continue. However, as major failures occur, we will reduce the number of MKII sites to those most important for MKII VLBI.

VLBA Atomic Clock and Frequency Standard

After extensive rework of the physics package by the manufacturer, Sigma Tau Standards Corp., the six year old hydrogen maser #1 returned to Socorro. It will be monitored at the AOC lab to confirm the promised improved stability, higher line Q, lower vac ion currents, and stable IF level. In December, the youngest maser, #11, was returned to Sigma Tau for rework of the physics package to correct low line Q, excessive IF level decay, and degraded stability. The rework should be completed in February.

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, several military systems, and harmonic emissions from TV transmitters. Motorola's IRIDIUM Satellite Communications Division has requested that NRAO measure and provide the near- and far-side lobe envelope patterns of VLA and VLBA antennas. The patterns will assist the Mobile Satellite Service

(MSS) in complying with proposed FCC regulations for adjacent band interference in the 1610.6 - 1613.8 MHz radio astronomy band. Electronics staff assisted scientific staff in measuring one VLA antenna in September and the Los Alamos VLBA antenna in October, and in preparing the report delivered to Motorola in December. The results will be presented at the URSI National Radio Science Meeting in January.

L. AIPS

The 15JUL93 release of "Classic AIPS" was made available only a little more than a month late. By the end of December, the release had been shipped to 94 institutions, 33 by magnetic tape (of 4 kinds) and 61 by electronic file copies. The improved installation procedures have generated complements from recipients of the system. The 15JAN94 release is also likely to be about a month late to allow the completion and checkout of some of the changes listed below.

The ports of AIPS to DEC's Alpha computer (OSF/1 operating system) and HP's 9000/735 were cleaned up during the quarter using machines loaned to us by the vendors. A new port to personal computers (80386 and 80486 architectures) using the Linux (a public-domain UNIX, not DOS) operating system was developed and will be verified and released with the 15JAN94 release.

Two new verbs were developed to help users find the desired function amongst the plethora of AIPS tasks and verbs. They are APROPOS to list all helps having user-specified word(s) in their one-line descriptions and ABOUT to list all helps by category keywords. Programs to build and maintain the needed text files for these were also written. A new verb to switch between standard epochs in AIPS headers was written; RUN was enhanced to read files from anywhere; a new verb was written to allow long procedures to avoid running out of temporary space for literals; and the POPS verbs were rearranged to be more sensible and to make room for more new ones. The writing of end-of-files was speeded up for most magnetic tape applications, and the deleting of print files was given a time delay to allow the print operation to occur first.

A number of new tasks were written. They are: RFI to locate and report periods of interference; UVCRS to compare data from places in the uv plane where tracks cross; CCEDT to edit clean components tables based on flux and position; and TCOPY to copy tapes. During the quarter, FITLD, the task to translate VLBA data into AIPS, was enhanced to do data selection and file concatenation and to handle changing frequencies and misordered data. The VLB task to do baseline-oriented fringe fitting was given more user controls and numerous improvements in delay-rate space fitting. The holography task HOLGR has been upgraded. The data and model plotting task VBPLT was enhanced to plot autocorrelation data and its time averaging was corrected. The data concatenation task DBCON was changed to do frequency-dependent corrections for position offsets. All pseudo-array processor code was upgraded to allow "AP" memories in excess of 16 megawords.

M. AIPS++

The Astronomical Information Processing System (AIPS++) is a software system primarily for astronomical data analysis being developed by an international consortium of institutions mainly supporting radio telescope instrumentation. The members of this consortium are: ATNF, Australia; BIMA, USA; HIA/DRAO, Canada; NFRA, the Netherlands; NRAL, UK; TIFR/NCRA, India; and the NRAO.

We were pleased to be able to distribute the first library release of AIPS++ in October 1993. This release does not contain much that is of direct interest to astronomers, but does contain building blocks of interest to groups building C++ applications using n-dimensional arrays, tables, FITS, etc. Some compromises in the contents of the release were made: fewer examples of application programs were included with the release than originally hoped, and perhaps less documentation providing an overview of the library was included than we would have liked. Despite this, over 80,000 lines of code and comments were release, along with related documentation. Our efforts seem to have been justified. By the end of the year, the library source code had been down-loaded by 132 external people. Other results of the release are that the libraries are in the best shape that they have ever been in, and that the AIPS++ project better understands the steps we need to take for the next release. Readers interested in more information about

the library release or interested in obtaining a copy can get it via anonymous ftp from aips2.cv.nrao.edu in directory /pub/aips++/RELEASED/libaips-3 .

We have set ourselves some admittedly ambitious goals for further releases. Our main goal is to release a beta version of AIPS++ in December 1994 with the first formal release in March 1995.

