JULY 1979

NATIONAL RADIO ASTRONOMY OBSERVATORY

JULY PROGRESS REPORT

VLA PROGRAM

August 15, 1979

NATIONAL RADIO ASTRONOMY OBSERVATORY

MONTHLY PROGRESS REPORT

VLA PROGRAM

JULY 1979

SYSTEMS INTEGRATION DIVISION

The array was scheduled for 53 percent of the time; 44 percent went to astronomical programs and the remaining 9 percent to tests. The average downtime for the month was approximately 14 percent.

First fringes using antenna 21 were obtained on July 13, 1979. The twenty-one antennas currently outfitted with electronics are located at stations N14, W32, E1, W16, E2, W24, E4, W40, W48, E3, E8, E16, E12, W56, W64, E18, W8, N4, N6, N2 and W12. These stations are positioned approximately 1.14, 5.22, 0.08, 1.59, 0.04, 3.19, 0.15, 7.66, 10.47, 0.09, 0.48, 1.59, 0.97, 13.64, 17.16, 1.95, 0.48, 0.15, 0.27, 0.05 and 0.97 km respectively from the array center. Our longest astronomically usable baseline is approximately 18 km. Antenna 19 was declared operational on July 31, 1979, bringing the total number of operational antennas to 19. Antennas 1, 5 and 9 are currently unavailable for observation. Antennas 20 and 21 are in the shakedown stage. The test array consists of antennas 3 and 11.

ELECTRONICS DIVISION

The front end for antenna 21 was installed on the antenna with a room temperature GaAs Fet amplifier instead of cooled parametric amplifiers in the C channel. The C channel receiver noise temperatures were 200 K at C-band and 130 K at L-band. AIL has begun to deliver parametric amplifiers again, but at a very slow rate because of the difficulty they are having in obtaining varactors. A full review of the paramp situation will be carried out at AIL in early August.

Production of modules for the new spectral line baseband system (modules T3, T4, T5, T6) and the new front end IF system (modules F4,F7,F8) is now in full swing in preparation for the system upgrading which is due to start later this year. Spectral line baseband systems are now scheduled to be installed at the rate of one per week starting in the middle of October. Front end IF systems are scheduled to be installed at the rate of one per week starting in late November. Meanwhile, installation of the new systems on the test array (antennas 3 and 5) has been progressing and should be complete in early August, allowing more extensive systems testing to be carried out.

The paper design for the new sampler module (D1 module) has been completed and prototype construction is beginning. The sampler module has been a particularly unreliable module and the new design cures most of the known problems. It is planned that the sampler modules for IF's B and D, which are needed in late 1980, will be built to the new design. Older sampler modules will be retrofitted to the new design at a later date.

The new waveguide test set was successfully tested during the month. This test set operates in channel 11 and it is planned to have it permanently installed to allow continuous monitoring of waveguide performance. Using a signal source with precise level control at the most distant antennas on an array arm, the loss of the waveguide can be measured with an accuracy of ±0.3 dB. The signal can be swept over a 400 MHz range to allow measurement of the fine structure in the waveguide transmission response.

During the month an experiment was carried out to quantitatively determine the effect of interference on the VLA. A cw signal at a precise frequency and level was radiated from Langmuir Labs on top of Mount Baldy in the Magdalena range while the array was mapping a source. The experiment was carried out at L-band. The data from this experiment is still being reduced as the month ends.

COMPUTER DIVISION

The on-line interim spectral line software is nearing a state of operability. Spectra can be calculated at all bandwidths for the two antennas equipped with the baseband IF receivers; an observation of an OH source revealed the lines at the expected places.

The mapping system for the PDP-11/70 computer now has all the mapper features implemented in the DEC-10, and is now carrying the main burden of mapping computation. The input convolution and gridding are done in the array processor, as appropriate for such computation-heavy tasks. The CLEAN algorithm, as implemented in the 11/70, has problems, and is under revision, but has been successfully used for large cleans. Next items needed - a revision of map formats to make them more consistent throughout the system, and the incorporation of CLEAN into the system of mapping programs.

