US/GR BK/

NATIONAL RADIO ASTRONOMY OBSERVATORY

QUARTERLY REPORT

July 1 – September 30, 1998

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APPENDIX A. PREPRINTS

A. TELESCOPE USAGE

The following telescopes have been scheduled for research and maintenance in the following manner during the third quarter of 1998.

	140 Foot	12 Meter	VLA	VLBA
Scheduled Observing (hrs)	1605.00	284.00	1721.40	1073.50
Scheduled Maintenance and Equipment Changes	156.75	0.00	231.80	399.00
Scheduled Tests and Calibration	14.25	1924.00	2561.00	275.50
Time Lost	46.25	70.50	28.70	35.00
Actual Observing	1558.75	213.50	1692.70	1038.50

B. 140 FOOT OBSERVING PROGRAMS

The following continuum programs were conducted during this quarter.

No.	Observer(s)	Program
D195	de Pater, I. (UC, Berkeley) Millan, R. (UC, Berkeley) Maddalena, R.	Jupiter's radio spectrum from 74 MHz up to 8000 MHz.
R271	Romero, G. (IAR, Argentina) Combi, J. (IAR, Argentina) Azcarate, I. (IAR, Argentina) Cersosimo, J. (Puerto Rico)	A search for intraday variability in EGRET blazars.

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B662	Balser, D. Bania, T. (Boston) Huang, M. (Boston) Shah, R. (Virginia) Rood, R. (Virginia) Jackson, J. (Boston)	Measurements of ionized carbon in the Milky Way.
B680	Bourke, T. (CfA) Myers, P. (CfA) Robinson, G. (New South Wales) Hyland, H. (Southern Cross University)	OH Zeeman observations of Northern molecular clouds.
B685	Burrows, D. (Penn State) Nishikida, K. (Penn State)	21 cm observations of x-ray absorbing clouds toward the center of Loop I.

No.	Observer(s)	Program
C313	Carilli, C. Menten, K. (MIPR, Bonn) Reid, M. (CfA) Rupen, M.	A search for redshifted HI 21 cm absorption towards red quasars and red gravitational lenses..
L319	Lockman, F. J. Murphy, E. (Johns Hopkins)	21 cm HI mapping of the galactic plane.
M412	Murphy, E. (Johns Hopkins)	The magnetic field in galactic neutral hydrogen.
R270	Rood, R. (Virginia) Balser, D. Bania, T. (Boston)	^{3}He abundances in galactic HII regions.
S430	Sato, F. (Tokyo Gakugei University)	HI gas in the upper Scorpius shell with the Lupus molecular clouds.
S434	Sato, F. (Tokyo Gakugei University)	HI in the Taurus-Perseus region.
W411	Wootten, H. A.	Water in comets.

The following pulsar programs were conducted during this quarter.

No.	Observer(s)	Program
A118	Arzoumanian, Z. (Cornell) Taylor, J. (Princeton) Nice, D. (Princeton)	Bimonthly timing of 63 pulsars at 500 and 800 MHz.
B687	Backer, D. (UC, Berkeley) Somer, A. (UC, Berkeley) Sallmen, S. (UC, Berkeley) Foster, R. (NRL)	Pulsar timing array.
N018	Nice, D. (Princeton) Thorsett, S. (Princeton)	Monitoring the irregularities in the rotation and orbital motion of an eclipsing binary pulsar, B1744-24A.

The following very long baseline programs were conducted this quarter.

No.	Observer(s)	Program
M424	Molotov, I. (Lebedev) Likhachev, S. (Lebedev) Chuprikov, A. (Lebedev)	Low frequency VLBI observations for RadioAstron mission pre-fly survey.
V021	Minter, A.	Orbiting VLBI observations of the pulsar 0329+54.
V034	Murphy, D. W., *et al.*	VSOP continuous monitoring of 1928+738.

No.	Observer(s)	Program
VS04 VS05 VS06 VS07 VS09 VS10	Hirabayshi, H. (ISAS, Japan)	VSOP survey

C. 12 METER TELESCOPE OBSERVING PROGRAMS

The following line programs were conducted during this quarter.

No.	Observer(s)	Program
B691	Butner, H. (Arizona) Lada, C. (CfA) Alves, J. (CfA) Lada, E. (Florida) Charnley, S. (NASA/Ames)	Tracing the density profile of starless cores: CS versus dust extinction.
B693	Butner, H. (Arizona) Charnley, S. (NASA/Ames) Yonekura, Y. (Osaka U.)	Study of the density and velocity structure of the B1 core.
C316	Clancy, R. T. (SSI, Boulder) Sandor, B. (JPL)	Mars climate studies and spacecraft support.
C323	Clancy, R. T. (SSI, Boulder) Sandor, B. (JPL)	Mars and Venus temperature and water studies.
H329	Helfer, T. Thornley, M. (MPIfEP, Garching) Regan, M. (DTM/Carnegie) Sheth, K. (Maryland) Vogel, S. (Maryland) Wong, T. (UC, Berkeley) Blitz, L. (UC, Berkeley)	Zero-spacing data for BIMA observations of nearby galaxies.
H334	Helfer, T. Thornley, M. (MPIfEP, Garching) Regan, M. (DTM/Carnegie) Sheth, K. (Maryland) Vogel, S. (Maryland) Harris, A. (Maryland) Wong, T. (UC, Berkeley) Blitz, L. (UC, Berkeley) Bock, D. (UC, Berkeley)	Zero-spacing data for BIMA survey of nearby galaxies.
W409	Wootten, H. A. Shah, R. (Virginia)	Study of hot core chemistry in low-mass protostars.

D. VERY LARGE ARRAY OBSERVING PROGRAMS

Third quarter, 1998, was spent in the following configurations: B configuration from: July 1 to September 30.

The following research programs were conducted with the VLA during this quarter.

No.	Observer(s)	Program
AA229	Anantharamaiah, K. (Raman Institute) Goss, W. M. Zhao, J. (CfA)	High resolution H92 line towards Arp 220. 3.6 cm line
AA230	Anantharamaiah, K. (Raman Institute) Viallefond, F. (Paris Obs.) Goss, W. M. Mohan, R.N. (Raman Institute)	H92 recombination line towards NGC 4151. 3.6 cm line
AA231	Anantharamaiah, K. (Raman Institute) Kassim, N. (NRL) Lazio, T. J. W. (NRL) Goss, W. M. Lang, C. (UCLA)	Possible new filament near the galactic center. 20 cm
AB850	Barvainis, R. (Haystack) Antonucci, R. (UC, Santa Barbara)	Search for absorption from the molecular torus of AGNs. 1.3 cm line
AB860	Bietenholz, M. (York U.) Frail, D. Weiler, K. (NRL)	Low frequency observations of 3C58 and Vela X. 90 cm
AB863	Becker, R. (UC, Davis) Helfand, D. (Columbia) Schechter, P. (MIT) White, R. (STScI)	High resolution imaging of two gravitationally lensed quasars. 3.5 cm
AB869	Black, G. Campbell, D. (Cornell) Nicholson, P. (Cornell)	Radio source occultation by Saturnian ring system. 20 cm
AB870	De Breuck, C. (LLNL) van Breugel, W. (LLNL) Rottgering, H. (Leiden) Miley, G. (Leiden)	Highest redshift radio galaxies. 6, 20 cm
AB872	Butler, B. Palmer, P. (Chicago)	Giacobini-Zinner: An OH Occultation event by a short period comet . 20 cm line
AB873	Briggs, F. (Groningen/Kapteyn)	Confirming possible OH megamaser at z=0.17. 20 cm line

No.	Observer(s)	Program
AB874	Brown, A. (Colorado/JILA) Osten, R. (Colorado/JILA) Pallavicini, R. (Palermo) Ayres, T. (Colorado/JILA) Jones, K. (Queensland) Harper, G. (Colorado/JILA)	Multiwavelength study of flaring and coronal structure on HR1099. 2, 3.6, 6, 20 cm
AB875	Bennett, P. (Colorado/JILA) Harper, G. (Colorado/JILA) Brown, A. (Colorado/JILA) Bauer, W. (Wellesley College)	1997/98 Eclipse of VV Cephei. 1.3, 2, 3.6, 6 cm
AB876	Bietenholz, M. (York U.) Frail, D. Hester, J. (Arizona)	Time-variability in the radio structure of the Crab nebula. 6 cm
AB878	Bauer, F. (Virginia) Condon, J. Thuan, T. (Virginia)	Energy sources and beaming in the brightest x-ray galaxies. 6 cm
AB879	Becker, R. (UC, Davis) White, R. (STScI) Helfand, D. (Columbia)	FIRST survey. 20 cm
AC507	Cooray, A. (Chicago) Grego, L. (Chicago) Carlstrom, J. (Chicago) Joy, M. (NASA/MSFC) Holzapfel, W. (Chicago)	Radio source contamination in Sunyaev-Zeldovich Effect observations. 1.3, 2, 3.6 cm
AC511	Chiuderi-Drago, F. (Florence) Franciosini, E. (Florence) Massi, M. (MPIR, Bonn) Neidhofer, J. (MPIR, Bonn) Bastian, T.	Radio and x-ray observations of UX Ari with the VLA and Beppo SAX. 0.7, 2, 3.6, 6, 20, 90 cm
AC512	Cesaroni, R. (Arcetri) Hofner, P. (NAIC) Rodriguez, L. (Mexico/UNAM) Marti, J. (CNRS, France)	Jet or VC HII region? Continuum emission from massive proto star IRAS 20126+4104. 3.6 cm
AD415	Devereux, N. (New Mexico State) Hameed, S. (New Mexico State) Miller, N. (New Mexico State) Churchwell, E. (Wisconsin)	Infrared luminous early type spiral galaxies. 6 cm
AD417	Dallacasa, D. (Bologna) Tschager, W. (Leiden) Grueff, G. (Bologna) Mack, K. (Bologna)	New sample of gigahertz-peaked spectrum radio sources. 1.3, 2, 3.6, 6, 20, 90 cm

No.	Observer(s)	Program
AD420	DiFrancesco, J. (CfA) Myers, P. (CfA) Williams, J. (CfA) Wilner, D. (CfA)	Detecting a very young protostar in L1544. 3.6 cm
AE118	Erickson, W. (Tasmania) Gergely, T. (NSF) Bastian, T. Vourlidas, A. (George Mason)	Solar active regions. 90 cm
AE119	Erickson, W. (Tasmania) Webber, W. (New Mexico State) Duric, N. (New Mexico) Perley, R.	74 MHz observations of edge-on galaxies. 90 cm
AE120	Eales, S. (U. College Cardiff) Lilly, S. (Toronto) Bond, D. (CITA) Gear, W. (Cambridge) Hammer, F. (Paris Obs.) Le Fevre, O. (Marseille Obs.)	Sources detected in a submillimeter survey. 20 cm
AE122	Eyres, S. (Keele) Evans, A. (Keele) Bode, M. (Liverpool JMU) O'Brien, T. (Liverpool JMU) Davis, R. (Manchester) Ivison, R. (Royal Obs.)	Classical and recurrent novae: target of opportunity observations. 1.3, 2, 3.6, 6, 20 cm
AF337	Frail, D. Kulkarni, S. (Caltech) Vakil, D. (Caltech)	Late time radio emission from well localized gamma ray bursts. 3.6, 6, 20 cm
AF339	Falcke, H. (MPIR, Bonn) Zensus, J. A. (MPIR, Bonn) Ho, L. (CfA)	Compact radio cores in nearby galaxies. 2 cm
AF340	Fassnacht, C. (Caltech) Pearson, T. (Caltech) Readhead, A. (Caltech) Browne, I. (Manchester) Wilkinson, P. (Manchester) Myers, S. (Pennsylvania)	VLA Monitoring of gravitational lens 1608+656. 3.6 cm
AF346	Fich, M. (Waterloo)	Structure of HII regions and measuring elemental abundances. 6, 20 cm

No.	Observer(s)	Program
AF350	Falcke, H. (MPIR, Bonn) Lobanov, A. (MPIR, Bonn) Wright, M. (UC, Berkeley) Bower, G. (MPIR, Bonn) Aller, M. (Michigan) Terasranta, H. (Helsinki) Patnaik, A. (MPIR, Bonn)	Monitoring extremely variable spiral III Zw 2. 1.3, 2, 3.6, 6, 20, 90 cm
AF355	Feigelson, E. (Penn State) Grosso, N. (CNRS, France) Montmerle, T. (CNRS, France)	Rho Ophiuchus star forming region - coordinated with SAX. 3.6 cm
AG535	Greenhill, L. (CfA) Menten, K. (MPIR, Bonn)	SiO masers in regions of massive star formation. 0.7, 1.3 cm line
AG539	Cruz-Gonzalez, I. (Mexico/UNAM) Salas, L. (Mexico/UNAM) Porras, A. (INAOE, Mexico) Rodriguez, L. (Mexico/UNAM)	Exciting source of the curved molecular hydrogen jet near S187. 3.6 cm
AG543	van Gorkom, J. (Columbia) Valluri, M. (Rutgers) Duc, P. (ESO) Reichborn-Kjennerud, B. (Columbia) James, E. (Columbia)	An HI selected dwarf sample in Hydra. 20 cm line
AG551	Gomez, Y. (Mexico/UNAM) Dgani, R. (Mexico/UNAM) Kurtz, S. (Mexico/UNAM)	Planetary nebula Abell 30.
AH628	Hjellming, R. Mioduszewski, A. Rupen, M.	Radio and x-ray activity in galactic black holes. 2, 3.6, 6, 20 cm
AH648	Harris, D. (CfA) Leahy, J. P. (Manchester) Leighly, K. (Columbia)	X-ray emitting radio hotspot in 3C390. 2 cm
AH649	Harper, G. (Colorado/JILA) Brown, A. (Colorado/JILA) Bennett, P. (Colorado/JILA) Hummel, C. (USNO) Baade, R. (Hamburg U.) Kirsch, T. (Hamburg U.) Reimers, D. (Hamburg U.)	Monitoring the eclipse of Zeta Aurigae's B Star HII region. 2, 3.6, 6 cm

