NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

1 July 1993 - 30 September 1993

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A. TELESCOPE USAGE

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

	140 Foot	12 Meter	VLA
Scheduled observing (hrs)	1875.00	501.75	1708.8
Scheduled maintenance and equipment changes	217.75	1674.50	243.5
Scheduled tests and calibrations	115.25	31.75	261.8
Time lost	44.25	54.50	82.02
Actual observing	1830.75	447.25	1626.8

B. 140 FOOT TELESCOPE

The following continuum programs were conducted during this quarter.

No.	Observer(s)	Program
D177	Depree, C. (North Carolina) Carilli, C. (Leiden) Holdaway, M.	Total power measurements of NGC 253 at 8.25 GHz.
H287	Heiles, C. (Calif., Berkeley) Levenson, N. (Calif., Berkeley)	A search at 21 cm for new supernova remnants.

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
A111	Azcarate, I. (IAR, Buenos Aires) Cersosimo, J. (IAR, Buenos Aires)	Twenty-one centimeter search for new evidence of the warping in the Galactic plane.
B493	Rood, R. (Virginia) Bania, T. (Boston) Wilson, T. (MPIR, Bonn) Balser, D. (Boston)	^{3}He+ measurements at 8.666 GHz toward galactic HII regions.

No.	Observer(s)	Program
B603	Blades, J. (STScI) Bowen, D. (STScI) Lockman, F. J. Murphy, E. (Virginia) Roth, K. (STScI)	Twenty-one centimeter mapping of galactic HI toward M81.
B610	Bock, J. (Calif., Berkeley) Heiles, C. (Calif., Berkeley)	Correlation of HI 21 cm and CII 157 micron lines.
C280	Codella, C. (Univ. Di Firenze) Felli, M. (Arcetri)	Three centimeter hydrogen radio recombination line observations of SFRs with H_2O masers.
H288	Heiles, C. (Calif., Berkeley) Levenson, N. (Calif., Berkeley) Frail, D. Kulkarni, S. (Caltech)	A 21 cm search for rapidly expanding HI shells near pulsars.
L271	Lockman, F. J. Savage, B. (Wisconsin)	Search at 1420.4 MHz for high-velocity HI toward QSOs.
L273	Lockman, F. J.	HI mapping of Ursa Major.
M360	McMahon, P. (MIT) Hewitt, J. (MIT) Moore, C. (MIT) Carilli, C. (Leiden) Rupen, M.	A search for HI absorption towards gravitational lenses.
M361	Murphy, E. (Virginia) Lockman, F. J.	Twenty-one centimeter observations of the magnetic field in galactic HI.
M365	Menten, K. (CFA)	A search for NH_2CH_2CN at 9072 MHz.
R255	Rood, R. (Virginia) Bania, T. (Boston)	A novel search at 8.667 GHz for SETI beacons.
T313	Tifft, W. (Arizona)	A fundamental test at 21 cm for redshift variability.
V080	Verschuur, G. (Rhodes College)	Twenty-one centimeter observations to substantiate published claims of the Zeeman effect in emission profiles.
V081	Verschuur, G. (Rhodes College)	Mapping the polarized beam structure of the 18 cm feed in preparation for future thermal OH Zeeman effect observations.
W280	Wootten, H. A.	Monitoring of H_2O in star-forming cores in Rho Oph.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
B550	Backer, D. (Calif.,Berkeley) Foster, R. (NRL) Sallmen, S. (Calif., Berkeley)	Measurements at 800 and 1400 MHz of the timing of an array of pulsars.
M369	McKinnon, M. Fisher, J. R.	Timing the pulsar PSR B1823-13.
T302	Taylor, J. (Princeton) Nice, D. (Princeton) Thorsett, S. (Caltech) Arzoumanian, Z. (Princeton) Shrauner, J. (Princeton) Wan, L. (Princeton) Sayer, R. (Princeton) Camilo, F. (Princeton)	Pulsar timing observations over the range 780-820 MHz and 1300-1350 MHz.

C. 12 METER TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B606	Balonek, T. (Colgate) Dent, W. (Massachusetts)	Study of the evolution of extragalactic radio sources at millimeter wavelengths.
B607	Brown, R. Frayer, D. (Virginia)	CO associated with the z = 0.437 absorption system toward 3C 196.
G333	Gensheimer, P. (Illinois)	Study of vibrationally excited SiCC in IRC+10216.
G335	Gao, Y. (SUNY)	Tracing the merging process of luminous IR galaxies with CO.
L275	LaRosa, T. (NASA/MSFC) Magnani, L. (Georgia) Shore, S. (NASA/MSFC)	A statistical study of turbulence in a molecular cloud without star formation.
M355	McMullin, J. (Maryland) Mundy, L. (Maryland)	Study of high temperature/shock chemistry in Serpens.
S351	Sage, L. (Nevada) Sparke, L (Wisconsin) Richter, O.-G. (STScI) Sackett, P. (Pittsburgh)	The evolution of interacting galaxies: A study of polar rings.

No.	Observer(s)	Program
S367	Sahai, R. (Chalmers/Onsala) Wootten, H. A. Wild, W. (ESO) Schwarz, H. (ESO)	Study of molecular lines in the compact planetary M1-16.
T289	Turner, B.	A search for PO in cold, dense molecular clouds.
T329	Turner, B. Steimle, T. (Arizona State) Meerts, L. (Katholieke U, Netherlands)	A search for circumstellar and interstellar NaCN.
T330	Turner, J. (UCLA) Beck, S. (JILA)	CO mapping of the interacting dwarf galaxy NGC 5253.
W328	Wolf, G. (Unaffiliated)	Study of CS abundances in outflow regions.

D. VERY LARGE ARRAY

Third quarter 1993 was spent in the following configurations: C configuration from July 1 to August 30; CnB configuration from August 30 to September 30.

No.	Observer(s)	Program
AA123	Andre, P. (CNRS, France) Feigelson E. (Penn State) Leous, J. (Penn State) Montmerle, T. (CNRS, France)	Monitoring the circular polarization from the magnetic star S1 in the ρOph cloud.
AA160	Anderson, M. (Sydney) Ekers, R. (ATNF, Epping) Danziger, I. (ESO) White, G. (Sydney)	Radio ID content in selected regions of ROSAT all-sky X-ray survey. 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
AA164	Andre, P. (CNRS, France) Bontemps, S. (CNRS, France) Russell, S. (SCP, Dublin) Wootten, H. A. Ward-Thompson, D. (Cambridge) Saraceno, P. (IAS, Frascati) Knee, L. (Chalmers/Onsala) Nordh, L. (Stockholm Obs.) Cernicharo, J. (Yebes Obs.)	Youngest low-mass protostars. 3.6 cm

No.	Observer(s)	Program
AB414	Becker, R. (Calif., Davis) White, R. (STScI)	Monitoring radio stars HD193793 and P Cygni. 2, 6 cm
AB456	Burke, B. (MIT) Hewitt, J. (MIT) Roberts, D. (Brandeis)	Monitoring 0957+561 A, B. 6 cm
AB626	Beck, S. (Tel Aviv U.) Ho, P. (CFA) Turner, J. (UCLA)	NGC 5253. 2 cm
AB677	Borkowski, K. (Maryland) White, S. (Maryland) Harrington, J. (Maryland)	Radio emission from the hydrogen-deficient planetary nebula Abell 30. 3.6 cm
AB678	Broeils, A. (Cornell) Haynes, M. (Cornell) Baumgardt, K. (Cornell)	HI study of the internal kinematics of Sa galaxies. 20 cm line
AB679	Berkhuijsen, E. (MPIR, Bonn) Beck, R. (MPIR, Bonn) Hummel, E. (Royal Obs.)	Structure of the magnetic field in the central region of M31. 20 cm
AB680	Brouillet, N. (Bordeaux Obs.) Baudry, A. (Bordeaux Obs.)	Mapping the H_2O masers in M82. 1.3 cm line
AB682	Beasley, A. Bastian, T. Ball, L. (Sydney) Wu, K. (Sydney)	Survey of cataclysmic variables. 3.6 cm
AB687	Benaglia, P. (IAR, Buenos Aires) Goss, W. M. Schwarz, U. (Groningen/Kapteyn) Kalberla, P. (MPIR, Bonn)	HI absorption distance to Tycho's SNR (3C 10). 20 cm line
AB689	Barvainis, R. (Haystack) Lonsdale, C. (Haystack) Antonucci, R. (Calif., Santa Barbara)	Radio sources in radio-quiet quasars. 20, 6, 3.6, 2 cm
AB691	Brown, A. (Colorado) Dempsey, R. (STScI) Linsky, J. (Colorado) Guedel, M. (Colorado/JILA) Stewart, R. (Sydney)	Choromospheric spectroscopy of the RS CVN binary HR1099. 3.6, 6, 20 cm
AC308	Condon, J. Cotton, W. Perley, R.	All Sky Survey. 20 cm