We have expended some effort on investigating the performance of our TOPS-10 operating system, and tuning it to our load. In the course of this it was concluded that we could increase throughout during the prime shift by about 30% by adding an additional 128 k of main memory. We are now looking into how best to do this.

The IMPS image system here has been extended to the point that it can calculate display polarization, percentage polarization and spectral index maps.

ANTENNA DIVISION

Work of the Antenna Division at the end of the month stood as follows:

Antenna Nos. 22 & 23

Awaiting mechanical outfitting.

Antenna No. 24

Mechanical outfitting approximately 90% complete. All cable trays, cabling junction boxes and switches installed. Waveguide, rotary joints and air conditioning modifications completed. Remainder of outfitting consists of installation of subreflector, feeds and touch-up painting.

Antenna No. 25

Moved on July 23 to Station CN6 to await mechanical outfitting.

Antenna No. 26

Reflector and pedestal assembly mated on July 5 and antenna panel installation started. Panel installation and alignment completed on July 19 with an RMS of 0.0105. Antenna moved on July 24 to master paid for final alignment and servo installation.

Antenna No. 27

Reflector assembly started on July 20. Pedestal assembly started on July 24.

Antenna No. 28

Test assembly at manufacturers completed. Sand-blasting and painting in progress.

SITE AND WYE DIVISION

Waveguide Installation

Installed approximately 6200 feet of waveguide, set to line and grade and backfilled between BN6, BN7 and BN8. Trenched 6080 feet on North arm. Completed waveguide installation between CN9 and BN5. Installed 864 feet to line and grade and backfilled.

Phase IV

Overall completion 90%. Track work on the West arm is still 98% complete with small modifications required before final acceptance. Track work on the East arm is partially complete to AE8. First lift of ballast has been placed to AE7. Round Place Construction is 99% complete with the earthwork. Electric work is 86% complete.

Phase V

Overall completion 28%. Mountain States, the dirt work subcontractor, has completed all of the excavation work on the North and West arms and has completed the subgrade prep work to AN7. He has started clearing and grubbing on the East arm. W. A. Smith has partially layed track to BN6.

PROJECT MANAGEMENT

General

Land Acquisition: On July 5th the U. S. Attorney for the State of New Mexico filed a Memorandum Brief to the Land Commission refuting certain claims made by ranchers Taylor, Ake and Dunlap. On July 27th the Land Commission submitted its report which recommended $219,000 as just compensation to the three ranchers, compared to $2,300,000 requested and $71,300 offered by the

U. S. Government. The U. S. Attorney, on instructions of the Department of Justice, filed objections to the Commission's recommendation on August 6th. The defendants then filed a motion requesting thirty days to answer the U.S. objections, which was granted by the Judge. If the Judge orders the U.S. to pay the recommended compensation, it will require an additional payment of $203,400, including deficiency sums and interest back to 1975.

Procurement: There has been no marked improvement in the parametric amplifier supply situation. The AIL Division of Cutler Hammer is now working with three different suppliers of diodes for varactors. A considerable number are being received and tested, but those meeting the NRAO specifications are very few. Our plant visits have convinced us that AIL is doing everything they can to solve this problem.

New Mexico Gross Receipts Tax: There has been no action on this matter since the State filed its appeal on June 15th.

Personnel

The personnel changes as of July 31, 1979 are as follows:

Division	Budgeted 12/79 Level	6/30/79 Level	Additions	Reductions	7/31/79 Level
Site & Wye	9	9	0	0	9*
Antenna	17	14	0	1	13
Electronics	54	54	1	1	54*
Operations Management	3	3	0	0	3
Computer	14	12	2	0	14
Array Operations	11	9	1	1	9*
Program Management	28	27	0	0	27**
TOTAL	136	128	4	3	129

* Does not include one part-time employee
** Does not include three part-time employees

