NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

July 1 - September 30, 1990

TABLE OF CONTENTS

A. TELESCOPE USAGE

The following telescopes have been scheduled for research and maintenance in the following manner during the third quarter of 1990.

	140-ft	12-m	VLA
Scheduled observing (hrs)	1884.00	247.75	1628.9
Scheduled maintenance and equipment change	220.00	6.00	267.1
Scheduled tests and calibrations	96.00	1954.25	318.2
Time lost	59.25	54.75	104.2
Actual observing	1824.75	240.75	1524.7

B. 140-FOOT OBSERVING PROGRAMS

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B-493	Bania, T. (Boston) Rood, R. (Virginia) Wilson, T. (MPIR)	Measurements at 8.666 GHz of the $^3He^+$ abundances in the interstellar medium.
B-531	Bell, M. (Herzberg) Seaquist, E. (Toronto)	Search for HI recombination lines in absorption against the nuclear continuum of selected NGC sources.
B-533	Bell, M. (Herzberg) Seaquist, E. (Toronto)	Observations of OH and HCS at 5 cm to examine the dust lane and nuclear region of Cent A.
B-538	Bell, M. (Herzberg) Feldman, P. (Herzberg) MacLeod, J. (Herzberg) Watson, J. (Herzberg) Seaquist, E. (Toronto)	Study at discrete frequencies, over the range 4.7 to 6.3 GHz, hydrogen recombination lines with high delta n values.
C-260	Clark, F. (AFGL) Day, J. (Kentucky)	Observations in an attempt to detect atmospheric OH at 6.035 GHz.
G-310	Giovanelli, R. (NAIC) Haynes, M. (Cornell) Freudling, W. (Cornell) Miller, B. (Washington)	Search for intergalactic HI clouds.
L-246	Lockman, F. J. Savage, B. (Wisconsin)	Observations of hydrogen toward QSOs.

No.	Observer(s)	Program
R-247	Richter, O.-G. (STScI) Sackett, P. (Pittsburgh) Sparke, L. (Wisconsin)	HI survey of polar ring galaxies.
V-68	Verschuur, G. (unaffiliated)	Zeeman effect measurements at 21 cm in regions of Cirrus and CO emission.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
B-484	Backer, D. (Berkeley) Foster, R. (Berkeley)	Timing observations at 800 and 1330 MHz of millisecond pulsars.
T-265	Taylor, J. (Princeton) Stinebring, D. (Oberlin) Dewey, R. (JPL) Nice, D. (Princeton) Thorsett, S. (Princeton) Arzoumanian, Z. (Princeton)	Pulsar timing observations over the range 800-840 and 1330 MHz.

The following very long baseline programs were conducted, and the stations used for the observations are coded as follows:

A - Arecibo 1000 ft
B - Effelsburg, MPIR 100 m
Dm - Goldstone 210 ft 64 m
Ds - Madrid DSN 210 ft 64 m
Fn - Fairbanks NASA 85 ft
G - Green Bank 140 ft
H - Hat Creek 85 ft
Jb - Jodrell Bank 250 ft
Km - Haystack 120 ft
Kp - Kitt Peak 25 m
Kw - Westford 18 m
Lm - Medicina 32 m
Na - NASA Goldstone 12 m
No - Noto, Sicily 32 m
O - Owens Valley 130 ft
Pt - Pietown 25 m
R - Crimea, USSR 30 m
So - Onsala 25 m
Sn - Onsala 20 m
T - Torun 15 m
U - USNO Richmond, FL 60 ft
VLBA - All available VLBA 25 m
Wn - Westerbork n=1-14x26 m
Yn - Socorro n=1-27x25 m

No.	Observer(s)	Program
AH-52V	Browne, I. (Manchester) Patnaik, A. (Manchester) Wilkinson, P. (Manchester)	Observations at 18 cm of 1750+50, a possible small gravitational lens, with telescopes B, Lm, So, Wn, Jb, Km, G, O, H, Y, and VLBA.

No.	Observer(s)	Program
AH-54V	Migenes, V. (Manchester) Patnaik, A. (Manchester)	Phase measurement tests at 2.8 cm of four selected sources, with telescopes B, Lm, No, R, Km, G, O, and Pt.
B-104V	Baath, L. (Onsala) Rantakyro, F. (Onsala) Okopi, J. (Onsala)	Comparison of high dynamic range maps of 3C 345, with telescopes B, Jb, Wn, So, Lm, Km, G, O, H, Y, and VLBA.
B-106V	de Bruyn, A. (NFRA) Wilkinson, P. (Manchester)	Studies at 18 cm of the age and kinematics of 41.9+58, a SNR in M82, with telescopes B, Wn, Lm, Jb, So, Km, G, O, and Y.
B-530V	Briggs, F. (Pittsburgh) Garwood, R. Baum, S. (NFRA) van Gorkom, J. (Columbia)	Fueling rates for radio galaxies: studies of infalling 21 cm hydrogen gas in absorption, with telescopes G, Yn, A, and Wn.
B-534V	Bartel, N. (CFA) Rupen, M. (CFA) Shapiro, I. (MIT) Preston, R. (JPL) Rius, A. (Inst. of Astronomy, Madrid)	Observations at 3.6 cm over a 3-day period in an attempt to make a movie of an exploding star, with telescopes B, Lm, Sn, DSS63, Km, G, Y, DSS14, OVRO, and NASA Fairbanks 85'.
C-267V	Clark, T. (NASA) Ryan, J. (NASA) Vandenberg, N. (Interferometrics) Ray, J. (Interferometrics) Kuehn, C. (Interferometrics)	Observations at S and X band to measure the stability of the North American Plate and to study its deformation along the western margin, with telescopes G, Kw, Fn, Na, and U.
D-14V	Diamond, P. Norris, R. (CSIRO) Booth, R. (Chalmers) Zensus, A.	Second epoch observations at 18 cm of the compact OH maser OH127.8-0.0, with telescopes B, Jb, Wn, So, Lm, Km, G, O, and Pt.
G-67V	Giovannini, G. (Bologna) Comoretto, G. (Arcetri) Feretti, L. (Bologna) Venturi, T. (Bologna) Wehrle, A. (Caltech)	Observations at 18 cm of the low luminosity radio galaxy NGC 315, with telescopes B, Wn, Jb, So, Lm, Km, G, O, Y, and VLBA.

No.	Observer(s)	Program
L-61V	Lonsdale, C. (Haystack) Lonsdale, J. (Caltech) Smith, H. (San Diego)	Search at 18 cm for compact radio cores in starburst galaxies, with telescopes B, G, O, Y, and Kp.
L-62V	Lazio, T. J. (Cornell) Cordes, J. (Cornell)	Measurements at 18 cm of angular broadening of extragalactic sources behind the Andromeda Nebula, with telescopes B, K, G, O, and Y.
M-110V	Mutel, R. (Iowa) Spangler, S. (Iowa)	Studies at 50 cm of the differential image wander of the compact double 2050+364, with telescopes B, Jb, Lm, Wn, G, O, and VLBA.
M-111V	Mutel, R. (Iowa) Jie, D. (Iowa) Phillips, R. (Haystack)	Monitoring at 2.8 cm of the radio core of BL Lac, with telescopes B, Lm, No, R, Km, G, O, H, Pt, and Sa.
M-114V	Marscher, A. (Boston) Zhang, Y. F. (Boston) Shaffer, D. (Interferometrics) Marcaide, J. (Astrofisica, Spain) Alberdi, A. (MPIR) Elosegui, P. (IAA, Grenada)	Observations at 2.8 cm of the peculiar superluminal 4C 39.25, with telescopes B, Lm, No, R, Km, G, O, H, and Pt.
M-119V	Matveyenko, L. (Space Res. Inst., USSR) Baath, L. (Onsala) Mantovani, F. (Bologna) Nesterov, N. (Space Res. Inst., USSR) Padriella, L. (Bologna) Rantakyro, F. (Onsala)	Observations at 50 cm of superluminal radio sources, with telescopes B, Jb, Lm, Wn, G, O, and VLBA.
M-297V	Menten, K. (CFA) Reid, M. (CFA) Moran, J. (CFA) Pratap, P. (CFA)	Observations at 1.6 cm of interstellar menthol and ammonia masers, with telescopes G, O, and Km.
P-106V	Preuss, E. (MPIR) Alef, W. (MPIR)	Observations at 18 cm of NGC 4151 with parsec/subparsec resolution, with telescopes B, Wn, Jb, So, Lm, Km, G, and Y.