No.	Observer(s)	Program
AH651	Herrnstein, J. Ransom, S. (CfA) Greenhill, L. (CfA) Eikenberry, S. (Caltech) Anderson, S. (Caltech) Lorimer, D. (MPIR, Bonn) Kramer, M. (MPIR, Bonn) Backer, D. (UC, Berkeley)	Search for steep spectrum sources in northern globular clusters. 6, 20 cm
AI075	Ivison, R. (Edinburgh) Smail, I. (Durham) Blain, A. (Cambridge) Kneib, J. (Toulouse Obs.)	Deep imaging of a new population of intensely star forming galaxies. 6, 20 cm
AK452	Koopmans, L. (Groningen/Kapteyn) de Bruyn, A. (NFRA) Jackson, N. (Manchester) Wilkinson, P. (Manchester) Fassnacht, C. (Caltech) Myers, S. (Pennsylvania)	Time delay monitoring of the CLASS gravitational lens B1600+434. 3.6 cm
AK453	Kassim, N. (NRL) Lazio, T. J. W. (NRL) Anantharamaiah, K. (Raman Institute) Goss, W. M. Falcke, H. (MPIR, Bonn)	74 MHz imaging of the galactic center. 90 cm
AK456	Kulkarni, S. (Caltech) Bloom, J. (Caltech) Djorgovski, S. (Caltech) Vakil, D. (Caltech) Frail, D.	Radio afterglows of gamma ray bursters. 2, 3.6, 6, 20 cm
AK468	Koerner, D. (JPL) Millares, R. (Pennsylvania) Chandler, C. (Cambridge) Sargent, A. (Caltech)	Radial structure of circumstellar disks. 0.7, 1.3, 2, 3.6 cm
AK469	Kameno, S. (NAO, Japan) Hamaguchi, K. (Kyoto) Umemoto, T. (NAO, Japan) Tsuboi, Y. (Kyoto) Koyama, K. (Kyoto) Fomalont, E.	Jet ejection from protostar R1 in R CrA star forming region. 3.6 cm
AK470	Kurtz, S. (Mexico/UNAM) Watson, A. (Mexico/UNAM) Hofner, P. (NAIC)	Multiconfiguration imaging of extended ultracompact HII regions. 3.6 cm

No.	Observer(s)	Program
AL439	Leahy, J. P. (Manchester) Spencer, R. (Manchester) Garrington, S. (Manchester)	Prototype classical double 3C 295. 0.7, 1.3 cm
AL441	Ludke, E. (UFSM, Brazil) Katz-Stone, D. (USNA)	Spectral analysis of CSS galaxies. 1.3, 2 cm
AL443	Lynds, R. (KPNO-NOAO) O'Neil, E. (KPNO-NOAO)	Continuum observations of NGC 6745. 6, 20 cm
AL444	Alberto-Lopez, J. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM)	Search for proper motions in core of remarkable object KjPn 8. 3.6 cm
AL445	Lacey, C. (Mexico/UNAM) Goss, W. M. Duric, N. (New Mexico) Pannuti, T. (New Mexico)	SNRs in nearby galaxies. 6, 20 cm
AL448	Lacey, C. (Mexico/UNAM) Goss, W. M.	Search for 1720 MHz OH masers in the nearby irregular galaxy NGC 4449. 20 cm line
AL449	Lebron, M. (Mexico/UNAM) Rodriguez, L. (Mexico/UNAM) Lizano, S. (Mexico/UNAM)	Neutral flows from compact HII regions: 21cm HI observations. 20 cm line
AL450	Lonsdale, C. (Haystack) Barvainis, R. (Haystack) Donovan, D. (Boston)	A new population of quasar related radio sources. 6, 20 cm
AL451	Laine, S. (Hertfordshire) Gottesman, S. (Florida)	Anomalous radio continuum in NGC 7479. 20 cm
AL452	Law-Green, D. (Leicester) Hirst, P. (Leicester) Ward, M. (Leicester) O'Brien, P. (Leicester)	PDS 456, a nearby radio quiet quasar. 6, 20 cm
AL453	Law-Green, D. (Leicester) Zezas, A. (Leicester) Ward, M. (Leicester) Hirst, P. (Leicester)	Radio imaging of x-ray selected starbursts and composite galaxies. 6, 20 cm
AL454	Law-Green, D. (Leicester) Hirst, P. (Leicester) Ward, M. (Leicester) O'Brien, P. (Leicester) Bleackley, P. (Leicester) Thean, A. (Manchester)	Radio structures of narrow-line Seyfert 1's. 6, 20 cm

No.	Observer(s)	Program
AL456	Liszt, H. Lucas, R. (IRAM)	OH in clouds with CH+. 20 cm line
AM585	Marti, J. (CNRS, France) Mirabel, I. F. (CNRS, France) Rodriguez, L. (Mexico/UNAM) Chaty, S. (CNRS, France)	Monitoring the radio outbursts of GX 354-00. 3.6, 6 cm
AM596	Menten, K. (MPIR, Bonn) Neuhauser, R. (MPIfEP, Garching) Preibisch, T. (Wurzburg)	Class I protostars in R CrA. 3.6 cm
AM599	Miller, N. (New Mexico State) Owen, F.	Large scale surveys of Abell 2255 and 2256. 20 cm
AM602	Mirabel, I. F. (CNRS, France) Rodriguez, L. (Mexico/UNAM) Dhawan, V.	Radio, infrared, and x-ray observations of microquasar 1915+105. 2, 3.6, 6 cm
AM603	Morganti, R. (Bologna) Oosterloo, T. (Milano Obs.) van Moorsel, G. Killeen, N. (CSIRO) Tadhunter, C. (Sheffield)	HI absorption in radio galaxies. 20 cm line
AM605	Meehan, L. (Missouri) Wilking, B. (Missouri) Claussen, M. Wootten, H. A.	Water masers and collimated outflows. 1.3 cm line
AN079	Neff, S. (NASA/GSFC) Ulvestad, J. Smith, D. (NASA/GSFC) Fanelli, M. (NASA/GSFC)	SNR and HII regions in NGC 4038/9 ("the Antennae"). 2, 3.6 cm
AO136	Owen, F.	330 MHz observations of M87. 90 cm
AP365	Patnaik, A. (MPIR, Bonn) Porcas, R. (MPIR, Bonn) Menten, K. (MPIR, Bonn) Kemball, A.	Arcsec-scale structure of the gravitational lens system B0218+357. 6, 20 cm
AP369	Parma, P. (Bologna) de Ruiter, H. (Bologna)	New sample of weak nearby radio galaxies. 6, 20 cm
AP370	de Pater, I. (UC, Berkeley) Sault, R. (CSIRO)	Jupiter patrol at the VLA. 20, 90 cm
AP371	de Pater, I. (UC, Berkeley) Butler, B.	Jupiter's radio spectrum from 74 MHz up to 8000 MHz. 90 cm

No.	Observer(s)	Program
AP373	Paredes, J. (Barcelona) Ribo, M. (Barcelona) Marti, J. (CNRS, France)	Radio emitting x-ray binaries from NRAO VLA sky survey. 3.6, 6, 20 cm
AP374	Pratap, P. (Haystack) Zhang, Q. (CfA) Ho, P. (CfA)	Continuum observations of the NGC 7538 molecular cloud. 3.6, 6 cm line
AR386	Rudnick, L. (Minnesota) Treichel, K. (Minnesota) Mack, K. (Bologna) Klein, U. (Bonn U.) Katz-Stone, D. (USNA)	Electron populations and ages in radio galaxies. 20, 90 cm
AR395	Rodriguez, L. (Mexico/UNAM) Torrelles, J. (IAA, Andalucia)	Search for maser radio recombination lines from thermal jet source. 3.6 cm line
AR396	Rupen, M. Anantharamaiah, K. (Raman Institute)	Radio recombination lines and OH in NGC 1052. 3.6, 20 cm line
AS568	Sramek, R. Panagia, N. (STScI) Van Dyk, S. (UCLA) Weiler, K. (NRL)	Properties of radio supernovae. 1.3, 2, 3.5, 6, 20, 90 cm
AS599	Stockton, A. (Hawaii) Ridgway, S. (Oxford)	Radio-optical alignment in z~1 quasars. 3.6, 6 cm
AS626	Snellen, I. (Cambridge) Schilizzi, R. (NFRA) Rottgering, H. (Leiden) deBreuck, C. (Leiden) Miley, G. (Leiden)	New sample of faint compact steep spectrum sources. 3.6 cm
AS632	Sahu, K. (STScI) Baum, S. (STScI) Kaiser, M. (NASA/GSFC) O'Dea, C. (STScI) Shaw, R. (STScI)	The most luminous x-ray cluster RXJ 1247.5-1145. 6, 90 cm
AS637	Stanghellini, C. (Bologna) Dallacasa, D. (Bologna) O'Dea, C. (STScI) Baum, S. (STScI) Fanti, R. (Bologna) Fanti, C. (Bologna)	Extended emission, polarization and variability in GPS sources. 1.3, 2, 3.6, 6, 20, 90 cm

No.	Observer(s)	Program
AS638	Slysh, V. (Lebedev) Val'tts, I. (Lebedev) Kalensky, S. (Lebedev) Golubev, V. (Lebedev)	Methanol masers in star forming regions. 0.7 cm line
AS640	Slee, O. (CSIRO) Roy, A. Andernach, H. (ESA, Spain) Reynolds, J. (CSIRO)	Structure in steep spectrum relics near cluster centers. 20 cm
AS642	Smith, B. (Colorado/JILA) Struck, C. (Iowa State) Higdon, J. (CSIRO)	High resolution HI Mapping of NGC 7828/9 (Arp 144). 20 cm line
AS643	Sridharan, T. (CfA) Menten, K. (MPIR, Bonn) Ramesh, B. (NAO, Japan) Schilke, P. (MPIR, Bonn)	Systematic search for high mass protostars. 3.6 cm
AT206	Thilker, D. (New Mexico State) Braun, R. (NFRA) Walterbos, R. (New Mexico State)	HI Supershells in M33. 20 cm line
AT210	Thorsett, S. (Princeton) Taylor, J. (Princeton) Nice, D. (Princeton) Briskin, W. (Princeton)	Timing fast pulsars at the VLA. 6, 20, 90 cm
AT211	Taylor, G. Fabian, A. (Cambridge)	X-ray to radio correlations in cooling flow clusters. 6, 20 cm
AT220	Thornley, M. (MPIfEP, Garching)	Weak spiral density waves in flocculent spiral NGC 7331. 20 cm line
AW489	Wilner, D. (CfA) Ho, P. (CfA) Rodriguez, L. (Mexico/UNAM) Zhang, Q. (CfA)	Continuum studies of T-Tauri disks. 0.7 cm
AW492	Wyrowski, F. (MPIR, Bonn) Schilke, P. (MPIR, Bonn) Walmsley, C. M. (Arcetri)	Vibrationally excited cyanoacetylene in G10.47+0.03. 0.7 cm line
AW495	White, S. (Maryland) Kundu, M. (Maryland)	Stellar flares and the solar analogy: an XTE/EUVE/VLA campaign. 3.6, 20 cm

No.	Observer(s)	Program
AX004	Xanthopoulos, E. (Manchester) Browne, I. (Manchester) Wilkinson, P. (Manchester) Patnaik, A. (MPIR, Bonn) Porcas, R. (MPIR, Bonn) King, L. (Manchester)	Monitoring the CLASS gravitational lenses B1030+074 and B1933+503. 3.6 cm
AZ104	Zhao, J. (CfA) Goss, W. M.	Proper motions of ionized gas near Sgr A*. 1.3 cm
AZ106	Zhang, Q. (CfA) Hunter, T. (CfA) Sridharan, T. (CfA) Cesaroni, R. (Arcetri)	High mass protostar 20126+4104. 1.3 cm line
AZ107	van Zee, L. Salzer, J. (Wesleyan U.) Skillman, E. (Minnesota)	Kinematic constraints on BCD to dE evolutionary scenarios. 20 cm line

E. VERY LONG BASELINE ARRAY OBSERVING PROGRAMS

The following research programs were conducted with the VLBA during this quarter.

No.	Observer(s)	Program
BA027	Alef, W. (MPIR, Bonn) Preuss, E. (MPIR, Bonn) Kellermann, K.	Polarimetric monitoring of the outburst in 3C111. 0.7 cm
BA030	Attridge, J. (Brandeis) Roberts, D. (Brandeis) Wardle, J. (Brandeis)	Blazar 1055+018. 2, 3.6, 6, 18 cm
BA034	Aaron, S. (MPIR, Bonn) Lobanov, A. (MPIR, Bonn) Ros, E. (MPIR, Bonn) Wardle, J. (Brandeis) Roberts, D. (Brandeis)	Jet opacity and properties of the BLR in 3C309.1. 0.7, 1.3, 2, 3.6, 6, 18 cm
BA035	Anantharamaiah, K. Romney, J. Walker, R. C.	Radio recombination lines towards 3C84. 1.3 cm with single VLA antenna
BB082	Blundell, K. (Oxford) Rawlings, S. (sOxford) Beasley, A.	Gravitational lens candidates. 18 cm
BB094	Boboltz, D. (Haystack) Marvel, K. (Caltech)	Observations of the 43-GHz SiO masers towards NML Cyg. 0.7 cm

No.	Observer(s)	Program
BB096	Booth, R. (Chalmers, Onsala) Lee, J. (Chalmers, Onsala) Winnberg, A. (Chalmers, Onsala) Colomer Samartin, F. (Yebes Obs.) Diamond, P.	Comparison of size and distribution of SiO masers in two transitions. 0.7 cm
BB097	Bradshaw, C. (George Mason) Geldzahler, B. (George Mason) Fomalont, E.	Radio parallax of Sco X-1. 6, 18 cm
BB101	Bower, G. (MPIfR) Backer, D. (UC, Berkeley)	Gamma ray blazar NRAO 530. 0.7, 1.3, 3.6 cm
BC070	Charlot, P. (Bordeaux) Sol, H. (Paris Obs.) Vicente, L. (Paris Obs.)	Multi-frequency monitoring of BL Lac object OJ287. 1.3, 3.6, 6 cm
BC075	Combes, F. (Paris Obs.) Baudry, A. (Bordeaux) Wiklind, T. (Chalmers, Onsala) Desmurs, J. (Yebes Obs.)	Mapping C_3H_2 absorption toward the gravitational lens PKS 1830-211. 0.7, 1.3 cm
BC081	Cotton, W. Fanti, C. (Bologna) Fanti, R. (Bologna) Dallacasa, D. (Bologna) Foley, A. (NFRA) Schilizzi, R. (NFRA) Spencer, R. (Manchester)	Faraday rotation in the core of 3C138. 6 cm with VLA single antenna
BC082	Cordes, J. (Cornell) Lazio, T. J. W. (NRL) Spangler, S. (Iowa) Rickett, B. (UC, San Diego) Hankins, T. (NMIMT) Frail, D. Chatterjee, S. (Cornell) McLaughlin, M. (Cornell)	Multi-station dynamic spectra of pulsars. 90 cm with phased VLA
BC083	Carilli, C. Perlman, E. (STScI) Stocke, J. (Colorado/JILA) Conway, J. (Chalmers, Onsala)	The HI absorbing cloud at z=0.2467 in PKS 1413+135. 18 cm
BC089	Claussen, M. Marvel, K. (Caltech) Wootten, H. A.	Proper motions of water masers in NGC 1333. 1.3 cm with VLA single antenna