VLA PROGRAM
MAJOR SUBCONTRACTS AND PURCHASE ORDERS PLACED

NUMBER P.O. SUBCONTRACT	VENDOR	ITEM DESCRIPTION	DATE PLACED	DOLLAR AMOUNT	DELIVERY DATE	CURRENT STATUS - ALL FIRM FIXED PRICE CONTRACTS EXCEPT WHERE NOTED
P. O. S-06387 Amend. #2	Milliflect	Subreflectors	10/23/78	$ 61,200	Complete by 8/31/79	
P. O. S-08423	Rimo Manufacturing, Inc.	C Band Horns	11/17/78	$ 36,600	Complete by 10/01/79	On schedule.
VLA-323	Logemann Bros.	Transporter	1/17/79	$ 788,758	1/17/80	
P.O. S-08684	A & K Railroad Materials, Inc.	Wood Cross Ties	1/17/79	$ 375,000	Complete by 10/79	
P.O. S-08685	Standard Pipe-protection	Coating of Waveguides	2/2/79	$ 61,793	Complete by 2/15/80	
VLA-345	G. C. Dean	Labor Hour (Waveguide installation)	3/19/79	$ 170,000	One Year Completing 3/18/80	
VLA-346	Wm. A. Smith Contracting Co., Inc.	Phase V Construction	4/26/79	$ 2,820,000	June, 1980	
P.O. S-09818	Dataram Corp.	Very Large Memory	5/22/79	$ 161,625	8/15/79	
P.O. S-09849	BWH/CVA Joint Venture	A/E Service Phase V	5/16/79	$ 39,000	June, 1980	
P.O. S-08645	DEC	Computer Maintenance	1/08/79	$ 90,063	CY '79	Monthly expenditure rate estimated at $7,500.
P.O. S-06827 Amend. #2	C.T.I. Cryogenics	Cryocooler	5/23/78	$ 239,760	2/15/80	
VLA-325	Pacific Railroad Constructors, Inc.	Phase IV Construction	6/23/78	$ 2,916,080	9/16/79	Work progressing satisfactorily.

7/31/79

VLA PROGRAM
MAJOR SUBCONTRACTS AND PURCHASE ORDERS PLACED

NUMBER P.O. SUBCONTRACT	VENDOR	ITEM DESCRIPTION	DATE PLACED	DOLLAR AMOUNT	DELIVERY DATE	CURRENT STATUS - ALL FIRM FIXED PRICE CONTRACTS EXCEPT WHERE NOTED
VLA-5 Amend. #12	BWH/CVA Joint Venture	E/A Title I and II	6/11/73	$ 1,090,684		Title I -Completed Title II -Completed Title III -Completed Title IV -VLA-325 Supervision
VLA-6 Amend. #21	E-Systems, Inc.	28 Radio Telescopes	10/18/73	$ 18,156,054		Delivery in Progress.
VLA-29 Amend. #5	Sterling-Detroit	Focusing Feed Mounts thru Antenna 28 plus spares	6/17/74	$ 1,002,380		Complete
VLA-70 P.O. 52322 CO. #7	Sumitomo Electric USA, Inc.	3000 pieces of waveguide and 3900 pieces of coupling sleeves.	11/03/78	$ 3,215,847	7/31/79; 10/31/79; and 1/31/80	Next 1000 pieces of waveguide and coupling sleeves to arrive Oakland port bt 7/31/79.
VLA-233 P.O. S-02611	Silicon Systems, Inc.	Custom Integrated Circuits	12/12/76	$ 206,375	5/31/79	Complete except for 468 each of Item 4.
VLA-256	New Mexico State University	Archaeological Excavation	9/20/77	$ 107,000	2/20/79 Completion	$88,450 invoiced thru 7/31/79 Final reports expected by 8/79
P.O. S-07990	AIL Division Cutler-Hammer	Parametric Amplifiers	9/21/78	$ 197,600	Complete by 1/21/80	6 sets received. No additional delivery information available at this time.
P.O. S-08085	AIL Division Cutler-Hammer	Parametric Upconverters	10/23/78	$ 102,525	4/13/79 thru 8/13/79	
P.O. S-08510	RLC Electronics, Inc.	Switch filter assemblies and filters	12/12/78	$ 193,943	Start 4/3/79	
P.O. S-08558	Allen Avionics	L.C. Filters	1/08/79	$ 69,500	Complete by 7/31/79.	Complete
P. O. S-08329	Contact Systems, Inc.	Various Wiring Modules	10/31/78 1/19/79	$ 30,486	Complete by 9/30/79	

