National Aeronautics and
Space Administration

Budget Estimates

FISCAL YEAR 1986

Volume II

Construction of Facilities

CONTENTS

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

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Project Justification By Location:

Space Transportation Facilities at Various Locations ..... CF 1
Space Shuttle Payload Facilities at Various Locations ..... CF 2
Goddard Space Flight Center, Greenbelt, Maryland ..... CF 3
Jet Propulsion Laboratory, Pasadena, California ..... CF 4
Ames Research Center, Moffett Field, California ..... CF 5
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Various Locations ..... CF 7
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SUMMARY
INFORMATION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

GENERAL STATEMENT

The Construction of Facilities (CoF) appropriation provides contractual services for the repair, rehabilitation and modification of existing facilities; the construction of new facilities; the acquisition of related facility equipment; the design of facilities projects; and advance planning related to future facilities needs.

The funds requested for 1986 provide for: the continuation of prior year's endeavors in meeting the facilities requirements for the Space Shuttle; Space Shuttle Payload support operations; modification of aeronautical research and development facilities; repair, rehabilitation, and modification of other facilities to maintain, upgrade and improve the usefulness of the NASA physical plant; minor construction of new facilities; and facility planning and design activities.

The projects and amounts in the budget estimate reflect Space Shuttle and Space Shuttle Payload requirements that are tine sensitive to meet specific milestones. Other program requirements for 1986 include the construction of additions to the resedrch project laboratory, and construction of a spacecraft systems development and integration facility at Goddard Spacecraft Center; construction of a microdevices laboratory at the Jet Propulsion Laboratory; ongoing construction on the numerical aerodynamic simulation facility at the Ames Research Center; modifications to the 16-foot transonic tunnel for improved productivity and research capability, at the Langley Research Center; and modification of 64-meter antennas, DSS-14, Goldstone, California, and DSS-43, Canberra, Australia.

The FY 1986 proyram continues to meet the objectives of preserving and enhancing the capabilities and usefulness of existing facilities and ensuring safe economical and efficient use of the NASA physical plant. This request continues the necessary rehabilitation and modification program begun in prior years and continues a repair program. The purpose of the repair program is to restore facilities to a condition substantially equivalent to their originally designed capability. The minor construction program continues to provide a means to accomplish smaller facility projects which accommodate changes in technical and institutional requirements.

Funds requested for facility planning and design cover advance planning and design requirements for potential future projects, master planning, facilities studies, engineering reports and studies and the preparation of facility project design drdwings and bid specifications.

The request for FY 1986 is $149,300,000, a decrease of $700,000 from the appropriation for FY 1985. Outlays are estimated to be $162,300,000 in FY 1986, a decrease of $4,700,000 from the estimate for FY 1985.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

CONSTRUCTION OF FACILITIES

For construction, repair, rehabilitation and modification of facilities, minor construction of new facilities and additions to existing facilities, and for facility planning and design not otherwise provided, for the Kational Aeronautics and Space Administration, and for the acquisition or condemnation of real property, as authorized by law, [$150,000,000] *$149,300,000,* to remain available until September 30, [1987] *1988*: ***Provided.*** That, notwithstanding the limitation on the availability of funds appropriated under this heading by this appropriation Act, when any activity has been initiated by the incurrence of obligations therefor, the amount available for such activity shall remain available until expended, except that this provision shall not apply to the amounts appropriated pursuant to the authorization for repair, rehabilitation and modification of facilities, minor construction of new facilities and additions to existing facilities, and facility planning and design: ***Provided further,*** That no amount appropriated pursuant to this or any other Act may be used for the lease or construction of a new contractor-funded facility for exclusive use in support of a contract or contracts with the National Aeronautics and Space Administration under which the Administration would be required to substantially amortize through payment or reimbursement such contractor investment, unless an appropriation Act specifies the lease or contract pursuant to which such facilities are to be constructed or leased or such facility is otherwise identified in such Act: ***Provided further,*** That the Administrator may authorize such facility lease or construction, with [the approval of] *notice to* the Committees on Appropriations, if he determines that deferral of such action until the enactment of the next appropriation Act would be inconsistent with the interest of the Kation in aeronautical and space activities [: ***Provided further.*** That with- funds appropriated under the Research and Development account and the Space Flight, Control and Data Communications account to NASA in this Act, and subsequent appropriations Acts, NASA may enter into a contract with the California Institute of Technology to amortize the Central Engineering Building over a twelve-year period for a total cost of not to exceed $17,000,000, plus applicable financing costs equal to the prime rate plus 2 percent, under the authority granted under Public Law 98–45. The building shall be built at the Jet Propulsion Laboratory with title to be vested initially in the California Institute of Technology, and to revert to NASA upon completion of payments] (*Department of Housing and Urban Development—Independent Agencies Appropriation Act. 1985.*)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES

Program and Financing (in thousands of dollars)

Identification code 80-0107-0-1-999	1984 actual	1985 est.	1986 est.
Program by activities:			
Direct program:			
1. Space transportation systems	46,211	44,767	28,153
2. Scientific investigations in space	2,016	11,954	13,527
4. Space research and technology	---	1,200	240
5. Aeronautical research and technology	29,362	42,173	21,999
7. Supporting activity	69,309	86,197	90,698
Total direct program	146,898	186,291	154,617
Reimbursable program	2,860	11,032	12,287
10.00 Total obligations	149,758	197,323	166,904

Program and Financing (in thousands of dollars)

Identification code 80-0107-0-1-999	1984 actual	1985 est.	1986 est.
11.00 Offsetting collections from Federal funds.	-3,212	-10,000	-12,500
Unobligated balance available, start of year: For completion of prior year budget plans:			
21.40 Appropriation	-116,710	-128,871	-91,548
22.40 Unobligated balance transferred from other accounts	-3,450	---	---
Unobligated balance available, end of year: For completion of prior year budget plan:			
24.40 Appropriation	128,871	91,548	86,444
25.00 Unobligated balance lapsing	243	---	---
39.00 Budget authority	155,500	150,000	149,300
Budget authority:			
40.00 Appropriation	155,500	150,000	149,300
42.00 Transferred from other accounts	---	---	---
43.00 Appropriation (adjusted)	155,500	150,000	149,300
50.00 Reappropriated	---	---	---
Relation of obligations to outlays:			
71.00 Obligations incurred, net	146,546	187,323	154,404
72.40 Obligated balance, start of year	107,131	144,893	165,216
74.40 Obligated balance, end of year	-144,893	-165,216	-157,320
77.00 Adjustments in expired accounts	---	---	---
90.00 Outlays	108,784	167,000	162,300

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1986 ESTIMATES

SUMMARY OF THE BUDGET PLAN BY LOCATION

Location	FY 1984	FY 1985 (In Dollars)	FY 1986
George C. Marshall Space Flight Center.....	---	1,600,0003	---
Space Transportation Facilities.....	60,550,000	31,200,000	29,900,000
Space Shuttle Payload Facilities.....	12,000,000	6,700,000	1,200,000
Goddard Space Flight Center.....	---	2,200,000	11,800,000
Jet Propulsion Laboratory.....	4,300,000	12,200,000	8,900,000
Ames Research Center.....	3,900,000	11,500,000	8,200,000
Hugh L. Dryden Flight Research Facility.....	800,003	---	---
Langley Research Center.....	9,500,000	13,500,000	4,900,000
Lewis Research Center.....	10,600,000	---	---
Various Locations.....	1,450,000	13,800,000	17,400,000
Repair.....	17,500,000	18,000,000	22,000,000
Rehabilitation and Modification.....	21,500,000	22,000,000	27,000,000
Minor Construction.....	8,800,000	5,000,000	6,000,000
Facility Planning and Design.....	8,600,000	12,000,000	12,000,000
Total Plan.....	155,500,000	150,000,000	149,300,000