No.	Observer(s)	Program
AC345	Condon, J. Helou, G. (IPAC, Pasadena) Sanders, D. (Hawaii) Soifer, B. (Caltech)	The extended IRAS bright galaxy sample. 20 cm
AC347	Cordes, J. (Cornell) Lundgren, S. (Cornell) Romani, R. (Stanford)	A ram-pressure driven pulsar nebula. 3.6 cm
AC355	Chengalur, J. (Cornell) Lu, N. (IPAC, Pasadena)	NGC 5403: A spiral galaxy with an unusual warped HI disk. 20 cm line
AC356	Claussen, M.	Survey of 25 GHz methanol maser emission. 1.3, 3.6, 6 cm line
AC359	Chambers, K. (Hawaii)	Molecular gas in high redshift radio galaxies. 1.3 cm line
AC361	Claussen, M. Goss, W. M. Beasley, A. Cram, L. (Sydney) Green, A. (Sydney)	H92α recombination line in Sagittarius E. 3.6 cm line
AC362	Claussen, M. Benson, J. Gaume, R. (NRL)	Search for H_20 maser emission in shocked gas toward the supernova remnant IC 443.
AC364	Claussen, M. Wilking, B. (Missouri)	Search for water masers in the bipolar outflow source L1551. 1.3 cm line
AC371	Chernin, L. (CFA) Masson, C. (CFA)	Water maser in L1448.
AD290	Drake, S. (USRA/GFSC) White, N. (NASA/GSFC) Florkowski, D. (USNO) Linsky, J. (Colorado/JILA)	ROSAT/VLA observations of four Algol binaries. 3.6, 20 cm
AD311	Dwarakanath, K. Owen, F.	Radio emission from blue galaxies. 20 cm
AD314	Doyle, L. (NASA/Ames) Vikramsingh, R. (NASA/Ames)	Stellar mass loss in young sun-type stars. 1.3, 2, 3.6, 6, 20 cm

No.	Observer(s)	Program
AD315	Duric, N. (New Mexico) Goss, W. M. Viallefond, F. (Meudon) Lacey, C. (New Mexico) Gordon, S. (CFA)	Survey of SNRs in nine nearby galaxies. 6 cm line
AD316	Dubner, G. (IAFE) Giacani, E. (IAFE) Goss, W. M. Winkler, P.-F. (Middlebury College)	Four small-diameter galactic SNRs. 6 cm
AD320	Drake, S. (USRA/GFSC) Bookbinder, J. (CFA) Linsky, J. (Colorado)	A survey of the "non-magnetic" CP stars. 3.6 cm
AD321	de Pater, I. (Calif., Berkeley) Grossman, A. (Maryland)	Jupiter's south equatorial belt. 2 cm
AD325	Drake, S. (NASA/GFSC) Linsky, J. (Colorado) Simon, T. (Hawaii) Stewart, R. (Sydney) Slee, B. (Sydney)	Survey of unconfirmed Parkes stellar detections.
AE091	Escalante, V. (Mexico/UNAM) Gomez, Y. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM)	Atomic hydrogen in selected planetary nebulae. 20 cm line
AE093	Engels, D. (Hamburg)	Double QSO HE1104-1805. 6 cm
AF227	Fey, A. (NRL) Gaume, R. (NRL) Claussen, M. Nedoluha, G. (NRL) Johnston, K. (NRL)	"Cometary" HII regions. 2 cm
AF241	Feretti, L. (Bologna) Andernach, H. (Canarias, Spain) Giovannini, G. (Bologna) Perley, R.	Jets in 3C 31 and 3C 449. 3.6, 6 cm
AF249	Frail, D. Whiteoak, J. (Sydney) Goss, W. M.	Radio imaging around young pulsars. 20, 90 cm
AG326	Giovannini, G. (Bologna) Feretti, L. (Bologna) Ventui, T. (Bologna) Wehrle, A. (IPAC, Pasadena)	Radio galaxy 3C 338. 3.6 cm

No.	Observer(s)	Program
AG382	Goss, W. M. Schwarz, U. (Groningen/Kapteyn) Dubner, G. (IAFE) Winkler, F. (Middlebury)	Search for HI associated with Cas A. 20 cm line
AG384	Grossman, A. (Maryland) Muhleman, D. (Caltech)	Saturn's atmosphere. 1.3, 2 cm
AG393	Guedel, M. (Colorado/JILA) Schmitt, J. (MPE, Garching) Benz, A. (ETH, Zurich) Elias, N. (USNO)	Rotational modulation in HD 129333, an analog of the infant sun. 3.6, 6, 20 cm
AG394	Guedel, M. (Colorado/JILA)	An X-ray flux limited sample of main-sequence F stars.
AG399	Goss, W. M. Wood, D. Benaglia, P. (IAR, Buenos Aires)	Recombination line observation of the Sickle and Pistol. 3.6 cm line
AG401	Gaume, R. (NRL)	Outburst in NGC 2024 IRS 2. 1.3, 2, 3.6, 6 cm
AH437	Hewitt, J. (MIT) Turner, E. (Princeton) Chen, G. (MIT) Angelus, A. (MIT)	Monitoring the "Einstein Ring" gravitation lens MG1131+0456. 6 cm
AH489	Habbal, S. (CFA) Esser, R. (CFA) Karovska, M. (CFA) Gonzalez, R. (CFA)	Study of the source region of the solar wind. 2, 3.6, 6, 20 cm
AH492	Hjellming, R. Gehrz, R. (Minnesota) Seaquist, E. (Toronto) Taylor, A. (Calgary)	Image and light curve evolution of the novae Puppis 1991 and Cygni 1992. 1.3, 2, 3.6, 6, 20 cm
AI045	Impey, C. (Arizona) Bothun, G. (Oregon) van Gorkom, J. (Columbia)	HI from gas-rich, low surface brightness galaxies. 20 cm line
AI047	Impey, C. (Arizona) Foltz, C. (MMTO) Hooper, E. (Arizona)	The radio properties of optically selected QSOs. 3.6 cm
AI049	Ishizuki, S. (Tohoku U.) Ishii, T. (Tohoku U.)	Star formation in starburst and hotspot galaxies. 20 cm
AK319	Katz-Stone, D. (Minnesota) Rudnick, L. (Minnesota)	Three-frequency mapping of FR 1 radio galaxy 3C 449. 6, 20 cm

No.	Observer(s)	Program
AK327	Kaufman, M. (Ohio State) Brinks, E. Elmegreen, D. (Vassar) Elmegreen, B. (IBM) Struck-Marcell, C. (Iowa State)	Ocular and caustic galaxies undergoing close tidal encounters. 20 cm line
AK328	Kliem, B. (AI, Potsdam) Krueger, A. (AI, Potsdam) Mazets, E. (IPTI/Russia) Aschwanden, M. (Maryland)	Fine structures in impulsive solar bursts. 20, 90 cm
AK331	Kobulnicky, C. (Minnesota) Dickey, J. (Minnesota) Conti, P. (Colorado)	Spectral index mapping of Wolf-Rayet galaxies. 3.6, 6 cm
AK332	Kassim, N. (NRL) Burns, J. (New Mexico State) Perley, R. Erickson, W. (Maryland) Dwarakanath, K. Taylor, G. (Caltech)	Observations of extended radio sources at 74 MHz. 90 cm
AK333	Kraemer, K. (Boston) Jackson, J. (Boston)	High resolution ammonia observations in W49. 3.6, 6 cm
AK336	Kruger, A. (AI, Potsdam) Hilderbrandt, J. (AI, Potsdam) Kliem, B. (AI, Potsdam) Gopalswamy, N. (Maryland) Kundu, M. (Maryland)	Magnetic fine structure of solar active regions. 2, 3.6, 6 cm
AK337	Kim, K. (Chungnam U.)	Six cluster halo sources. 20, 90 cm
AK338	Kenny, H. (CMC/Kingston) Taylor, A. (Calgary)	CH Cygni outburst.
AK346	Kulkarni, S. (Caltech) Frail, D. Kassim, N. (NRL) Murakami, T. (ISAS, Japan)	Radio counterparts of soft gamma ray bursters. 20, 90 cm
AL150	Lestrade, J. (JPL) Preston, R. (JPL)	Statistical properties of RSCVn stars.
AL292	Langston, G.	Gravitational lens MG1654+1346. 3.6, 6 cm