No.	Observer(s)	Program
BD046	Diamond, P. Kemball, A. Boboltz, D. (Haystack)	Monitoring SiO masers through a cycle of Mira TX Cam. 0.7 cm with VLA single antenna
BF038	Falcke, H. (MPIR, Bonn) Antonucci, R. (UC, Santa Barbara) Ulvestad, J. Barvainis, R. (Haystack) Krichbaum, T. (MPIR, Bonn) Wilson, A. (Maryland)	Compact Seyfert galaxy Mrk 1210. 18 cm
BF042	Faison, M. (Wisconsin) Goss, W. M. Diamond, P. Taylor, G.	Imaging small-scale galactic HI structure. 18 cm with phased VLA
BF044	Falcke, H. (MPIR, Bonn) Bower, G. (MPIR, Bonn) Zensus, J. A. (MPIR, Bonn) Aller, M. (Michigan) Aller, H. (Michigan) Terasranta, H. (Helsinki)	Extremely variable spiral galaxy III Zw 2. 0.7, 2 cm
BG073	Gomez, J-L. (ESA, Spain) Marscher, A. (Boston) Alberdi, A. (ESA, Spain)	3C 120 rapid variations. 0.7, 1.3 cm
BG077	Fomalont, E. Gurvits, L. (NFRA) Kellermann, K.	Resolution matching survey of VSOP survey sources. 2 cm
BH041	Harris, D. (CfA) Silverman, J. (CfA) Junor, W. (New Mexico)	26W20, a radio/x-ray galaxy with no emission lines. 18 cm
BH048	Herrnstein, J. Greenhill, L. (CfA) Beasley, A. Loeb, A. (CfA) Moran, J. (CfA) Braatz, J.	Search for very high redshift water maser emission. 2, 3.6, 6 cm

No.	Observer(s)	Program
BI008	Imai, H. (NAO, Japan) Shibata, K. (NAO, Japan) Migenes, V. (Guanajuato U.) Inoue, M. (NAO, Japan) Sasao, T. (NAO, Japan) Miyoshi, M. (NAO, Japan) Murata, Y. (ISAS, Japan) Marvel, K. (Caltech) Diamond, P.	Monitoring of stellar water masers with the VLBA. 1.3 cm
BJ027	Johnston, K. (USNO) Fey, A. (USNO) Gaume, R. (USNO) Eubanks, T. M. (USNO) Kingham, K. (USNO) Clark, T. (NASA/GSFC) Ma, C. (NASA/GSFC) Ryan, J. (NASA/GSFC) Vandenberg, N. (Interferometrics) Himwich, E. (Interferometrics) Shaffer, D. (Radioferometrics) Gordon, D. (NASA/GSFC) Fomalont, E. Walker, R.C.	Geodesy/Astrometry observations for 1998. 3.6 cm, scheduled as RDV10.
BK053	Krichbaum, T. (MPIR, Bonn) Lobanov, A. (MPIR, Bonn) Britzen, S. (NFRA) Witzel, A. (MPIR, Bonn) Zensus, J. A. (MPIR, Bonn)	Broad band variability and jet bending in PKS 0528+134. 0.7, 1.3, 3.6 cm
BL038	Lestrade, J-F. (Paris Obs.) Phillips, R. (Haystack) Jones, D. (JPL) Preston, R. (JPL)	Search for extra solar planets by VLBI astrometry. 3.6 cm with phased VLA
BL058	Lonsdale, C. (Haystack) Diamond, P. Smith, H. (UC, San Diego) Lonsdale, C. (Caltech)	Radio supernovae in OH megamaser galaxy Arp 220. 3.6, 6, 18 cm with phased VLA
BL066	Lobanov, A. (MPIR, Bonn) Krichbaum, T. (MPIR, Bonn) Kraus, A. (MPIR, Bonn) Witzel, A. (MPIR, Bonn) Otterbein, K. (Heidelberg Obs.)	0836+710 jet kinematics related to the broad band activity. 0.7, 1.3, 3.6 cm
BL067	Lazio, T. J. W. (NRL) Cordes, J. (Cornell)	G359.28-0.92, the Mouse.

No.	Observer(s)	Program
BM094	Marecki, A. (Copernicus/Torun) Spencer, R. (Manchester) Owsianik, I. (Copernicus/Torun)	Mid-scale symmetric objects. 18 cm
BM095	Marscher, A. (Boston) Cawthorne, T. (Lancashire) Gear, W. (Cambridge) Stevens, J. (Cambridge) Marchenko, S. (St. Petersburg State U.) Yurchenko, A. (St. Petersburg State U.) Gabuzda, D. (Lebedev) Lister, M. (Boston) Forster, J. (UC, Berkeley)	Monitoring bright AGNs. 0.7 cm
BM096	Cotton, W. Fanti, R. (Bologna) Mantovani, F. (Bologna)	Search for Faraday rotation in 3C99. 6, 18 cm
BM097	Migenes, V. (Guanajuato U.) Slysh, S. (Lebedev) Fomalont, E. Horiuchi, S. (NAO, Japan) Ludke, E. (UFSM, Brazil) Altunin, V. (JPL)	Survey of OH maser regions. 18 cm
BM100	Marcha, M. (Lisbon) Bondi, M. (Bologna) Dallacasa, D. (Bologna) Stanghellini, C. (Bologna) Polatidis, A. (Chalmers, Onsala)	Structure of low luminosity BL Lac objects and flat spectrum RGs. 6 cm
BM101	Marecki, A. (Copernicus/Torun) Owsianik, I. (Copernicus/Torun) Falcke, H. (MPIR, Bonn) Niezgoda, J. (Copernicus/Torun)	Looking for CSO candidates among newly discovered GPS galaxies. 2, 6 cm
BM110	Denn, G. (Iowa) Mutel, R. (Iowa)	Monitoring BL Lac. 0.7, 1.3, 2 cm
BM112	Moran, J. (CfA) Greenhill, L. (CfA) Herrnstein, J. Diamond, P. Bragg, A. (CfA) Trotter, A. (CfA) Henkel, C. (MPIR, Bonn)	Next generation study of NGC 4258 accretion disk physics. 1.3 cm with phased VLA
BM113	Mioduszewski, A. Hjellming, R. Rupen, M.	Fading x-ray transient CI Cam. 18 cm with VLA single antenna

No.	Observer(s)	Program
BR053	Ratner, M. (CfA) Bartel, N. (York U.) Lebach, D. (CfA) Lestrade, J-F. (Paris Obs.) Shapiro, I. (CfA)	Astrometry of HR 8703 in 1998 for the Gravity Probe-B mission. 3.6 cm with phased VLA
BR056	Roberts, D. (Brandeis) Moellenbrock, G. (ISAS, Japan) Wardle, J. (Brandeis) Gabuzda, D. (Lebedev) Brown, L. (Connecticut)	Multi-wavelength polarization sensitive VLBA observations of 3C345. 0.7, 1.3, 2, 3.6 cm
BR058	Rupen, M. Mioduszewski, A. Hjellming, R.	The radio afterglow of CI Cam. 2, 3.6, 6, 18 cm with VLA single antenna
BS060	Stirling, A. (Manchester) Spencer, R. (Manchester) Garrett, M. (NFRA) McKay, D. (Manchester) Fender, R. (Sussex) Ogley, R. (Open University)	Confirmation of milliarcsecond scale radio jets in Cygnus X-1. 2, 3.6 cm with phased VLA
BS065	Sasao, T. (NAO, Japan) Miyoshi, M. (NAO, Japan) Manabe, S. (NAO, Japan) Kameya, O. (NAO, Japan) Asaki, Y. (NAO, Japan) Imai, H. (NAO, Japan) Mochizuki, N. (Nobeyama Obs.) Omodaka, T. (Kagoshima U.) Yasuda, S. (Kagoshima U.) Okudaira, A. (Kagoshima U.)	Towards determination of outer rotation curve of the Milky Way galaxy. 1.3 cm
BT034	Taylor, G. Beasley, A. Frail, D. Kulkarni, S. (Caltech)	VLBA observations of gamma ray bursters. 3.6 cm
BT038	Tingay, S. (JPL) Preston, R. (JPL) Jones, D. (JPL) Murphy, D. (JPL) Meier, D. (JPL) Jauncey, D. (CSIRO) Tzioumis, A. (CSIRO) Reynolds, J. (CSIRO)	Monitoring of Centaurus A, the closest active radio galaxy. 3.6 cm
BT039	Taylor, G.	Investigating extreme Faraday rotation measures in quasar cores. 2, 3.6, 6 cm

No.	Observer(s)	Program
BU013	Falcke, H. (MPIFR) Roy, A. Ulvestad, J. Wilson, A. (Maryland) Wrobel, J.	Component motions in two Seyfert galaxies. 1.3, 2, 3.6 cm
BV031	Vermeulen, R. (NFRA) Kellermann, K. Cohen, M. (Caltech) Zensus, J. A. (MPIR, Bonn) van Langevelde, H. (NFRA)	Kinematics of HI absorbing gas towards the nucleus of NGC 1052. 3.6, 6, 18 cm with phased VLA
BW041	Wilson, A. (Maryland) Ulvestad, J. Mundell, C. (Maryland) Roy, A.	Free-free absorption in megamaser galaxies. 2, 6, 18 cm
V015	Vestrand, W. T. (New Hampshire)	Two epoch mapping of three variable CGRO blazars: 1633+382. 6 cm polarization with phased VLA
V021	Minter, A.	Orbiting VLBI observations of the pulsar 0329+54. 18 cm
V030	Preston, R. (JPL)	Pearson-Readhead survey from space: 0133+476, 0153+744. 6 cm
V034	Murphy, D. (JPL) Guirado, J. (JPL) Conway, J. (Chalmers, Onsala) Preston, R. (JPL) Jones, D. L. (JPL) Meier, D. (JPL) Hirabayashi, H. (ISAS, Japan) Kobayashi, H. (ISAS, Japan) Murata, Y. (ISAS, Japan)	Continuous monitoring of 1928+739. 6 cm
V044	Alef, W. (MPIR, Bonn)	SVLBI of the nearby broad line radio galaxy 3C390.3. 6 cm
V047	Gurvits, L. (NFRA)	Extremely high redshift quasars: 2126-158. 6 cm with phased VLA
V050	Kollgaard, R. (Fermilab)	X-ray selected BL Lacertae objects: 2155-304. 18 cm
V053	Witzel, A. (MPIR, Bonn)	Polarization variability of intraday variable sources: 1803+784. 6 cm with phased VLA
V057	Gabuzda, D. (Lebedev)	Polarization monitoring of 4 BL lacertae objects: 1803+784. 18 cm with phased VLA
V061	Romney, J.	Core of 3C84. 18 cm

No.	Observer(s)	Program
V064	Zensus, J. A. (MPIR, Bonn)	Physics of the jet in quasar 3C345 at light year resolution. 6 cm with phased VLA
V077	Booth, R., (Chalmers, Onsala) Diamond, P. Lindqvist, M. (Chalmers, Onsala) Kemball, A.	W30H Observation. 18 cm with phased VLA
V083	Langston, G.	High frequency variables: 1413+135. 6 cm
V085	Schilizzi, R. (NFRA)	GPS galaxies and quasars: 1404+286, 1550+582. 6 cm
V093	Moellenbrock, G. (ISAS, Japan)	Polarization structure in the bent jets of gamma emitting blazars. 6 cm with phased VLA
V103	Slysh, V. (Lebedev)	Non-scattered OH masers: Cep A. 18 cm
V112	Reynolds, J. (CSIRO)	Nearby lobe-dominated radio galaxies: Pictor A. 6 cm
V116	Kedziora-Chudczer, L. (Sydney)	Intraday variable source PKS 0405-385. 18 cm
V118	Iguchi, S. (NAO, Japan)	BL Lac object OT081 = 1749+096. 6 cm
V125	Kameno, S. (NAO, Japan)	Distribution of spectral index in the CSS 3C380. 6, 8 cm with phased VLA
V129	Inoue, M. (NAO, Japan)	Obscuring system in 3C84. 6 cm with phased VLA

F. SCIENCE HIGHLIGHTS

Socorro

VLA Reveals Protoplanetary Disks in Close Binary Pair - VLA observations at 7 mm have shown dust disks surrounding a pair of young stellar objects in the star-forming region L1551. The stars are separated by only 45 AU, and the disks have radii of about 10 AU. The mass of these disks is estimated to be about 0.05 solar masses, more than enough to form planetary systems. The observations indicate that planetary systems can form in close binary systems, though the disks are truncated.

Investigators: L. Rodriguez, P. D'alessio, Y. Gomez, S. Lizano, J. Canto, and A. Raga (UNAM); D. Wilner, P. Ho (CfA); J. Torrelles (Granada); and A. Pedlar (Jodrell Bank).

Soft-Gamma Repeater "Afterglow" Strengthens Magnetar Model - A short-lived radio source detected toward the soft gamma ray repeater SGR 1900+14 is interpreted as the synchrotron nebula powered by particle outflow accompanying high-energy bursting activity from a magnetar—a neutron star with a 10^{15} Gauss magnetic field. Following a gamma ray outburst on 27 August, the short-lived radio source, combined with a 5.16 s periodicity in the x-ray counterpart, provides new support for the magnetar model.

Investigators: D. Frail; and J. Kulkarni and J. Bloom (Caltech).