On the way towards this goal, we are aiming for an internal milestone in March 1994 to be able to provide determined programmers at AIPS++ consortium sites sufficient tools and examples that they can begin the first stages of application development (e.g., begin work on appropriate data fillers). Thus, this is a release of code which will enable our colleagues to make progress on aspects of AIPS++ which are specific to their own instruments.

The experience of the library release has been sufficiently valuable that we see the need for going through an improved version of the release process before our beta release in December of 1994. We are therefore proposing that an internal alpha "friendly astronomer" release occur in June or July 1994. This will be the first test of the release process we want to develop, and should have enough in the code that (determined) astronomers can begin using the code we are developing for astronomical applications. Problems with the alpha release should be recognized in time that we will be able to make final decisions on how to proceed with the beta release.

The June/July release will consist of compiled tasks and some sort of user interface and documentation to "friendly astronomers" within the consortium sites. This release will act as a means of communication with astronomers within consortium institutions: astronomers will be able to see what we are doing, and we will be able to garnish feedback from them concerning the tasks which need to be provided and the style of the User Interface.

The goals outlined above are very ambitious, and depend on a number of software develpoments occuring as planned. Progress will be monitored closely, so that if modifications in the project plans are needed they can be implemented in a reasonable fashion. Stay tuned.

N. SOCORRO COMPUTING

In keeping with Internet standards, an alias has been created for use when obtaining files from the AOC through anonymous ftp. Since this alias is independent of any particular system, using it will mean that any future change in the location of our anonymous ftp area will be transparent to users. The new alias is "ftp.aoc.nrao.edu". Similarly, to reach the NRAO online information system through mosaic, the alias "http://info.aoc.nrao.edu/" has been created.

The VLA archive copying project is progressing well. Current data is archived to 8 mm Exabyte tape after it arrives at the AOC; all of the 1993 VLA data has been copied. Data from the years 1976-1980 have been completely transcribed from 9-track to Exabyte and work is continuing chronologically with 1981. The database on the archived data is gradually being accumulated. Better optimization of search procedures and database organization will be needed before we make it available to astronomers. We anticipate this will happen during the first quarter of 1994.

The maintenance database program developed in-house which is used for the VLA and VLBA parts inventories, problem tracking, preventive maintenance scheduling, etc., has proven to be successful for most users, but is not complete and requires considerable performance tuning. Rather than put in the effort to expand the program a search will be made for a commercial software package suitable for the needs.

Consistent with plans described in past reports, on January 10, 1994, the NRAO Socorro will see the end of an era: the last NRAO Convex C-1 will be shut down permanently. With the advent of new workstations, this system is no longer cost-effective to run as it provides only slightly more CPU power for most jobs than the average desktop system, at a much higher operating cost. The Mark II correlator was the last key equipment supported on this system, and it already has been turned off.

O. GREEN BANK TELESCOPE PROJECT

Antenna

Design - The final design model was received from Radiation Systems, Inc. (RSI) in November. It has been reviewed and accepted by NRAO. The optimized structure design was within specification and provided an improvement over the unoptimized model in areas of weight, pointing, and surface accuracy. With the acceptance of the final design, work was begun to turn the model into detailed manufacturing drawings.

Fabrication - Fabrication of the structural steel was slow during the report period due to the design delay. However, it is anticipated that the detailed manufacturing drawings of the elevation wheel and box structure and surface back-up structure will be put into fabrication beginning in January 1994.

Other items which were accomplished during the report period include release of the subreflector truss assembly fixtures to fabrication and procurement, acceptance testing of the stow pin actuator and the subreflector positioner mechanism, procurement of the forging and machining of the elevation stub shaft and inspection of the feed turret assembly, the prime focus feed boom and prime focus feed positioner assembly at the fabrication house.

Construction - Several major events occurred at the site during the period. Among them were the successful transfer of electrical power to the antenna which involved completion of the installation of the cable wrap, power lines and transformer on the antenna and switchover of live power to the system.

Upon completion of all welding up through level 3, the shoring towers were removed from beneath the alidade. Erection of levels 1 through 4 are 100 percent complete and levels 4 through 6 on the west side (the side nearest the derrick tower crane) are nearing 100 percent completion. Welding of levels 1 through 3 is 100 percent complete and levels 4 through 6 (west side) are approaching 75 percent complete. The stairs, towers and grating for access to levels 1 through 6 are 100 percent complete.

A milestone was reached in December when the alidade structure was rotated 180 degrees in azimuth by using one of the four actual servo cabinets and two 30 horsepower motors along with their gear boxes, brakes, and tachometers. The ability to rotate the alidade provides the construction crew with the ability to reach any part of the structure with the derrick tower crane and will allow erection of the east side tower to proceed above level 4.

Other items completed at the site during the report period include installation of the cryogenic room on the alidade and completion of the assembly and welding of the elevation bearing weldments.

