

Part Total

Move 85-3

ADDITIONAL BASELINE TO INTERLAC

NO. 121

Label	Division	Time Manhrs	Cost \$		Time Man Wks
M	Maintenance	942	306,292. ⁰⁰	Supervision	23.55
O	Telescope Operations	306			7.65
M	Telescope Mechanics	1946			48.65
G	Purchasing & Contract	263			6.58
O	Telescope Operations	1491			37.28
S	Shop	646			16.15
n	Engineering	2935			73.40
l	Electronics	2760			69.00
l	Electronics	4644			116.10
-	Computer	520			13.00
-	Materials Cost	=	438,600. ⁰⁰		=
	Contract Cost	=	592,000. ⁰⁰		=
	Totals	16,453	1,336,892. ⁰⁰		411.36

Does not include anything for Contingencies or for inefficiency due to part time work. (on this project when time is available)

Part I

Site (Move 85-3)

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Division	Time Man hours	Cost \$		Time Man Wks			
Maintenance	624	} 419,880 ⁰⁰		Supervision	15.60		
Telescope Operations	20				50		
Telescope Mechanics	30				75		
Purchasing & Contract	130				3.25		
Telescope Operations	640				Technician	16.00	
Shop	16				40		
Engineering	929				23.25		
Electronics	—			Design & Engr	—		
Electronics	—			Technician	—		
Computer	—				—		
Materials Cost	—	64,800 ⁰⁰			—		
Contract Cost	—	63,000 ⁰⁰			—		
Total	2,389	1,69,788⁰⁰			59.75		

Task

Site

NATIONAL RADIO ASTRONOMY OBSERVATORY

1. Site Investigation

- a. Establish exact location and approximate area needed.
- b. Determine ownership, establish availability, acquire copies of deed(s).
- c. Negotiate temporary use of property.
- d. Make soil tests.
- e. Investigate security measures necessary.

Design & Supervision	Construction	Cost in Dollars	Time	Cost in Dollars	Remarks
Time	Division	Time	Division		
120	En	50	M	---	
146	En-130+PC/16				
16	En	40	16-S + 24 M.		
				6 Wks	\$5000.00
				2 Wks	5000

2. Develop Site Plan

- a. Design access road.
- b. Design parking.
- c. Investigate telescope clearances.
- d. Design foundations for telescope and microwave tower.
- e. Select equipment housing and storage.
- f. Investigate standby power requirements.
- g. Specify and/or design air conditioning, lighting, and heating.
- h. Design utility services.
- i. Investigate service elevator requirements.
- j. Complete overall site plan design including landscaping and seeding.
- k. Prepare environmental impact statements.

80	En.				
16	En.				
80	En.				
100	En	256	240 M + 16 PC		
10	En.	10	PC	6 Mo	5800.00
					30000
50	En	30	20 M + 10 PC	3 Mo	5000.00
60	En	250	240 M + 10 PC	2 Wks	1000.00
8	En. E'	40	30 TM + 10 PC	6 Mo	15000.00
20	En	50	50 M.		1200.00
	Not Req-				

3. Finalization of Property Acquisition

- a. Determine size from site plan.
- b. Obtain approval of method of use (lease, buy)
- c. Prepare appropriate documents to acquire use of land.
- d. Negotiate final arrangements.

80	En				
10	PC.				

4. Contracts (Foundations)

- a. Specify number of distinct contracts.
- b. Prepare RFQ packages.
- c. Obtain necessary approvals.
- d. Put out RFQs
- e. Award contracts.
- f. Supervise contract fulfillment.