No.	Observer(s)	Program
AL293	Lang, K. (Tufts) Willson, R. (Tufts) Kile, J. (Tufts) Bogod, V. (Pulkovo Obs.) Gelfreikh, G. (Pulkovo Obs.)	Nonthermal sources in solar active regions. 2, 3.6, 6, 20, 90 cm
AL294	Leone, F. (Catania) Trigilio, C. (Bologna) Umana, G. (Bologna)	Testing the proposed models for radio emission from CP stars. 1.3, 2, 6, 20 cm
AL296	Lehnert, M. (IGPP) Armus, L. (Caltech)	The radio halo of NGC 660 — evidence for supernova-driven winds. 6, 20 cm
AL298	Leone, F. (Catania) Trigilio, C. (Bologna) Umana, G. (Bologna)	Monitoring magnetic chemically peculiar stars.
AL299	Li, J. (Toronto) Seaquist, E. (Toronto)	A warped disk or a counter-rotating outer HI ring in NGC 7625. 20 cm line
AM397	Molnar, L. (Iowa) Niermann, S. (Iowa) Kniffen, D. (Sydney) Mattox, J. (NASA/GSFC)	Radio counterparts of EGRET gamma ray point sources. 3.6 cm
AM402	Marcha, M. (Manchester) Browne, I. (Manchester) Laing, R. (Cambridge)	Polarization structure and flow speed in low luminosity jets. 6, 20 cm
AM406	Moriarty-Schieven, S. (DRAO) Rogers, C. (DRAO) Dewdney, P. (DRAO)	HI in the NGC 7023 photodissociation region. 20 cm line
AM410	Moore, E. (Boston) Gottesman, S. (Florida)	Barred spiral galaxies NGC 1530 and NGC 3319. 20 cm line
AM411	Moshir, M. (IPAC, Pasadena) Aldering, G. (Minnesota) Condon, J.	Very faint IRAS galaxies and microjansky radio sources. 20 cm
AM412	Muhleman, D. (Caltech) Grossman, A. (Maryland) Butler, B. (Caltech) Slade, M. (JPL)	Determination of Titan's spin with radar. 3.6 cm line
AM413	Marcha, M. (Manchester) Browne, I. (Manchester) Patnaik, A. (Manchester) Wrobel, J.	Structure of flat spectrum radio galaxies. 20 cm

No.	Observer(s)	Program
AM415	Mirabel, F. (CNRS, France) Rodriguez, L. (Mexico/UNAM)	Proper motions and variability in the lobes of 1E1740.7-2942. 6 cm
AM418	McIntyre, V. (CFA) Puche, D. (CFA) Huchra, J. (CFA)	Star formation and internal kinematics of irregular galaxies. 20 cm line
AN061	Norris, R. (Sydney) Sramek, R.	Extended emission of Arp 220. 3.6 cm
AO103	O'Donoghue, A. (St. Lawrence) Eilek, J. (NMIMT) Owen, F.	Spectral index observations of 3C 465. 90 cm
AO116	Oren, A. (Calif., San Diego) Wolfe, A. (Calif., San Diego)	Faraday rotation survey of the halo of M31. 6, 20 cm
AP253	Puche, D. (CFA) Westpfahl, D. (NMIMT) Carignan, C. (Montreal)	Incipient spiral structure in UGC 2259. 20 cm line
AP257	Palmer, D. (NASA/GSFC) Schaefer, B. (NASA/GSFC) Cline, T. (NASA/GSSFC) Laros, J. (Los Alamos) Hurley, K. (Calif., Berkeley) Fishman, G. (NASA/MSFC) Kouveliotou, C. (NASA/MSFC)	Gamma ray bursts as targets of opportunity.
AP264	Puche, D. (CFA) Westpfahl, D. (NMIMT)	High resolution HI study of IZW18. 20 cm line
AP265	Prieto, A. (MPIPA, Munich) Freudling, W. (ESO)	HI in the Seyfert galaxy NGC 5252. 20 cm line
AP266	Peng, Y. (Maryland) Vogel, S. (Maryland)	W33A: A pre-outflow massive star-forming core. 1.3, 3.6, 6 cm
AP270	O'Dea, C. (STScI) 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
AR268	Rodriguez, L. (Mexico/UNAM) Curiel, S. (CFA)	Radio monitoring of the outburst in SVS13. 3.6, 6 cm

No.	Observer(s)	Program
AR279	Roettiger, K. (New Mexico State) Burns, J. (New Mexico State) Loken, C. (New Mexico State) Owen, F.	Steep spectrum radio sources in rich clusters. 20 cm
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) Saunders, R. (Cambridge) Cotter, G. (Cambridge) Lacy, M. (Oxford) Baldwin, J. (Cambridge)	Giant radio galaxies at high redshift. 20 cm
AR299	Rhee, G. (Nevada)	Radio galaxies in high redshift clusters. 6 cm
AS333	Sramek, R. Weiler, K. (NRL) van Dyk, S. (NASA/Ames) Panagia, N. (STScI)	Statistical properties of radio supernovae. 2, 6 cm
AS478	Subrahmanyan, R. (TIFR) Benaglia, P. (IAR, Argentina) Goss, W. M.	Electron temperatures in HII regions. 90 cm
AS479	Swain, M. (Rochester) Bridle, A. Baum, S. (STScI)	3C 353. 3.6 cm
AS484	Salter, C. (NAIC) Junor, W. (Unaffiliated) Bignell, R. C. Saikia, D. (TIFR)	Optically thick planetary nebulae. 6 cm
AS491	Sokolov, K. (IRA, Ukraine)	Sample of extended extragalactic radio sources. 20, 90 cm
AS504	Skinner, C. (IGPP) Barlow, M. (U. College, London) Sylvester, R. (U. College, London)	Radio survey of M-supergiants in Perseus and Cassiopeia. 3.6, 6 cm
AS506	Simpson, C. (Florida) Gottesman, S. (Florida)	HI observations of low-mass dwarf galaxies. 20 cm line
AS508	Stocke, J. (Colorado) Perlman, E. (Colorado)	Unusual clustering of radio sources near the globular cluster M10. 3.6, 6, 20 cm

No.	Observer(s)	Program
AS509	Saunders, W. (Oxford) Rowan-Robinson, M. (Queen Mary) Maddox, S. (Oxford) Pedlar, A. (Manchester) Smoker, J. (Manchester)	IRAS galaxy candidates behind the Milky Way. 20 cm
AS511	Seaquist, E. (Toronto) Ivison, R. (Toronto)	Symbiotic behavior among OH/IR color mimics. 3.6 cm
AS515	Schiminovich, D. (Columbia) van Gorkom, J. (Columbia)	HI observations of shell galaxies. 20 cm line
AS516	Shaver, P. (ESO) Wall, J. (Cambridge) Kellermann, K.	Accurate positions of unidentified flat-spectrum Parkes sources.
AS518	Stocke, J. (CASA, Colorado) Carilli, C. (Leiden) Urry, M. (STScI) Donahue, M. (DTM/Carnegie) Shull, J. (CASA, Colorado)	HI imaging of a low redshift Lyα forest cloud. 20 cm line
AT143	Sevenster, M. (Leiden) te Lintel Hekkert, P. (Mt. Stromlo Obs.) Habing, H. (Leiden) Blommaert, J. (Leiden) Dejonghe, H. (Utrecht) Rich, M. (Columbia)	Survey of the galactic plane. 18 cm
AT145	Thorsett, S. (Caltech) Taylor, J. (Princeton) McKinnon, M. (NMIMT) Hankins, T. (NMIMT) Stinebring, D. (Oberlin)	Timing fast pulsars. 6, 20, 90 cm
AT146	Torrelles, J. (IAP, Granada) Rodriguez, L. (Mexico/UNAM) Ho, P. (CFA) Canto, J. (Mexico/UNAM)	Protoplanetary disk associated with Cepheus A-HW2. 1.3 cm line
AT149	Thuan, T. (Virginia) Condon, J. Dennefeld, M. (Paris Obs.) Boller, T. (MPIEP/Garching)	ROSAT/IRAS galaxies. 6, 20 cm
AT154	Thorsett, S. (Caltech) Taylor, J. (Princeton) McKinnon, M. (NMIMT) Hankins, T. (NMIMT) Stinebring, D. (Oberlin College)	Timing fast pulsars at the VLA. 20, 90 cm