VLA PROGRAM
MAJOR SUBCONTRACTS AND PURCHASE ORDERS PLACED

NUMBER P.O. SUBCONTRACT	VENDOR	ITEM DESCRIPTION	DATE PLACED	DOLLAR AMOUNT	DELIVERY DATE	CURRENT STATUS - ALL FIRM FIXED PRICE CONTRACTS EXCEPT WHERE NOTED
VLA-326 P.O. S-08191 C.O. #1	California Computer Products, Inc.	Data Storage Subsystem	11/12/78 12/18/78	$ 221,190	2/01/79	99% complete.
VLA-344 P.O. S-08595	Wheeler Construction Co.	Crushed Stone	1/08/79	$ 668,660	Complete by 4/01/80	
P.O. S-08230	Structures, Inc.	Feed Support Structures	10/23/78	$ 26,855		Complete

NATIONAL RADIO ASTRONOMY OBSERVATORY
VERY LARGE ARRAY
STATUS AS OF JULY 31, 1979
CY -79

PROJECT NUMBER	DESCRIPTION	ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCT. IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	NET BALANCE
11000	SITE/WYE	5,356,050	556,456	1,185,596	3,695	1,181,901	3,705,860	4,891,456	464,594
12000	ANTENNA	1,549,000	58,469	479,891	23	479,868	818,191	1,298,082	250,918
13000	ELECTRONICS	2,764,000	198,528	1,265,406	31,080	1,234,326	911,148	2,176,554	587,446
14000	COMPUTER	1,392,000	16,697	91,507	---	91,507	386,044	477,551	914,449
17000	PROGRAM MANAGEMENT	120,000	10,040	67,744	---	67,744	2,147	69,891	50,109
18000	COMMON COSTS	487,752	39,242	262,813	---	262,813	12,726	275,539	212,213
19000	CONTINGENCY	504,004	---	---	---	---	---	---	504,004
	TOTAL PROGRAM	12,172,806	879,432	3,352,957	34,798	3,318,159	5,836,116	9,189,073	2,983,733

Note: Project allocation consists of $11,500,000 in new funding, $7,752 in Common Cost commitments carried forward, and $665,054 in prior years funds. A portion of the prior year funds were re-allocated in February, 1979.

NATIONAL RADIO ASTRONOMY OBSERVATORY
VERY LARGE ARRAY
STATUS AS OF JULY 31, 1979

TOTAL PROGRAM

PROJECT NUMBER	DESCRIPTION	ALLOCATION	EXPENDED MONTHLY	TOTAL EXPENDED	TRANSFER TO FIXED ASSETS	BALANCE CONSTRUCT. IN PROGRESS	TOTAL COMMITTED	TOTAL EXPENDED & COMMITTED	NET BALANCE
11000	SITE/WYE	24,541,144	649,686	19,853,147	7,226,664	12,626,483	4,225,400	24,078,547	462,597
12000	ANTENNA	22,600,391	455,054	20,650,710	11,783,289	8,867,421	1,686,889	22,337,599	262,792
13000	ELECTRONICS	16,947,720	321,208	15,138,331	6,884,289	8,254,042	1,214,121	16,352,452	595,268
14000	COMPUTER	5,126,512	16,697	3,805,323	2,529,107	1,276,216	405,935	4,211,258	915,254
16000	SYSTEMS INTEGRATION	201,022	---	201,022	179,369	21,653	---	201,022	---
17000	PROGRAM MANAGEMENT	1,905,296	10,040	1,852,602	1,676,390	176,212	2,584	1,855,186	50,110
18000	COMMON COST	1,723,100	39,242	1,498,161	1,235,347	262,814	12,726	1,510,887	212,213
19000	CONTINGENCY/RESERVE	504,004	---	---	---	---	---	---	504,004
	SUB TOTAL	73,549,189	1,491,927	62,999,296	31,514,455	31,484,841	7,547,655	70,546,951	3,002,238
30000	RETIREMENTS	(10,820)	---	(10,820)	(10,820)	---	---	(10,820)	---
	TOTAL PROGRAM	73,538,369	1,491,927	62,988,476	31,503,635	31,484,841	7,547,655	70,536,131	3,002,238