No.	Observer(s)	Program
R-51V	Readhead, A. (Caltech) Wilkinson, P. (Manchester) Xu, W. (Caltech) Pearson, T. (Caltech) Lawrence, C. (Caltech) Herbig, T. (Berkeley)	Large scale snapshot survey at 18 cm of active galactic nuclei, with telescopes B, Lm, So, Wn, Jb, K, G, O, H, Y, and VLBA.
S-86V	Sakurai, T. (Iowa) Spangler, S. (Iowa) Cairns, I. (Iowa) Mutel, R. (Iowa) Armstrong, J. (JPL)	Reference observations at 18 cm for studies of density turbulence in the outer solar corona, with telescopes Km, G, O, Y, and VLBA.
S-88V	Sanghera, H. (Manchester) Browne, I. (Manchester) Fanti, C. (Bologna) Muxlow, T. (Manchester) Saikia, D. (TIFR) Spencer, R. (Manchester) Tzioumis, A. (CSIRO) Wilkinson, P. (Manchester)	Studies at 18 cm of selected steep spectrum sources, with telescopes B, Wn, Jb, So, Km, Km, G, O, Y, and VLBA.
U-19V	Unwin, S. (Caltech) Wehrle, A. (Caltech) Zensus, A.	Studies at 2.8 cm of the evolution of the parsec-scale jet in 3C 45, with telescopes B, Lm, No, Km, G, O, H, and Pt.
V-4V	de Vicente, P. (Yerbes) Alef, W. (MPIR) Romney, J. Kellermann, K.	Observations at 2.8 cm of the nucleus structure of 3C 84, with telescopes B, Lm, No, R, Km, G, O, H, and Pt.
W-59V	Wehrle, A. (Caltech) Unwin, S. (Caltech)	Studies at 18 cm of the parsec-scale morphologies of high and low redshift quasars, with telescopes B, Jb, Wn, So, Lm, R, T, Km, G, O, Y, and VLBA.

C. 12-METER TELESCOPE

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
S-338	Sage, L. (MPIR) Henkel, C. (MPIR) Mauersberger, R. (IRAM)	Study of the abundance of ^{13}C in nearby galaxies.

No.	Observer(s)	Program
S-339	Sage, L. (MPIR) Henkel, C. (MPIR) Mauersberger, R. (IRAM)	A search for rare molecules in nearby galaxies.
W-274	Walker, C. (Caltech) Black, J. (Arizona)	A search for vibrationally-excited CS toward young stellar objects.

D. THE VERY LARGE ARRAY

No.	Observer(s)	Program
AA-108	Anderson, M. (Minnesota) Rudnick, L. (Minnesota) Perley, R.	The time evolution of SNR Cassiopeia A. 6 and 20 cm.
AA-112	Anantharamaiah, K. (Raman Inst.) Goss, W. M.	Recombination lines from NGC 253. 3.5 cm line.
AA-114	Aller, H. (Michigan) Aller, M. (Michigan) Bregman, J. (Michigan)	X-ray/radio variability in active galactic nuclei (with ROSAT). 2 cm.
AA-115	Aschwanden, M. (NASA-GSFC) Bastian, T. Benz, A. (SFIT, ETH)	VLA/VLBA/PHOENIX observations of decimetric solar radio bursts. 20 and 90 cm.
AA-116	Alexander, P. (Cambridge) Crane, P. Wilding, T. (Cambridge) Pooley, G. (Cambridge)	Star formation in nine late-type galaxies. 3.8 and 20 cm.
AB-414	Becker, R. (Calif., Davis) White, R. (STScI)	Monitoring radio stars HD193793 and P Cygni. 2 and 6 cm.
AB-456	Burke, B. (MIT) Hewitt, J. (Haystack) Roberts, D. (Brandeis)	Monitoring Lens 0957+561. 6 cm.
AB-562	Barvainis, R. (Haystack) R. Antonucci, (Calif., Santa Barbara)	A new continuum component in radio quiet quasars. 2 cm.
AB-564	Baum, S. (NFRA) Garwood, R. Briggs, F. (Pittsburgh) van Gorkom, J. (Columbia)	Circumnuclear HI absorption for radio galaxies. 20 cm phased array VLB.

No.	Observer(s)	Program
AB-571	Baudry, A. (Bordeaux Obs.) Jacq, T. (Bordeaux Obs.) Walmsley, C. M. (MPIR) Henkel, C. M. (MPIR) Schulke, P. (MPIR)	HDO absorption in NGC 7538 IRS1. 1.3 cm line.
AB-572	Baudry, A. (Bordeaux Obs.) Brouillet, N. (Bordeaux/MPIR) Klein, U. (MPIR, Bonn) Henkel, C. (MPIR, Bonn) Jacq, T. (Bordeaux Obs.)	H_2O maser activity in the inner nucleus of M82. 1.3 cm line.
AB-573	Becker, R. (Calif., Davis) Helfand, D. (Columbia) White, R. (STScI)	A sample of O-stars from a survey of the galactic plane. 6 cm.
AB-579	Bookbinder, J. (CFA) Linsky, J. (Colorado) Brown, A. (Colorado) Fleming, T. (MPIfEP, Garching) Bromage, G. (Rutherford Appleton)	Monitoring M dwarfs during the ROSAT all-sky survey. 3.8, 6, and 20 cm line.
AC-256	Capetti, S. (Torun) Ferrari, A. (Torun) Massaglia, S. (Torun) Trussoni, E. (Torun) Morganti, R. (Bologna)	Knots in low luminosity radio galaxy jets. 6 cm.
AC-259	Carilli, C. (CFA) Perley, R. Dreher, J. (NASA/Ames)	Cygnus A. 1.3 cm.
AC-270	Cowan, J. (Oklahoma) Branch, D. (Oklahoma)	Intermediate age supernovae 1957D and 1950B in M83. 20 cm.
AC-278	Carilli, C. (CFA) Ho, P. (CFA)	Two nuclear starburst galaxies. 20 and 90 cm.
AC-279	Carilli, C. (CFA) van Gorkom, J. (Columbia)	HI observations of two quasar-galaxy pairs. 20 cm line.
AC-280	Carral, P. (NASA/Ames) Keto, E. (Caltech)	Recombination lines in ultra-compact HII regions G34.3+0.2 and G5.8-0.4.1.3 line.

No.	Observer(s)	Program
AC-281	Condon, J. Helou, G. (Caltech) Sanders, D. (Hawaii) Soifer, B. (Caltech)	UGC 12914/5 collision. 20 cm line.
AC-282	Corbelli, E. (Cornell) Schneider, S. (Massachusetts)	HI absorption by NGC 4651 in the quasar 3C 275.1. 20 cm line.
AD-188	Drake, S. (SASC) Simon, T. (Hawaii) Florkowski, D. (USNO) Stencel, R. (Colorado) Bookbinder, J. (CFA)	Variability of M supergiants: Alpha Orionis. 2 and 6 cm.
AD-244	Dey, A. (Berkeley) van Breugel, W. (Caltech)	Images of radio-loud far-infrared galaxies. 6 cm.
AD-251	de Pater, I. (Berkeley) Dickel, J. (Illinois)	Saturn's atmosphere. 3.8 cm.
AD-252	de Pater, I. (Berkeley)	Jupitor patrol. 20 cm.
AD-254	Dey, A. (Berkeley) van Breugel, W. (Caltech)	Radio-loud, far-infrared galaxies. 20 cm.
AD-255	Dressel, L. (ARC) Gallagher, J. (AURA, Inc.)	Spectral indices of sources in blue compact galaxies. 20 cm.
AE-064	Elias, N. (Pennsylvania)	Serpentid binary star V367 Cygni. 3.5 cm.
AE-067	Erickson, W. (Tasmania) Jacobson, A. (UCLA)	Ionospheric structure. 90 cm.
AE-068	Elias, N. (Pennsylvania)	Detection of more Serpentids. 6 and 3.8 cm.
AE-069	Elias, N. (Pennsylvania) Dorren, J. D. (Pennsylvania)	Stars with highly active chromospheres (with Rosat). 2, 3.8, 6, and 20 cm.
AF-177	Felli, M. (Arcetri) Churchwell, E. (Wisconsin)	Nonthermal emission from Theta Ori A. 3.5 and 2 cm.
AF-186	Fernini, I. (New Mexico) Burns, J. (New Mexico State) Bridle, A. Perley, R.	Jet/counterjet ratios in RGs. 6 cm.