Green Bank

Radio recombination lines of Carbon have been observed in absorption towards the supernova remnant Cas A at 560 MHz and 770 MHz using the 140 Foot Telescope. At higher frequencies these lines appear in emission, are narrow, and are essentially Doppler-broadened. They appear to result from a population inversion in ionized Carbon in a cloud that is predominantly neutral and atomic. These and other data are modeled as arising from a region with a temperature of 75 K, a density of a few hundred hydrogen atoms per cubic cm, and an electron density of 0.02 per cubic cm. With these properties, the cloud is nearly in pressure equilibrium with its surroundings.

Investigators: N. Kantharia, K. Anantharamaih (Raman Research Inst.); and H.E. Payne (STScI).

G. PUBLICATIONS

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

H. CHARLOTTESVILLE ELECTRONICS

Amplifier Development, Design, and Production

The MAP project, which has occupied the amplifier group at the Central Development Laboratory (CDL) for the last two years, is nearing completion. All but four of the flight + spare amplifiers have been completed; 14 amplifiers are undergoing testing and adjustment. There is some cleanup work to be completed before the project is officially over, and we may need to provide additional support from time to time if there are problems with amplifier performance, but the bulk of the work will end shortly.

Marian Pospieszalski completed a new design for 85–90 GHz for use on the VLBA. Its predicted performance is optimized for VLBA use. Ed Wollack (now at GSFC) and Bill Lakatosh completed a prototype of a new version of the Q-band amplifier optimized for 40–50 GHz for use on the GBT, VLA, and VLBA. An improved body has been designed which will make assembly easier, and milling machine programming is in progress.

Plans are being drafted to produce enough amplifiers over the next two years to:

1. Retrofit four VLBA W-band receivers;
2. Retrofit 13 VLA Q-band receivers;
3. Retrofit four VLA new-style K-band receivers;
4. Build the 4-beam, 2-polarization receiver for the GBT;
5. Build 16 new Q-band receivers for the VLA;
6. Build eight new-style K-band receivers for the VLA;
7. Provide sufficient spares.

Superconducting (SIS) Millimeter-Wave Mixer Development

Balanced and Sideband Separating Mixers – Analyzed 200–300 GHz sideband-separating mixers using QuickWave EM simulator to study higher-order mode coupling around substrates in millimeter-wave integrated circuits (such as our balanced and sideband separating mixers). Eccosorb MF 112 should damp the resonances well, but there is little reliable published data on the properties of such absorbing materials at 200–300 GHz and cryogenic temperatures. A cryogenic Fourier transform spectrometer would allow measurement of the properties of materials such as this, which are vital to the success of the MMA.

SIS Mixer Design – Modified our existing SIS mixer analysis program to include the excess noise caused by multiple Andreev reflections. MAR appear to be associated with the excess sub-gap leakage current in many Nb SIS junctions, and cause excess shot noise as a result of individual carriers crossing and re-crossing the barrier several times.

Wafer Test Circuits – A liquid helium dewar has been equipped for measuring superconducting test circuits which will be included on every SIS wafer. It is hoped that data from the test circuits will allow us to avoid measuring many non-optimum mixers and select only those with parameters (stub length, etc.) close to optimum for the particular material characteristics of a given wafer.

Work with UCLA on a Photomixer Coupling Circuit – Analysis of a waveguide mount, proposed by UCLA for the photomixers they are developing for the Millimeter Array (MMA), revealed two resonances within the intended band. Modifying certain dimensions moves the resonances out of the desired band, but it is not clear whether the design is suitable for scaling to the shorter millimeter wavelengths.

Noise Properties of Balanced Amplifiers – The balanced amplifier is used in applications requiring a better input match than is possible with a single-ended amplifier. While the impedance matching property of the balanced amplifier is well known, its noise behavior appears not to be widely understood. In MMA Memo #227, it is shown that the outgoing noise waves at the input and output of a balanced amplifier are uncorrelated even though they originate in the same components. Hence, a sliding short-circuit at the input produces no variation in the output noise of the amplifier. The properties of a balanced amplifier are similar to those of an amplifier preceded by an isolator, although the noise wave emerging from inputs of the two circuits originates in different elements. The noise theory of the balanced amplifier applies also to balanced mixers based on quadrature hybrids.

Vacuum Windows – Continued work on a low-loss, low-leakage, 100 GHz vacuum window for the VLA—this is being used as a prototype for a possible MMA design. A problem with air bubbles between PTFE and quartz layers appears to be due to the pressure in the vacuum chamber rising during the out-gasing of the epoxy mix, which is therefore not out-gasing sufficiently.

Automated SIS Measurements – Work has started on an automatic SIS mixer testing system. Because of the enormous amount of time involved in testing mixers manually over wide frequency ranges, it is essential to develop a reliable computer-controlled system to handle this work for the MMA.

MMA Planning – During this quarter, considerable time was spent in planning the details of SIS mixer development for the MMA. The MMA Internal Review in Tucson was attended by three engineers from the CDL SIS receiver group.

Visitors – V. Radhakrishnan spent three days visiting the CDL in September for discussions on fundamental noise limits and definitions. It was agreed that a physically meaningful and consistent framework was given by: (i) the Callen & Welton formula for the radiation from a black body; (ii) the Caves formula for the minimum noise of an amplifier or mixer; and (iii) Tucker's quantum mixer theory. To use any other formulas (e.g., the Planck law instead of the Callen & Welton) would require modification of the other two.

Visits – GSFC: Visited detector fabrication lab at NASA/GSFC. They will be making 1000-element bolometric x-ray detector arrays with Nb transition-edge temperature sensors for NASA's Constellation-X satellites. They have considerable Si membrane expertise, which may be relevant to our future SIS mixer designs.

SUNY: The Nb foundry at SUNY/Stony Brook was set up by Prof. J. Lukens in the 1970's for physics research on superconductors. Lukens was probably the first to use electron-beam lithography for Nb circuits, and they now routinely use a combination of e-beam- and photo-lithography. They use a "planarization" process, developed by IBM, which avoids the uneven surface that develops during normal Nb circuit fabrication. A most impressive aspect of the SUNY foundry is the emphasis on process monitoring and quality control—unusual in a university laboratory—which has been driven largely by their work on large array oscillators, where uniformity of junction parameters across a wafer is critical. They showed us excellent I-V curves for junctions as small as 0.5 um x 0.5 um (0.25 um^2) and critical current densities up to 100,000 A/cm^2.

SIS Mixer Production – During this quarter the CDL assembled and tested eight SIS mixers, all using Nb circuits fabricated at the University of Virginia.

Electromagnetic Support

GBT – Work on the 385–520 MHz short-backfire antenna to improve its performance at the high end of the band is in progress.

General – A Ka-band phase shifter designed to operate between 26.5 to 40.0 GHz was fabricated and tested. The measured differential phase shift between the two orthogonal polarizations is within ± 3.5 degrees off the value at mid frequency. The absolute value of the phase shift is lower by about 8 degrees from 90 degrees as predicted by a Finite-Difference Time-Domain program. A second phase shifter will be measured soon before a design change is done.

A dual reflector analysis program was installed and tested for its accuracy. This program is based on Geometric Theory of Diffraction and Physical Optics methods. This program will be useful in calculating cross-polarization levels of dual reflector antennas accurately.

VLA – A problem at the input section of the K-Band feed resulted in resonances/suckouts in the front-end measurements. This problem has been identified and corrected.

GBT Spectrometer

Much of the past quarter was spent working on the design of Xilinx chip personalities to support observing modes in both the GBT and Tucson spectrometers. Work on the Tucson system modes was completed in September, and the GBT work is about 80 percent complete.

Some work was done on the system design of the MMA correlator. Most of this work involved support of the project review meeting in Tucson in July.

A test correlator for the MMA was started this quarter. This system will use hardware designed for the GBT spectrometer. Support for the Tucson spectrometer was provided for the initial start-up of the system. This work involved several trips to Tucson.

Frequency Coordination

In the area of frequency coordination, A. R. Thompson has chaired two meetings of U.S. Working Party 7D (Radio and Radar Astronomy) during the quarter. These have been held at NSF headquarters in Ballston, Virginia. Important items have included analysis of the effects on radio astronomy of feeder links of low-earth-orbit satellites in the bands 1390–1393 and 1429–1432 MHz, and preparation of documents for the Conference Preparatory Meeting for the World Radiocommunication Conference of year 2000. Allocations to radio astronomy in bands above 71 GHz will be on the agenda of that conference. During the tests of emissions of the Iridium satellite system during the previous quarter, it was found that the broadcast signal channels produced emissions in the 1610.6–1613.8 GHz frequency band that exceeded the interference threshold values for radio astronomy. These signals will be active during the four-hour nighttime period when the satellites should not cause interference to radio astronomy. We have now been informed by Motorola/Iridium that action has been taken to correct the levels in the radio astronomy band during these periods.

I. GREEN BANK ELECTRONICS

GBT IF System

Completed signal conditioning card/box for helium pressure sensors and ambient temperature sensors. This initial unit has a prototype board with circuits for two pressure sensors and four temperature sensors. The unit was installed in the Mockup and readings are being logged along with DCR data.

RF testing of the repackaged Optical Driver Module was completed successfully. Production of the remaining units awaits technician time.

GBT Fiber IF System

Circuit boards for the feed-back link were sent out for fabrication.

GBT Servo System

Although a program to exercise all components of the feed arm servo weekly was put into place, because of various mechanical problems, only the feed turret system can be moved at this time. A 30-day reliability test will be made as soon as the system is repaired.

A meeting is held regularly between NRAO, COMSAT, and RSI/PCD to address the current servo issues.

GBT Active Surface

Actuator cable installation continues. Over 50 percent of the cables are installed. A few actuators were tested before and after welding. No problems were encountered. A few of the actuators are leaking oil. This appears to be oil that has separated from the

grease, and is considered normal. The active surface computers were integrated into the GBT network and given their final names and addresses. Integration into the Monitor and Control (M&C) message system will begin soon.

GBT Mockup

The Mockup has been used over the past quarter to help integrate the electronics for the GBT with the M&C software. This testbed has proven to be very beneficial. A stable version of the M&C software is available for system tests, and a test version of the software is available for the M&C group to test new software features.

Quadrant Detector

Work on eliminating RFI generation by the laser power supply was conducted. Tests are not completed yet on a new power supply from the manufacturer. Some discussion has been held on mounting the quadrant detector.

Holography

Phase stability measurements show that new LO modules are required to meet the long-term stability for holography. These are on order.

Equipment Room

The HVAC controllers have been modified to control the temperature to within 0.2C of the setpoint. Tests have shown that this PID controller works as expected.

Prime Focus Receiver

The IF conditioner was completed in August. The low-band dewar is undergoing extensive tests. Some of the amplifiers were sent back to the CDL for repair.

GBT Receiver Systems

C-Band Receiver - Significant amounts of time were spent tracking down cooling problems. The receiver is still in use at the 140 Foot Telescope. The new Vac Ion controller is assembled and bench tested. It will be installed on the Vac Ion pump in October.

Q-Band Receiver - The mechanical design of the fixturing to test the prototype Q-band RF assembly in a lab test dewar is still in progress. Outfitting of the test dewar with electronics and cabling is underway.

S-Band Receiver - The machine shop has finished making the new OMT ridges designed to move a resonance out of important VLBI bands. The remainder of the parts for this receiver are being fabricated in the shop.

Site Operations

OVLBI - Overall, the station is in good shape. Two-way timing (TWT) control problems appear to be solved, and phase noise in the two-way path residuals is lower than ever. Work was done to move the operations from the trailer into the new control room in the Jansky Lab.

Interference Protection Group - Electronics is an integral part of the Interference Protection Group. Over the past quarter we have tested and re-tested many subsystems, identifying sources of RFI in each subsystem. Work was completed on a data acquisition system for the anechoic chamber.

Telescope Support - Work to move operations into the new control rooms in the Jansky Lab addition for the USNO 20 meter, Green Bank Interferometer, and 85-3 was begun.

Maintenance, repair, and installation support was supplied to the 140 Foot, USNO 20 meter and the OVLBI earthstation telescopes. This includes electronic maintenance, electronic design projects to assist users for special projects, and cryogenic support

for virtually every receiver in Green Bank. Normal day-to-day support of UNIX workstations, weather station, time systems, and local area networks is also provided.

J. TUCSON ELECTRONICS

1-mm Array, 220-250 GHz Receiver

This receiver is now in routine use. Several early operational problems have been identified and solved. We have identified two faults in this system which may be the source of the problems with baseline stability which sometimes affects wide-bandwidth measurements. This receiver is the ideal candidate for the development of automatic tuning of receivers, and the software to realize this has been developed and implemented. Although all of our receivers are tuned remotely over the computer network at the telescope site (or even tuned over the Internet from our downtown offices), the precise tuning still relies on the telescope operator closing the loop. The receiver characteristics are such that a simple lookup table of tuning parameters is not adequate to ensure optimum performance. With eight receivers to tune, this clearly puts considerable demand on the operator and can lead to inefficiency in the setup time needed for a new observer, even though the individual receiver channels are less complex to tune than our regular single-beam systems. We are currently using the experience gained with automating the 1-mm Array system to modify the tuning procedure for all receivers on the 12 Meter Telescope.

The 8-Channel, 4-Beam, 3-mm System

A commercially available frequency tripler for the LO has been tested and works well at 4 K. This validates the concept of using coaxial lines to input the LO to the dewar at one third of the LO frequency. The dewar has been built and awaits testing. The design of the basic receiver insert has been completed and fabrication has begun. A crossed-grid polarization diplexer designed to operate at 4 K has been constructed and tested. A prototype 2-channel system is currently being tested.

Planned Wide-band Continuum Receiver

The availability of HEMT amplifiers covering the frequency range from 70–90 GHz raises the possibility of building a continuum receiver with a sensitivity of around 50 mJy per root sec; the extraordinarily high sensitivity comes from the very wide bandwidths. The major problem to be overcome is the 1/f noise which has been reported from early experiments. Although not necessarily worse in this system than in other HEMT amplifiers, the extremely large (bandwidth times integration time) product means that much lower levels of 1/f gain modulation can dominate the residual noise in the detected output from the receiver. Progress with this project is dependent on available manpower, and has been given lower priority than the multi-beam systems mentioned above.

New Phase Lock Control

One of the most efficient observing modes, generally applicable to relatively narrow bandwidth observations, is frequency switching. Unlike other switching schemes, in this observing mode the object of interest is in the telescope beam and in the spectrometer passband for 100 percent of the time. At present, we are limited in our ability to frequency switch, in both switching rate and in total frequency throw, by the analog phase lock system. We have designed, tested, and installed a digital phase lock system into our 2/3 mm receiver that combines both frequency and phase control and provides faster, reliable switching over a broader frequency range. We can now routinely switch by as much as ±35 MHz, making frequency switching useable for a wide variety of research projects. We are currently producing digital phase lock systems for all of our receivers.