SUMMARY OF BUDGET PLAN BY COGNIZANT OFFICE

	FY 1984	FY 1985 (In Dollars)	FY 1986
Office of Space Flight	72,550,000	37,400,000	31,100,00
Office of Space Science and Applications	1,600,000	12,200,000	20,700,00
Office of Aeronautics and Space Technology	24,000,000	27,400,000	13,100,00
Office of Space Tracking and Data Systems	4,950,000	16,000,000	17,400,00
Office of Management	52,400,000	57,000,000	67,000,00
Total Plan	155,500,000	150,000,000	149,300,000

SUMMARY OF BUDGET PLAN BY SUBFUNCTION

Code No.				
253	Space Flight	60,550,000	31,200,000	900,00
254	Space Science, Applications, and Technology	12,000,000	8,300,000	000,00
255	Support Space Activities	58,950,000	85,200,000	300,00
(250)	Subtotal, General Science, Space and Technology	131,500,000	124,700,000	200,00
402	Air Transportation	24,000,000	25,300,000	13,100,00
	Total	155,500,000	150,000,000	00,

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1986 ESTIMATES

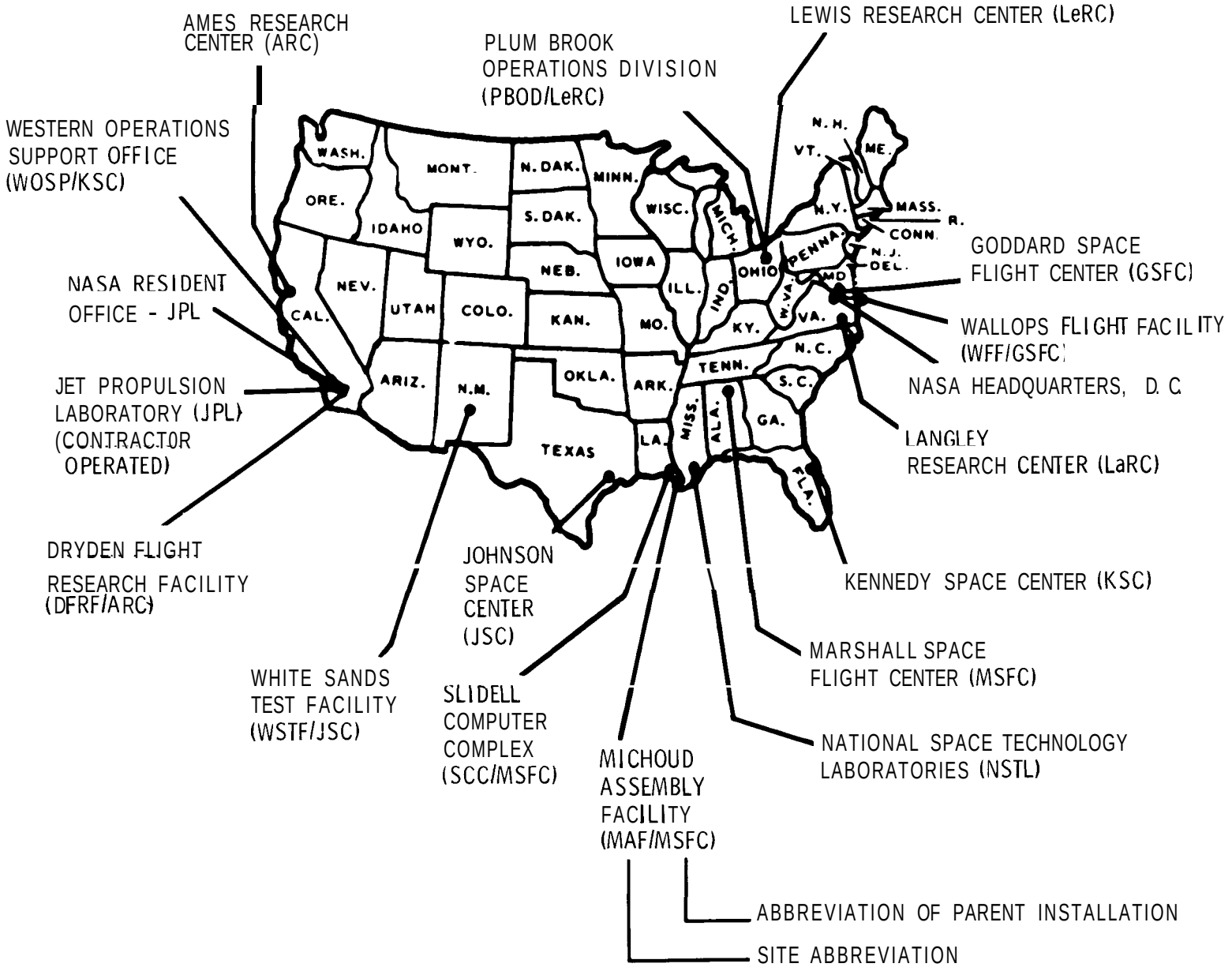
SUMMARY OF THE BUDGET PLAN BY LOCATION

Cognizant Office	Budget Activity	Subfunction Code	Location and Project	FY 1984	FY 1985	FY 1986	Page No.
				(Thousands of Dollars)			
			GEORGE C. MARSHALL SPACE FLIGHT CENTER	---	1,600	---	
SF	4	254	Repairs to Test Stand 500	---	1,600	---	
			SPACE TRANSPORTATION FACILITIES AT VARIOUS LOCATIONS AS FOLLOWS:	60,550	31,200	29,900	
SF	1	253	Construction of Orbiter Modification and Refurbishment Facility (KSC)	---	---	14,000	CF 1-1
SF	1	253	Construction of Thermal Protection System Facility (KSC)	---	---	3,690	CF 1-8
SF	1	253	Modifications for Advanced Technology Engine Test Stand S-1C (MSFC)	---	---	5,500	CF 1-15
SF	1	253	Modifications for Enhanced Life Support Systems Testing (JSC)	---	---	1,100	CF 1-21
SF	1	253	Modifications to Pad A Payload Change-Out Room (KSC)	---	---	2,200	CF 1-26
SF	1	253	Modifications to Space Shuttle Main Engine Support Systems (NSTL)	---	---	2,500	CF 1-32
SF	1	253	Modifications of Site Electrical Substation (JSC)	---	3,200	---	
SF	1	253	Modifications for Single Testing (NSTL)	---	3,000	---	
SF	1	253	Construction of Launch Complex 39 Logistics Facility (KSC)	10,000	10,930	---	
SF	1	253	Construction of Solid Rocket Booster Assembly and Refurbishment Facility (KSC)	10,000	15,090	---	
SF	1	253	Modifications for Additional Chillers for Mission Control Center (JSC)	2,300	---	---	
SF	1	253	Modifications to Mobile Launch Platform #3 (KSC)	26,550	---	---	
SF	1	253	Modification of Manufacturing and Final Assembly Facilities for External Tanks (MAF)	11,700	---	---	