No.	Observer(s)	Program
AF-188	Feretti, L. (Bologna) Bettoni, D. (Padova Observatory)	Galaxies with kinematical evidence of recent mergers. 20 cm.
AF-190	Fomalont, E. van Gorkom, J. (Columbia) van Breugel, W. (Caltech) Ekers, R. (CSIRO)	Fornax A. 20 cm line.
AF-194	Frail, D. Seaquist, E. (Toronto) Bode, M. (Preston Poly.)	Search for non-thermal remnant of old Nova V732Sgr (1940). 6 and 20 cm.
AF-197	Feretti, L. (Bologna) Giovannini, G. (Bologna)	Cluster radio galaxies of small size. 6 and 20 cm.
AF-198	Frail, D. Kulkarni, S. (Caltech)	A possible PSR/SNR association. 20 cm.
AF-199	Frail, D. Hjellming, R.	A kinematic distance to LSI+61°303. 20 cm line.
AF-201	Fernini, L. (New Mexico) Burns, J. (New Mexico State)	Depolarization asymmetry in radio galaxies. 3.8 cm.
AF-202	Fey, A. (NRL) Gaume, R. (NRL) Claussen, M. (NRL) Johnston, K. (NRL)	Cometary HII region candidates. 1.3, 6, and 20 cm line.
AF-203	Fomalont, E. Kellermann, K. Windhorst, R. (Arizona State) Kristian, J. (MWaLCO)	Spectral indices of sources in the deep field at 1416+52. 20 cm.
AF-204	Fomalont, E. van Breugel, W. (Caltech) Ekers, R. (CSIRO)	Fornax A: spectral index, depolarization, rotation measure. 6 cm.
AF-205	Fruchter, A. (DTM/Carnegie) Goss, W. M.	Eclipse of PSR 1957+20. 90 cm.
AF-206	Fruchter, A. (DTM/Carnegie) Goss, W. M.	Spectral indices of globular cluster sources; detect diffuse emission. 6 and 20 cm.

No.	Observer(s)	Program
AH-295	Habing, H. (Leiden) Goss, W. M. Winnberg, A. (Onsala) van Langevelde (Leiden)	Monitoring OH/IR stars at the galactic center. 20 cm line.
AH-364	Hunt, G. Patnaik, A. (Manchester) Salter, C. (TIFR) Shaver, P. (ESO)	High surface brightness SNRs and SNRs with "blow-outs." 90 cm.
AH-384	Halpern, J. (Columbia) Helfand, D. (Columbia)	An X-ray pulsar in the nearest molecular cloud. 3.8 and 20 cm.
AH-390	Hjellming, R. Gehrz, R. (Minnesota) Taylor, A. (Calgary) Seaquist, E. (Toronto)	Resolving radio novae. 3.8, 6, and 20 cm.
AH-400	Hanisch, R. (STScI) Miley, G. (Leiden) Rottering, H. (Leiden) de Jong, J. (Leiden)	Rich X-ray cluster Abell 2256. 90 cm.
AH-403	Hill, G. (Texas)	A complete sample of UT radio sources. 6 cm.
AH-404	Hamilton, T. (Columbia) Helfand, D. (Columbia)	The Einstein Eridanus deep survey field. 20 cm.
AH-406	Hines, D. (Texas) Wills, B. (Texas) Cutri, R. (Arizona)	Radio structure and spectra of IRAS QSOs. 3.8, 6, and 20 cm.
AH-407	Ho, P. (Harvard) Ishiguro, M. (Nobeyama) Kawabe, R. (Nobeyama) Okumura, S. (Nobeyama) Turner, J. (UCLA)	Synchroton emission in three nearby normal spiral galaxies. 20 cm.
AH-411	Ho, P. (Harvard) Haschick, A. (Haystack)	The possibly collapsing core of G10.6-0.4. 1.3 cm line.
AJ-184	Jackson, J. (MPIfEP, Garching) Eckart, A. (MPIfEP, Garching)	NH_3 absorption toward Centaurus A. 1.3 cm line.

No.	Observer(s)	Program
AJ-186/ AJ194	Johnston, H. (Caltech) Kulkarni, S. (Caltech) Goss, W. M. Cornwell, T. Perley, R.	Deep imaging of globular clusters 20 and 90 cm.
AJ-190	Jackson, N. (Manchester) Browne, I. (Manchester) Shone, D. (Manchester) Clarke, D. (New Mexico)	Structure and polarization of 0800+608. 3.8 cm.
AJ-191/ AJ-192/ AJ-193	Jauncey, D. (CSIRO) Jones, D. (JPL) Meier, D. (JPL) Murphy. D. (JPL) Preston, R. (JPL) Perley, R. Rao, P. (TIFR) Tzioumis, A. (TIFR) Muxlow, T. (TIFR) Patnaik, A. (TIFR)	Monitoring possible Einstein ring 1830-211. 3.6 cm. 15 and 22 GHz observations of a possible Einstein ring. 1.3 and 2 cm. Mapping of the field around a Einstein ring. 6 cm.
AK-240	Kapahi, V. (TIFR) McCarthy, P. (MWaLCO) van Breugel, W. (Caltech) Subrahmanya, C. (TIFR) Hunstead, R. (Sydney)	Quasar with twin jets. 3.5 and 20 cm.
AK-245	Kundu, M. (Maryland) Schmahl, E. (Maryland) White, S. (Maryland) Gopalswamy, N. (Maryland)	Studies of solar active regions and flares. 3.8, 6, and 20 cm.
AK-249	Klein, U. (MPIR) Brinks, E. Skillman, E. (Minnesota)	Low frequency spectral indices of compact dwarfs. 20 and 90 cm.
AK-252	Kapahi, V. (TIFR) Athreya, R. (TIFR) Subrahmanya, C. (TIFR) van Breugel, W. (Caltech) McCarthy, P. (MWaLCO)	Intermediate strength un-identified Molongolo sources. 6 cm.
AK-254	Keto, E. (Caltech) Proctor, D. (Caltech)	Mass inflow onto an IR point source: G34.3+0.2. 1.3 cm line.

No.	Observer(s)	Program
AK-256	Kollgaard, R. (Lafayette College) Holdaway, M. Wehrle, A. (Caltech)	The halo of 0106+013. 3.8, 6, and 20 cm.
AL-150	Lestrade, J.-F. (JPL) Preston, R. (JPL)	Statistical properties of RSCVn stars. 6 cm.
AL-219	Lang, K. (Tufts) Leeson, W. (Tufts) Willson, R. (Tufts)	Isolated white dwarf stars with mega-gauss magnetic fields. 6 cm.
AL-221	Lang, K. (Tufts) Leeson, W. (Tufts) Willson, R. (Tufts)	Narrow-band features in solar active regions. 20 cm.
AL-222	Lang, K. (Tufts) Willson, R. (Tufts) Trottet, G. (Paris Obs.) Kerdraon, A. (Paris Obs.) Benz, A. (SFIT, ETH)	Solar bursts in space, time, and frequency 20 and 90 cm.
AL-223	Lang, K. (Tufts) Leeson, W. (Tufts) Willson, R. (Tufts) Gelfreikh, G. (Pulkovo Obs.) Bogod, V. (USSR Acad. of Sci.)	Solar maps at the time of the July 22 solar eclipse. 2, 3.8, 6, and 20 cm.
AL-226	Lacy, M. (Cambridge) Warner, P. (Cambridge) Rawlings, S. (Cambridge) Saunders, R. (Cambridge)	A faint source sample selected at 38 MHz. 6 and 20 cm.
AL-227	Liszt, H. Quintana, H. (Catolica)	Mapping of dumbbell (DB) galaxies.
AM-290	Menon, T. K. (British Columbia)	Structure of interacting galaxies. 6 cm.
AM-296	Murphy, D. (JPL) Perley, R.	Flip-flop superluminals? 20 cm.
AM-297	Murphy, D. (JPL) Perley, R.	Where is the counter jet in 3C 273? 20 cm.
AM-298	Mitchell, D. (Berkeley) de Pater, I (Berkeley)	Sub-surface imaging of Mercury. 3.8, 6, and 20 cm.

No.	Observer(s)	Program
AM-301	Menard, F. (IAP, Paris) Puche, D.	Exciting sources of reflection nebulae. 1.3 and 3.8 cm.
AM-303	Malkan, M. (UCLA) Baganoff, F. (UCLA)	X-ray/radio variability of active galactic nuclei (with ROSAT). 3.8 cm.
AM-305	Molnar, L. (Iowa) Mutel, R. (Iowa) Deng, J. (Iowa)	Interstellar scattering in the Cygnus X region. 3.6, 18, and 20 cm.
AM-306	Muhleman, D. (Caltech) Grossman, A. (Caltech) Butler, B. (Caltech) Slade, M. (JPL)	Radar observations of Titan and Saturn's rings. 3.8 cm line.
AM-307	McHardy, I. (Oxford) Lehto, H. (Oxford) Branduari-Raymont, G. (U. College London) Mason, K. (U. College London)	The ROSAT X-ray deep survey area. 20 cm.
AM-308	McHardy, I. (Oxford) Callanan, P. (Oxford) Lehto, H. (Oxford)	Globular cluster X-ray sources. 3.8, 6, and 20 cm.
AN-054	Norris, R. (CSIRO) Roy, A. (Sydney) Allen, D. (AAU) Sramek, R.	Cool but extremely luminous far-infrared galaxies. 3.8 and 20 cm.
AO-088	Owen, F. Eilek, J. (NMIMT)	Observations of M87. 3.8 cm.
AO-098	Owen, F. Perley, R.	B3 classical doubles. 3.8 cm.
AP-183	Pedlar, A. (Manchester) Axon, D. (Manchester) Baum, S. (Manchester) O'Dea, C. (Manchester) Unger, S. (RGO)	NGC 4151. 3.8 and 6 cm.
AP-184	Pedlar, A. (Manchester) Collison, P. (Manchester) Saikia, D. (TIFR) Axon, D. (Manchester) Unger, S. (RGO)	Hot spot galaxy NGC 1808. 3.8 cm.