Another capability which will become practical thanks to the enhanced digital phase lock is "sideband smear" operation. This is a powerful technique of reducing confusion in spectral line observations from features appearing in the unwanted sideband. The principles have been established during some ad hoc test observations performed at the 12 Meter Telescope, and have been described in conference proceedings. The practical implementation of a usable system at the 12 Meter has been hampered by the performance of the phase lock system; fast switching times over a relatively large bandwidth are required. The digital phase lock should solve these problems.

Receiver Component Servo Systems

Given the importance of the accuracy and reliability of the servo drivers for the components of the 12 Meter receivers, we have investigated these aspects on our 1 mm Array system. By implementing a periodic test and maintenance procedure for all of the mechanical systems in these servo drivers, we have dramatically improved the accuracy, reliability, and repeatability of these systems. This will have direct impact on our ability to quickly and automatically tune all of the 12 Meter receivers.

Cryogenics

All receivers on the 12 Meter Telescope rely heavily on reliable operation of cryogenic systems. A new cryogenic compressor system has been developed for our closed-cycle 4 K refrigerator. The individual compressor units for the Gifford-McMahon refrigerator and the Joule Thomson expansion valve have been combined into a single unit, resulting in a smaller installation with lower power consumption. All four of these units have been fabricated, tested, and installed on the telescope.

Quadrant Detector and Thermal Sensors

One of the main contributions to pointing changes on the 12 Meter Telescope is lateral movement of the subreflector, with respect to the main telescope surface. This is caused by unbalanced thermal effects on the subreflector support structure. We have installed a system on the 12 Meter to sense these changes; we have a laser quadrant detector to measure the lateral motion of the subreflector mount, with respect to the telescope central hub structure, and we have thermistors continuously monitoring the temperature of the feed legs and other parts of the telescope structure. We are currently trying to gather statistics to enable us to understand the detailed relationship between the thermal distribution of the telescope and telescope pointing offsets. At a later date we hope to incorporate the thermal data into our telescope pointing model to give real time pointing corrections.

New Digital Spectrometer

A new digital spectrometer, called the Millimeter Auto Correlator (MAC), has been installed at the 12 Meter Telescope. The MAC, which is a GBT correlator clone, has twice the instantaneous bandwidth currently available for our multibeam systems, and uses a single wideband sampler for each IF channel. This new design should avoid the persistent platforming problems experienced with our now decommissioned hybrid correlator spectrometer. The MAC will support the existing 1.3 mm and 3 mm, and any future, multi-beam systems on the telescope. The MAC currently functions with a subset of its available bandwidth modes, but is none the less in routine operation at the telescope.

Software

Continuum On-The-Fly Analysis - Eric Greisen has added tasks to the AIPS package which allow the analysis of continuum on-the-fly (OTF) data. By employing the Emerson, Klein, Haslam deconvolution algorithm, these analysis tasks add greatly to our complement of OTF analysis software. This development has also expanded the scientific capabilities of the 12 Meter by adding continuum OTF to its complement of observing modes.

K. SOCORRO ELECTRONICS

VLA AZ/EL Encoder Interface Replacement

A positive decision to implement a prototype was made. The Servo group with aid from the DCS group, will design and build the first unit. The project start may be fourth quarter 1998 to first quarter 1999.

VLA Pie Town Link

Development and construction activities are proceeding in the connection of the PT antenna to the VLA as *Antenna 27* via 104 km of Western New Mexico Telephone Company (WNMTC) standard single mode fiber. The current system design is reflected in drawing B12625B001 Rev2, dated July 10, 1998.

Several new VLA style modules are required: M30 Relay Control Module, M31 Dataset Interface Module (a XYLINX replacement to the F5, L5 combination), M32 Digital Transceiver Module (800 Mbit/sec Fiber optic 16-line digital multiplexer), T201 IF Converter Modules, T202 Analog Fiber Transmitter, and T203 Analog Fiber Receiver. Eleven expanded delay card prototypes (675u) have been built and tested.

Rack and prototype module hardware is currently about 70 percent complete. Project parts (including SMT), PCB's, and test equipment now totals approximately $150K.

The WNMTC 12 fiber cable (of which two are used for the Pie Town link) was recently severed by power company activities at the VLA . The connections were restored by NRAO. Delays in the supply of a high power CW 80 mW Solid State laser for the analog segment of the link has necessitated in-house construction of a Distributed Feedback Laser replacement. Work continues to resolve intermittent behavior of the modified delay cards at power-up time.

A comprehensive eight-step test and integration plan beginning with C- and X- band single IF baseline products between Pie Town and four VLA antennas is expected to commence mid November 1998.

GPS Receivers

Seven of the Truetime model XL-AK-600 GPS receivers that have been chosen to replace the Odetics 325 are in the field and working well. One additional receiver has arrived and will be tested before being sent to the field.

VLBA Masers

Maser #1 at the Brewster VLBA site, which was modified in April with a hand-wound inductor in a tuned circuit, has improved by a factor of two in IF degradation rate. Maser #11 at the North Liberty VLBA site, which had the same retrofit this quarter, has not improved and will require more troubleshooting. Maser #4, which had an excessively increasing palladium heater voltage, developed a vacuum problem. The hydrogen purifier and pirani gauge assemblies were changed and the maser is being worked on to improve vacuum levels. Because the hydrogen ion pumps of Maser #6 have operated at a relatively high pressure for several years, they were replaced.

Correlators

Eleven delay cards have been modified for use with the extended delay range required for the Pie Town to VLA connection. These cards have been tested in the system and are ready for the first fringe testing scheduled for the fourth quarter. New VLA analog sum power supply assemblies have been fabricated for the four IFs, with the goal of reducing noise on the sums. One has been temporarily installed in IF C for possible evaluation by users. All are waiting for fabrication of covers before final installation. Errors detected during testing of the serial interface data lines for the new correlator system controller are being investigated. Work continues on the remaining Technical Reports covering the VLBA correlator.

VLBA Data Acquisition and Playback

NRAO is planning to procure a number of triple-cap headstacks during the fourth quarter of 1998. Several members of the VLBI community have worked together with Spin Physics and Metrum to agree on a specification for the triple-cap headstack, as well as the traditional single-cap headstack. NRAO is planning to loan Spin Physics a set of read electronics, as well as a thin tape upgrade, to enable them to test the headstacks adequately and verify that they meet the new specification. Metrum has already had this capability for some time.

The dry air kits for the head assemblies have now been installed at the St. Croix, Hancock, and North Liberty VLBA sites as well as at several playback drives. At St. Croix, the site technician noted that the kit reduced the relative humidity in the headstack area from 39 percent to 26 percent. The kits have not introduced new problems, and we plan to build them for the rest of the VLBA tape drives as funds become available.

The formatter expansion, which doubles the recording bandwidth to 512 Mbps, is now complete at Pie Town, Los Alamos, Owens Valley, and Kitt Peak VLBA sites. The outfitting has slowed down due to personnel changes, and will continue into 1999.

VLA K-Band Front-End

Front-ends #3 and #4 are fabricated and lab testing is complete. The H_2O radiometer sub-system had some problems with noise from the 5 MHz external clock. The voltage to frequency converters were replaced with units that don't require an external 5 MHz clock. A signal channel data collecting prototype was tested and this solved the clock noise problem. The H_2O sub-system was redesigned. The new design will be fabricated, tested, and integrated into the front-ends during the early fourth quarter.

VLBA 3-mm Front-Ends

The Front-End Group completed the new dewar design. The Engineering Services Division machine shop did the fabrication for two units. Front-End #3 was assembled and lab tested.

A problem arose during the testing. The matching teflon formed a bubble on the vacuum side of the quartz window. The window was returned to Tony Kerr at the CDL in CV. The windows will be sent back to the AOC early next quarter. Front-End #4 is assembled but the finish machining of the polarizer has not been completed.

Amplitude Equalizers for the VLA

The average passband for the VLA antennas has a large slope across the 50 MHz bandwidth. This affects the observing center frequency during continuum observations. We plan to implement a simple equalizer circuit to correct band pass shapes after the bandwidth has been expanded to 70 MHz.

Increasing the VLA Continuum Bandwidth

Work on increasing the VLA continuum bandwidth on all four IFs continues. The parts to increase the bandwidth to 70 MHz for 27 antennas have been ordered. The 240 IF filters needed in the F7 and F8 front-end modules will be fabricated by the VLA machine shop. The 70 MHz low-pass filters in the screen room will be tested and retuned as necessary to match group delay. The T3 modules will have new filters installed and the mixers will be biased and retuned to lower secondary mixer products. The existing 50 MHz pass-band will not be affected by this upgrade but the narrow band filters installed for JPL and Voyager will be eliminated. On a three antenna test of the increased bandwidth there was an improvement of 24 percent in signal to noise and the phase closure error was within 2 degrees. This phase of the project will start in the fourth quarter.

VLBA Power Supply Upgrade

The P103 5 volt power supply in the VLBA D-rack is near its current limit when eight base band converters are present. This supply is being upgraded to a P107 5 volt supply capable of supplying enough current for 12 BBCs. Currently, 5 VLBA sites have been retrofitted, with the remainder to be completed by the end of the second quarter 1999.

VLA Final LO Replacement

We have been informed that Fluke will no longer support the model 6061 synthesizers by the year 2000. These synthesizers are used as the final LO in the back end at the VLA. We are currently working on plans to do an in-house design to replace these synthesizers. Preliminary design studies are on going and the design will start in the first quarter 1999.

Interference Protection

The Socorro Interference Protection Group web page was upgraded this quarter to allow interactive plotting of W8 pad monitor spectrum analyzer data for multiple days. Additional "SYSQUICK" plots for P through K band at the VLA were added to the web site, as well as individual VLBA site plots showing the RFI environment as of Spring, 1998.

The RF Environmental Monitoring System (RF-EMS) hardware at the VLA continued to be upgraded, tested, and improved over the summer months. New software was added which allows the IPG to setup and run the AILTEK receiver via modem (and PCANYWHERE), and interactively see the spectral plots on a one-shot or peak-hold basis. The new software was tested under Win95, and is being converted to Linux operation in order to allow true multitasking operation. A wideband lightning protection system was designed and tested. Meanwhile, L-, S-, and C-band data from the system continued to be collected and analyzed.

Electromagnetic compatibility (EMC) tests of new and proposed equipment continued during the third quarter. Lab and field tests were conducted in order to determine the extent of undesirable emissions from a wireless modem system proposed by New Mexico Tech, and a Gateway PC for the VLA site.

Frequency coordination efforts worked on during the 3rd quarter included a re-analysis of the proposed, 2m repeater for Mauna Kea, the wrap-up of the long standing Paxson Communications, ABQ TV-14 legal battle, and a statement of our concerns related to the proposed addition of a new electronic site at Mt. Withington Peak by the US Forest Service. Recurring notifications and coordination efforts with 7 US Air Force Frequency Coordinators continued, as well as special coordination with the US Space Command for GPS tests.

L. COMPUTING AND AIPS

Observatory-Wide Computing

Planning - In the past quarter, much of the observatory-wide computing effort has focused on the development of a status report and long-range plan for computing at the NRAO. The intent is to cover all major aspects of computing at all sites. The document will be used primarily for internal planning purposes and will be updated every year. Discussions with the staff at all major sites are in progress, and the 1999 version will be completed by December 1998.

Hardware - One of the chronic problems in radio astronomy, which has been steadily worsening over the past few years, is the time required to load and back up large datasets (i.e. up to tens of gigabytes). We are beginning to see more experiments, particularly VLBI, with individual files which exceed the storage capacity of a single high-density Exabyte tape; these files therefore cannot be backed up on traditional media. NRAO already has two Digital Linear Tape (DLT) drives. While the capacity and transfer rates of these drives have lived up to the claims for the technology, we have some concerns about the robustness of the hardware and the media for general use. Two Exabyte Mammoth drives have therefore been ordered for evaluation. While these drives have about 2/3 the capacity and transfer speed of DLT, the hardware and media are significantly less expensive and may be more durable for use by many different people. After this evaluation, we will decide which medium to invest in further.

Additional funds were received for computing purposes during the summer, with the result that the desperately-needed improvements in networking infrastructure in Green Bank and Charlottesville are now proceeding. Charlottesville will replace an aging Ethernet switch which frequently causes problems on the local network, as well as the old router which is no longer supported by the manufacturer. Green Bank will be able to introduce high-speed networking into the original Jansky Lab through the use of optical fiber, the only medium which can be used there because of RFI considerations.

Almost half of the hardware upgrades planned for 1998 have now been installed; the remainder are awaiting completion of the Linux support infrastructure at all four sites and will be ordered in October.

AIPS

Personnel - Exchange visits between Charlottesville and Socorro continue to be useful; Desai visited Charlottesville during May, Greisen spent a month in Socorro during June/July. Beasley began a one-year transfer to Charlottesville in July. There are approximately 4.5 full-time equivalent employees in the AIPS group.

15APR98 - The 15APR98 version of AIPS has been distributed to over 188 sites, running 198 installations (including Solaris, Linux, DEC Alpha, HP and SGI versions). The number of AIPS installations has grown impressively over the last year (33 percent, 15APR97-15APR98).

Support for SunOS 4 pre-compiled binaries will be dropped in future releases. The majority of AIPS distributions are now received by ftp (82 percent), although a CD ROM distribution is now available, and is growing rapidly in demand. One attractive feature of the CD ROM is the ability to use the binaries directly from the CD, keeping only data and a small footprint (10MB) on the processing machine. This is particularly attractive for laptop computers.

15OCT98 - The TST version of AIPS 15OCT98 is currently distributed nightly to 26 sites throughout the US, Europe, and Japan (22 automatically, four on request). At present the release of 15OCT98 is on schedule, at which time 15OCT97 (the pre-CVX "SPACE-VLBI" version) will no longer be available; full support for SVLBI processing has been available in 15APR98 and 15OCT98.

Hardware - AIPS running on Linux PCs continue to show impressive absolute and cost-relative performance. NRAO recently received a shipment of Pentium II-400 systems and the AIPS group have performed preliminary benchmarks on them. The best AIPSMARK so far is 14.5 when the system is configured with 256MB of memory. The number comes out somewhat lower with 128MB (14.1) and 64MB (12.5). A new benchmarking suite will need to be produced within a year or two to more adequately measure the performance (current suite now completes in under five minutes, which may be too short to be representative).