Note: Project allocation excludes $325,811 withheld and paid directly to other agencies by the NSF in prior years.

Project allocation includes $11,500,000 for CY-79 funding, of this amount, the NSF has made $11,480,000 available.

NATIONAL RADIO ASTRONOMY OBSERVATORY
VLA PROGRAM

FINANCIAL STATUS REPORT
(in thousands)

As of: July 31, 1979

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	(A)	Allocation to Date (C)				Outlook (B)			
Item	Program Ceiling	Allocated	Expended and Committed	Allocated Balance	Un-allocated Balance	Estimate to Complete	Estimate Total	(Over) Under Ceiling	Notes
Site and Wye	27,860	24,541	24,079	462	3,319	2,888	26,967	893	
Antennas	20,400	22,600	22,338	262	(2,200)	361	22,699	(2,299)	
Electronics	17,000	16,948	16,352	596	52	1,320	17,672	(672)	
Computer	4,850	5,127	4,211	916	(277)	1,508	5,719	(869)	
Systems Integration	400	201	201	-	199	-	201	199	
Program Management	2,650	1,905	1,855	50	745	350	2,205	445	
Common Cost	-	1,723	1,511	212	(1,723)	596	2,107	(2,107)	
Subtotal	73,160	73,045	70,547	2,498	115	7,023	77,570	(4,410)	
Contingency	2,840	504	-	504	2,336	1,000	1,000	1,840	
TOTAL	76,000	73,549	70,547	3,002	2,451	8,023	78,570	(2,570)	

NOTES: (A) Includes $293K for site acquisition, $15.7K for ECAC Study, and $17.1K for NSF Ad Hoc Advisory Panel. Allocated and Expended includes $11K in assets which were retired in prior years.