No.	Observer(s)	Program
AP-189	Parijskij, Y. (Leningrad) Soboleva, N. (Leningrad) Temirova, A. (Leningrad) Goss, W. M.	Sources from a RATAN-600 survey. 20 cm.
AP-196	Puche, D. Brinks, E. Westpfahl, D. (NMIMT)	Structure of the ISM in nearby dwarf galaxies. 20 cm line.
AP-203	Phillips, R. (Haystack) Ambruster, C. (Haystack)	Young G star HD82558. 3.8 and 20 cm.
AR-221	Rodriguez, L. (UNAM) Moran, J. (CFA) Curiel, S. (CFA)	Study of the remarkable triple source in Serpens. 6 cm.
AR-222	Roland, J. (IAP, Paris) Fraix-Burnet, D. (IAP, Paris) Mellier, (IAP, Paris) Soucail, G. (IAP, Paris)	Study of an optical jet. 6 cm.
AR-223	Rudnick, L. (Minnesota) Anderson, M. (Minnesota) Meisenheimer, K. (MPI Heidelberg) Roser, H. (MPI Heidelberg)	Testing Fermi-acceleration models for 3C33 south. 2 cm.
AR-227	Rupen, M. (CFA) Condon, J.	A search for radio supernovae in nearby galaxies. 6 cm.
AR-228	Roberts, D. (Oklahoma) van Gorkom, J. (Columbia) Goss, W. M. Leahy, P. (Manchester)	Recombination line observations of Sgr A West. 3.8 cm line.
AR-229	Ratner, M. (CFA) Lebach, D. (CFA) Barthel, N. (CFA) Shapiro, I. (CFA)	Reference star search for the NASA gyroscope relativity experiment. 3.8 cm.
AR-230	Rawlings, S. (Cambridge) Alexander, P. (Cambridge) Eales, S. (Toronto)	Radio galaxy 6C 1232+39 at z = 3.22. 3.8 and 6 cm.
AR-231	Reid, M. (CFA) Menten, K. (CFA)	"Light curves" for Mira variables. 3.8 cm.
AR-232	Reynolds, S. (NC State)	Small-scale structure in young supernova remnants. 20 cm.

No.	Observer(s)	Program
AS-333	Sramek, R. Weiler, K. (NRL) van der Hulst, J. (NFRA) Panagia, N. (STScI)	Statistical properties of radio supernovae. 2 and 6 cm.
AS-411	Skinner, S. (Colorado) Brown, A. (Colorado) Linsky, J. (Colorado)	Properties of four Herbig Be stars. 2, 3.8, 6, and 20 cm.
AS-414	Szomoru, A. (Kapteyn) van Gorkom, J. (Columbia) Sancisi, R. (Kapteyn) Gregg, M. (Mt. Stromlo Obs.)	HI properties of void galaxies. 20 cm line.
AT-105	Taylor, G. (UCLA) Perley, R.	Spectral index and depolarization of Hydra A. 90 cm.
AT-107	Taylor, A. (Calgary) Goss, W. M. Coleman, P. (Kapteyn)	Sources from a WSRT galactic plane survey. 20 cm.
AT-108	Terlevich, R. (RGO) Brinks, E. Skillman, E. (Minnesota) Terlevich, E. (RGO)	Seyfert galaxy NGC 1068. 20 cm line.
AU-039	Urry, C. (STScI) Padovani, P. (STScI) White, R. (STScI)	Optically selected sample of BL Lac objects. 2, 6, and 20 cm.
AV-165	Velusamy, T. (TIFR)	CTB 80. 90 cm.
AV-176	van Breugel, W. (Caltech) McCarthy, P. (MWaLCO) Kapahi, V. (TIFR)	High redshift molonglo radio galaxies. 3.8, 6, and 20 cm.
AV-179	Veale, A. (Colorado) Linsky, J. (Colorado) Brown, A. (Colorado) Fleming, T. (MPIfEP, Garching) Neff, J. (NASA-GSFC) Schmitt, J. (MPIfEP, Garching) Rodono, M. (Catania Obs.) Byrne, P. (Rutherford Lab) Bromage, G. (Rutherford Lab)	3-D structure of RS CVn stellar atmospheres. 3.8, 6, and 20 cm.
AV-180	Viallefond, F. (Meudon)	Survey of spiral M101. 20 cm line.

No.	Observer(s)	Program
AV-181	van Gorkom, J. (Columbia) van der Hulst, J. (NFRA)	HI imaging of nearby galaxy Centaurus A. 20 cm line.
AW-230	Wrobel, J. Unger, S. (RGO)	Monitoring of the Seyfert NGC 5548. 3.5 line.
AW-249	Wills, B. (Texas) Shastri, P. (Texas)	Core variability in lobe-dominated quasars. 6 cm.
AW-251	Wilson, T. (MPIR) Johnston, K. (NRL) Henkel, C. (MPIR) Schilke, P. (MPIR) Walsmsley, C. (MPIR)	Ammonia maser in W51. 1.3 cm line.
AW-257	Wilkinson, P. (Manchester) Polatidis, A. (Manchester) Readhead, A. (Caltech) Xu, W. (Caltech) Pearson, T. (Caltech)	Caltech-Jodrell VLBI survey sources. 6 cm.
AW-258	Wagner, S. (MPI, Heidelberg) Appenzeller, I. (MPI, Heidelberg) Quirrenbach, A. (MPIR)	Jets and extended narrow line regions in Seyfert galaxies. 6 cm.
AW-260	Wannier, P. (JPL) Andersson, B. (JPL) Morris, M. (UCLA)	Warm HI halos around molecular clouds. 20 cm line.
AY-033	Yin, Q. Heeschen, D. Saslaw, W. (Virginia)	Likely starburst galaxies. 6, 20, and 90 cm.
AY-035	Yin, Q. Thuan, T. (Virginia)	Blue compact dwarf galaxies. 20 cm.
AY-037	Yusef-Zadeh, F. (Northwestern) Cornwell, T.	HH-like streamers in Orion. 3.8 and 6 cm.
AY-040	Yusef-Zadeh, F. (Northwestern) Morris, M. (UCLA)	Search for ultra-high velocity ionized gas from Sgr A*. 3.8 cm.
AZ-044	Zhao, J. (New Mexico) Ekers, R. (CSIRO) Goss, W. M. Lo, K. (Illinois) Narayan, R. (Arizona)	Flux density variations caused by RISS in Sgr A. 3.8, 6, and 20 cm.

No.	Observer(s)	Program
AZ-046	Zwarthoed, G. (Amsterdam) Penninx, W. (Amsterdam)	Four unclassified low mass X-ray binaries. 6 cm.

E. THE VERY LONG BASELINE ARRAY (INTERIM OPERATIONS)

No.	Observer(s)	Program
BB-002	Brown, R. Benson, J.	The apparent structure of Sgr A. 1.3 and 6 single antenna VLB.
BC-005	Conway, J. (Caltech) Vermeulen, R. (Caltech)	Phase connection VLBI. 6 cm single antenna VLB.
BM-004A	Molnar, L. (Iowa)	20 cm (with AM305).
BT-001	Taylor, G. (UCLA)	2 and 6 cm (with AS333 and AS414).
BV-002	van Langevelde, H. (Leiden) Diamond, P. Habing, H. (Leiden) Winnberg, A. (Onsala) Goss, W. M.	Distance to the galactic center using OH/IR stars. 18 cm phased array VLB.

The following VLBI observations were conducted with the VLA.

No.	Observer(s)	Program
VB-104	Baath, L. (Onsala) Rantakyro, F. (Onsala) Okopi, J. (Onsala)	3C 345 - comparison of high dynamic range maps at 18 cm. 18 cm single antenna VLBI.
VB-105	Bartel, N. (CFA) Rupen, M. (CFA) Shapiro, I. (CFA) Preston, R. (JPL) Rius, A.	Monitoring SN 1986J. 3.6 cm phased array MKIII VLB.
VB-106	de Bruyn, A. G. (NFRA) Wilkinson, P. (Manchester)	Age and kinematics of 41.9+58, a powerful SNR in M82. 18 cm phased array VLBI.
VAH-53	Wehrle, A. (Caltech)	18 cm single antenna.

F. SCIENTIFIC HIGHLIGHTS

Green Bank

Eclipsing Binary Pulsar in Terzan 5

Nice *et al.* (Princeton University) have observed the eclipsing millisecond binary pulsar 1744-24A at 800, 1330, and 1660 MHz. They find that the pulsar is eclipsed behind an 0.1 solar mass companion for up to half of each 109-minute orbit. They conclude that the companion's eclipsing region is much larger than its Roche lobe. The duration of the eclipse varies with observing frequency as ν^{β} with $\beta = -0.6$. Occasionally, the pulsed signal disappears entirely for several hours, that is, for times outside the known eclipse interval. After some of the anomalous disappearances, the pulse arrival times are delayed. This suggests that the disappearance may be caused by excess material in the vicinity of the binary system.