Support for DLT (digital linear tape) drives was added in 15APR98.

Documentation - At the present time we are converting the AIPS Cookbook from TeX to LaTeX, enabling conversion of the master Cookbook text to HTML. We plan to place the entire AIPS documentation system (Cookbook and all help documentation) on-line with full indexing and cross-referencing during 1998. Tasks to manipulate AIPS help files within browsers are now available in 15OCT98.

General Developments -

- 24-bit TV displays - From 15OCT98 and onwards a 24-bit XAS AIPS TV display is available on workstations whose graphics support 24-bit color.
- Multiple TV/Tek/MSG servers - 15OCT98 offers the option to have more than one set of TV/plot/message windows per workstation display and to support multiple displays (especially X terminals) from a single computer.
- FLGIT - A new task FLGIT was created to removed RFI interference from spectral-line data sets based on deviations from linear fits to the spectra or from median-window filtered spectra. This task has been primarily used to support the 74 MHz and P-band programs at the VLA.
- Y2K testing - Further Y2K testing of AIPS was performed by using the VLBA correlator to produce a dataset seemingly observed in February 2001. Loading the correlated data into AIPS did expose small deficiencies in date reading in tables.
- Calibration transfer - The VLBA correlator can now automatically attach flagging, system temperature, weather, gain curve and phase-cal information to VLBA data sets. Detailed revision of the definition of the data tables and of the reader routines in FITLD was required to enable in-house testing of this capability. The format definition for FITS interferometry data (previously VLBA memo #108) is currently under revision.
- A serious bug in the frequency axis for lower sideband VLBA data was found and corrected during Q2.
- Interactive editing options have been added to EDITR and EDITA, allowing difmap-style editing of data sets.
- Using the g77 EGCS 1.0.3 compiler the AIPS group have now produced a native port of AIPS to Linux running on a DEC Alpha; AXLINUX will now be added to the list of supported architectures.
- Support of tasks to read VLBI Mark III data from the Bonn correlator has continued throughout 1998.
- Consolidation and version numbering of the tasks involved in porting VLBA correlator data to the USNO/GSFC Calc/Solve package has been undertaken during the second and third quarters of, in particular the task CL2HF.
- The size of various AIPS internal memory spaces was increased to support a procedure set designed to calibrate and produce MERLIN images automatically.
- CONFI - A task CONFI was added to find optimal configuration of an array using the criteria of minimizing side lobes. This task has been written for MMA studies but can be used for general array design.
- SPLAT - The task SPLAT was created to reduce the size of data sets by allowing time and frequency-averaging when applying calibration, optionally producing single-source or another multi-source dataset.

Software

Security - We are in the process of purchasing enough licenses of an anti-virus program to cover all PCs connected to our networks. One of the features of this program is that it can run continuously and scan all files downloaded from the Internet or transferred from removable media. While there has been no major virus propagation within NRAO, they do appear on small numbers of systems fairly regularly; this software should reduce the frequency and spread of viruses.

NCSA - This quarter marks the end of the 1998 fiscal year for the first year of this grant. Despite the difficulty of hiring for the second position in the budget, substantial progress has been made. Poster papers and a demonstration of results will be presented at the Astronomical Data Analysis Software and Systems (ADASS) meeting in November. Current implementation efforts are

progressing on several fronts, including spectral-line imaging, UV-data gridding, image mosaicing, and performance tuning using the SGI/Cray Scientific Library parallel FFT routines, which in testing produced an increase in speed of approximately 50 percent over existing AIPS++ code.

A frame-relay connection has been installed between NRAO in Socorro and the University of Illinois at Urbana-Champaign (UIUC) campus. This will permit simple and reliable network access both to NCSA's facilities and to our collaborators in the UIUC Department of Astronomy; the normal Internet connections do not provide acceptable performance. Although the bandwidth will be adequate for the mostly-interactive work required during the current phase of the project, much higher bandwidth will be needed to make the facilities useful for production work. This will be part of the fiscal 1999 efforts.

Socorro Computing

Networking - the fiber optic installation at the VLA site was completed, resulting in vastly enhanced computing connectivity to and from the various buildings at the site.

Hardware - At the AOC, we have recently begun official support and installation of Intel/Linux based PCs. The decision to begin support was based on several factors: performance versus Sparc/Solaris, an existing installed base which required more centralized support, and increased local Linux expertise as a result of recent changes in staffing.

Four new 400 MHz PCs were purchased with RedHat Linux 5.1 installed. With help from Charlottesville, we are now in a position to install Linux machines in a simple, consistent manner making central administration feasible. Aipsmarks on the newest machines, 400 MHz Pentium-IIs with two, 9 GB Ultra-wide SCSI disks and 128 MB of memory, are slightly above 14. An effort is under way to add third-party software to eventually offer the same variety of choices as under Solaris. We expect to add more of these or similar machines in the fall of 1998.

The two remaining public Sparc-20 work stations were replaced with Ultra 10 machines. This means that all public machines at the Array Operations Center (AOC) are Sun Ultra's. We have no plans to move public workstations to the Intel platform until we have gained more experience with it.

An effort is well underway to select a new AOC server to replace arana, the Auspex server that has served us well for many years. We expect to finish the selection process in the second half of September and purchase and install the new machine in the following months.

Division News - A reorganization in the Computer Division took place in Socorro. The VLA and the VLBA online groups were merged into the Array Support Group, headed by Steve Blachman. The primary role of this group will be to provide software support to ensure successful operation of the VLA and VLBA. This merger will enable us to allocate the extensive expertise and resources, which until now were divided among two groups, to either instrument as needed. We believe a combined group will be in a much stronger position to tackle upcoming large projects.

VLA Online System Rebuild - A project was started to rewrite the VLA online system in order to make it less dependent on the Modcomp computers that currently are at the heart of the system. The main reasons for this are that there are serious concerns about the continued long-term viability of the Modcomps and their maintenance, the software is over a decade old, and the operator interface imposes severe restrictions on the efficient operation of the instrument. We intend to use the rebuild as the first part of a larger project to add new capabilities to the VLA and also to position ourselves for any future VLA upgrade. We have formed a formal project to be run by the Array Support Group of the Socorro Computer Division. The aim of the project will be to determine the requirements for the system rebuild, produce a formal written design document and, following a critical review of the design, implement the new system. This must be done while still keeping the VLA fully operational.

Personnel - Rich Moeser started work in the Array Support Group; his Java expertise is a welcome addition to a group in which this language is starting to play a major role. Ron Heald accepted a position with the Millimeter Array Project; his position is currently being advertised. The System Manager position that opened up when Vic Kiff resigned is still open; we have made two offers to promising candidates but were turned down in both cases. We find it increasingly difficult to attract skilled professionals to our Socorro location.

Green Bank Computing

As part of the observatory-wide computer upgrade, three older Suns were upgraded. One of these systems was to replace the central server (sadira). This will be installed later this year when the appropriate disks are delivered and configured.

In line with the rest of the observatory, several other Suns will be replaced by PCs running (RedHat) Linux. We procured two such systems to start the process of migration, and several others are planned for later in the year. One of these was to enable the system administrator to develop the Linux installation and support procedures for the public systems and GBT control computers; this uses the NRAO Linux distribution maintained and distributed from Charlottesville. In addition, the GBT Monitor and Control system now completely supports communication between systems of different architecture (e.g., Suns and PCs); this will allow Linux computers to control the GBT.

We have purchased board-replacement upgrades to twelve PCs. We also propose to purchase approximately ten new PCs. There are two main driving reasons for these upgrades. Through an observatory-wide purchase, we propose upgrading the version of AutoCAD to the current release; several of the people who use AutoCAD have computers which are too old to run the current version. In addition, this will enable us to retire many older PCs which are known not to be compliant with the millennium change.

We have a need to track the component maintenance history on the GBT, so we are actively tracking the progress of the newly acquired product for this purpose on the VLA and VLBA in New Mexico. The support for the VLA and VLBA is expected early next year. Initially, we will use the product on the server in Socorro. If, as expected, we decide to adopt the package, a second copy will be purchased for the local Green Bank server.

In order to prepare for the higher volume of network traffic when the GBT is in operation, we will replace the old (coaxial) Ethernet wiring in the Jansky Lab with fiber, which can support communication at 100 megabits/second. The purchase of the fiber and connectors will be done later this year. The Ethernet switches are proposed for next year. We plan to put the Macintosh computers onto their own subnet to reduce some of the traffic on the main Green Bank local area network.

The new PBX in Green Bank is in and working. This provides us with voice mail at long last. The long distance service has been switched to FTS2000, which eliminates the long delays in placing calls, gives lower noise connections, and provides automatic billing. We also have a new terminal server and a new modem bank to provide modern dial-in capabilities.

Year 2000 Issues

Financial Systems - A new version of the payroll software from ADP which NRAO uses is now available on a testbed system in-house. This version allows the client application to run on a Windows 95 PC, optionally based on an NT fileserver, using TCP/IP networking. The release paves the way to upgrade our Fiscal PC systems to Windows 95 and drop the old Novell networking software as well, thus making them Y2K-compliant. Since this is the first release of such support from ADP, the software will be thoroughly tested prior to deployment, which is currently planned for late 1998.

Although Y2K-compliant, the older model of IBM AS/400 computer used for our J. D. Edwards purchasing and accounting package will soon cease to be supported by IBM; the version of the software we have is also being replaced by the manufacturer. A major upgrade of this platform is therefore necessary, whether to a newer release/model of the same products or to something entirely different. A review of software which supports these critical functions is underway, with a view to evaluating the state of PC-based client-server packages in this market. Y2K compliance will of course be a mandatory requirement of any alternative that may ultimately be recommended. A report is expected by March of 1999.

PCs - Older PCs will have a problem with the century bit in their real-time clocks after the year 2000. A large selection of software is available for updating this automatically during the first reboot after the turn of the century. NRAO has selected a freeware program to provide a patch to automate this update in systems that run unattended at remote locations, such as the MMA site in Chile. This update only needs to be done once, so systems at sites with local support can be done by hand; in such cases it is better to have fewer software packages involved. Newer PCs are not affected by this problem.

Telescope Operations - The Green Bank Interferometer control software has been evaluated and made Y2K compliant. The NRAO does not currently intend to operate the 140-ft telescope in Green Bank beyond the end of 1999. We are, however, assessing the degree of non-compliance in its control software, and estimating the effort required to fix it, in case that becomes necessary. With the exception of the VLBA, all other NRAO telescopes have completed testing and are Y2K-compliant. The remaining VLBA tests are still scheduled for the first part of 1999; the results will be reported at that time.

Communications and Networking - The ancient telephone PBX in Green Bank has now been replaced; there are no Y2K compliance issues with the new one, which is leased. The PBX in Charlottesville needs a minor update to prevent calendar inaccuracies in the voicemail system; this will be applied in early 1999. The few remaining old computer network routers are being replaced this year with models which are Y2K-compliant.

Outside Services - NRAO has begun the process of contacting our providers of services such as electric power, water, telephone (including local, long-distance, and cellular), banks, Internet access providers, and emergency services, to determine the status of their

Y2K compliance assessment, remediation efforts, and contingency plans. While there is probably very little we can do to provide our own backup for these critical utilities, we need to be aware of their situation so that we can estimate the likelihood of a service loss and be prepared in the event they are not available during early 2000.

M. AIPS++ PROJECT

In Single Dish support, we have made a number of enhancements and bug fixes to the dish environment. The full SDFITS convention is now understood by dish. There is full support for multi-polarization data in all dish operations. The command line interface to dish was significantly improved and the internals of dish were somewhat reorganized. A fair amount of real single-dish data from a number of different telescopes has been collected for use in demonstrations and testing of dish.

In support of the GBT, we have developed a basic continuum commissioning software suite in AIPS++. A script was written for reducing total power scans from the GBT spectral processor. These reduced data can then be processed using dish. The AIPS++ RFI monitoring program for use in Green Bank was revised based on feedback from the RFI committee in Green Bank. This program is now in use by the 140 Foot/GBT operators.

In Synthesis support, development has proceeded on a broad front in key synthesis areas such as imaging and calibration, in line with the long-standing AIPS++ policy in this area, but with some resources devoted to an additional development stream for a limited end-to-end data reduction capability ("thin-path" capability) for instruments such as the VLA. In addition, synthesis development for instruments where AIPS++ is in the critical path (such as WSRT), remains a priority. The overall aim of the current development is to expand the scientific capabilities and user base of the system as a strong priority. The current emphasis is on application development over library development.

Work on data fillers has continued this quarter, with an update to the BIMA filler (D. Roberts and P. Teuben), and initial design and development work for a prototype VLA filler (R. Marson and A. Kemball), in keeping with the "thin-path" strategy for the VLA. Basic components for graphical display and editing of visibility data are required for "thin-path" capabilities for all instruments, and are an important element in developing early automated data reduction capabilities. This is a priority at several instruments. Design work for uv display components has proceeded this quarter (A. Kemball), in consultation with the developers of the Display Library (D. Barnes and N. Killeen). This work will continue in collaboration with P. Barnes (NRAO), who joined the project in June. The Glish visibility display tool "visplot" has also been revised and extended during this quarter (T. Cornwell).

A significant focus has been retained in this quarter on the development of cross-calibration capabilities across a broad front to expand the current calibration facilities in the system (A. Kemball). The initial version of this upgrade will be available in the third beta release. A formalization of calibration table formats for visibility- and image-plane effects has been completed, together with the framework for the continuing development of more advanced calibration parametrization, interpolation and solvers.

A primary development effort in imaging has concerned mosaicing, which has seen renewed emphasis in this quarter (M. Holdaway and T. Cornwell). A mosaicing algorithm development workshop is planned for July 1999 by M. Holdaway, who joined the project in July, Michael Rupen and Tim Cornwell. Mark is taking the lead in mosaicing implementation in AIPS++. T. Cornwell has worked on wide-field imaging questions relevant to space-based arrays, as part of a collaboration with NRL.

In Glish, preparations began for the upcoming beta release of AIPS++ and public release 2.7 of Glish. The user manual was updated to document all of the additions since the last public release of Glish. The whole manual was reviewed in the process of doing this update. A small number of minor new features have been added, but overall Glish changes are now slowly considerably.