Cognizant Office	Budget Activity	Subfunction Code	Location and Project	FY 1984	FY 1985	FY 1986	Page No.
				(Thousands of Dollars)			
			SPACE SHUTTLE PAYLOAD FACILITIES AT VARIOUS LOCATIONS, AS FOLLOWS:	12,000	6,700	1,200	
SF	2	254	Construction of Payload Control Rooms (KSC).....	---	---	1,200	CF 2-1
SF	2	254	Construction of Additions to Cargo Hazardous Servicing Facility (KSC).....	---	4,600	---	
AST	2	254	Construction of Biomedical Research Facility (ARC).....	---	2,100		
SF	2	254	Construction of Cargo Hazardous Servicing Facility (KSC)	9,000	---	---	
SF	2	254	Modifications to Spacecraft Assembly and Encapsulation Facility (SAEF-2) for Cargo Processing (KSC).....	3,000	---	---	
			~~GODDARD SPACE FLIGHT~~ CENTER	---	2,200	11,800	
SSA	2	254	Construction of Additions to Research Projects Laboratory	---	---	3,800	CF 3-1
SSA	2	254	Construction of Spacecraft Systems Development and Integration Facility.....	---	---	8,000	CF 3-9
ST&DS	7	255	Construction of Addition to the Network Control Center...	---	2,200	---	
			JET PROPULSION LABORATORY	4,300	12,200	8,900	
SSA	7	255	Construction of Microdevices Laboratory.....	---	---	8,900	CF 4-1
SSA	7	255	Construction of Earth and Space Science Laboratory.....	---	12,200	---	
ST&DS	7	255	Construction of Frequency Standards Laboratory.....	2,700	---	---	
SSA	7	255	Modifications to Space Flight Operations Facility.....	1,600	---	---	
			AMES RESEARCH CENTER	3,900	11,500	8,233	
AST	5	402	Construction of Numerical Aerodynamic Simulation Facility	---	11,500	8,200	CF 5-1
AST	5	402	Construction of Fluid Mechanics Laboratory...,.....	3,900	---	---	
			HUGH L. DRYDEN FLIGHT RESEARCH FACILITY	800	---	---	
ST&DS	7	255	Construction of Aeronautical Tracking Facility.....	800	---	---	

Cognizant Office	Budget Activity	Subfunction Code	Location and Project	FY 1984	FY 1985	FY 1986	Page No.
				(Thousands of Dollars)			
			LANGLEY RESEARCH CENTER	9,500	13,800	4,900	
AST	5	402	Modifications to 16-Foot Transonic Tunnel for Improved Productivity and Research Capability....	---	---	4,900	CF 6-1
AST	5	402	Modifications to 8-Foot High Temperature Tunnel.....	---	13,800	---	
AST	5	402	Modifications and Addition for Composite Materials Laboratory (1293A).....	5,109	---	---	
AST	5	402	Modificatioins to 30- by 60-Foot Wind Tunnel (643).....	4,400	---	---	
			LEWIS RESEARCH CENTER	10,600	---	---	
AST	5	402	Modifications for Small Engine Component Testing Facility	7,000	---	---	
AST	5	402	Modifications to Icing Research Tunnel (11).....	3,699	---	---	
			VARIOUS LOCATIONS	1,450	13,800	17,400	
ST&DS	7	255	Modification of 64-Meter Antenna DSS-14, Goldstone, California (JPL).....	---	---	8,500	CF 7-1
ST&DS	7	255	Modification of 64-Meter Antenna DSS-43, Canberra, Australia (JPL).....	---	---	8,900	CF 7-8
ST&DS	7	255	Construction of 34-Meter Antenna, Madrid, Spain (JPL)....	---	6,003	---	
ST&DS	7	255	Modifications of 64-Meter Antenna, DSS-63, Madrid, Spain (JPL)..	---	7,800	---	
ST&DS	7	255	Relocation of 26-Meter STDN Antenna, Spain (JPL).....	1,450	---	---	
MGMT	7	255	Repair of Facilities at Various Locations, Not in Excess of $750,000 Per Project	17,500	18,000	22,000	CF 8-1
MGMT	7	255	Rehabilitation and Modification of Facilities at Various Locations, Not in Excess of $750,000 Per Project	21,500	22,000	27,000	CF 9-1
MGMT	7	255	Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations, Not-in Excess of $500,000 Per Project	4,800	5,000	6,000	CF 10-1
MGMT	7	255	Facility Planning and Design.....	8,600	12,000	12,000	CF 11-1
			TOTAL.....	155,500	150,000	149,300	

LOCATION OF MAJOR AND COMPONENT INSTALLATIONS



RECORDED VALUE OF CAPITAL TYPE PROPERTY
IN-HOUSE AND CONTRACTOR-HELD
AS OF SEPTEMBER 30, 1984
(DOLLARS IN THOUSANDS)

REPORTING INSTALLATION	LAND	BUILDING	OTHER STRUCTURES AND FACILITIES	LEASEHOLD IMPROVEMENTS	TOTAL	EQUIPMENT	FIXED ASSETS IN PROGRESS	GRAND TOTAL
AMES RESEARCH CENTER	2,929	239,847	22,842	0	265,618	343,836	206,711	816,165
ARC MOFFETT FIELD, CA.	2,928	222,698	11,718	0	237,344	260,422	196,747	694,513
DRYDEN FLIGHT FACILITY EDWARDS, CA.	0	16,453	10,778	0	27,231	83,414	9,964	120,609
VARIOUS LOCATIONS (a)	1	696	346	0	1,043			1,043
GODDARD SPACE FLIGHT CENTER	2,860	152,869	119,745	0	275,454	533,488	31,736	840,698
GSFC - GREENBELT, MD.	1,362	102,613	19,220	0	123,195	231,787	25,293	380,275
TRACKING STATIONS NETWORK	28	15,779	39,336	0	55,143	202,129	2,368	259,640
WFF - WALLOPS ISLAND, VA.	1,470	34,412	61,176	0	97,058	58,949	4,095	160,102
VARIOUS LOCATIONS (a)	0	45	13	0	58	40,623	0	40,681
JET PROPULSION LABORATORY	1,188	104,266	75,648	1,879	182,981	283,850	53,230	520,061
JPL - PASADENA, CA.	1,188	93,261	15,535	1,877	111,861	216,384	53,230	381,475
DEEP SPACE NETWORK	0	11,005	60,113	2	71,120	67,466		138,586
JOHNSON SPACE CENTER	10,888	212,379	68,896	0	292,163	551,269	47,142	890,574
JSC - HOUSTON, TX.	7,319	175,186	41,855	0	224,360	452,861	42,975	720,196
WHITE SANDS TEST FACILITY LOS CRUCES, NM.		9,569	21,437		31,006	22,381		53,387
VARIOUS LOCATIONS (a)	3,569	27,624	5,604	0	36,797	76,027	4,167	116,991
KENNEDY SPACE CENTER	71,345	415,235	460,511	0	947,111	423,636	72,585	1,443,332
KSC - CAPE CANAVERAL, FL.	71,345	415,235	460,511		947,111	141,396	72,585	1,161,092
WESTERN TEST RANGE, LOMPOC, CA.					0	3,768		3,768
VARIOUS LOCATIONS (a)	0	0	0	0	0	278,472		278,472
LANGLEY RESEARCH CENTER	162	147,046	308,456	0	455,664	216,123	61,073	732,860
LARC - HAMPTON, VA.	162	147,046	308,405		455,613	203,097	61,073	719,783
VARIOUS LOCATIONS (a)	0	0	51		51	13,026		13,077
LEWIS RESEARCH CENTER	3,651	230,067	81,591	136	315,445	159,139	23,298	497,882
LERC - CLEVELAND, OH.	316	153,660	62,529	136	216,641	135,719	23,298	375,658
PLUM BROOK, SANDUSKY, OH.	3,335	76,407	19,062		98,804	6,624		105,428
VARIOUS LOCATIONS (a)	0	0	0	0	0	16,796		16,796
MARSHALL SPACE FLIGHT CENTER	7,164	244,620	143,985	0	395,769	397,902	0	793,671
MSFC - HUNTSVILLE, AL.	0	127,690	65,699	0	193,389	262,470	0	455,859
MICHOUD ASSEMBLY FACILITY, AL.	7,095	106,980	64,992	0	179,067	49,594		228,661
SLIDELL COMPUTER COMPLEX, AL.	69	5,101	2,587	0	7,757	5,166		12,923
VARIOUS LOCATIONS (a)	0	4,849	10,707	0	15,556	80,672		96,228
NATIONAL SPACE TECH. LABS.	18,061	72,844	193,199	0	284,104	31,252	0	315,356
NSTL - NSTL STATION, MS.	18,061	72,844	193,198	0	284,104	31,191		315,295
VARIOUS LOCATIONS (a)	0	0	0	0	0	61		61
NASA HEADQUARTERS	0	0	0	0	0	28,896	0	28,896
NASA - HDQ., WASH., D.C.	0	0	0	0	0	12,087		12,087
VARIOUS LOCATIONS (a)	0	0	0	0	0	16,809		16,809
AGENCY TOTAL	118,248	1,819,173	1,474,873	2,015	3,414,309	2,959,391	495,755	6,879,495