Timing Accuracy of Millisecond Pulsars

Backer and Foster (Berkeley) have continued to refine pulse arrival time measurements. On PSR1937+21, the rms accuracy over a five-day interval was ± 130 nanoseconds. This is the highest timing accuracy ever achieved at any telescope. After a set of pulsars has been monitored at several epochs to this accuracy, both solar system ephemerides will be improved and limits to the gravitational radiation remaining from the early universe will be lowered.

High Order Recombination Lines

Bell and colleagues (Herzberg Institute of Astrophysics) have detected hydrogen recombination lines near 6 GHz with Δn up to 15 in the HII regions, W51. At higher frequencies these lines may be detectable up to $\Delta n = 26$. Given the ability to measure line strengths over large ranges of both n and Δn, these investigations will help determine (1) departures from LTE in HII regions, (2) the importance of Stark effect, (3) comparisons of theoretical and observational oscillator strengths, and (4) precise values of electron density and temperature.

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

A prototype version of the 38-45 GHz amplifier using Linear Monolithics devices was built and tested. The noise performance of this amplifier was excellent. The measured receiver temperature at 41 GHz was 45 K, which corresponds to an amplifier

noise temperature of no more than 30 K if the losses at the amplifier input (dewar transition and associated waveguide) and the contribution of the mixer and IF amplifier at the output are taken into account.

Production and testing of 1.2-1.8 GHz, 12-18 GHz, 21-25 GHz, and 26-36 GHz amplifiers continued.

A summary of amplifier deliveries in this quarter is given in the table below:

FREQUENCY BANDS	NUMBER OF AMPLIFIERS	COMMENTS
1.2-1.8	14	
12-18	2	
21-25	9	8 refurbished with new devices
26-36	4	
38-45	1	New design
Grand Total	30	

This brings the total number of amplifiers delivered in the period January 1-September 30, 1990 to 76.

Superconducting (SIS) Millimeter-Wave Mixer Development

Millimeter-wave work this quarter in Charlottesville has focused largely on construction of front-end inserts for the new multi-band SIS receivers to be installed on the 12-meter telescope:

1.3-mm band: The original pair of 200-260 GHz inserts were destroyed following the failure of a vacuum window in Tucson. The two spare inserts have been shipped to Tucson, and the originals are being re-built.

3-mm band: Four 3-mm band inserts are now under test in Charlottesville, two for 68-90 GHz and two for 90-116 GHz, and should be shipped to Tucson in the next month. These all use the type-D WR-10 mixer, which is slightly modified for the lower band. An improved insert for the lower band, using a new WR-12 mixer, is under construction.

2-mm band: Mixers for the new 130-170 GHz receivers are almost ready for testing. The inserts are still being designed. The mixers will use SIS junctions designed for the 90-116 GHz band until proper junctions (now being designed) are available.

We have begun designing two new mask sets for SIS mixers to be fabricated at UVa. One will contain devices primarily for operation up to 200 GHz, including experimental *tunerless* mixers (i.e., requiring no mechanical tuning) for the 2- and 3-mm bands. The other mask set will include small chip and integrated (tunerless) designs for the 200-260, 260-310, and 330-360 GHz bands. It is hoped that tunerless mixers suitable for the 8-beam 230-GHz receiver will result from this work.

During this quarter we have built (or rebuilt) and tested a total of nine SIS mixers operating from 68-260 GHz.

Acousto-Optical Spectrometer Project:

Work on this project continued to be suspended during this quarter. It is expected that some part-time work will be done during the fourth quarter, mainly testing of modifications previously designed in an effort to improve stability. Current plans call for transferring the project to Tucson at the beginning of 1991.

OVLBI Earth Station Project

Work continued on the preliminary design and on refurbishing of the 45-foot antenna during this quarter. A 15 GHz room-temperature receiver with beam switching was built and tested. It is to be used for aperture efficiency tests of the re-aligned antenna.

Negotiations with NASA on the management of the project were nearly complete at the end of the quarter. A draft memorandum of understanding has been agreed upon in principle, and the provisions of a management plan have been discussed with JPL; the latter document is in preparation.

Efforts to recruit the technical design team were started at the end of the quarter.

I. GREEN BANK ELECTRONICS

Green Bank Telescope

A major project is underway to replace the collapsed 300-foot telescope with a state-of-the-art 100-meter class telescope. The Green Bank electronics division is supplying expertise to the design effort in a few areas.

Work continued on various aspects of the optics configuration. It was confirmed using ray tracing techniques that the antenna aperture illumination of the dual reflector gregorian system is identical to that of a symmetrical antenna, when the subreflector and feed tilt angles satisfy the Mizugutch condition. The design of a prototype prime focus feed for 800 MHz is nearing completion, and it is hoped that a model can be fabricated and tested during the coming quarter. An analysis of the field-of-view of several dual shaped reflector systems was completed and the results presented to the Scientific Working Group advisory committee. These results showed that, for reflector systems shaped for high on-axis gain, the antenna gain falls rapidly as feeds are placed off-axis. Because this effect makes the use of feed arrays difficult, and because the shaping for uniform aperture illumination also causes an increase in near sidelobe levels, the SWG consensus was that we should opt for reflector designs achieving broad field-of-view and low near sidelobes rather than extremely high on-axis gain.

Progress was also made in several areas of the active surface design. Bids for prototype quantities of position transducers and motors for the active surface have been evaluated and parts ordered. Electronics and mechanical hardware required for testing of these prototypes is being designed and debugged. Testing of a distance measuring system that may be used for pointing and surface measurement continues. Various techniques for analyzing the phase of the modulated laser return signal (proportional to incremental distance) are being considered. Also, long-term drift of the measured distance has been found to be largely due to electronics problems; these can be circumvented by measuring the phase of the outgoing light.

Interferometer Upgrade

The USNO is funding the upgrade of the Interferometer to improve their time-keeping capabilities. As part of this upgrade, the three antennas have been outfitted with cooled S/X receivers. Receivers for 327 MHz and 610 MHz have been added to the 85-3 antenna. The 85-3 telescope is operated as a VLBI terminal in conjunction with other USNO antennas and as a single dish pulsar timing antenna. The 85-1 and 85-2 antennas are operated as a connected interferometer to continue a long-term flux monitoring program. Another aspect of the upgrade is the provision of a data acquisition terminal for the VLBI data. This terminal will consist of a VLBA data acquisition rack, longitudinal recorder, and control computer.

Nine converters for the VLBA data acquisition rack were completed during the quarter. Ten more are being assembled. The rack control computers were tested, and initial system tests on the first system were completed. A test tape was sent to Haystack for evaluation. The system will be moved to the interferometer in the fall quarter.

140-foot Cassegrain Receivers

The current 140-foot cassegrain receiver systems use parametric upconverters and 18-25 GHz masers to cover the 5-25 GHz frequency range. A project is underway to replace the upconverters with HEMT amplifiers and to also extend the frequency range to greater than 30 GHz. The masers will be retained because of their significantly superior noise performance over current HEMT technology. The first step in this project is to redesign the LO for frequency flexibility to 35 GHz.

During this quarter testing of components for the LO system and 32 GHz upgrade continued. It is estimated that the upgrade to 32 GHz is 90 percent complete, with completion of this part of the project slated for winter 1990-91. The 32 GHz amplifiers have been installed in the existing dewars.

Spectral Processor

The Spectral Processor is a high time resolution spectrometer capable of producing two 40 MHz spectra each 25.6 μs. A fair amount of flexibility, in terms of bandwidth, number of channels, and averaging time is included to make the instrument useful for spectroscopy. It has special signal averaging capabilities built-in to facilitate its use as a pulsar back-end.

The final four baseband converters were completed during the quarter, giving the spectral processor a complement of eight plus a spare. Digital cards for the second rack were installed and tested in the system, completing the second FFT engine. The hardware in the system now produces 2048 spectral channels from various configurations of IF inputs with a maximum total input bandwidth of 80 MHz. Software to control the added capabilities is in the debug phase.

Miscellaneous

The second and third VLBA S-band receivers were completed during the quarter. Several subassemblies for the VLBA C-band receivers were built. The first VLBA 43 GHz receiver was shipped. Due to faulty commercial components, only one channel is available. Parts for several more 43 GHz receivers were ordered.

J. 12-METER ELECTRONICS

Receiver Status

90-115 GHz SIS Receiver. Owing to an unfortunate accident, this dual-channel receiver had to be repaired and modified during the quarter. As a result of an ice plug which formed during routine operation, the liquid helium tank used in the hybrid refrigerator ruptured. The receiver has been rebuilt with a closed-cycle 4K system and is now back in routine operation.