In AIPS++ Infrastructure, little new work was performed apart from bug fixes and miscellaneous cleaning up.

In Image Analysis, all work was connected with regions in images. The support for regions is now at a state where it can be incorporated into existing applications (planned mainly for the next quarter).

In the System area, we have continued to suffer the loss of Jeff Uphoff, who was dedicated 50 percent to system work, and the move of Joe McMullin to Charlottesville. Logistics demand a full-time astronomer at the GBT so we will end up down half a person for system work. Some small relief comes from the fact that Ger van Diepen has agreed that starting September 1st he would take over the role of technical manager from Brian Glendenning. In September he visited Socorro to discuss the tasks and the system work with the AIPS++ management. It resulted in a system plan which is laid down in note 220. It describes the future plans in the system area. Ger will work with Darrell Schiebel on implementing a triage approach to our systems work until a more acceptable long-term solution is found.

In the area of Parallelization, the most significant accomplishment has been the development of parallel algorithm iterator by Wes Young. This algorithm iterator allows an application programmer to implement high level algorithms which loop over

independent pieces of data. The obvious test case for this is independent spectral line channels. Wes has implemented a Clark CLEAN algorithm using these classes.

In preparation for an NSF site review at NCSA, Doug Roberts benchmarked the parallel Clark CLEAN application. This test was in preparation for a large scale imaging and deconvolution project that the parallel group is enabling. This significant project entails making maps (> 6K on a side) and a large number of spectral line channel (>100). The parallel group is helping Dave Westphal to process this large HI data set of M33. In initial tests performed for the NSF site review, good speed-up (almost a linear slope of 1.0) was observed between 1–16 processors. However the slope was substantially worse (slope of 0.5) between 16–32 processors. The group is investigating the performance. It is possible that this has exposed an I/O bottleneck. This test suggests that understanding I/O performance is important to ultimate parallel performance.

In Documentation, we produced a document to help new users: Getting Started in AIPS++. This is a large expansion by Anantha of a seed document written by Tim Cornwell some time ago. It explains AIPS++ in terms that astronomers (mainly Anantha, Michael Rupen and Bob Hjellming) are comfortable with. This document is a key ingredient of the third beta test.

In Management, the replacement of Brian Glendenning by Athol Kemball (as Deputy Project Manager) and Ger van Diepen (as Technical Leader) has proceeded extremely smoothly. This was aided by a very successful visit of Ger to Socorro in September, and by weekly phone conferences between Athol, Ger and Tim Cornwell.

JCMT has approached AIPS++ with the desire to use AIPS++ as the platform for the new ACSIS multi-beam/correlator project. We have agreed that we expect that this will be possible, pending negotiations on the exact requirements. We expect that the support required from the Project will be small. We plan to discuss more details in a visit by Tony Willis and others to Socorro in mid November.

Finally, the preparation of the third beta release continues at the same time this report is being written. The pre-release code was frozen on October 2, and is now being tested, principally by testers and project staff at the AOC. If all goes well with the testing, we expect a release by approximately October 15. Thereafter, we plan to move to a different scheme for distributing the system. Instead of a large beta release every 6-12 months, we plan to release binaries for the stable builds. Every month, we attempt to certify one build as being stable and complete. It has to pass a number of tests, including both our standard unit-testing and interactive, Glish-based tests. It is then placed on our ftp server in order that those wishing to acquire a good-quality build can do so using our inhale mechanism. In the new approach to distributions, we will build binaries for each stable version, and also make these available on the ftp server. Installation of a new stable system is then possible approximately every month. This has the advantage for the users that new features and bug fixes appear rapidly, and for the project, that we can more easily and quickly get feedback on new capabilities. It is envisaged that this new "trickle-out" approach will continue until the first public release next year.

N. GREEN BANK TELESCOPE

Antenna

The Green Bank Telescope is actually beginning to resemble it's concept drawings now that the reflector back-up structure (BUS) has been fully installed and the vertical feed arm started.

In October 1997, six of the BUS modules had been installed on the supporting box girder structure while the balance (16 modules) remained on the ground. A 310-ton mobile crane was brought to the site to accomplish ground repositioning of modules so they could be handled directly by the S70 tower derrick. The mobile crane brought a resultant schedule and cost advantage.

Concurrent with the erection of the BUS modules, the 1036 intermodule members were reinstalled and welded. The intermodule members are needed to give the BUS its integrity. To accomplish this task, three additional tower cranes were brought in. The extra tower cranes have been in constant use since acquisition, expediting the various erection functions. Temporary walkways were put up along the perimeter top and bottom chords of the modules in order to properly position and weld the intermodule members.

Eight of the 22 reflector backup structure modules are supported by one or two temporary supports. When the first two modules went up, provisions were made to land the modules in their correct location by putting rollers (pipes) under the support point plates. When it was found that the support points were in line with the temporaries within one-half an inch, the rollers were discarded. This indicated three things: first, the rigging of the units had been done correctly; second, the modules were somewhat stiffer than anticipated; third, no erection stresses were being built into the backup structure due

to pulling or jacking at the support points. The average time for installation of each of the 22 modules was 2 to 2 1/2 weeks. The planning and careful execution of the erection of the BUS has paid-off in the accuracy achieved in the RMS of the actuator support points, i.e., 3/4″ RMS (19.5 mm RMS).

Actuators

Most of the active surface actuators were installed on the front chords of the BUS modules prior to lifting. As the modules were placed at the base of the S70 tower derrick, several of the small mobile cranes were used to expedite this operation. Actuators which would interfere with the installation of the intermodule members or obstructed target areas were left off. These actuators were filled-in when the modules were in place atop the box structure. This fill-in operation started in April of 1998 and lasted until mid August. Today, all 2209 of the active surface actuators are in place while over 300 have been accurately positioned. Accurate positioning is presently constrained to the area of the BUS, directly over the rigid support of the box structure. It was originally specified that the surface panel actuators be aligned on the top chords of the BUS to a positional accuracy of one degree. To insure the proper alignment of the 2004 surface panels, and to maintain the nominal two millimeter panel gaps, the Contractor has elected to reduce the allowable positional accuracy of the actuators to one tenth of a degree. This means that the top of each actuator will be aligned normal to the surface to within one millimeter (0.40"). Regarding the translational accuracies (six degrees of freedom) the target at the top of each actuator must fall within a 1/8" diameter cylinder, 1/4" long. These tolerances are being achieved presently in the alignment of the actuators installed on that portion of the BUS, which is directly above the box support structure. Obviously, this area has been selected as it will have the rigidity to avoid changes in actuator alignment when the BUS loads are transferred from the temporary to permanent supports.

Permanent Supports

The permanent supports function to carry the live and dead loads incident upon the BUS back, or down, to the box girder structure and thereby to the elevation shaft which is supported by the alidade and the foundation/ground. Under certain conditions loads incident upon the BUS are carried to the box girder which transfers the loads through the elevation wheel and gear to the alidade and thus to the foundation/ground. There are sixteen joints welded to the back of the various BUS modules. Of these, thirteen needed to be redesigned, either to reconfigure the joint to achieve greater stress path efficiency or to correct bad welding. Rework of the BUS joints began in May 1998 and is now 84 percent complete. There are 20 welded joints on the box structure at various levels. Rework of these joints is 26 percent complete. There are 30 permanent beams carrying loads between the BUS and box joints. Six percent of these have been installed.

Surface — Actuator Cables

Actuator cable runs are currently being installed in the cable raceways, from the proximate vicinity of the actuators to the actuator control room. More than 50 percent have been installed. Run installation is ahead of schedule. The cabling installation is expected to be complete before contractor acceptance testing of the telescope.

Vertical Feed Arm

The vertical feed arm consists of 13 modules plus the feed/receiver room and upper feed arm. By the end of September 1998, the bottom two sections on each side of the 200-foot vertical feed arm will be in place on the outboard end of the horizontal feed arm. Two additional sections, and the platform which supports the feed/receiver room, have been assembled and await erection along with the upper feed arm and feed/receiver building. The upper 60-foot portion of the feed arm has been trial erected at site including the deployable prime focus boom, the prime focus rotation mount, the subreflector, and the subreflector adjustment mechanism. The feed arm servo, which controls the above equipment had been installed and

preliminary tests run. The feed/receiver room, which is located directly below the upper feed arm, has been located nearby with the secondary focus feed turret in its roof. In early 1998, additional servo tests were conducted and the photogrammetric setting of the subreflector surface and calibration of the six subreflector "Stewart platform" actuators was accomplished. In October-November 1998, the upper feed arm servo will be operated continuously for at least a month. Additional photogrammetric measurements will be made to allow final setting of the subreflector surface to a tolerance somewhat better than 0.004 inches RMS.

The Vertex Platform has been installed on the telescope and the access walkways to the vertical feed arm have been installed.

Recently, the Contractor sent 20 surface panels to the site to test shipping, handling, installation, and alignment procedures. The panels were unpainted so that they might be returned to Contractor's plant for remeasurement on the contour measurement machine (CMM). This will provide an evaluation of the above procedures with respect to any deteriorations of surface tolerances. NRAO has provided a prototype panel corner setting tool which the Contractor is using to familiarize his personnel with its operation. Initial experiments with the panel setting tool revealed that the primary obstacle to achieving the desired panel-to-panel setting accuracy of 0.001" is the mechanical adjustment, not the measurement instrument. It was pointed out to the Contractor that in order to realize the benefits of the 0.004" accuracy of the individual panels, and to fit the (CMM) data, the corner-to-corner accuracy of 0.001" must be achieved. Moreover, if their mechanics could not adjust the panels to this accuracy, neither could NRAO, and thus the surface would be out of spec. This forced a closer examination of the panel adjustment mechanism and the procedure. A number of ideas are being investigated and NRAO is optimistic that a solution will be found.

GBT Servo

(Progress on the GBT Servo is addressed in the Green Bank Electronics section of this report.)

GBT Spectrometer

(Progress on the GBT Spectrometer is addressed in the Charlottesville section of this report.)

GBT Software General

We were pleased to have Stephane Jouteux with us this summer. He has now returned to France to pursue graduate studies in astronomy in Nice. We thank him for his contributions to the GBT by leaving us a Graphical User Interface (GUI) builder for the operators' screens. We wish him well in his career.

Monitor and Control

The major task this quarter was the preparation for a radical change to the part of M&C dealing with control parameters. The issue being addressed is the ability to communicate these parameters between computers which have differing architectures. (For monitor data, this was more critical and the changes were included in release 2.7.) In particular we are faced with sending control information to the PCs in the Metrology system, which are "little endian" computers, from Suns, which are "big endian" machines. Of more immediate importance, however, is the movement within NRAO towards having PCs running Linux as the major computing platform. These "little endian" computers need to be able to send control information to the single board computers, which are all "big endian." The redesigned control system includes an data description library which provides a flexible description of the parameters sent to devices in terms of data types and units. This enables encoding and decoding of parameters in an architecture-independent manner based on XDR. As far as we can see, this will be the last major perturbation to the system. Since this change was a major perturbation, it required a new release (2.8) of the M&C software. With the help of an automated procedure for the code conversion, every device driver had to be updated. We were very pleased when the release was essentially complete by the target date of the end of September.

There were essentially two reasons to do this now. The first was the major effort to enhance the GUI for the Operators' interface. The second was the fact that it would take significantly less effort to do it now than to do it later. The changes to the control parameters also required changes to the libraries used to provide the support for the Operators' interface (Tcl/Tk) and Observers' interface (Glish).

We now have a utility to test the Glish interface to all telescope systems by iterating though all devices, managers, and their associated control and monitor points. We also now have a watchdog system which will check the single board computers and alert the rest of the system to problems. This has already proved useful, and it will obviously provide better operational reliability.

Much of the remaining work in M&C was geared towards completing important outstanding tasks to free manpower to concentrate on the integration of the Spectrometer. This is clearly a major priority confirmed by the recent GBT Science Workshop. We plan to begin a major effort on this in October. Since this is extremely important, we may have to defer such items as the message browser and the upgrade of the Spectral Processor control software if necessary.

The M&C and AIPS++ groups have agreed upon a new simplified and unified directory structure for the storage of all FITS files produced by the M&C system. This is now fully implemented, and is being used by the engineers locally and by the AIPS++ data filler. Discussions are in progress to refine the AIPS++ Measurement Set for the GBT to handle the single dish data more naturally.

We now have specifications for the software needed for commissioning and acceptance of the GBT. This includes the usual operations to determine system temperature, efficiency, opacity, beam, focus, pointing, etc. The software to reduce the data from the appropriate observations will be written in AIPS++.

Observers' Displays

We have completed the macro processor needed to generate Glish code from the tables produced by the interface processor. The Observers' screens using this new tool were very successfully demonstrated at the GBT science workshop.

O. MILLIMETER ARRAY

The last quarter has been exceptionally busy for the staff involved with the MMA Project. Strong bonds have been established with the Republic of Chile; the first comprehensive review of the project led to revisions of the project emphasis; the NSF Oversight Committee made several suggestions that benefit the project and focus our efforts; and there have been important developments in Europe that are expected to lead to an enhanced project.

In July, Associated Universities, Inc., received final approvals from the Foreign Ministry of the Republic of Chile to establish and operate an observatory in Chile under the same terms and conditions that other foreign observatories operate there. We are grateful to our many colleagues in Chile for their support and encouragement in making this happen. We are committed to making the MMA of mutual benefit to both our communities through a continuing partnership.

Also in July, the President of the Republic, with the approval of the Mining Ministry, declared the Chajnantor site to be a science preserve for the MMA and other scientific facilities requiring the exceptionally dry and transparent atmosphere that this site offers. In a separate declaration the Chilean science agency, CONICYT, was named to administer use of the preserve. These declarations were made in an elegant ceremony at La Moneda attended by representatives of the Republic of Chile, AUI, NSF, NRAO, Chilean universities and observatories in Chile.

The month of July ended with an Internal Project Review. At this occasion all the people working on the MMA together with the university-based MDC participants and representatives of the MAC met to review the work planned in the MMA Design and Development phase. These plans were summarized for the group in the initial draft of the MMA Project Book. The purpose of the review was to identify issues that need resolution, issues either missing from the Project Book, or issues requiring a restructuring of the work presented in the Project Book. The Project Book and a summary of the issues raised at the Project Review can be found on the MMA web pages.