No.	Observer(s)	Program
AV199	van Langevelde, H. (Leiden) Habing, H. (Leiden) Diamond, P. Winnberg, A. (Chalmers/Onsala)	Water masers in galactic center OH/IR stars. 1.3 cm line
AV206	van Moorsel, G. Oosterloo, T. (Bologna)	HI observations of two compact groups of galaxies. 20 cm line
AW230	Wrobel, J. Unger, S. (Cambridge)	International monitoring of the Seyfert NGC 5548. 3.6 cm
AW326	Westpfahl, D. (NMIMT) Adler, D.	Interarm HI in M81. 20 cm line
AW340	Womble, D. (Calif., San Diego) Dickey, J. (Minnesota) Kazes, I. (Paris Obs.) Carilli, C. (Leiden)	Quasar galaxy pair 0248+430. 20 cm line
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, 20 cm
AW350	Wills, B. (Texas) Shastri, P. (Calif., Berkeley)	Core variability in lobe-dominated quasars. 3.6 cm
AW351	Williams, B. (Delaware)	HI synthesis of three compact groups. 20 cm line
AW352	Wennmacher, L. (Bonn U.) Stark, R. (Leiden) Dickey, J. (Minnesota)	A very compact, high density, interstellar cloud. 20 cm line
AW353	Wang, Q. (Colorado/JILA) Li, Z. (Colorado/JILA) Begelman, M. (Colorado/JILA) Zhao, J.-H.	Radio observation of the X-ray-emitting trail of PSR 1929+10. 20 cm
AW355	Wood, D. Strom, K. (Massachusetts) Strom, S. (Massachusetts)	HI photodissociation regions in L1641.
AW356	Wannier, P. (JPL) Anderson, B. (JPL) Moriarty-Schieven, G. (DRAO)	The HI environment of the molecular cloud L1457. 20 cm line

No.	Observer(s)	Program
AW357	Wilson, T. (MPIR, Bonn) Gaume, R. (NRL) Johnston, K. (NRL)	The heating source of the Orion-KL nebula. 1.3 cm line
AW358	Westpfahl, D. (NMIMT) Puche, D. (CFA)	High resolution HI mapping of NGC 3938. 20 cm line
AW359	Wilcots, E. Hodge, P. (Washington) Miller, B. (Washington)	High resolution HI study of IC 10. 20 cm line
AW360	Wilcots, E. Hodge, P. (Washington) Miller, B. (Washington)	High resolution continuum study of IC 10. 3.6, 6, 20 cm
AW361	White, S. (Maryland) Aschwanden, M. (Maryland)	The magnetic field configuration in the solar corona. 20, 90 cm
AW362	White, S. (Maryland)	The stellar activity cycle on active stars. 3.6, 6, 20 cm
AY052	Yang, H. (Minnesota) Skillman, E. (Minnesota)	Evolution of an SNR in giant HII region. 3.6 cm
AY053	Yin, Q.-F. Heeschen, D.	Supernova activity in Mkn 297. 2, 3.6, 6, 20 cm
AY055	Yun, M. (Caltech) McIntyre, V. (CFA)	Galaxy-scale gaseous collisions and ring galaxies. 20 cm line
AY056	Yun, M. (Caltech) Bryant, P. (Caltech) Scoville, N. (Caltech)	Atomic gas in and around ultraluminous IRAS galaxies. 20 cm line
AY059	Yusef-Zadeh, F. (Northwestern) Mehringer, D. (Chicago)	A search for weak H_2O masers at the galactic center. 1.3 cm line
AZ062	Zhou, S. (Illinois) Evans, N. (Texas) Mundy, L. (Maryland)	Probing the protostellar disk in NGC 2071. 1.3 cm line
AZ063	Zijlstra, A. (ESO, Garching) Pottasch, S. (Groningen/Kapteyn)	Resolving the optical-radio flux discrepancy of planetary nebulae. 3.6, 6 cm

E. VERY LONG BASELINE ARRAY

No.	Observer(s)	Program
BB020	Briggs, F. (Pittsburgh) Taramopoulos, A. (Pittsburgh)	Infalling, absorption line gas.
BC023	Colomer, F. (Chalmers/Onsala) Graham, D. (MPIR, Bonn) Bujarrabal, V. (Yebes Obs.) Booth, R. (Chalmers/Onsala) Diamond, P. Ronnang, B. (Chalmers/Onsala)	SiO masers.
BD002	Diamond, P. Kemball, A. (HartRAO) Benson, J. Junor, W. (Unaffiliated) Zensus, J. A.	Monitoring the structure of SiO masers with VLBA.
BD003	Diamond, P. Beasley, A.	Proper motion of the OH and H_2O masers in W43(OH).
BG011	Greenhill, L. (CFA) Moran, J. (CFA) Reid, (CFA) Argon, A. (CFA)	Refining the water maser proper motions in M33/IC 133.
BG0016	Gordon, D. Hughes (NASA/GSFC) Clark, T. (NASA/GSFC) Ryan, J. (NASA/GSFC) Niell, A. (Haystack) Rogers, A. (Haystack) Vandenberg, N. (NASA/GSFC)	NASA/GSFC godesy program: North American plate stability
BJ002	Jones, D. (JPL) Jauncey, D. (Sydney) Preston, R. (JPL) Reynolds, J. (Sydney) Murphy, D. (JPL) Tzioumis, A. (Sydney)	Einstein ring PKS 1830-211.
BJ009	Junor, W. (Unaffiliated) Biretta, J.(STScI)	Structure and evolution of light-month scales in nucleus of M87.

No.	Observer(s)	Program
BK004	Kuehn, C. (Interferometrics) MacMillan, D. (Interferometrics) Himwich, W. (Interferometrics) Clark, T. (NASA/GFSC) Ma, C. (NASA/GSFC)	Tropospheric propagation delay models.
BK009	Krichbaum, T. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Graham, D. (MPIR, Bonn) Schalinski, C. (IRAM) Zensus, J. A.	Evolution of complex structure on subparsec scales in 3C 84.
BK010	Krichbaum, T. (MPIR, Bonn) Standke, K. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Zensus, J. A. Schalinski, C. (IRAM)	Cygnus A.
BK011	Krichbaum, T. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Graham, D. (MPIR, Bonn) Zensus, J. A.	Monitoring 3C 273 and 3C 279.
BL002	Lestrade, J.-F. (JPL and Meudon) Jones, D. (JPL) Preston, R. (JPL) Phillips, R. (Haystack)	Radio star astrometry for HIPPARCOS tie-in.
BM010	Molnar, L. (Iowa) Mutel, R. (Iowa)	Interstellar scattering in Cygnus X.
BM025	Menten, K. (CFA) Reid, M. (CFA)	Search for SiO emission from OH/IR stars close to the galactic center.
BM026	Migenes, V. (CSIRO) Trigilio, C. (Bologna) Umana, G. (Bologna)	HR 1099.
BN001	Niell, A. (Haystack) Potash, R. (NASA/GSFC) Corey, B. (Haystack) Clark, T. (NASA/GFSC) Vandenberg, N. (NASA/GSFC)	NASA/GSFC geodesy program: Hancock/Westford ties.
BP011	Preston, R. (JPL) Costa, M. (West Australia) King, E. (Tasmania) Jauncey, D. (CSIRO) Jones, D. (Sydney)	Monitoring the nucleus of Centaurus A.

No.	Observer(s)	Program
BP012	Preston, R. (JPL) Moellenbrock, G. (Brandeis) Zensus, J. A. Linfield, R. (JPL) Roberts, D. (Illinois) Jauncey, D. (CSIRO) Gervits, L. (Lebedv) Schilizzi, R. (NFRA)	Survey at 22 GHz in support of VSOP and Radioastron missions.
BR013	Ryan, J. (NASA/GSFC) Eubanks, M. (USNO) Corey, B. (Haystack) Potash, R. (NVI/GSFC) Niell, A. (Haystack) Vandenburg, N. (NASA/GSFC)	NASA/GSFC geodesy program: Hawaii ties and deformation.
BR017	Ratner, M. (CFA) Bartel, N. (York U.) Lebach, D. (CFA) Lestrade, J.-F. (JPL and Meudon) Shapiro, I. (CFA)	Astrometry of HR 5110 for NASA/Stanford gravity probe-B.
BR018	Rupen, M. Conway, J. Sramek, R. Romney, J. Bartel, N. (York U.) Weiler, K. (NRL) van Dyke, S. (NRL) Panagia, N. (STScI) Rius, A. (Madrid) Cannon, W. (York U.) Graham, D. (MPIR, Bonn) Davis, R. (Manchester)	Supernova 1993J in M81.
BS007	Shaffer, D. (NASA/GSFC) Potash, R. (NASA/GSFC) Clark, T. (NASA/GSFC) Ma, C. (NASA/GSFC) Niell, A. (Haystack) Corey, B. (Haystack) Walker, R. C. Junor, W. (Unaffiliated)	Use of phase delay to reduce measurement error.
BS008	Shaffer, D. (NVI/GSFC) Ma, C. (NASA/GSFC) Kingham, K. (USNO)	Astrometry.