200-360 GHz Schottky Receiver. This receiver is unchanged since the last report. The various mixer pairs will be retired as the new SIS receivers come on line.

200-240 GHz SIS Receiver. This dual-channel receiver is scheduled for final tests on the telescope in October and will be in regular use for observers in November. In the laboratory, the measured receiver noise temperatures vary from 100 K DSB at 200 GHz to 130 K DSB at 240 GHz. We hope to improve these noise temperatures slightly in the future.

New 68-115 GHz SIS Receiver. Completion of this receiver has been delayed. We now hope for completion and telescope tests by the end of the year.

New 130-170 GHz SIS Receiver. The mixer design for this band has been completed in the Central Development Lab. If the mixer tests go well, we hope for telescope tests in March 91.

Upgrade of the 230 GHz 8-beam Receiver. Work has started on upgrading the 230 GHz 8-beam Schottky receiver to an SIS receiver. Due to heavy work loads, the timetable for the completion of this upgrade is uncertain. We hope for completion by the end of 91.

K. VLA ELECTRONICS

Improvements in Antenna Pointing

Antenna pointing errors degrade the performance of synthesis telescopes at both low and high frequencies. At low frequencies strong background sources are randomly located in the primary beam, and pointing errors then limit the achievable dynamic range. At high frequencies the pointing errors become a significant fraction of the primary beamwidth, so the source being imaged is affected directly. For example, at 44 GHz a 20" pointing error causes a 30 percent change in amplitude. Solar-induced tilts, which used to dominate our pointing errors, have been greatly reduced through external insulation of the antenna yoke and base support.

An important pointing problem being investigated now is the occurrence of tilts of up to 20 arcseconds on the azimuth axis of a few antennas at certain azimuth angles. This effect is believed to be caused by deformations or perturbations in the azimuth bearings. This, and other problems such as an antenna tilt caused by constant wind force, could be corrected in the future by an active correction scheme utilizing electronic tilt- meters mounted on the antenna structure. Testing of the stability of the redesigned tilt-meter units show a long-term stability of about 3 arcseconds. Eight have been fabricated and tested. Two VLA antennas have been outfitted with two sets of tilt-meters on each antenna. Engineering testing of these four units installed on the antenna are complete. In order to provide more information about these antennas, plans are underway to instrument 32 temperature probes at various locations on these antennas by the last quarter of this year. Further system testing will continue through 1990.

RFI Improvements

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

Four prototype RFI enclosures for the vertex mounted "B" racks have been installed and tested. These RFI enclosures eliminate the remaining antenna-generated interference at 327 MHz. There is still some locally generated RFI noticeable at 75 MHz. The remaining twenty-four RFI enclosures have not been procured due to an increase in cost by a factor of two. An in-house design for a new RFI enclosure is complete. Construction of prototype was completed in the third quarter of this year, and testing of this enclosure has started.

1.3-1.7 GHz T_{sys} Improvements

HI imaging is the most important class of spectral line project at the VLA. The observation of HI in emission (either galactic of extragalactic) is almost always

sensitivity limited, either because the HI has to be followed to the faint outermost regions of galaxies or because more angular or frequency resolutions are desirable.

The VLA 18-21 cm wavelength receiver currently has system temperatures of approximately 60 K. A significant fraction of this system temperature results from the need to locate front-ends for all four of the VLA's original frequency bands in the same cryogenic dewar. Lack of space in the dewar prevents the polarization splitters from being cooled. We plan to correct these deficiencies by installing individually-packaged VLBA-style receivers on each VLA antenna and expect significant gains in sensitivity to result. For example, using cryogenically cooled HEMT amplifiers on the fully optimized VLBA antennas, the measured system noise temperature is 30 K at 18-21 cm. Although some effects, such as subreflector diffraction, will prevent VLA noise temperatures from ever being quite as low as these VLBA values, a VLBA L-band front-end installed on a VLA antenna as a test gave a system temperature of about 35 K.

Presently three VLA antennas have the improved VLBA style L-band receiver installed. Two more of the new front-end systems are now in the assembly process. By the end of this year, five VLA antennas should have the improved VLBA style receivers.

High Time Resolution Processor

We are currently instrumenting the VLA with a high time resolution processor (HTRP). The system will be used for observations of time varying phenomena like flare stars, pulsars, etc., and for monitoring radio frequency interference (RFI). The system utilizes existing components such as the VLA analog sum phased array outputs and the VLBI MK III IF-VIDEO converter system which serves as a set of tunable filters with selectable bandwidths. This provides 14 pairs of RCP and LCP frequency signals from the phased array VLA. Total power detector and cross multipliers are used to measure all four products with integration periods of 25 microseconds to 5 milliseconds. The data acquisition system is a 64-channel multiplexer and a 12-bit analog to digital converter with maximum sampling rate of 100,000 samples/sec. This is installed on a 386-based personal computer with a 20 MHz clock and a 140 MB hard disk. The data acquisition system has been used to obtain 2-channel phased array VLA signals for developing software and understanding the system stability problems. The bench testing of the 64-channel system is complete. Array testing is also complete. Astronomical observation are now underway. This project is complete.

L. AIPS

Two implementations of the AIPS TV server for the X Window System now are available to be shipped with new releases of AIPS. Beginning with the 15OCT90 release of AIPS, we will ship XAS (developed at the Naval Research Laboratories) in addition to XVSS, which was developed in-house. Since it is more general in its treatment of displays, XVSS is somewhat slower than XAS. These are in addition to the SUN-specific TV server that is still supported.

A new version of the AIPS users' guide (AIPS Cookbook) is now available. Many changes had occurred in AIPS since the last edition was published in 1986, including the major Fortran 77 code revision, plus the calibration software for both the VLA and

VLBI. Together with the AIPS programmers guide (Going AIPS) that was published earlier this year, there is now a complete up-to-date version of the main AIPS documentation.

Most of the improvements to the software have been in the area of data calibration. The tasks which fill visibility data from the VLA (FILLM) and the Mark III VLBI correlator (MK3IN) have received much attention and are now more flexible and robust. In particular, the VLA is now capable of observing in many new spectral line modes, and major changes were needed to support them fully. A new task to allow interactive editing (IBLED) of baseline oriented (u, v) data editing was added. The main calibration task (CALIB) was simplified by removing the VLBI fringe fitting algorithm into a separate task. The sortless mapping task (HORUS) has been enhanced to produce maps up to 4k x 4k in size on any computer architecture.

M. VLA COMPUTER

The Solbourne Unix file and compute server ZIA have now replaced VAX3 for all user accounts. The standard application tasks such as Genplot, TeX, and E-mail now work under Unix on ZIA. An introduction to Unix class as well as an introduction to Unix manual were prepared in order to ease the transition form VMS to Unix. Hardware maintenance on VAX3 has been discontinued and the system will be shutdown on Oct 1, 1990. The plan is to remove several disk drives from VAX3 to the microVax and to attach the line printer to VAX1. Future plans also call for dropping the hardware maintenance on VAX1 but to continue running the VAX1 system for most of 1991. Spare parts from the VAX3 system will be used to maintain the VAX1 system. After 1991, the only VMS computer at the AOC will be the microVAX.

The Unix version of OBSERVE for SUN workstations is now being tested and used. It is available by logging into the guest account on ZIA and on the public SUN 3/60 workstations. This Unix version is identical to the PC program released last June. Future releases of the program using the X Window System are planned.

Work continues on a translation program for reading old format ModComp archive tapes and writing the data in the new archive format. A program to do this translation has been written for the ModComps, but that program does not run on Unix systems. The current program is written in C and will run on the Convex or Sparc systems. This is the first part of an effort to copy all of the old VLA archive data onto higher density tapes.

A single user workstation for spectral line post processing has been installed in the VAX3 image display room. This Sparc station is configured with 1.8 gigabytes of disk storage and is the only in-house workstation devoted entirely to data reduction. This workstation will remove some spectral line processing from the Convex C1s and will give added experience with AIPS data reduction in a typical workstation environment.

N. VERY LONG BASELINE ARRAY

Antennas and Site Preparation

The first five antennas are now outfitted with a subset of the complete receiver package and are operable. The Pie Town, NM and Kitt Peak, AZ antennas routinely participate in Network observations. Los Alamos currently participates on a "best effort" basis due to operation budget restrictions. The Fort Davis, TX antenna was declared operable in the first quarter 1990. The North Liberty, IA antenna was declared operable the third quarter 1990. Outfitting of the Owens Valley, CA antenna is underway and scheduled to be operable in the fourth quarter 1990. Antenna erection on the completed Hancock, NH foundation is underway. At St. Croix,VI and Mauna Kea, HI, site preparation and antenna foundation construction are underway. The schedule for erection of antennas indicates the tenth and last antenna scheduled for assembly by December 1991.