8	En.				
45	En.	10	PC.		
8	En	8	PC.		
8	En	10	PC.		
90	En. (85')			6 Wks	45,000.00
40	En (40')			2 Wks	(9,000.00 - 40')

5. Purchased Items

- a. Specify
 - equipment housing
 - communications transmitter/receiver
 - visual surveillance monitor (see link)
 - heating (see 2)
 - standby generator (see 2)
 - telescope service elevator (see 2)
 - environmental equipment enclosure
 - temperature monitors
 - storage (see 2)
 - microwave tower (see link)
 - air conditioner (see 2)
 - lights (see 2)
 - dew point monitor
 - wind speed monitor
 - barometer
- b. Solicit prices and place orders.
- c. Install
 - equipment housing
 - communications transmitter/receiver

20	To				
		20	PC.	4 Mo	8000.00
		640	To		

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						10	1yr. lease	C
	80	En						
	10	PC						
	8	En						
	45	En	10	PC				(30-40)
	8	En	8	PC				
	8	En	10	PC				
	90	En (85)				6wks	45,000 ⁰⁰	
	40	En (40)				2wks	(9,000 = 40)	C
	20	To						
			20	PC				
			640	To		4-Mo	8000 ⁰⁰	
	9.75	+	1414	= (2389)				
	(40)							

Summary

M	624	Man hour	-	Maintenance
TO	20	"	-	Telescope Op - SVP
TM	30	"	-	Telescope Mechanics
PC	130	"	-	Purchasing - Contracts
TS	6+0	"	-	Telescope operations
S	76	"	+	Shop
En	929	"	-	Engineering
EI	-	"	-	Electronics Engr (Design Svp)
EI	-	"	-	Electronics Tech

\$127,800 - Total
 (45,000 - 9,000 = 36,000)
 Deduct For New Tel.

*

Part II

Link

Symbol	Division	Time Man hrs	Cost \$		Time Man Wks				
M	Maintenance	8.0	102,023 ⁰⁰	Supervision	2.0				
FO	Telescope Operations	12.8					3.2		
FM	Telescope Mechanics	1.60					4.0		
PC	Purchasing & Contract	—					—		
O	Telescope Operations	—				Technician	—		
S	Shop	2.40					6.0		
n	Engineering	4.64					11.6		
el	Electronics	1.656				Design & Engr	4.4		
el	Electronics	2.360				Technician	59.0		
—	Computer	—							
—	Materials Cost	—	143,000 ⁰⁰						
—	Contract Cost	—	4,000 ⁰⁰						
	Total	50.88	249,023 ⁰⁰		127.2				

II Link

C - Microwave Link Tasks

Task	N.R.A.O.				Contract - Purchase		
	Design	Superv.	Construction	Cost #	Time	Cost #	
	Time (man weeks)	Div	Time (man weeks)				Div
1. Determine Link Requirements							
a. b. c. d. e.	2.0	EL					
e. S. Select Freq. Obtain License	.6				f. 26-52 weeks		
2. Select Optimum Link Path	2.0	EL ^{eng}					
a. Plot Profiles	2.0	ENG					
b. c. Computation	.2	EL					
d. g. Computation	.4	EL					
3. Design Link	1.0	EN	3.2	TELE OPER			
a. Design	.2	EL		T.O.			
b. Design	2.0	EN _J	2.0	MAIN MO.			
c. Design Foundations	1.0	EN _J					
d. f. Design	2.0	EL					
4. a. Design Lobe Rotator	2.0	EL					
5. Procure Link Components	4.0	EL			42 weeks	\$135,000	
a. Prepare RFQ	4.0	EL			1-4-1's	0.5 (MW) PC	
b. Issue PO	?	PC				0.5 " PC	
6. Assemble Components	1.0	EL					
a. Assembly			4.0	EL			
b. c. "			8.0	FL			
d. e.			12.0	EL			
b. c. d. e.			6.0	S ^{SNIP}			
7. Test Assemblies	4.0	EL	8.0	EL			
8. Install Link Assemblies							
a. b. c. Rec. & Transmitters			4.0	EL			
d. e. Reflectors & Antennas			2.				
9.0 Test Link	1.0	EL	1.0	EL			
a. Align Antennas & Reflectors	4.0	EN	4.0	T M ^{EL}			