JUSTIFICATION
BY LOCATION

SPACE
TRANSPORTATION
FACILITIES

SPACE SHUTTLE
PAYLOAD
FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

SPACE TRANSPORATON FACILITIES

Office of Space Flight:	Amount	Page
Construction of Orbiter Modification and Refurbishment Facility, Kennedy Space Center	14,000,000	CF
Construction of Thermal Protection System Facility, Kennedy Space Center	3,600,000	CF
Modifications for Advanced Technology Engine Test Stand S-1C, Marshall Space Flight Center	6,500,000	CF
Modifications for Enhanced Life Support Systems Testin , Johnson Space Center	1,100,000	CF
Modifications to Pad A Payload Change-Out Room, Kennedy Space Center	2,200,000	CF
Modifications to Space Shuttle Main Engine Support Systems, National Space Technology Laboratories	2,500,000	CF
TOTAL	29,900,000	

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF ORBITER MODIFICATION AND REFURBISHMENT FACILITY

LOCATION PLAN

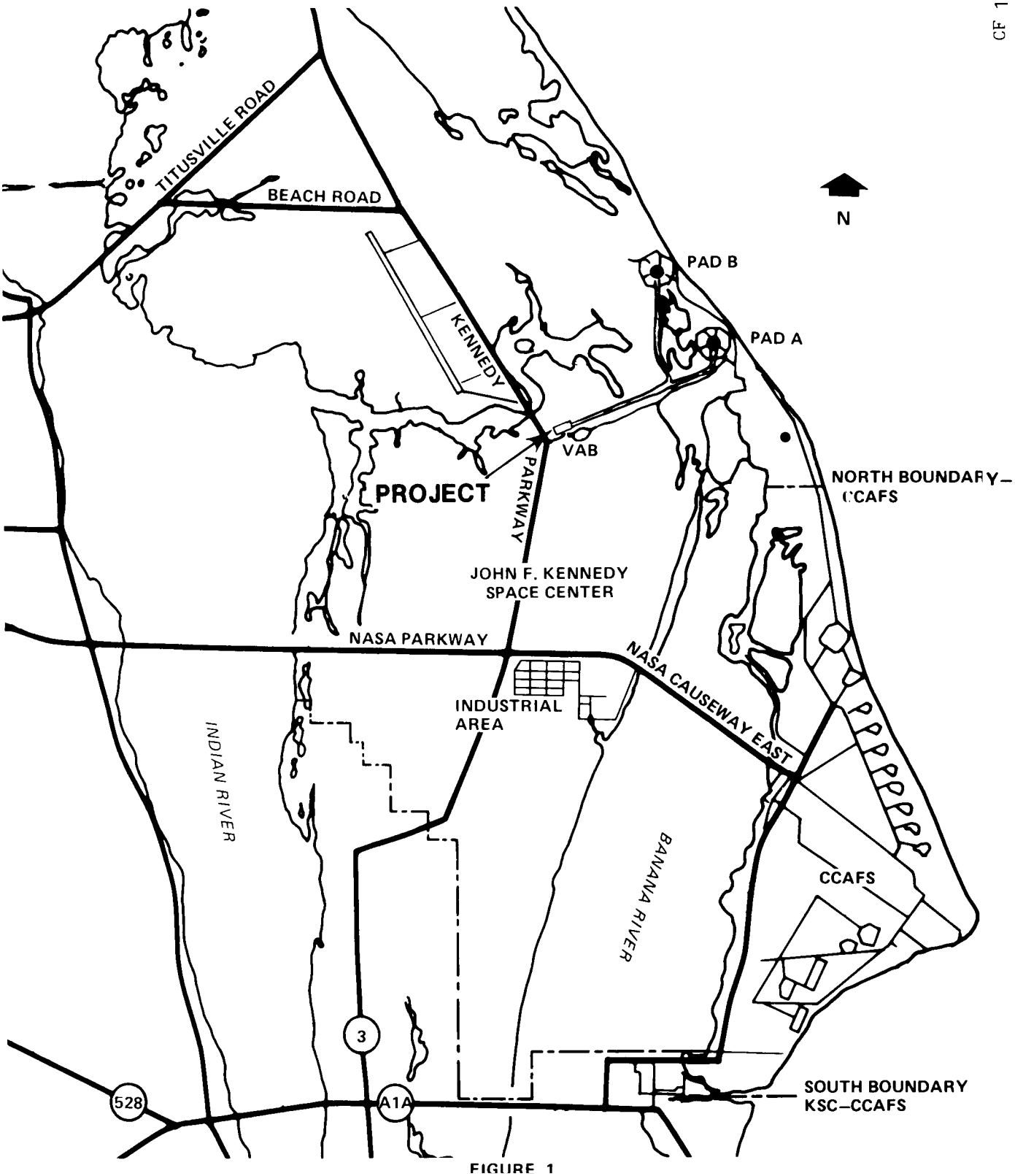


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE: Construction of Orbiter Modification and Refurbishment Facility

INSTALLATION: John F. Kennedy Space Center

FY 1986 CoF ESTIMATE: $14,000,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	992,000	---	992,000
Capitalized investment	N/A	---	---
Total	992,000	---	992,000

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of an orbiter modification and refurbishment facility adjacent to the existing Orbiter Processing Facility (OPF) (Figure 2). This structure will be similar to an existing OPF high bay without the service/deservice systems and equipment. It is required to provide an off-line facility for orbiter modifications, rehabilitation, and overhaul.

TIFI ATION:

With three orbiters permanently located at KSC, a third OPF high bay is needed to perform major repair work off-line so that the operational flow of orbiter processing for the next launch is not delayed or disrupted.

Earlier planning assumed that the existing two bays of the OPF could adequately accommodate a three-orbiter fleet at KSC. This was based on two orbiters being in the OPF bays and the third orbiter being either in the Vehicle Assembly Building (VAB), on a launch pad, or flying a mission. As the flight rate increases and turnaround times approach 28 days, it is now clear that the three orbiters at KSC will completely occupy the two bays of the OPF for essential processing in preparation for launch. Should an orbiter require refurbishment, repair, or storage, the only suitable place for doing this work or activity is the OPF Bays. However, no timeline allocation was planned for the possibility that an orbiter might have to be returned to the OPF after delivery to the launch pad. Thus, using an OPF Bay for this purpose would seriously disrupt the operational launch schedule because only one OPF bay would be available for launch processing. This would effectively reduce the orbiter processing capability by 50 percent.

No other facilities are available at KSC for off-line orbiter maintenance activity. The VAB could be used for temporary orbiter storage when four orbiters are on-site, but the facility is not suitable for orbiter maintenance. The .on-going hazardous operations within the VAB associated with processing and stacking of Solid Rocket Motors (SRM) preclude its use as a maintenance area. This project is required to maintain the integrity of the Space Transportation System.

IMPACT OF DELAY:

The shuttle manifest and operational schedules are dependent upon the continued dedication of both OPF high bays to Shuttle turnaround activity. A major modification or major scheduled maintenance or refurbishment of an orbiter would take one of these high bays out of service for operational processing and result in significant launch delays.