Electronics

A major new development during this quarter was the completion of the first front end for 43 GHz. This was tested in the laboratory in August, and demonstrated that a noise temperature as low as 70 K can be achieved in this band using cooled HEMT amplifiers. This unit will be installed and tested on the antenna at Pie Town in early October. A new converter module for this frequency has been designed, and should be ready for the October installation. Serial No. 8 front end for 8.4 GHz, and serial No. 7 for 23 GHz have both recently been shipped. The remaining units for these frequencies will be completed early in 1991. Construction and installation of the remaining front ends for 330/610 MHz, 2.3 GHz, 15 GHz, and 43 GHz will extend into early 1992.

Also, during the present quarter, rack set serial No. 8 was shipped to Owens Valley for installation. Good progress has been made on the final two rack sets which are being constructed this year, and they should be completed on time. As the quarter ends, the Data Acquisition Rack No. 9 is being completed, and will be shipped to Haystack Observatory for some systems testing before going to Brewster for installation. Also, at this time the group assembling Baseband Converter modules at Socorro are just completing the first of a batch of seven of these units, and testing and adjustment are about to begin. It is hoped that some of these modules will be available to provide greater bandwidths for observations by November.

Data Recording

The remaining VLBA recorders from the first production run--through serial No. 13--were shipped from Haystack Observatory during the third quarter 1990. These units are now installed at the first five antenna sites, NRAO development laboratories, USNO at Green Bank, and the VLA. Deliveries from a second production run of eight--through serial No. 21--are expected to start in October 1990, with shipment intervals of approximately one every two weeks. One of these is scheduled for a one-year loan starting in early 1991 to the Astro Space Center in the USSR to allow their staff to develop the necessary interfaces to ground stations for the Radioastron satellite, as well as earth-based VLBI antennas in the Soviet Union. A new change

order to Haystack for another 11 recorders is expected to be placed in fourth quarter 1990.

Orders were placed earlier in 1990 for significant field test quantities of thin-base recording tape with each of three competing vendors: Sony, Maxell and Ampex. Shipments began in the third quarter 1990, and testing began immediately after their receipt at Haystack. The field and laboratory tests will continue for at least a year. Among other tests, they are expected to be mixed into JPL/GSFC Network tape supplies for some participating observatories and processing sites. Durability, magnetic, and mechanical performance will be carefully monitored and analyzed before deciding in late 1991 on the supplier of the larger, operational quantities of tape.

Monitor and Control

During the third quarter priority was given to the conversion of the array control software to run under the VxWorks operating system and with obtaining its proper operation on the Motorola computer when upgraded to the 68030 processor (MVME 147). During the quarter, difficulties were experienced with computer communications, which made operations at Pie Town very slow to come on line. However, satisfactory operation at Pie Town has now been obtained with a leased line from the VLA site to the Pie Town computer running the SLIP networking protocol, and very satisfactory operation at Los Alamos using an Internet connection through LANL. Problems with the MVME 147 computer are clearly nearing resolution as the quarter ends, and it is planned to upgrade all sites to that CPU next quarter.

All stations have now been converted to vxWorks except for Fort Davis, which will be converted in October. A regular procedure for software updates, etc., has been established for the Array.

Some work has begun on overview screens, which run in the SUN3/260 array control computer and display data from all stations.

Correlator

Business arrangements with LSI Logic Corporation for production of the "FX chips" were finally concluded on August 3. The final, production phase of the purchase order issued previously to Hall-Mark Electronics Corporation was cancelled by mutual consent as necessitated by Hall-Mark's termination of their distribution franchise with LSI Logic. A first partial delivery of 117 production chips, packaged from semiconductor wafers fabricated for but not needed in the final prototype run, was received on September 27. The first of two major new production runs was started, with delivery of the entire 3200-part order scheduled during the fourth quarter.

Two of the four sets of multi-layer printed circuit boards--the multiplier/accumulator in the correlator and the track recovery in the playback interface--were received. Prototyping of the remaining two boards--the correlator FFT and playback deformatter--was completed, necessary modifications implemented in the layout, and fabrication started. It was decided to proceed with the latter two boards without a second prototype version.

With the completion of prototyping, procurement was initiated for the electronic components and other parts required to construct the bulk of the correlator and playback interface. A total of 11 competitive quotes were received, and orders placed at generally favorable prices. More than half of this material has already been received. Quotes were also solicited for assembly of all the printed-circuit boards, and an order was placed with the low bidder at a price just one-fourth the budget estimate.

Four racks to house the entire correlator system were ordered and received. Metal parts and backplanes for the twelve bins were also purchased and assembly started.

In all the procurements mentioned, to minimize costs it was decided to purchase the full quantities required for the final correlator system. As a result, the phased construction scheme now will be paced primarily by the speed with which the assembled modules can be checked out.

Completion of these procurements also allowed the scheduled final cost estimate to be done with high precision. The materials and services cost of the correlator proper has decreased to only about $770k (excluding spares), well less than half the cost projected in 1985 for the lag correlator then planned. Including the playback interface, an element of the data recording system which has been integrated into the correlator, the entire system will cost about $900k to construct.

A second playback drive was received on August 28, without the critical signal-path modules which are still being redesigned by Haystack Observatory. Since the control functions are available, however, the unit was immediately useful in real-time software development.

In the real-time control system, the nucleus of tasks constructed in the second quarter was extended and filled in. The station task, in particular, is now substantially complete, although some specialized modes have yet to be provided, and further debugging doubtless will be required as associated tasks are connected. Tasks which control the transition between models (on source changes, for example) and between tapes were started and are well advanced. A new set of tasks which supervise playback drives was created and tested as a stand-alone facility, and later integrated into the existing structure.

Data Processing

Preliminary plans were made last quarter for reading the FITS format data from the VLBA correlator. Software development this quarter consisted of debugging of editing and spectroscopic calibration functions and the debugging of the new graphical, data editing tool. More progress has been made in the processing of MkIII VLBI data for both continuum and spectroscopic data. (MkIII data is very similar to VLBA format data in this context.)

O. PERSONNEL

New Hires

Zhao, J.	Research Associate	07/01/90
Salter, C. J.	Associate Scientist, GB Operations	08/29/90
Waddel, B. S.	Electronics Engineer I	07/11/90
Glendenning, B. E.	Assistant Scientist, VLBA Project	07/27/90
Wood, D. O. S.	Assistant Scientist, SOC Operations	08/01/90
Palmer, P. E.	Visiting Scientist	07/16/90

Terminations

Hilldrup, K. C.	Sr. Sci. Programming Analyst	07/01/90
Rots, A. H.	Associate Scientist, SO Operations	07/05/90
Palmer, P. E.	Visiting Scientist	08/15/90
Hill, R. H.	Electronics Engineer I	07/17/90

Promotions

Uson, J. M.	to Scientist	07/01/90
Bastian, T. S.	to Assistant Scientist	07/01/90
Zensus, J. A.	to Assistant Scientist	07/01/90

PREPRINTS RECEIVED, JULY - SEPTEMBER 1990

ANDERSSON, B.-G.; WANNIER, P.G.; MORRIS, M. Warm Neutral Halos Around Molecular Clouds. III. Interpretation of HI and CO (J=1-0) Data.

ANDRE, P.; MONTMERLE, T.; FEIGELSON, E.D.; STEPPE, H. Cold Dust Around Young Stellar Objects in the rho Ophiuchi Cloud.

BRAUN, R. The Distribution and Kinematics of Neutral Gas in M31.

BRAUN, R.; WALTERBOS, R.A.M. Physical Properties of Neutral Gas in M31 and the Galaxy.

CARLSTROM, J.E.; KRONBERG, P.P. HII Regions in M82: High Resolution Millimeter Continuum Observations.

CLARK, F.O.; LAUREIJS, R.J. Dust and Molecular Properties of the Low Opacity Cloud L1563.

CLEGG, A.W.; CORDES, J.M. Variability of Interstellar Hydroxyl Masers.

CONDON, J.J.; FRAYER, D.T.; BRODERICK, J.J. UGC Galaxies Stronger than 25 mJy at 4.85 GHz.

CONWAY, J.E.; CORNWELL, T.J.; WILKINSON, P.N. Multi-Frequency Synthesis: A New Technique in Radio Interferometric Imaging.

D'ADDARIO, L.R. Time Synchronization in Orbiting VLBI.

DAHLEM, M.; AALTO, S.; KLEIN, U.; BOOTH, R.; ET AL A Comprehensive Study of the Peculiar Spiral Galaxy NGC 1808 I. Radio Continuum and CO Line Observations.

DAHLEM, M.; WIELEBINSKI, R.; KORIBALSKI, B.; MEBOLD, U. A Molecular Gas Ring in NGC 1808.

DETTMAR, R.-J.; KEPPEL, J.W.; ROBERTS, M.S.; GALLAGHER, J.S. The Diffuse Ionized Gas Perpendicular to the Plane of NGC 891.