IRON WORKERS

\$4000

May do this with N.R.A.O. Personnel

X

II Link

D. Modifications and Additions to Digital Equipment

Task	NRAD				Cost \$	Contract - Purchase	
	Design & Supply.		Construction			Time	Cost \$
	Time (man-weeks)	Div	Time (man-weeks)	Div			
1. Control Computer Mods.							
2. Data Communication & Monitoring	18.0	EL	18.0	EL			18,700
3. Delay Modifications	2.0	EL	2.0	EL			8,500
4. Lobe Rotator	2.0	EL	2.0	EL			8,500
	22.0		22.0				
	53.0		74.2				147,000
TOTAL ELECT ENGS.	41.4	✓					
TOTAL ENGINEERING	11.6	✓					
TOTAL PURCHASING	3						
	<u>53.0</u>						
TOTAL TO 13101110			59.0	✓			
TELESCOPE OPERATIONS			3.2	✓			
MAINTENANCE			2.0	✓			
CONTROL SHOP			4.0	✓			
TELESCOPE MECHANICS			4.0	✓			
			<u>74.2</u>				

x

Part III

Relocate 85-3

4

Symbol	Division	Time Man Hrs	Cost \$		Time Man Wks				
M	Maintenance	2.06	113,756 ⁰⁰	Supervision	5.15				
FO	Telescope Operations	1.50					3.75		
FM	Telescope Mechanics	1.660					41.50		
OC	Purchasing & Contract	1.05					2.63		
TO	Telescope Operations	5.55					13.88		
S	Shop	1.0					.25		
in	Engineering	12.42					31.05		
in	Electronics	8.24					20.60		
in	Electronics	15.56					38.90		
in	Computer	—					—		
—	Materials Cost	—	214,000 ⁰⁰		—				
—	Contract Cost	—	525,000 ⁰⁰		—				
	Totals	63.08	852,756 ⁰⁰		157.70				

- c. Fabricate.
- 4. At Bank site remove from 85-3.
 - a. Instrumentation cables
 - b. Cable trays.
 - c. Encoders.
 - d. Power and control wiring to telescope.
 - e. Lighting.
 - f. Conduit.
 - g. Limit switches.
 - h. Motor generator set
 - i. Air conditioning/heating.
 - j. Power transformer.
 - k. Equipment racks.
 - l. Equipment house.
- 5. Instrumentation cables (multiconductor and coax).
 - a. Determine requirements.
 - b. Procure parts
 - c. Assemble and test.
- 6. Power and control wiring to telescope.
 - a. Determine requirements.
 - b. Procure parts.
- 7. Air conditioning/heating (in site plan).
 - a. Determine requirements.
 - b. Pass to site plan group.
- 8. Install.
 - a. Conduit.
 - b. Power and control wiring to telescope.
 - c. Cable trays.
 - d. Instrumentation cables.
 - e. Encoders.
 - f. Lighting.
 - g. Limit switches.
 - h. Air conditioning/heating (in site plan).
 - i. Equipment house.
 - j. Telescope control panels and racks.
- 9. Electrical power - in site plan.
 - a. Determine amount of 3 phase power required.
 - b. Costs and time required to install power.
 - c. Pass to site plan group.
- 10. Telescope foundations.
 - a. Design.
 - b. Estimate cost and time required.
 - c. Pass information to site design group.
- 11. Telescope painting.
 - a. Prepare specification.
 - b. Prepare bid package.
 - c. Solicit quotes
 - d. Determine costs and time and award contracts.
 - e. Supervise painting.
- 12. Final adjustment of surface panels.
- 13. Final adjustment of encoders and setting of

			1100	El.					
	70	To	455	1155 TO 60 El 130 TM 110 M					
	24	El	90	ROEL+10PC		12.0 days	9000		
			160	El					
	80	El	24	To					
	10	PC							
	8	En	10	To					
	80	To	483	40 El 80 TM 96 M 272 TO					
	8	En	80	El					
		Incl. 26 PC	60	50 TM + 10 S					
		Incl. 26 PC							
		Incl. with site							
		Incl. with site							
		Incl. in (E - Either)							
	5	En							
		Incl. in site							
	8	En							
		Incl. in site							
	8	En							
	8	PC							
	12	En							
	20	En	10	PC					
	80	En							
	80	En	320	240 TM 80 TO		1 Mo	\$25,000		
	8	En	24	16 El 8 TO					
	722		4017			(6308)	\$739,000		