No.	Observer(s)	Program
BT003	Thorsett, S. (Caltech) Dewey, R. (JPL) Frail, D. Kulkarni, S. (Caltech) Thakkar, D. (Caltech)	Calibrators around three millisecond pulsars.
BT007	Thakkar, D. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Vermeulen, R. (Caltech)	Nuclei of low-luminosity radio galaxies.
BW003	Wrobel, J. Bridle, A. Walker, R. C.	Parsec scale structure of the twin-jet.
BW006	Witzel, A. (MPIR, Bonn) Krichbaum, T. (MPIR, Bonn) Standke, K. (MPIR, Bonn) Zensus, J. A. Schalinski, C. (IRAM)	Survey of radio sources at 43 GHz.
BZ005	Zensus, J. A. Krichbaum, T. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Leppanen, K. (Helsinki) Schalinski, C. (IRAM)	Monitoring the helical trajectories in 3C 345 at 43 GHz.
BZ008	Zhang, Y. (Boston) Marscher, A. (Boston)	The gamma bright quasar PKS 0528+134.
GC013	Campbell, R.(CFA) Corey, B. (Haystack) Shapiro, I. (CFA) Falco, E. (CFA)	Gravitationally lensed images of 0957+561.
GG021	Giovannini, G. (Bologna) Cotton, W. Feretti, L. (Bologna) Venturi, T. (Bologna) Lara, L. (CSIC, Andalucia) Marcaide, J. (IAP, Valencia) Wehrle, A. (Caltech)	Three low luminosity (FR-I) radio galaxies.
GJ006	Junor, W. (Unaffiliated) Biretta, J. (STScI)	Evolution of M87 nuclear jet on light-month scales.

No.	Observer(s)	Program
GK009	Krichbaum, T. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Steffen, W. (MPIR, Bonn) Zensus, J. A. Wagner, S. (Heidelburg)	0836+71 after a major optical/X-ray outburst.
GL009	Lestrade, J.-F. (JPL and Meudon) Phillips, R. (Haystack) Jones, D. (JPL) Preston, R. (JPL)	Astrometric observations of stars to tie-in HIPPARCOS.
GL013	Leppanen, K. (Helsinki) Valtaoja, E. (Helsinki) Schilizzi, R. (NFRA) Pilbratt, G. (ESTEC)	Sample of 15 AGN.
GM014	Massi, M. (Arcetri) Paredes, J. (Barcelona) Estalella, R. (Barcelona) Diego, F. (Florence)	Radio periodic star LSI +61 303O6.
GM017	Marcaide, J. (IAP, Valencia) Ros, E. (IAP, Valencia) Alberdi, A. (IAA, Granada) Guirado, J. (IAA, Granada) Rius, A. (IAA, Granada)	SN1993J: Distance to M31. 1.3 cm
GM018	Massi, M. (Arcetri) Drago, F. (Firenze) Paredes, J. (Barcelona) Estalella, R. (Barcelona)	Core-halo structure in UX Arietis.
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) Titus, M. (Haystack) Cannon, W. (York U.) Popelar, J. (Ottawa) Graham, D. (MPIR, Bonn) Venturi, T. (Bologna) Davis, R. (Manchester) Rius, A. (Madrid) Altunin, V. (JPL) Jones, D. (JPL)	1993J in M81.

No.	Observer(s)	Program
GZ010	Zensus, J. A. Leppanen, K. (Helsinki) Unwin, S. (Caltech) Wehrle, A. (JPL)	Evolution of the parsec-scale structure of 3C 345.
RD93	Clark, T. (NASA/GFSC) Ma, C. (NASA/GSFC) Ryan, J. (NASA/GSFC) Vandenberg, N. (NVI/GSFC) Gipson, J. (Interferometrics) Rogers, A. (Haystack) Niell, A. (Haystack) Corey, B. (Haystack)	NASA geodynamics program/DOSE VLBI FL techniques improvement.

F. SCIENTIFIC HIGHLIGHTS

Tucson

The 12 Meter Telescope was used to study emission from local CO and HCO+ toward BL Lac, where these and several other species (HCN, HNC, CN, C_2H) had been detected in absorption with the Plateau de Bure Interferometer (Lucas and Liszt, 1993, A&A 276, L33). Knowing the optical depth and brightness of the HCO+ line provides the excitation temperature, which then allows a determination of the thermal pressure in the gas. The same value can be derived from analysis of ^{13}CO or from comparison of the apparent and true ^{13}CO optical depths. Combined with the ^{12}CO emission, the temperature is determined separately as 7-9 K; the ambient number density is a few thousand per cc. The rich chemistry seen toward BL Lac is something of a surprise because the extinction is believed to be less than 1 magnitude in this direction.

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

Green Bank

New, sensitive measurements of the ^3He line have been made in several galactic HII regions. The line in W49 has finally been detected at an abundance of 6.8×10^{-6}, a value that is less than half of the measured proto-solar abundance. This sets a new upper limit to the abundance of ^3He produced in the big bang.

Investigators: D. Balser and T. Bania (Boston U.), C. Brockway (NRAO), R. Rood (U.Va), and T. Wilson (MPIR, Bonn)

Socorro

VLA, Satellites Probe Solar Flare — A high-time-resolution "movie" of a solar flare has been produced from VLA data. The VLA, along with the hard X-ray and soft X-ray telescopes on board the Japanese satellite Yohkoh, a high-speed, dual-channel Hα camera, and the BATSE instrument on board the CGRO, observed the flare on 20 August 1992. The VLA was used in its "fast-snapshot" imaging mode to observe the flare simultaneously in the 2 and 3.6 cm bands. Snapshot images were obtained at a rate of 5 per second. Analysis of the microwave data reveals the presence of a multiply impulsive, compact source located near the footpoint of a highly sheared coronal magnetic loop. The 2 and 3.6 cm emission propagates along the sheared loop with time, crosses the magnetic neutral line, and illuminates the magnetic footpoint of opposite polarity. The transit speed of the propagating microwave emission is roughly 2000 km/s, consistent with the Alfven speed. Of particular

interest is the fact that impulsive signals initiated at the first footpoint show a temporal delay and dispersion as they propagate to the footpoint of opposite magnetic polarity.

Investigators: T. Bastian (NRAO), N. Nitta (LPARL), A. Kiplinger (U. Colorado/NOAA)

VLA Produces High-Resolution HI Map of M81 — In an effort to study the star formation process in the interstellar medium of galaxies, investigators recently have completed a two-field, three-array HI map of the spiral galaxy M81 (NGC 3031) and its satellite dwarf galaxies. This B, C, and D-array map, the result of 62 hours of observing time, provides 12" spatial resolution with a velocity resolution of 2.5 km/sec and high sensitivity. The image allows study of the distribution and kinematics of the HI in the disk of the galaxy with unprecedented resolution, leading to a study of the star formation process and its subsequent effect on the surrounding interstellar environment. This image yields new information on the kinematics related to the streaming of the neutral hydrogen into the spiral density wave shock. The high velocity resolution also allows imaging of the velocity dispersion of the cloud system in different regions of the galaxy. The image is sensitive enough to detect interarm emission. The high spatial resolution will allow an accurate calculation of the arm to interarm intensity contrast. Each of these parameters will allow better characterization of the nature of the spiral density shock in M81 and its effect on the star formation process in the galaxy. The image also shows that the rotation curve drops on both sides of the galaxy. Thus, if there is dark matter in M81, it is not distributed in such a way as to make the rotation curve flat, as is observed in many other galaxies.

Investigators: D. Adler (NRAO) and D. Westpfahl (NMIMT)

G. PUBLICATIONS

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

H. CENTRAL DEVELOPMENT LABORATORY

Amplifier Development, Design and Production

Production of 26-36 GHz, 38-45 GHz, and 40-50 GHz amplifiers, as well as evaluation of millimeter-wave HFET's, continued this quarter.

A prototype 3.95-6.00 GHz amplifier has been fabricated and is currently being evaluated. This amplifier will be used on the GBT and is being considered as an IF amplifier for SIS receivers.

A production version of the 680-920 MHz balanced amplifier was fabricated and evaluated with satisfactory results. Five additional units are currently being built for the GBT.

Superconducting (SIS) Millimeter-Wave Mixer Development

Work has continued on SIS mixers for 130-170 GHz and 200-300 GHz for the 12 Meter Telescope. The new 130-170 GHz mixers reported in the 3/93 quarterly report have now been installed in three of the four 2 mm receiver inserts.

Two sources of intermittent short-circuits in the bias wiring of SIS receivers on the 12 Meter Telescope were described in the last quarterly report. These are now being remedied: we have replaced the fragile feed-through RFI filters (typically 19 filters per insert) with a new, more robust design, and we have replaced the troublesome heat-sinks in the SIS bias wiring with an improved design. So far, we have modified 8 of the 20 receiver inserts.

A number of SIS mixers have failed, apparently when receiver inserts were installed in, or removed from, the shipping container. In an attempt to remedy this, we have installed anti-static packing material in both containers, and replaced the PVC vacuum tubes used during shipping with aluminum tubes.