DUBNER, G.M.; BRAUN, R.; WINKLER, P.F.; GOSS, W.M. VLA Observations of the Supernova Remnant Puppis A at 327 and 1515 MHz.

FISHER, J.R. Upward Discharge Above Thunderstorms.

FRUCHTER, A.S.; GOSS, W.M. The Integrated Flux Density of Pulsars in Globular Clusters.

GORDON, M.A. Detection of CO Emission in the Elliptical Galaxies NGC 3265 and NGC 5666.

GREENHILL, L.J.; MORAN, J.M.; REID, M.J.; GWINN, C.R.; ET AL First Images of Water Vapor Masers in the Galaxy M33.

HILL, G.J.; LILLY, S.J. A Change in the Cluster Environments of Radio Galaxies with Cosmic Epoch.

HUMMEL, E.; BECK, R.; DETTMAR, R.-J. An Effelsberg/VLA Radio Continuum Survey of an Optically Selected Sample of Edge-On Spiral Galaxies.

KENNEY, J.; SCOVILLE, N.; WILSON, C. The Star-Forming Disk and CO Bar in M101.

KENNY, H.T.; TAYLOR, A.R.; SEAQUIST, E.R. AG Pegasi: A Multi-shell Radio Source.

KERR, A.R.; PAN, S.-K. Some Recent Developments in the Design of SIS Mixers.

KULKARNI, S.R.; GOSS, W.M.; WOLSZCZAN, A.; MIDDLEDITCH, J. Deep Radio Synthesis Images of Globular Clusters.

KUTNER, M.L.; VERTER, F.; RICKARD, L.J CO(J=2->1) Study of Molecular Clouds in the Southwest Arm of M31.

LICHTENBERGER, A.W.; LEA, D.M.; LI, C.; LLOYD, F.L.; ET AL Fabrication of Micron Size Nb/Al-Al2O3/Nb Junctions with a Trilevel Resist Liftoff Process.

LOCKMAN, F.J. The Neutral Halo in the Inner Galaxy.

LYNE, A.G.; MANCHESTER, R.N.; D'AMICO, N.; STAVELEY-SMITH, L.; ET AL An Eclipsing Millisecond Pulsar in the Globular Cluster Terzan 5.

MACCAGNI, D.; GIOIA, I.M.; HENRY, J.P.; MACCACARO, T.; ET AL MS 0129.2-2237: Interacting Galaxies at z=0.11.

MANGUM, J.G.; PLAMBECK, R.L.; WOOTTEN, A. Fossil DCN in Orion-KL.

MEYERS-RICE, B.A.; LADA, C.J. The Structure and Kinematics of Bipolar Outflows: Observations and Models of the Mon R2 Outflow.

MINH, Y.C.; IRVINE, W.M. Upper Limits for the Ethyl Cyanide Abundances in TMC-1 and L134N: Chemical Implications.

MORGAN, J.A.; SNELL, R.L.; STROM, K.M. Radio Continuum Emission from Young Stellar Objects in L1641.

NEFF, S.G.; HUTCHINGS, J.B. Evolution of Radio Quasars from Redshift 0.6 to 3.7.

O'NEAL, D.; FEIGELSON, E.D.; MATHIEU, R.D.; MYERS, P.C. A Radio Survey of Weak T Tauri Stars in Taurus Auriga.

OWEN, F.N.; WHITE, R.A. Surface Photometry of Radio Galaxies II. Cluster Sources.

PADIN, S.; WOODY, D.P.; HODGES, M.W.; ROGERS, A.E.E.; ET AL 223 GHz VLBI Observations of 3C 273.

PUCHE, D.; CARIGNAN, C.; BOSMA, A. HI Studies of the Sculptor Group Galaxies. VI. NGC 300.

PUCHE, D.; CARIGNAN, C.; VAN GORKOM, J.H. HI Studies of the Sculptor Group of Galaxies. V. NGC 253.

PUCHE, D.; CARIGNAN, C.; WAINSCOAT, R.J. HI Studies of the Sculptor Group Galaxies. III. NGC 55.

QIAN, S.J.; QUIRRENBACH, A.; WITZEL, A.; KRICHBAUM, T.P.; ET AL A Model for the Rapid Radio Variability in the Quasar 0917+624.

REID, M.J.; MENTEN, K.M. A Subarcsecond H2O Maser Shell Surrounding a Variable Star.

REUTER, H.-P.; KLEIN, U.; WIELEBINSKI, R. IRAM C18O(1-0) and VLA lambda lambda 6 and 20 cm Observations of M82.

REUTER, H.-P.; KRAUSE, M.; WIELEBINSKI, R.; LESCH, H. CO(201) and lambda 20 cm Radio Continuum Observations of NGC 3628.

RILEY, J.M.; WARNER, P.J. A One-Sided Jet in the Giant Quasar 4C74.26.

ROBERTS, D.A.; GOSS, W.M.; VAN GORKOM, J.H.; LEAHY, J.P. VLA Radio Recombination Line Observations of Sagittarius A West.

ROBERTS, M.S.; HOGG, D.E.; BREGMAN, J.N.; FORMAN, W.R.; JONES, C. Interstellar Matter in Early-Type Galaxies. I. The Catalog.

SAIKIA, D.J.; JUNOR, W.; CORNWELL, T.J.; MUXLOW, T.W.B.; SHASTRI, P. A VLA and MERLIN Study of Extragalactic Radio Sources with One-Sided Structure.

SAIKIA, D.J.; MUXLOW, T.W.B.; JUNOR, W. MERLIN Observations of the Unusual Superluminal Quasar 3C395.

SASLAW, W.C.; CHITRE, S.M.; ITOH, M.; INAGAKI, S. The Kinetic Evolution and Velocity Distribution of Gravitational Galaxy Clustering.

SCHOMBERT, J.M.; BOTHUN, G.D.; IMPEY, C.D.; MUNDY, L.G. CO Deficiency in LSB Galaxies: Clues to Their Star Formation History.

SEAQUIST, E.R.; ODEGARD, N. A Nonthermal Radio Halo Surrounding M82.

SEAQUIST, E.R.; PLUME, R.; DAVIS, L.E. OH Emission and the Nature of Minkowski's Footprint (M1-92)

SKINNER, S.L. Nonthermal Radio Emission from the X-ray Bright K5 IV Star 1E 1751 + 7046.

THOMPSON, R.J.; CORDOVA, F.A.; HJELLMING, R.M.; FOMALONT, E.B. The Proper Motion of the Soft X-ray Emitting Radio Pulsar PSR 0656+14.

TURNER, B.E. Observations and Chemistry of Interstellar Refractory Elements.

TURNER, B.E.; LUBOWICH, D.A. H2CO in IC443G: Unusual Excitation, and a Diagnostic of Shock Astrochemistry.

USON, J.M.; BOUGHN, S.P. Large Aperture BVRJK Photometry of Rich Abell Clusters: Constraints on Dark Matter.

USON, J.M.; BOUGHN, S.P.; KUHN, J.R. The Central Galaxy in Abell 2029: An Old Supergiant.

USON, J.M.; BOUGHN, S.P.; KUHN, J.R. Diffuse Light in Dense Clusters of Galaxies. I. R-Band Observations of Abell 2029.

VAN DISHOECK, E.; BLACK, J.H.; PHILIPS, T.G.; GREDEL, R. CO J=3->2 Observations of Translucent and High-Latitude Molecular Clouds.

VAN LANGEVELDE, H.J.; COTTON, W.D. Visibility Based Continuum Subtraction in Spectral Line Observations with Radio Synthesis Telescopes.

VANDEN BOUT, P.A. The Very Long Baseline Array and the Green Bank Telescope.

WANNIER, P.G.; ANDERSSON, B.-G.; MORRIS, M.; LICHTEN, S.M. Warm Neutral Halos Around Molecular CLouds. II. HI and CO (J=1-0) Observations.

WEILER, K.W.; SRAMEK, R.A. The Observation and Interpretation of Radio Supernova in Nearby Galaxies.

WILKINSON, P.N.; AKUJOR, C.E.; CORNWELL, T.J.; SAIKIA, D.J. 3C380: A Powerful Radio Source Seen End On?

WILKINSON, P.N.; TZOUMIS, A.K.; AKUJOR, C.E.; BENSON, J.M.; ET AL High-Quality Images of the CSS Quasars 3C 48 and 3C 380.

WITZEL, A.; QUIRRENBACH, A. Intraday Variability and the Compactness of Extragalactic Radio Sources.

WOOTTEN, A. Dense Core Structures and Fragmentation in the Rho Ophiuchi Molecular Cloud.

WROBEL, J.M. Radio Continuum Sources in Nearby and Bright E/S0 Galaxies: Sample Selection and Well-Studied Cases.

WROBEL, J.M.; HEESCHEN, D.S. Radio Continuum Sources in Nearby and Bright E/S0 Galaxies: Active Nuclei versus Star Formation.