Summary

- ✓ 206 Manhours - Maintenance
- ✓ 150 " - Tel. Operations Superv.
- ✓ 1660 " - Tel. Mechanics
- ✓ 705 " - Purchasing & Contracts
- ✓ 555 " - Telescope Operations
- ✓ 10 " - Shop
- ✓ 1242 " - Engineering
- ✓ 824 " - El. Eng'd Design
- ✓ 388 " - Electron. Tech.

Part III

Either Telescope

X

nbol	Division	Time Man hrs	Cost \$		Time Man Wks					
1	Maintenance	32	39189 ⁰⁰	Supervision	.80					
0	Telescope Operations	8					.20			
M	Telescope Mechanics	96					2.40			
G	Purchasing & Contract	28					.70			
0	Telescope Operations	296				Technician	7.40			
5	Shop	380						9.50		
n	Engineering	300						7.50		
1	Electronics	280				Design & Engr Technician	7.00			
1	Electronics	728						18.20		
-	Computer	-					-			
-	Materials Cost	-	16800 ⁵⁰		-					
-	Contract Cost	-	-		-					
		2148	55989 ⁰⁰		53.70					

Additional Tasks not Peculiar to the Choice of Telescope.

1. Encoders.
 - a. ^{Design &} Purchase material.
 - b. Fabricate.
2. Front end modifications.
 - a. Determine requirements.
 - b. Design phase control loop.
 - c. Procure components.
 - d. Assemble.
 - e. Make front end boxes available for modification.
 - f. Install phase control system.
 - g. Install frontend boxes on telescopes.
 - h. Test.
3. Encoder electronics.
 - a. ^{Design &} Procure components.
 - b. Fabricate.
 - c. Test.
 - d. Install. *Incl. With Telescope*
4. Install racks in equipment house.
5. Test of complete telescope control and monitor.
6. Complete frontend tests.
7. Telescope pointing and performance tests.

National Radio Astronomy Observatory				Contract - Purchase		
Design & Supervision		Construction		Cost in Dollars	Time	Cost in Dollars
Time	Division	Time	Division			
240	En	10	PC		6 Mo	\$5200 ⁰⁰
		380	S			
48	El					
40	El	8	PC		12 WK	10,000 ⁰⁰
		160	El			
		16	El			
		40	El			
		40	16El+16TM+8To		2 Day	800 ⁰⁰
16	El	32	16El+16To			Crane
80	El	10	PC		2 Mo	800 ⁰⁰
		240	El			
8	El	152	80El+40To+32M			
100	40El+60En	320	120El+120To+80TM			
40	El	80	46El+40To			
16	8El+8To	72	To			
✓588	+	1560	= 2148 ✓			✓\$16,800 ⁰⁰

Summary

✓M	32	Manhours	Maintenance
✓To	8	"	Telescope Operations Support
✓TM	96	"	Telescope Mechanics
✓PC	28	"	Purchasing & Contracts
✓To	296	"	Telescope Operations
✓S	380	"	Shop
	840		

✓En	300	Manhours	Engineering
✓El	280	"	Electronics Eng. & Design
✓El	728	"	Electronics Tech.
	1308		2148 ✓

Part IV Computer

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Inbol	Division	Time Man hrs	Cost \$	Supervision	Time Man Wks
M	Maintenance	—			—
TO	Telescope Operations	—		Supervision	—
TM	Telescope Mechanics	—			—
PG	Purchasing & Contract	—			—
TO	Telescope Operations	—		Technician	—
S	Shop	—			—
n	Engineering	—			—
l	Electronics	—		Design & Engr	—
l	Electronics	—		Technician	—
—	Computer	52.0	9,336 ⁰⁰		13.0
—	Materials Cost	—			
—	Contract Cost	—			
	Totals	52.0	9,336⁰⁰		13.0