A theoretical study of the trade-off in fixed-tuned SIS mixers between (tunable) bandwidth and receiver performance has been completed and is being distributed as NRAO Electronics Division Internal Report No. 295 and Millimeter Array Memorandum No. 103. Assuming practical values of the junction parameters, it is found that acceptable receiver performance should be obtainable over almost a full waveguide band (~35%) at 300 GHz.

During this quarter, we have built (or rebuilt) and tested a total of 13 SIS mixers, 6 SIS receiver inserts, and 1 frequency multiplier.

Electromagnetic Support

The coaxial output region of the 3.95-5.85 GHz orthomode transducer was analyzed. Based on this analysis, a prototype transducer was fabricated and measured. The measured return loss was better than 11 dB. Further design work continues.

A feed to cover the 3.95-5.85 GHz range was designed.

An X-band feed covering the 8-10 GHz range for the GBT was measured. The feed has good circular symmetry with low cross-polarization. The input return loss is better than 22 dB.

A section of the L-band GBT feed that was fabricated by stacking rings and bands at the Green Bank shop was measured. The return loss of this feed is better than 30 dB in the 1.15 to 1.75 GHz range. The fabrication technique seems to be good, and the rest of the feed will be completed in the next few months.

GBT Spectrometer

In the last quarter, the GBT spectrometer design advanced in several directions. No progress, however, was made on the correlator chip development because Hewlett Packard, the chip manufacturer, lost its entire wafer run before completion. Another wafer run has begun.

A test fixture for the correlator chip has been started in the CDL and is nearing completion.

The first part of a 2 GHz sampler has been breadboarded and preliminary tests have been performed. Results of this preliminary testing are encouraging but are, as yet, inconclusive pending analysis of the sampler output using a correlator chip.

The GBT spectrometer design proper has advanced. Two printed circuit board designs (the distributor board and the memory board) are essentially complete. The memory board is ready to be sent out for wirewrapping of a breadboard. The correlator card design is mostly complete and additional work on it is waiting for experience to be gained using the chip test fixture.

A test fixture for testing the memory board has been designed and construction has started. This test fixture will be used in the testing of the memory card breadboard.

OVLBI Support

A Costas loop demodulator has been developed and tested for the recovery of data from the QPSK modulation of the OVLBI downlink system. A prototype clock recovery unit has also been assembled and is undergoing testing as the quarter ends. These two items will make up the Demodulator Module which provides data streams to the decoder.

Two wirewrap board designs for the OVLBI decoder project have been tested in the CDL, and one of the boards has been installed for software testing in Green Bank.

I. GREEN BANK ELECTRONICS

140 Foot Telescope 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 modification involves changing approximately 600 wires on each of five wirewrap boards. Three boards have been completed and tested to date. Documentation is being updated to reflect the changes in the memory board, test board, and test procedure. The old Masscomp control computer is being replaced with a Sun IPX. Associated hardware changes include a new S-Bus expansion box, a memory upgrade, a second ethernet board, and two parallel interfaces. Rewrite of the spectral processor control and data acquisition software for the Sun IPX is about 70 percent complete, and we hope to have the pulsar observing portion ready for demonstration to the GBT Advisory Committee on October 14. The new software is the first implementation of the control and monitoring design to be used throughout the GBT monitor and control system.

Several changes were completed within the 140 Foot Telescope cassegrain receiver systems. A 6-18 GHz phase-locked LO synthesizer was finished and installed. The LO can be frequency switched over several tens of megahertz with transition times less than 5 milliseconds. Conversion of the X and Ku receivers from upconverter/maser to cooled HEMT amplifiers was completed by extensive changes to the vertex house equipment and cabling. A K-band HEMT amplifier was tried for the first time in place of the maser. Because of poor weather conditions, the initial results were inconclusive.

A prime focus receiver covering 680-920 MHz is under development for the GBT, and a feed for use on the 140 Foot with this receiver has been built. With additional corrugated sections, the same horn will become the GBT 680-920 MHz feed. Although measured amplitude and phase patterns of the feed look like those predicted from design curves, and should provide reasonably good efficiency/noise temperature for the 140 Foot Telescope, the cross polarization characteristics are not as good as desired. For example, the cross polarization lobe is about 18 dB below the coplanar main beam lobe on boresight. Since the feed aperture diameter for the 140 Foot optics is small (approximately 1.9 λ at 800 MHz), the poor cross polarization characteristics may be the result of flange currents. When the complete feed is assembled for GBT use, the diameter will be considerably larger, the effects of flange currents will diminish, and the cross polarization characteristics should improve. For optimum performance on the 140 Foot, it is possible to build a curved aperture corrugated horn to mitigate the flange currents, but a decision whether to do so will wait until measured performance on the 140 Foot is obtained.

Fifteen receiver installations were scheduled and completed this quarter.

GBT Development

Several receiver front-ends are under construction for the GBT project. An integrated 18-22 GHz and 22-26.5 GHz dual-beam front-end is complete. The first prime focus front-end is being assembled. Receivers for 8-10 GHz and 12-15.4 GHz are nearing completion, and the 3.95-5.85 GHz and 1.15-1.73 GHz receivers are being designed. Feed horns for all the above are completed or under construction. The LO and Test Tone routers to be located in the antenna receiver room are complete; the IF router is under construction. Microwave optical fiber links have been selected and components for the link modules are being gathered for assembly. Design concepts are being developed and evaluated for the control room IF distribution system. Tests of the prototype feed rotator mechanism and drive led us to change the motor design and add lightning protection and RFI suppression circuitry. This work is underway.

Development of electronics for the open-loop active surface system continued. In order to evaluate a prototype supply and the supply distribution system, 96 actuators were connected to the recently completed test set. They were run

simultaneously while transient responses and voltage drops were recorded. These tests showed that the existing design worked well. Design of the motor power supply control was completed. This system will act as a watchdog timer. If the control computers fail to communicate with the system in a set period of time, the actuator power supplies will be shut off. Emergency stop has also been interfaced into the watchdog timer.

Hardware and real-time software is being developed for a new continuum backend. Circuitry is being developed using Xilinx field programmable gate arrays for the integrating counters and timing generator.

The autocollimator pointing autocollimator/mirror servo loop was closed with satisfactory performance. During tests, the piezoelectric mirror platform failed, necessitating its return to the manufacturer.

Site Operations

Maintenance, repair, and installation support was supplied to the 140 Foot, Interferometer, and site computer facilities. Continuing intermittent problems have occurred with the Green Bank VLBA tape recorder vacuum system. Work went into isolating and correcting causes of temperature instabilities and phase cal problems in the Interferometer S/X receivers, and preparatory work for construction of two additional receivers began.

Applications for 54 separate transmitter sites within the National Radio Quite Zone (NRQZ) were processed. Preliminary evaluations of 34 possible transmitter sites were also processed at the request of possible applicants. The validity of the propagation model used for evaluation of transmitters in the NRQZ was questioned by interested parties. In answer to these concerns, our model was found to be in close agreement with independent studies done on three separate paths. To further improve our application evaluations, we are attempting to update and improve the computerized topography database.

K. TUCSON ELECTRONICS

Receivers and General Engineering

3 mm SIS — Improvements have been made to the cryogenics of this receiver that have lowered the physical temperature of the third cooling stage. This should improve the reliability of the receiver and reduce the loading on the 4 K stage.

2 mm SIS — New mixers from the CDL have been installed in this receiver. Whereas the old mixers were scaled from a 1 mm design, these mixers were designed specifically for the 2 mm band. The receiver noise temperature is nearly constant all the way across the band, from 130 to 170 GHz.

1 mm SIS — This receiver is currently being upgraded to contain the 260-300 GHz mixer set, to have independently tunable local oscillators for each polarization channel, to have a switchable tone for sideband tuning (image rejection), and to have a new on-board computer and tuning system. Work is scheduled for completion by November 1.

Continuum Chassis — Staff members are rebuilding the continuum chassis which feeds the digital continuum backend. The modifications should reduce noise in the system. In particular, we hope to reduce 60 Hz pickup.

Hybrid Spectrometer

The staff is investing considerable time in the Hybrid Spectrometer. Over the summer, we have installed the hardware necessary for flexible tuning of all eight IF sections. The software control for this system should follow later this year. We have also improved the cooling of the IF distribution system in an effort to increase stability.

In the Spectrometer itself, we have installed a fix to an overflow problem in the integrator card that was making the end filter segment of 600 MHz bandwidth spectra useless. This fix appears to be successful. We have also installed a lock-detect

system for the analog filter section. We have not been successful in fixing the low-level "ramps" and "sawteeth" that appear in the spectra in certain circumstances. We are continuing to pursue this problem, and may have a work-around observing procedure in the interim.