August began with the second review of the MMA project by the NSF MMA Oversight Committee (MMAOC). The MMAOC at an earlier meeting had made recommendations for an acceleration of the antenna procurement, a recommendation that the project implemented; the implementation was reviewed in August. One of the ramifications was the antenna vendor's meeting described in an accompanying article in this Newsletter. Other recommendations of this and

the earlier meeting emphasize the need for comprehensive project management structures. This recommendation is also being implemented. The MMAOC reviews are archived and available via the MMA WWW pages.

In September there were several gatherings of scientists and their science consortia and ministers interested in merging the European LSA project with the MMA. Significant progress appears to have been made toward the definition of a common effort in Europe. There is every reason to be optimistic that such a LSA/MMA merger will in fact become a reality.

In October we will concentrate on getting the Work Breakdown Structure for the MMA complete and firmly in place for the D&D phase of the project. The project will be reviewed by the MAC at a meeting in Chicago November 21. If there are issues you would like to bring to the attention of the MAC please contact one of the committee members. As you would expect, the MAC membership is also on the MMA web pages (click on library). In fact, the primary means of communication between the MMA and the community is electronic: The MMA e-news is circulated in the e-mail at regular intervals; to subscribe contact Kate Weatherall (kweather@nrao.edu).

P. PERSONNEL

New Hires

Bania, T.	Visiting Scientist	07/27/98
Black, G.	Research Associate	07/14/98
Effland, J.	Electronics Engineer I	07/25/98
Egan, D.	Mechanical Engineer I	08/24/98
Jouteux, Stephane	Scientific Programmer	07/21/98
Matthews, L.	Research Associate	09/22/98
Moeser, R.	Scientific Programmer Analyst	07/20/98
Palmer, P.	Visiting Scientist	07/01/98
Ray, J.	Junior Engineering Associate	08/05/98
Shah, R.	Junior Research Associate	09/01/98
Sumner, M.	Junior Engineering Associate	08/05/98

Terminations

Bailey, N.	Electronics Engineer I	08/14/98
Bania, T.	Visiting Scientist	08/25/98
Fleming, R.	Business Manager	09/30/98
Greenberg, J.	Electronics Engineer I	07/15/98
Hicks, S.	Junior Engineering Associate	08/14/98
Jouteux, S.	Scientific Programmer	09/14/98
Morris, A.	Junior Engineering Associate	07/30/98
Palmer, P.	Visiting Scientist	07/31/98
Roy, A.	Research Associate	09/23/98
Schulman, E.	Research Associate	07/31/98
Thach, K.	Senior Buyer	07/06/98
Uphoff, J.	Scientific Programmer Analyst	07/24/98
Willems, W.	Junior Engineering Associate	08/21/98
Wiseman, J.	Research Associate	08/28/98
Wollack, E.	Research Engineer	07/10/98

Promotions

Cotter, T.	to Electrical Engineer I	09/01/98
Ford, J.	to Head/Green Bank Electronics	07/01/98
Gasho, V.	to Mechanical Engineer III	09/01/98
Glendenning, B.	to Assoc Sci/Head of MMA Computing	07/01/98
Gordon, M.	to Scientist - Continuing Appointment	07/01/98
Holdaway, M.	to Associate Scientist - Research Support	07/13/98
Hunt, G.	to Scientist (C) - Continuing Appointment	07/01/98
Kemball, A.	to Deputy Asst Director/AIPS++ Project	07/01/98
McKinnon, M.	to Assoc Sci/Deputy Asst Director/GB Ops	07/01/98

Other Changes

McMullin, J.	Transfer from Green Bank to Charlottesville	09/01/98
Petencin, G.	Transfer from Socorro to Charlottesville	09/01/98

PREPRINTS RECEIVED, JULY - SEPTEMBER, 1998

ANGLADA, G.; VILLUENDAS, E.; ESTALELLA, R.; BELTRAN, M.T.; RODRIGUEZ, L.F.; TORRELLES, J.M.; CURIEL, S. Spectral Indices of Centimeter Continuum Sources in Star-Forming Regions: Implications on the Nature of the Outflow Exciting Sources.

AUGUSTO, P.; WILKINSON, P.; BROWNE, I. Flat-Spectrum Radio Sources with kpc-Scale Structure.

BALSER, D.S.; BANIA, T.M.; ROOD, R.T.; WILSON, T.L. 3He in the Milky Way Interstellar Medium: Abundance Determinations.

BECK, R.; BERKHUIJSEN, E.M.; HOERNES, P. A Deep lambda 20 cm Radio Continuum Survey of M31.

BELL, M.B.; WATSON, J.K.G.; FELDMAN, P.A.; TRAVERS, M.J. The Excitation Temperatures of HC9N and Other Long Cyanopolyynes in TMC-1.

BLOOM, J.S.; DJORGOVSKI, S.G.; KULKARNI, S.R.; FRAIL, D.A. The Host Galaxy of GRB 970508.

BLOOM, J.S.; FRAIL, D.A.; KULKARNI, S.R.; DJORGOVSKI, S.G.; HALPERN, J.P.; MARZKE, R.O.; PATTON, D.R.; OKE, J.B.; HORNE, K.D.; GOMER, R.; GOODRICH, R.; CAMPBELL, R.; MORIARTY-SCHIEVEN, G.H.; REDMAN, R.O.; FELDMAN, P.A.; COSTA, E.; MASETTI, N. The Discovery and Broad-Band Follow-Up of the Transient Afterglow of GRB 980703.

BLOOM, J.S.; KULKARNI, S.R.; HARRISON, F.; PRINCE, T.; PHINNEY, E.S.; FRAIL, D.A. Expected Characteristics of the Subclass of Supernova Gamma-Ray Bursts (S-GRBs)

BOBOLTZ, D.A.; SIMONETTI, J.H.; DENNISON, B.; DIAMOND, P.J.; UPHOFF, J.A. A Water Maser Flare in W49N: Amplification by a Rotating Foreground Cloud.

CAREY, S.J.; CLARK, F.O.; EGAN, M.P.; PRICE, S.D.; SHIPMAN, R.F.; KUCHAR, T.A. The Physical Properties of the MSX Galactic Infrared-Dark Clouds.

CLAUSSEN, M.J.; MARVEL, K.B.; WOOTTEN, A.; WILKING, B.A. Distribution and Motion of the Water Masers Near IRAS 05413-0104.

DJORGOVSKI, S.G.; KULKARNI, S.R.; BLOOM, J.S.; GOODRICH, R.; FRAIL, D.A.; PIRO, L.; PALAZZI, E. Spectroscopy of the Host Galaxy of the Gamma-Ray Burst 980703.

DUBNER, G.M.; HOLDAWAY, M.; GOSS, W.M.; MIRABEL, I.F. A High Resolution Radio Study of the System W50/SS433 and the Surrounding Medium.

FAISON, M.D.; GOSS, W.M.; DIAMOND, P.J.; TAYLOR, G.B. VLBA Imaging of Small Scale Structure in Galactic H I.

FRAIL, D.A.; MITCHELL, G.F. OH(MHz) Masers as Signposts of Molecular Shocks.

FRAYER, D.T.; IVISON, R.J.; SCOVILLE, N.Z.; YUN, M.; EVANS, A.S.; SMAIL, I.; BLAIN, W.; KNEIB, J.-P. Molecular Gas in the z = 2.8 Submillimeter Galaxy SMM 02399-0136.

FRAYER, D.T.; SEAQUIST, E.R.; THUAN, T.X.; SIEVERS, A. Molecular Gas in Markarian 109: Constraining the O2/CO Ratio in Chemically Young Galaxies.

GAENSLER, B.M.; STAPPERS, B.W.; FRAIL, D.A.; JOHNSTON, S. A Search for Pulsar Wind Nebulae Using Pulsar Gating.

HJELLMING, R.M.; RUPEN, M.P.; MIODUSZEWSKI, A.J.; KUULKERS, E.; MCCOLLOUGH, M.; HARMON, B.A.; BUXTON, M.; SOOD, R.; TZIOUMIS, A.; RAYNER, D.; DIETERS, S.; DUROUCHOUX, P. Radio and X-ray Observations of the 1998 Outburst of the Recurrent X-ray Transient 4U 1630-47.

ISHWARA-CHANDRA, C.H.; SAIKIA, D.J.; KAPAHI, V.K.; MCCARTHY, P.J. A Polarization Study of Radio Galaxies and Quasars Selected from the Molonglo Complete Sample.

KAWAMURA, J.H.; MASSON, C.R. Expansion of W 3(OH)

KOEKEMOER, A.M.; O'DEA, C.P.; BAUM, S.A.; SARAZIN, C.L.; OWEN, F.N.; LEDLOW, M.J. Constraints on UV Absorption in the Intracluster Medium of Abell 1030.

KOGAN, L. Correction Functions for Digital Correlators with Two and Four Quantization Levels.

KORALESKY, B.; FRAIL, D.A.; GOSS, W.M.; CLAUSSEN, M.J.; GREEN, A.J. Shock-Excited Maser Emission from Supernova Remnants: G32.8-0.1, G337.8-0.1, G346.6-0.2, and the HB3/W3 Complex.

KULKARNI, S.R.; FRAIL, D.A.; WIERINGA, M.H.; EKERS, R.D.; SADLER, E.M.; WARK, R.M.; HIGDON, J.L.; PHINNEY, E.S.; BLOOM, J.S. The gamma-ray Burst of 980425 and Its Association with the Extraordinary Radio Emission from a Most Unusual Supernova.

PREPRINTS RECEIVED, JULY - SEPTEMBER, 1998

LAINE, S.; KENNEY, J.D.P.; YUN, M.S.; GOTTESMAN, S.T. CO Distribution and Kinematics Along the Bar in the Strongly Barred Spiral NGC 7479.

LAROSA, T.N.; SHORE, S.N.; MAGNANI, L. A Dynamical Study of the Non-Star-Forming Translucent Molecular Clous MBM16: Evidence for Shear Driven Turbulence in the Interstellar Medium.

LUCAS, R.; LISZT, H. Interstellar Isotope Ratios from MM-Wave Molecular Absorption Spectra.

MARVEL, K.B.; SHUKLA, H.; RHEE, G. A VLA Search for Head-Tail Radio Sources in Abell Clusters.

MEIXNER, M.; CAMPBELL, M.T.; WELCH, W.J.; LIKKEL, L. Mass Loss Histories of Three Carbon Rich Evolved Stars as Revealed by 12CO Emission.

NAGAR, N.M.; WILSON, A.S.; MULCHAEY, J.S.; GALLIMORE, J.F. Radio Structure of Seyfert Galaxies. VIII. A Distance and Magnitude Limited Sample of Early-Type Galaxies.

ODEWAHN, S.C.; DJORGOVSKI, S.G.; KULKARNI, S.R.; DICKINSON, M.; FRAIL, D.A.; RAMAPRAKASH, A.N.; BLOOM, J.S.; ADELBERGER, K.L.; HALPERN, J.; HELFAND, D.J.; BAHCALL, J.; GOODRICH, R.; FRONTERA, F.; FEROCI, M.; PIRO, L.; COSTA, E. The Host Galaxy of the Gamma-Ray Burst 971214.

OWSIANIK, I.; CONWAY, J.E.; POLATIDIS, A.G. Renewed Radio Activity of Age 370 Years in the Extragalactic Source 0108+388.

SAGE, L.J.; WELCH, G.A.; MITCHELL, G.F. The Missing ISM of NGC 147 and M32.

SARAZIN, C.L.; KOEKEMOER, A.M.; BAUM, S.A.; O'DEA, C.P.; OWEN, F.N.; WISE, M.W. X-ray Properties of B2 1028+313: A Quasar at the Center of the Abell Cluster A1030.

SHANG, Z.; ZHENG, Z.; BRINKS, E.; CHEN, J.; BURSTEIN, D.; SU, H.; BYUN, Y.-I.; DENG, L.; DENG, Z.; FAN, X.; JIANG, Z.; LI, Y.; LIN, W.; MA, F.; SUN, W.-H.; WILLS, B.; WINDHORST, R.A.; WU, H.; XIA, X.; XU, W.; XUE, S.; YAN, H.; ZHOU, X.; ZHU, J.; ZOU, Z. Ring Structure and Warp of NGC 5907: Interaction with Dwarf Galaxies

SPITZAK, J.G.; SCHNEIDER, S.E. A Deep Survey of H I-Selected Galaxies: The Sample and the Data.

SWAIN, M.R.; BRIDLE, A.H.; BAUM, S.A. Internal Structure of the Jets in 3C 353.

TAYLOR, C.L.; KOBULNICKY, H.A.; SKILLMAN, E.D. CO Emission in Low Luminosity, H I Rich Galaxies.

TORRELLES, J.M.; GOMEZ, J.F.; GARAY, G.; RODRIGUEZ, L.F.; CURIEL, S.; COHEN, R.J.; HO, P.T.P. Systems with H2O Maser and 1.3 cm Continuum Emission in Cepheus A.

TURNER, B.E.; TERZIEVA, R.; HERBST, E. The Physics and Chemistry of Small Translucent Molecular Clouds. XII. More Complex Species Explainable by Gas-Phase Processes.

ULVESTAD, J.S. The ARISE Space VLBI Mission.

ULVESTAD, J.S. Future Space VLBI Missions.

ULVESTAD, J.S. Space Very Long Baseline Interferometry.

VAN ZEE, L.; SALZER, J.J.; HAYNES, M.P.; O'DONOGHUE, A.A.; BALONEK, T.J. Spectroscopy of Outlying H II Regions in Spiral Galaxies: Abundances and Radial Gradients.

WILKINSON, P.N.; BROWNE, I.W.A.; PATNAIK, A.R.; WROBEL, J.M.; SORATHIA, B. Interferometer Phase Calibration Sources - III. The Regions +20 deg <= delta B1950 <= +35 deg and +75 deg <= delta B1950 <= +90 deg.

XANTHOPOULOS, E.; BROWNE, I.; KING, L.; KOOPMANS, L.; JACKSON, N.; MARLOW, D.; PATNAIK, A.; PORCAS, R.; WILKINSON, P. The New Gravitational Lens System B1030+074.

YOUNG, L.M.; KETO, E.; HO, P.T.P. Radiative Transfer Modelling of the Accretion Flow onto a Star-Forming Core in W51.

ZHANG, Q.; HUNTER, T.R.; SRIDHARAN, T.K. A Rotating Disk Around a High-Mass Young Star.