PROJECT DESCRIPTION:

This project will provide a facility located northeast of and similar to an existing high bay of the OPF, without complete service/deservice systems and equipment. The structure will consist of a high bay maintenance area and supporting low bay (Figure 3). The high bay will be 95 feet in height, enclose approximately 30,000 square feet and duplicate the materials and dimensions of the two existing OPF high bays. An underground floor trench system will be provided to accommodate utility and special gaseous fuel systems that could be installed later if necessary. Side rails, crossbeams and a 30-ton bridge crane system will be provided, along with pits

in the floor to accommodate the orbiter floor lifting system. The floor lifts themselves as well as the workstands, are not included. The basic utility systems, including water, electrical and lighting, air-conditioning, and a deluge fire protection system are included in this project. The two-story supporting low bay will enclose approximately 26,000 square feet and accommodate mechanical and electrical equipment for the high bay, and house shop equipment, locker rooms, restrooms and engineering space for technicians and other support personnel. The existing tow way will be extended to the new facility for orbiter access.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition	---	---	---	---
Construction	---	---	---	14.000.000
High bay	SF	30,000	220.00	6,600,000
Low bay	SF	26,000	80.77	2,100,000
Sitework and utilities	LS	---	---	1,500,000
Air-conditioning	LS	---	---	1,050,000
Emergency exhaust system	LS	---	---	850,000
30-ton bridge crane system	LS	---	---	1,500,000
Equipment	---	---	---	
Fallout Shelter (not feasible)	---	---	---	---
Total				14,000,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Perspective

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Future CoF funding may be required if the facility is fully outfitted as an orbiter processing facility.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF ORBITER MODIFICATION AND REFURBISHMENT FACILITY