Control Software

The programming staff has completed a new X Windows user interface. This interface has numerous advantages over the old graphical user interface, including "pinnable" and "scrollable" windows. Both in-house and user-supplied line frequency catalogs are now available. These work in the same way that source position catalogs have in the past.

The engineering and programming staffs have added a number of additional monitoring devices to the system to improve safety, detect errors, and to provide better weather information for both on-site and remote observers. For example, the control system now monitors the drive system torque motor currents and temperatures. It also monitors the subreflector beam throw settings. Wind speed and direction and rain detection instruments are now interfaced to the system.

We continue to improve our remote observing capabilities. In addition to the new monitoring points mentioned above, we are also adding a video image system for selected views of control room equipment and the sky overhead.

A new "on-the-fly" mapping mode for the filter bank spectrometers is nearly finished. On-the-fly data acquisition with the Hybrid Spectrometer will be worked on during the year. The continuum on-the-fly system, developed over the last two years, is available now. Data analysis for on-the-fly observing is currently limited, but is being addressed.

Site Maintenance

Owing to mechanical fatigue, we have retired the "cherry picker" crane and man lift that was used to service the telescope and dome and to mount receivers and other equipment on the telescope. The cherry picker is being replaced with a flexible combination of a mobile man lift, crane, and fork lift.

The operations staff spent considerable time this summer inspecting, repairing, and relubricating the dome drive system. The drive sprockets and numerous rollers were replaced during the process.

K. SOCORRO ELECTRONICS

VLA 1.3-1.7 GHz Receiver Improvements

All 28 VLA antennas are now outfitted with the new improved frontends. We will complete two spare frontends in 1994.

VLA 40-50 GHz Receivers

All critical components for the receiver addition to ten VLA antennas have been received. The VLA machine shop has fabricated parts to complete seven receivers. We are assembling and testing the second receiver. One manufacturer has supplied cooled isolators that are useable in the 42 to 48 GHz range. One receiver with these isolators was installed in VLA antenna 8 in late September. The receiver and antenna performance will be evaluated during October. A second manufacturer has completed two improved isolators with adequate performance from 40 to 50 GHz. These isolators will be installed in the third and later receivers, with retrofits into the first two receivers at the end of the project. We expect five VLA antennas will be outfitted by January 1994.

VLA Waveguide

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

VLA Wye Monitor

The Wye Monitor provides the VLA Operator with voice phrase alarms detailing "antenna number," "arm," "generator," "UPS," "HVAC," "problem," etc. Operators interface via a touchscreen, bringing up windows for detailed information on monitored systems. This quarter we completed a full backup system ready to go online should a failure occur. Next quarter we expect to complete the interface to the correlator air conditioner, which 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-AP120 B array processor. A single VME computer will replace the above equipment, which is nearing the end of its repairable life. We received the VME array processor card and began testing and designing the interface. Two VME prototyping cards are in use. We plan to have several interfaces to the correlator prototyped by the end of the year.

VLA Antenna B-Rack Shields and Optical Fiber

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

VLBA Recorders

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

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

Nearly 400 thin tapes have been transferred to Acrometal "self-packing" reels and a supply shipped to the VLBA sites for use in observing. An accelerated life test on a sample of the new tapes and reels was begun to provide input for the procurement of additional tapes and reels in November.

A replacement input module for the VLBA formatter has been installed at all stations. The new design, called the "Digital Switch" module, includes counters that permit verification of PCAL on every input channel during observing.

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

Eighteen playback drives (PBDs) have been installed at the VLBA Correlator. The 19th drive is in the Array Operations Center (AOC) lab as a test bed and hot spare. The remaining six drives and one DAR are presently being used at the Haystack correlator and development lab, and are expected to be installed at the AOC by the end of this year.

VLBI/MKII

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

VLBA Atomic Clock

The six year old hydrogen maser #1 was returned to the manufacturer, Sigma Tau Standards Corp., for extensive rework of the physics package. When returned to Socorro in October, we expect much better stability, higher line Q, lower vac ion currents and stable IF level.

Interference

Efforts continue, at a low level, to identify, control and mitigate local sources of RFI, such as digital (microprocessor) devices and radio devices. Frequency coordination efforts through the National Science Foundation Spectrum Management Office and our informal network have concentrated on major radar installations (NEXRAD), several military systems, and harmonic emissions from TV transmitters. Motorola's IRIDIUM Satellite Communications Division has requested that NRAO measure and provide the near- and far- sidelobe envelope patterns of VLA and VLBA antennas. The patterns will assist the Mobile Satellite Service (MSS) in complying with proposed FCC regulations for adjacent band interference in the 1610.6-1613.8 MHz radio astronomy band. We measured one VLA antenna in September and anticipate measuring the Los Alamos VLBA antenna in October. We intend to present the results 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 September, we had shipped the release to 57 institutions, 19 by magnetic tape and 38 by electronic file copies. The improved installation procedures have generated complements from recipients of the system.

Many of the changes in AIPS during the last quarter were generated by our work on the VLBA, the VLA all-sky survey, and the DDT test package. AIPS task FITLD is the interface to the VLBA Correlator and continues to be upgraded to handle all of the varied outputs now coming from the Correlator. Testing and early data reduction for the sky survey has led to numerous, mostly small, improvements and corrections throughout the imaging and calibration software. Of particular interest is the option added to WFCLN to re-scale the residual image after deconvolution before the components are restored. This is needed to make the units of the residual and the components the same. The survey forced us to increase sharply the number of sources allowed in an AIPS file. It also caused us to improve and extend two tasks originally submitted to us by Walter Jaffe (Leiden). These are SAD, which finds, fits, and removes sources from images, and CCNTR which plots the results.

The DDT test is used to confirm the correctness of AIPS programs over time and differences in computer architecture and to measure the performance of computers. It was revised to use CALIB for the self calibration step rather than the obsolete ASCAL. A very large number of other changes were triggered by this, beginning with corrections to the handling of rotations and shifts in imaging, particularly in the subtraction of source models. Small bugs in the gridding, Fourier transforming, and beam fitting were also corrected. Imaging routines were given a user-controlled parameter to limit the area of the uv plane actually used and deconvolution routines were given a finer histogram and a user-set parameter to control the number of pixels searched for components in any major cycle. These changes have improved the speed and accuracy of the

imaging and deconvolution, at least when used correctly. All AIPS tasks which use the pseudo array processor now take advantage of as much of that memory as they can use profitably with limitations which can be set at run time.

The real-time version of FILLM has been released to allow users to load their data into AIPS at the VLA and AOC while the observations are proceeding. Task IBLED now handles small amounts of data nicely, allowing users a clearer view of the samples which need deletion. Two new verbs were added to manipulate history files: HITEXT writes history to a user-selected text file and STALIN "sends lines of history to Siberian salt mines." The POPS language processor was changed to allow verbs to be defined at run time and to find adverb values symbolically rather than through lists set at compile time. These changes mean that the users should never have to discard their old procedures and other POPS environment to pick up new verbs and adverbs. POPS can now handle long string adverbs correctly. And tasks run in batch mode now execute at an appropriately low priority.

M. AIPS++

We had intended to make an initial beta release of our infrastructure libraries on October 1st. The bad news is that we will unfortunately not be able to make this date. The good news is that we will almost certainly be able to make the release during October, which is still well within our originally projected dates. Work towards this goal has imposed a good discipline upon the people who have contributed code. Much of the code written before the adoption of coding and documentation standards has been changed to comply with these standards.

The most difficult, unexpected problem was with the new release of the C++ compiler from Sun. We had to spend several man months working with the vendor and on our own to circumvent the problems. It seems at present that these problems are behind us.

We continue to make good progress on the infrastructure. The code management system has had significant improvements, including improved capabilities for individual programmers to develop code in their own environment. Work on FITS is still progressing well. The prototype FITS classes need to be more fully integrated into the rest of the AIPS++ environment, making greater use of the table and mathematics classes. There has been significant progress on the design of a general command line interface. This was done as an independent prototype; work is in progress to integrate this more fully into the rest of AIPS++.

We have made some progress on the astronomical design relating to the processing of observing data and it's subsequent calibration. Unfortunately, we have not made as much progress as we had hoped. Most of the delay was attributable to a longer than expected learning time plus the lack of expected manpower available from the other consortium members. We intend to hold a two-day technical workshop in Socorro at the beginning of October to review progress to date in this area.

N. SOCORRO COMPUTING

In the online systems area, software support for the VLA All-Sky Survey and for referenced pointing is essentially complete. More attention can now be focused on software development for the new VLA correlator controller. In addition, we are evaluating SCSI disk subsystems for the Modcomp computers. If successful, this will allow us to reduce our dependence on aging disk technology and migrate to more modern storage which could also be used in future VLA real-time systems.