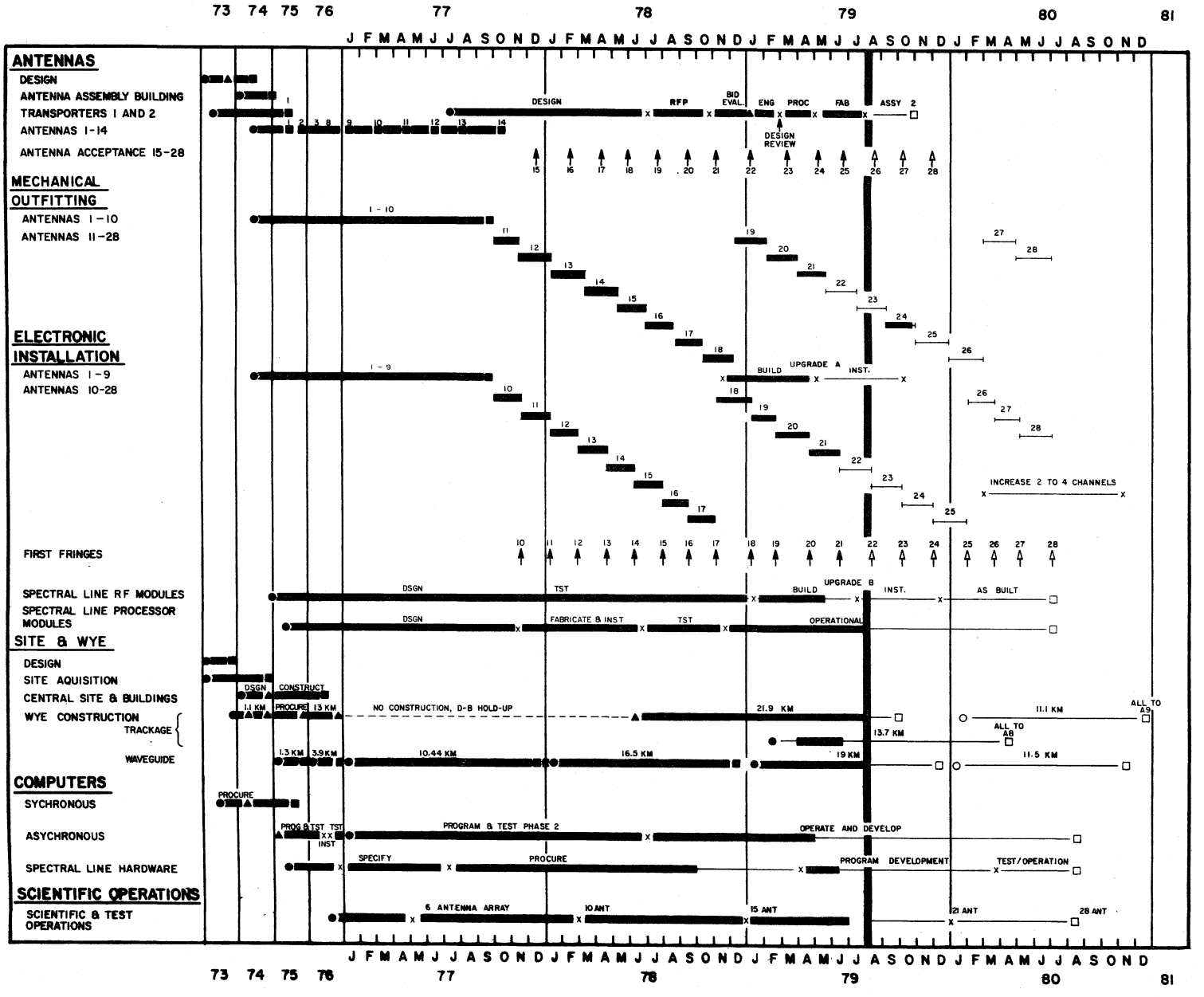
(B) Estimate to complete is as of March 1979 and it excludes $172K for airstrip. Escalation included for future years for Site/Wye work (8%); NRAO labor (6%); and certain electronic elements (8%). Antenna estimate is based upon the existing contract costs for fabrication of the antennas.

(C) Includes $11,500K of CY-79 Funding.

NATIONAL RADIO ASTRONOMY OBSERVATORY

VLA ACTIVITY SCHEDULE

UPDATE DATE: 8/1/79



TASKS

UPGRADE A	RECEIVER FRONT-END FILTERS, MODULES F4, F7, F8. INSTALL 5 ANT/MO. (25 MODULES)
UPGRADE B	SPECTRAL LINE IF MODULES T3, T4, T5, T6. INSTALL 4 SYSTEMS (24 MODULES) PER MONTH.
INCREASE 2 TO 4 CHANNELS	ADDITIONAL MODULES OF ABOVE TYPES. TOTAL 224. INSTALL 36 PER MONTH.

ABBREVIATIONS

DSGN — DESIGN	TST — TEST
LAB — LABORATORY	PRELM — PRELIMINARY
INST — INSTALL	OPNS — OPERATIONS
ANT — ANTENNA(S)	

SYMBOLS

O START OF A PHASE	△ CONTRACT AWARD
X END OF AN ACTIVITY	□ END OF A PHASE
↑ SCHEDULED	↑ COMPLETED

REV. NO.	REV DATE	DESCRIPTION
1	12/1/78	UPDATE PROGRAM PLAN