SITE PLAN

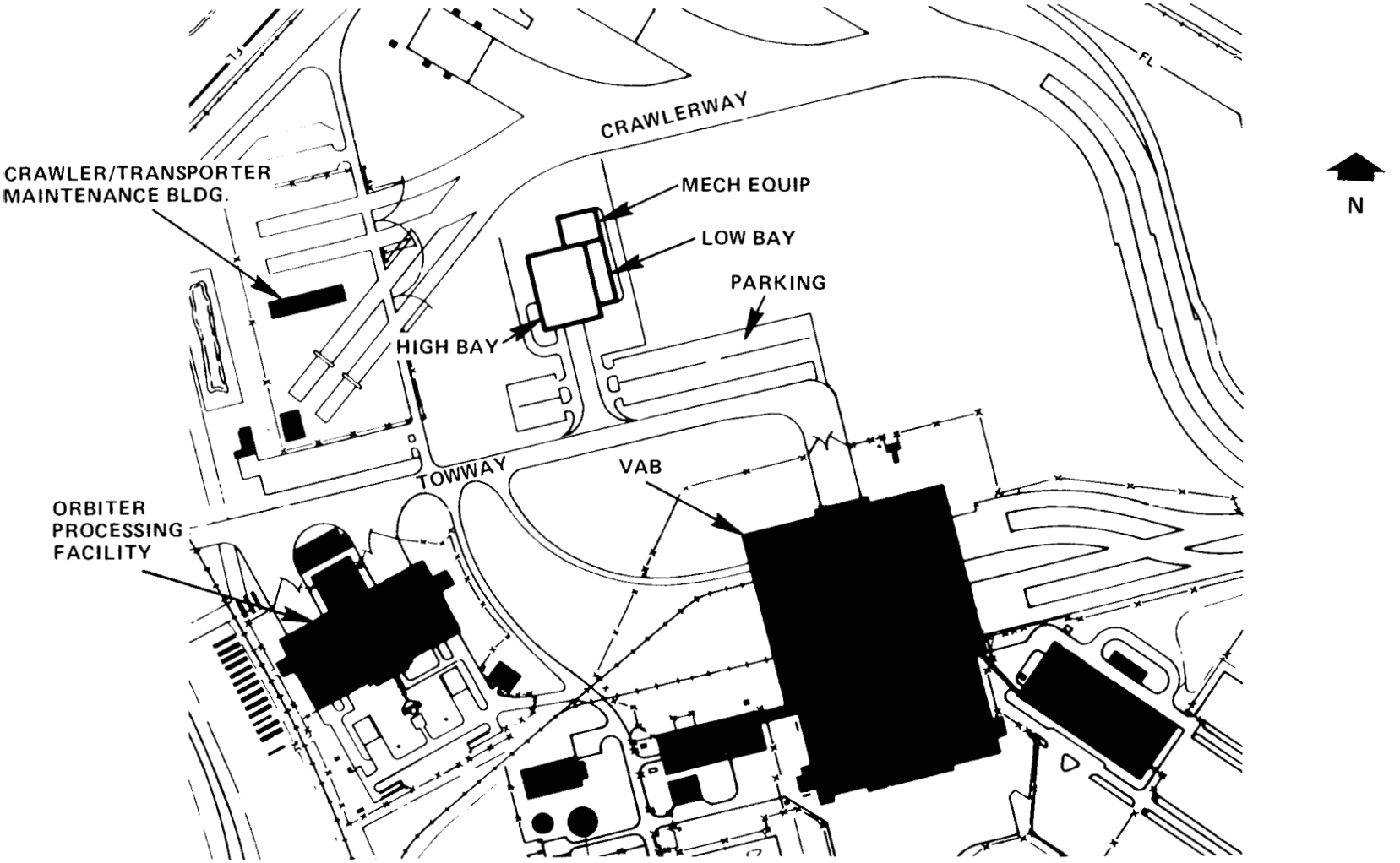


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF ORBITER MODIFICATION AND REFURBISHMENT FACILITY

PERSPECTIVE

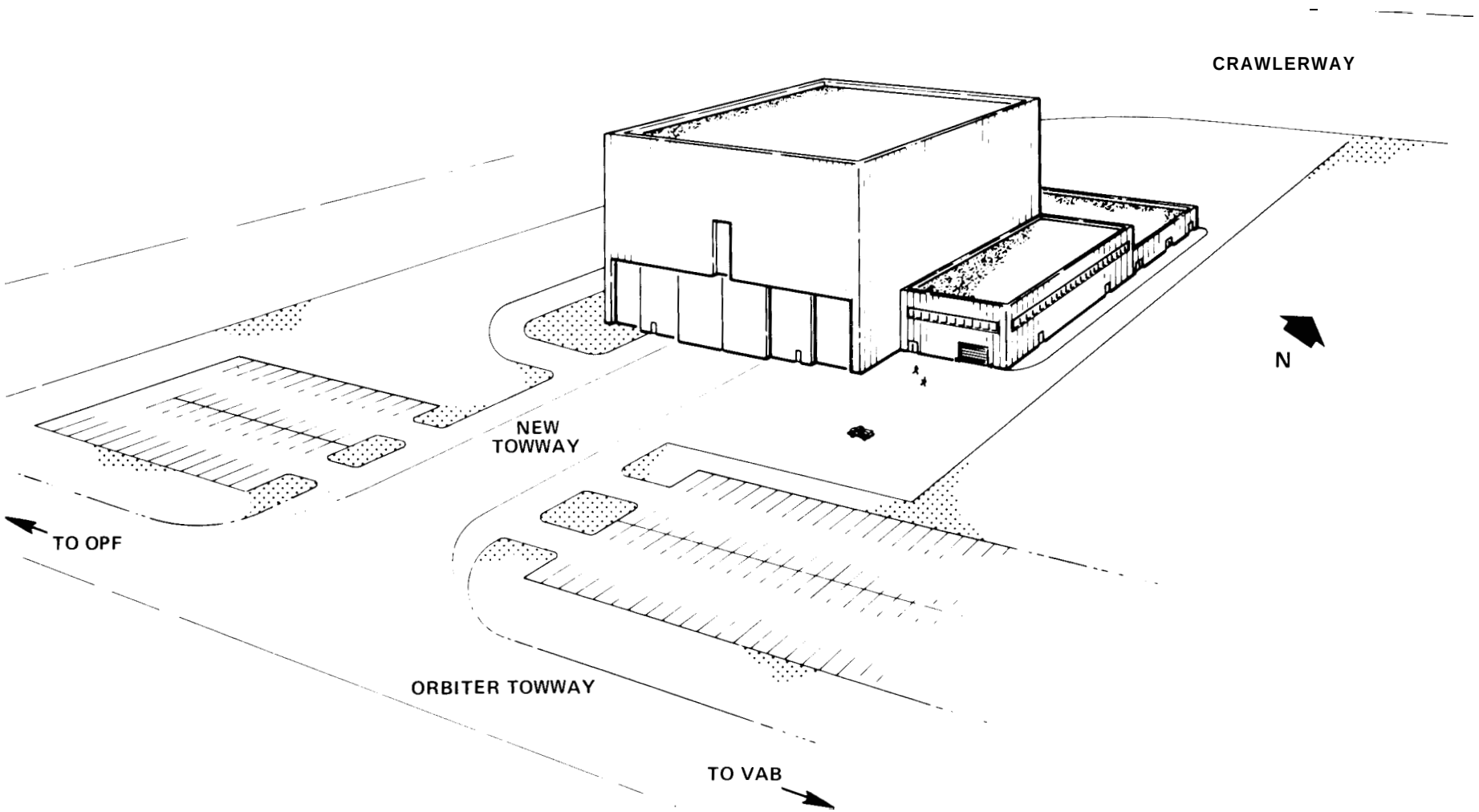


FIGURE 3

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF THERMAL PROTECTION SYSTEM FACILITY

LOCATION PLAN

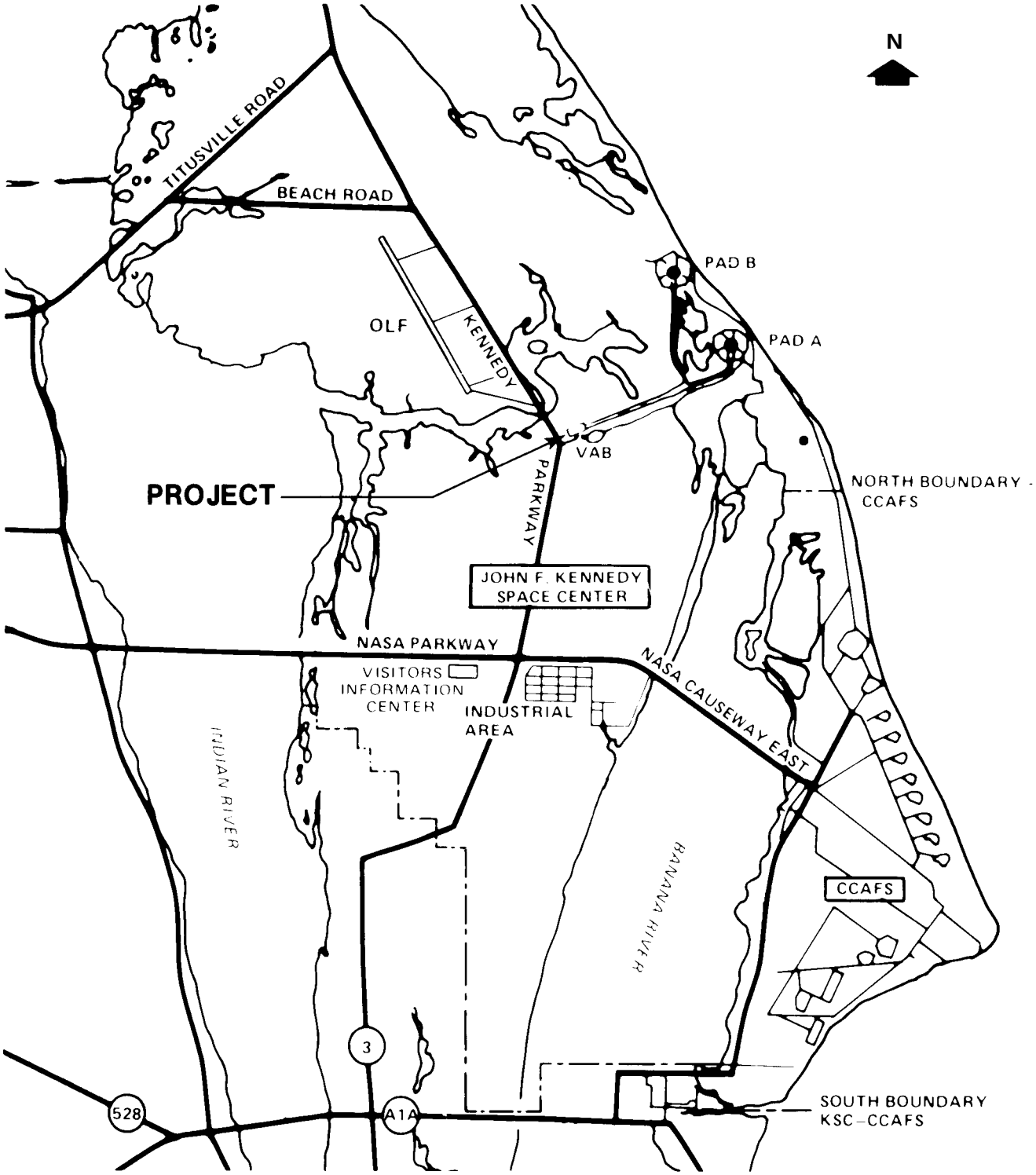


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE: Construction of Thermal Protection System Facility

INSTALLATION: John F. Kennedy Space Center

FY 1986 CoF ESTIMATE: $3,600,000

LOCATION OF PROJECT: Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	370,000	---	370,000
Capitalized investment	N/A	---	---
Total	370,000	---	370,000

SUMMARY PURPOSE AND SCOPE:

This project provides for the relocation, expansion, and consolidation of the present Space Shuttle orbiter Thermal Protection System (TPS) activities at KSC. To meet increased flight rates and the processing of three orbiters at KSC, greater efficiency must be achieved by centralizing TPS functions in an adequate facility located adjacent to other orbiter processing activities (Figures 1 and 2).

PROJECT JUSTIFICATION:

The present TPS facility at KSC, has supported "single orbiter" TPS operations since STS-2. During this time, there has not been a need to perform TPS work on two orbiters simultaneously. As the flight schedule increases, however, it will be necessary that two orbiters be prepared for back-to-back launches.

The existing TPS facility (K6-1095) is situated near the OPF but is of substandard construction materials and is poorly configured for TPS operations. The building is not air conditioned and temperatures frequently exceed 100°F. Adjacent trailers used to supplement the needed space are rapidly deteriorating from weather and heavy use and they do not provide adequate fire protection. Expansion and upgrading of these existing facilities would not be cost-effective because of their obsolescence, low quality materials, and poor construction. As flight rates have increased, the need to support critical TPS functions have caused other related activities to be located in the OPF and in facilities at Cape Canaveral Air Force Station, thereby fragmenting the total TPS operation. The situation will deteriorate as the flight rates increase. A new consolidated TPS facility is needed now in the immediate proximity of the OPF where it can efficiently support the Shuttle program (Figure 3).

After delivery of the last orbiter to KSC, it is anticipated that the tile manufacturing capability, currently located in California, will be relocated to KSC. 'his will reduce the time lost in shipping tiles across country for all East Coast launches. The new TPS facility proposed by this project will be designed to accommodate this manufacturing capability.

IMPACT OF DELAY:

Delay in implementing this project will necessitate costly and inefficient additions/modifications to existing facilities to accommodate the KSC TPS activity. With the requirements imposed by reduced orbiter turnaround timelines, higher flight rates, and increased orbiter fleet size, this new facility is critical to provide responsive support of planned launch schedules.