Work is continuing with the new online documentation system described in the last report. We have begun testing with selected external sites for feedback in such areas as locating items of interest, clarity of the documentation, and ease of use of the overall system. We expect to make this system generally available to our user community by the end of October.

Real-time filling of VLA data is now available to observers at the AOC. Before it can be made accessible elsewhere, a number of issues (such as privacy of the data) will need to be resolved.

This summer the AOC began initial preparations for migrating the Sun workstations to Sun's new operating system, Solaris 2. Extensive learning, planning, and preparation by system administration staff is necessary to ease the transition from our users' perspective, and it is likely to be several months before the migration actually happens. AIPS is already supported under Solaris 2.2.

We are taking advantage of this major change to coordinate system configuration with the other NRAO sites, with the goal of minimizing the cross-site differences in the new Solaris environment. This will not only make it easier for NRAO staff and visitors to use the computers at different sites, but also will allow us to collaborate on system support and reduce duplication of effort.

O. GREEN BANK TELESCOPE PROJECT

Antenna

Schedule — In response to NRAO's request for a recovery schedule to bring the GBT back to the original delivery date, Radiation Systems, Inc. (RSI) has responded that the delay in completing the rotating structure design has had a serious impact on detailing, procurement, fabrication and installation of the remainder of the GBT. After considering and incorporating a number of options to recover the lost time, including adding manpower and extra shifts during fabrication and installation and revising manufacturing and installation procedures, RSI believes that the one year slip reflects the best realistic timetable for completion of the GBT. NRAO is continuing to review the proposed delay and its impact on the overall project, and is working with RSI to seek ways to minimize the schedule slippage.

Design — The optimized structure design was nearing completion at the end of the quarter. Indications were that the final model will be within specification and will be improved over the unoptimized model in areas of weight, pointing and surface accuracy. Work also continued on the detailed joint analysis in the rotating structure. Sample joints in the elevation wheel and box were being detailed for fabrication and evaluation. The analysis of the elevation shaft was completed during the quarter.

Construction — Welding on the first three levels of the alidade was near completion, including the alidade corner members which would complete the connection of the alidade lower levels to the wheel assemblies, allowing the structure to be rotated in the near future. Preparations were being made to remove the shoring towers which supported the alidade during the erection/welding process.

The lower levels of the alidade stair tower, man-lift and alidade loading platform were installed. The generator/motor generators were placed into position on Level 1. Assembly of the cryogenics room was begun. Work began on the electrical installation on the alidade, including the main power supply and power switchover.

Active Surface and Pointing (Open Loop)

A subsystem to monitor and control various parts of the active surface control system has been designed and constructed. The system includes power supply monitoring and control, actuator temperature monitor circuits, watchdog timers, and emergency stop interfaces. It awaits software development for testing. A board which interfaces actuator cables to motor drive and LVDT read-out modules, and provides transient suppression was evaluated; many small changes were required, so a revised drawing has been completed. In order to evaluate a prototype supply and supply distribution system, 96 actuators were connected to the recently completed test set. They were run simultaneously while transient responses and voltage drops were recorded. These tests showed that the existing design worked well.

Progress of the actuator and motor vendors continued to be monitored. The first 16 of the retrofitted actuators were shipped August 24. A detailed schedule for the balance was prepared and agreed to by the vendors.

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

Active Surface and Pointing (Closed Loop)

This period has seen the completion of the ordering of the major components needed for the production of 20 rangefinders. The cost is well within the initial estimates. A fourth axis for the Green Bank mill has been delivered and is operational. This will greatly aid the mass production of the rangefinders.

The establishment of the calibration range that will be used for the absolute calibration of the rangefinders is progressing well and has become the focus of activity for the group.

A major step forward in the software effort occurred with the implementation of the algorithms required to transform the individual rangefinder co-ordinate systems to the external 3-dimensional coordinates. This is an essential step for the pointing and surface implementation of the laser system on the GBT.

Work resumed on the active surface panel test. The panel assembly was modified to more accurately represent the system that will be used on the GBT. Also, the metrology rangefinders are now being addressed over Ethernet and the software system is steadily evolving towards the system that will be used on the GBT. The next demonstration should be very close to the system needed for the high speed measurement of the surface.

Servo

Effort in this area consisted of monitoring the progress of the servo contractor RSI/Precision Controls Division (PCD). Progress in both hardware and software is approximately in line with the new schedule with a few exceptions. A bothersome development was the failure of the 60 hour burn-in test by all motors due to overheating. The motor vendor identified a design error, and is modifying the motors to meet specifications. This will cause a 1 month delay in the completion of the 60 hour burn-in, but will have very little ripple effect. PCD plans to test the as-built Prime Focus Feed mechanism to derive the parameters from it, as well as to test various pieces of hardware and software. A similar approach may be utilized for the other mechanisms. RSI/PCD has recently revamped its schedule to take into account its production capabilities and the slippage in the overall telescope schedule. The new schedule calls for factory sell-off in February 1994.

Electronics

LO and IF System — Circuit cards for the IF MCB Interface were wrapped and assembly of the module began. Units to be evaluated for the second system LO and for the analog fiber optic links were ordered.

Receivers — Wiring of the receiver cardcages for the 8-10 and 12-15.4 GHz receivers neared completion. Assembly and fit-up of the dewars continued. Drawings for the 3.95-5.85 GHz feed assembly were completed and submitted for fabrication. Fabrication of the 680-920 MHz feed horn is approximately 50% complete.

HFSS simulation of the 3.95-5.85 GHz OMT coaxial probes and ridge terminations was used to attempt to improve the probe match. Fabrication of the OMT neared completion.

Backends — Circuit design for the continuum receiver proceeded during the period. Segments of a control program were written and tested with portions of the VME interface circuitry. Circuit design for the 256K channel spectrometer continued.

Other — Shop acceptance tests of the Feed Turret were witnessed at the fabrication subcontractor. The subreflector positioner and prime focus boom were also viewed under construction in the subcontractor shop.

The turret cable wrap has been assembled and operates satisfactorily. Wear tests are underway.

Equipment layouts were done for the Receiver Room fixed racks, and fabrication drawings were submitted to the shop.

Monitor and Control

Generic Control Software — The first test for a generic approach for building connections between screen components and panel control parameters was a success. We are now confident that we can greatly reduce our effort for writing software for specific devices and digital interfaces for the telescope.

Spectral Processor — Two controllers need to be written for the Spectral Processor upgrade and port to the GBT. Work continued on both. The generic control software described above is being used.

140 Foot Telescope Test — Communication between a single-board computer and the 140 Foot Telescope's Honeywell 316 computer were developed and tested during the summer maintenance shutdown. This means the two computers are able to exchange information packets. The definition and format of the packets to be used during the test are being agreed upon.

Data Analysis

Progress was made on gridding single dish data, writing simple FITS binary tables, and a Motif version of the table browser. The program to take SD-FITS line data and grid it into an Aips++ data array was completed. For simulating data sets a very simple class for writing FITS binary tables and for reading such tables was written. As an exercise to compare the Motif and Interviews libraries, a Motif based table browser was written.

Also, the AIPS++ development environment in Green Bank was maintained. In particular the Aips++ account was moved to a more general SUN IPX used for data analysis. Khoros and other data processing systems were also moved. Two software products were reviewed: the new version of PV-Wave with the combined IMSL library and a data visualization program from IBM called Data Explorer. PV-WAVE and possibly Data Explorer will be available on the GBT data analysis system.

P. PERSONNEL

New Hires

C. Heiles	Visiting Scientist	07/01/93
M. Leach	Visiting Elec. Engineer I	07/12/93
A. Novikov	Visiting Elec. Engineer I	07/12/93
C. Barnbaum	Research Associate	08/01/93
P. Palmer	Visiting Scientist	08/01/93
R. Simon	Asst. Director, Computer Systems	08/30/93
B. Marcks	Head, MIS Division	09/07/93

Terminations

C. Carilli	Research Associate	08/20/93
P. Palmer	Visiting Scientist	08/31/93
J. Zhao	Research Associate	06/29/93
J. Lamb	Electronics Engineer I	09/24/93
G. Croes	Asst. Director, Computer Systems	07/31/93
P. Koppang	Electronics Engineer I	08/06/93
C. Heiles	Visiting Scientist	07/31/93

Change in Title

D. Frail	to Assistant Scientist	07/01/93
P. Napier	to Scientist	07/01/93
R. Norrod	to Head/ Green Bank Electronics	08/01/93
R. Perley	to Scientist	08/23/93

Other

J. Porter	transfer from Green Bank to Socorro	08/01/93
R. Perley	return from Leave for Professional Advancement	08/23/93

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