A tragic accident occurred at the site on November 16, which resulted in the death of one of Radiation Systems, Inc.'s ironworkers. The Occupational Safety and Health Administration has conducted a review of the site and is expected to issue a report of its findings in January 1994.

Active Surface and Pointing (Open Loop)

Support of the vendor of the transorb board continued. This board interfaces actuator cables to motor drive and LVDT read-out modules, and provides transient suppression. First article inspection of the initial completed boards was made on December 20, 1993. The vendor, Wave Tek International, Inc., anticipates completing the order in early January.

The software effort continues up the C++ and VxWorks learning curve. As part of this effort, work continued on converting a Turbo C program to perform low level tests of the spectral processor, to run in the SUN and VxWorks environment. This program is an important diagnostic tool for the spectral processor.

As reported previously, testing of final version actuators continues on the 85-1 interferometer test-stand. One of the actuators has become slower than the other; tests were conducted that point to the motor as the cause of the decreased speed. The actuators are still operating within spec, and both actuators have now exceeded the 2000 hour operational goal.

Several control panels have been returned from being chromated, and wiring of the first panel has begun.

A meeting was held with RSI personnel to discuss a few interface details, the most important of which is assembly of connectors to actuators cables. NRAO personnel visited a vendor proposed by RSI to do this work, and found the vendor satisfactory.

Active Surface and Pointing (Closed Loop)

Rangefinder - During the report period, tests and evaluation of the first article production mirror assembly continued. Some problems were encountered and solutions devised. Careful tests on the performance of the rangefinder on the calibration range are leading to slight changes in the optical arrangement. The first four oscillator assemblies have been received from the commercial vendor and are satisfactory.

Retroreflectors - Sixteen hundred of the 2400 retroreflectors for the active surface have now been received and NRAO anticipates that the order will be completed in January 1994. Quality control is excellent and testing of samples indicate that all specifications are being met.

Development of a wide angle retroreflector (used to connect the ground and telescope coordinate systems) at the Optical Science Center at the University of Arizona has continued and the first prototype has been delivered and evaluated with good results.

Servo

Effort in this area consisted of monitoring the progress of the servo contractor RSI/Precision Controls Division (PCD). A test procedure for the subreflector positioning mechanism was reviewed. Tests of the positioning mechanism were witnessed at March Metalfab, in Hayward, CA. The design met most of the NRAO specifications. However, several problem areas were identified which will be corrected. Also a few tests, such as backlash, need to be better instrumented to verify that the mechanism indeed meets specification. Mode shapes of the final tipping structure design are being prepared for use in the dynamic analysis.

Electronics

Construction of the GBT 8-10 GHz and 12-15.4 GHz front-ends was completed this quarter, and testing is underway. Assembly of the first prime-focus front-end continues. The receiver room IF rack assembly was completed, and testing of the IF router and first optical drier module began. Laboratory control programs for the above front-ends and the IF rack were completed and debugged. Generation of fabrication drawings for the 3.95-5.85 GHz and 1.15-1.73 GHz front-ends continued, and fabrication and assembly of portions of these systems is underway. Design, procurement, and assembly work on the revised prototype feed rotator and controller is about 90 percent complete. A first-article power supply assembly for the turret front-ends was constructed and evaluated and the remaining seven units are under construction. Rack frames for the receiver room fixed racks were fabricated.

Development of the continuum backend continued. Most of the components for the digital section have been received. Major portions of the Xilinx implementation have been designed and simulated. A test program running under VxWorks has been written, and learning of tools and techniques to be used for production of the final real-time code continues.

Problems have been encountered with the design or fabrication of the 1024 lag correlator chips, which will impact the new spectrometer construction project. The situation is under review.

Monitor and Control

A first version of the control software including hardware drivers, controllers, local/ethernet access, GUI editor, control consoles, dynamic binding to software control and monitor points was completed and demonstrated on the 140 Foot Telescope and spectral processor. From this test and demonstration a list of bugs and enhancements were compiled and work was begun on them.

In addition, work has begun on the software framework for integrating antenna control and the various precision pointing systems.

Plans are being made to provide GBT software for a subclass of the 140 Foot Telescope observers by summer 1994 for purposes of observer feedback and operator training.

P. PERSONNEL

New Hires

Davis, R.	Visiting Scientist	09/20/93
Nice, D.	Research Associate	10/01/93
Radford, S.	Assistant Scientist, Research Support	10/05/93
Mahle, W.	Senior Personnel Representative	11/08/93

Terminations

Novikov, A.	Visiting Elec. Engineer	10/31/93
Duquet, R.	Sr. Scientific Programming Analyst	12/31/93
Wade, C.	Scientist	12/31/93

Changes in Title

Milner, R.	to Computing Systems Manager	12/01/93
van Moorse, G.	to Head/VLA Computing	12/01/93

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