PROJECT DESCRIPTION:

This project provides for the construction of a two-story building on the existing OPF paved parking site. The steel framed structure will enclose a total area of approximately 42,000 square feet and provide for TPS facility operations which include TPS tooling and stock rooms, TPS machine shop, tile repair and bonding areas, and other special tile fabrication, cleaning and coating shops. The building will be provided with heating, ventilation, and air-conditioning (HVAC); compressed air system; nitrogen system; vacuum system; dust collection system; sanitary waste collection and storm drainage system; electric power; telephone; fire protection and detection system.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	3,600,000
Site development	LS	---	---	574,000
Architectural/structural	SF	42,000	19.80	832,000
Mechanical	SF	42,000	16.67	700,000
Electrical	SF	42,000	15.55	653,000
Civil	LS	---	---	532,000
TPS & OPF paved parking.	LS	---	---	309,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				3,600,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Floor Plan

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF THERMAL PROTECTION SYSTEM FACILITY

SITE PLAN

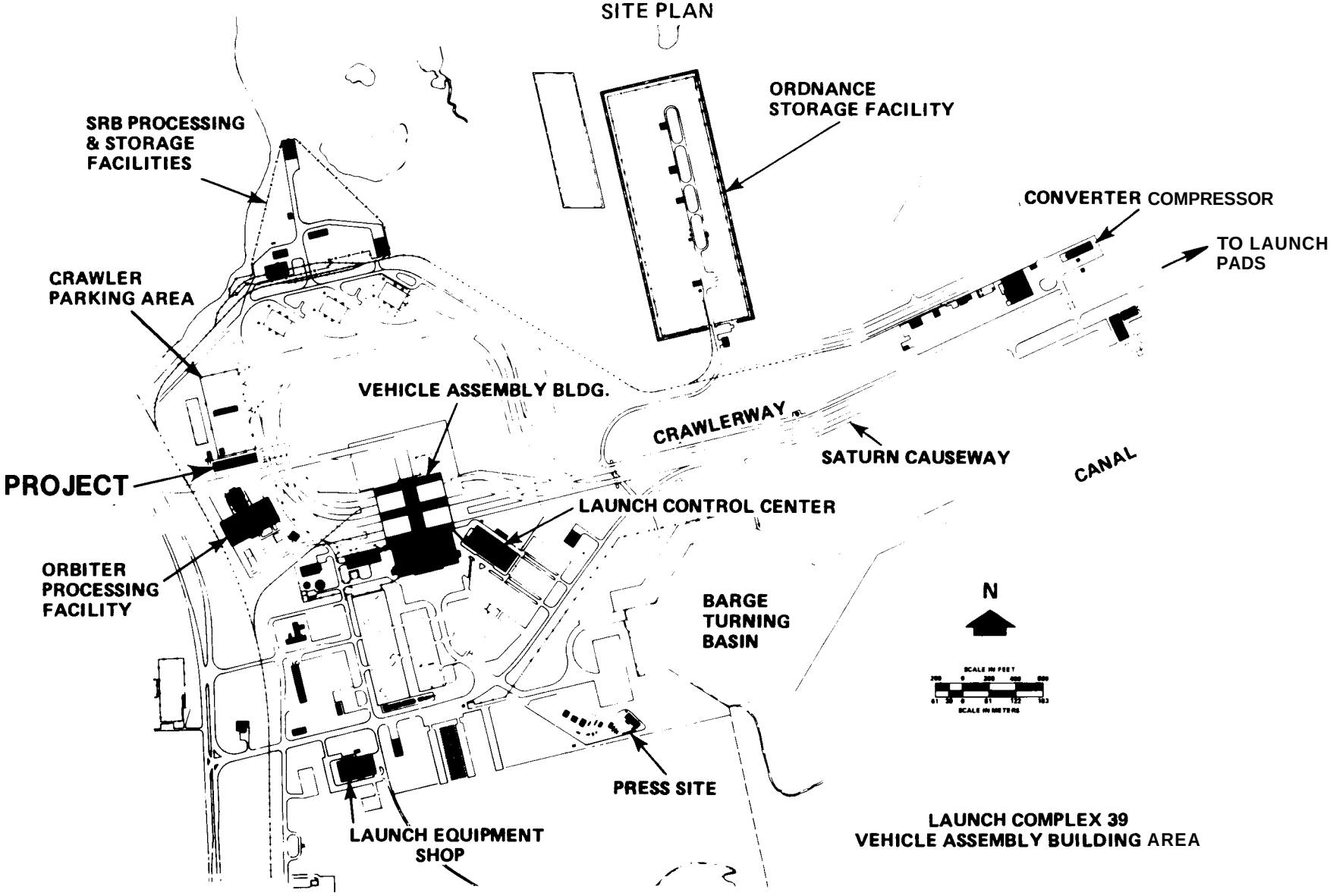
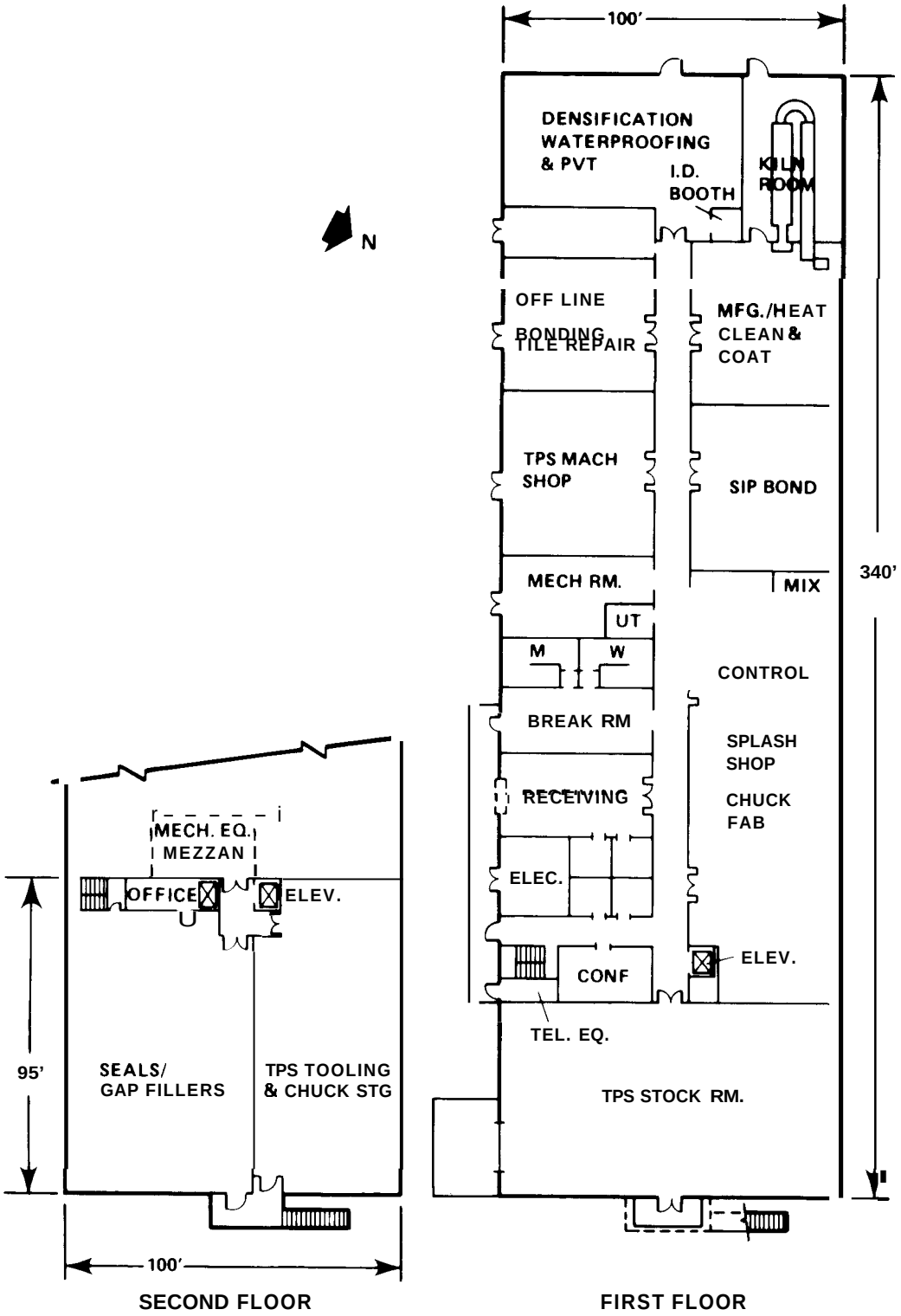


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF THERMAL PROTECTION SYSTEM FACILITY

FLOOR PLAN



SECOND FLOOR

FIRST FLOOR

FIGURE 3

CF 1-

MARSHALL SPACE FLIGHT CENTER
FY 1986 CoF ESTIMATES
MODIFICATIONS FOR ADVANCED TECHNOLOGY ENGINE TEST STAND S-IC

LOCATION PLAN

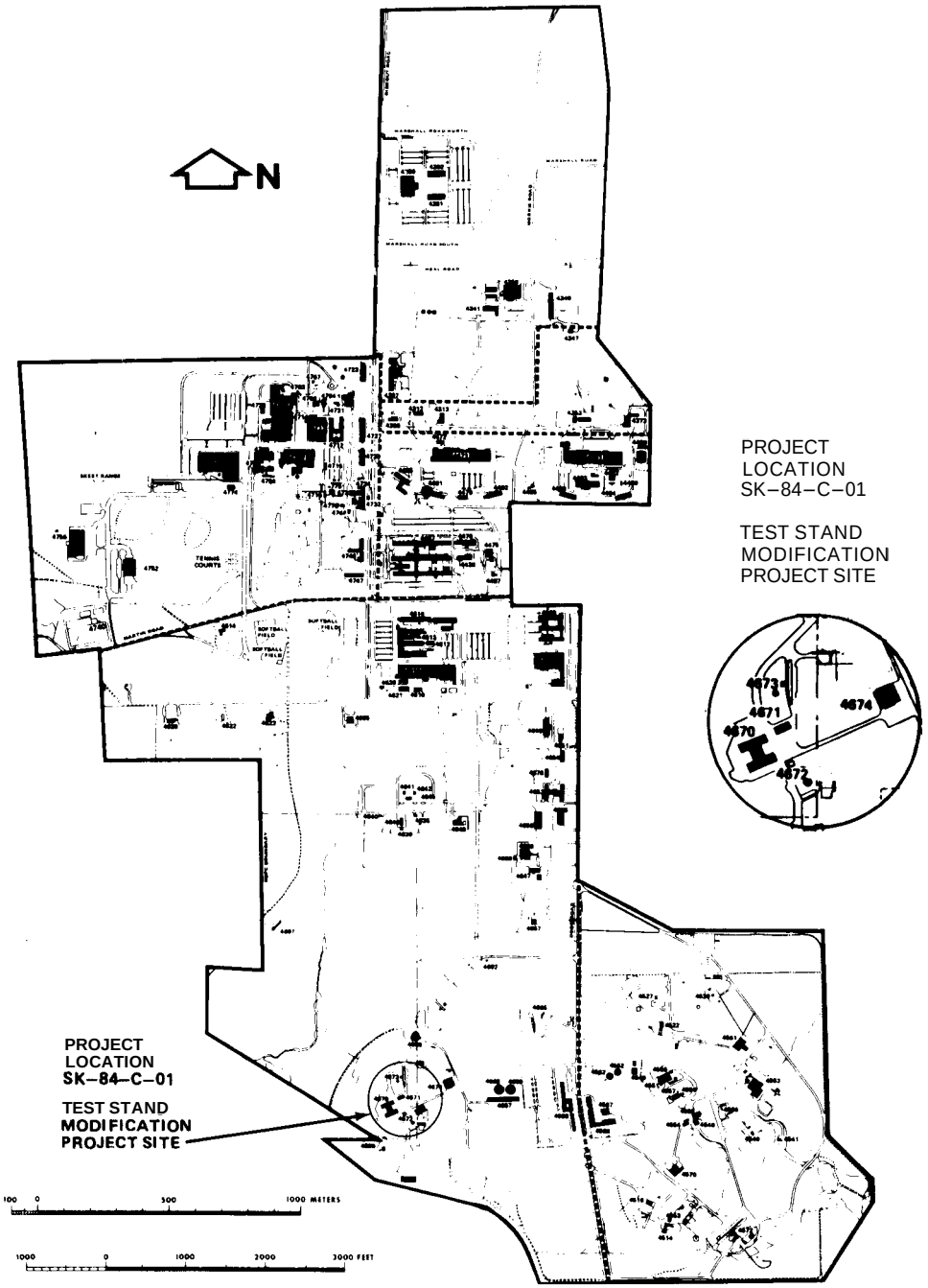


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE: Modifications for Advanced Technology Engine Test Stand S-IC

INSTALLATION: George C. Marshall Space Flight Center

FY 1986 CoF ESTIMATE: $6,500,000

LOCATION OF PROJECT: Marshall Space Flight Center, Madison County, Alabama

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding..	515,000	---	515,000
Capitalized investment	N/A	16,615,000	16,615,000
Total	515,000	16,615,000	17.110.000

SUMMARY PURPOSE AND SCOPE:

This project modifies propulsion test systems that are essential in meeting the cost effectiveness and extended life goals of the Space Shuttle Main Engine (SSME). This will provide an integrated subsystem test bed for "hot firing" of the SSME. Modifications will be made to the structural, mechanical, electrical, and propellant systems of the S-IC Test Stand Complex. These modifications will provide a major tool for updating and improving the SSME.

PROJECT JUSTIFICATION:

The development of advanced technology chemical propulsion systems are essential for the Space Shuttle to achieve its full potential and lowest cost of operation in providing routine access to space. New materials and fabrication techniques for engine components are currently being pursued in the technology development program. The major barrier to transferring this advanced technology to the development and upgrading of the SSME is the need for the feasibility demonstration of the complete engine system. An Integrated Subsystem Test Bed (ISTB) of the SSME will permit the incorporation of major subsystems development into a prototype engine system for "hot fire" testing. The ISTB test activities will experimentally measure engine operating conditions with modified high pressure fuel pumps and related equipment that cannot be adequately tested independent1y.

Conducting "hot fire" testing of the ISTB requires the modification of the S-IC Test Stand at MSFC. Development of the "hot fire" propulsion test capability at MSFC will permit the integration of new engine technology with the SSME without impacting the production, development and testing programs at Santa Susana and NSTL which are necessary to support SSME flight programs. The S-IC Test Stand has been selected as the most effective candidate for these technology test bed development activities.

The modifications of the S-IC Test Stand at MSFC is required at this time to provide the capability to demonstrate advanced propulsion systems for designing improved Space Shuttle engines to be available in this decade.

IMPACT OF DELAY:

Delay of this project will prevent timely development testing of prototype engine systems for improved Space Shuttle Main Engines, and will adversely impact long term Space Shuttle operations.

PROJECT DESCRIPTION:

The test stand structural modifications include removal of the steel supports and platform systems and other systems and items of equipment that were used in previous test programs. Engine mounting systems, propellant run tanks, an aspirator, and engine access platforms will be installed (Figure 2). Mechanical modifications include the installation of liquid hydrogen and oxygen propellant systems, high pressure gas and hydraulic systems, cooling water system for the flame deflector, and firex systems. The electrical modifications include the electrical power system, lighting, control valves, communications and instrumentation systems, and an uninterruptible power system.

PROJECT COST ESTIMATE:

This project estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	6,500,000
Structural	---	---	---	2,800,000
Removal of steel supports and platforms	---	---	---	300,000
Engine mounting systems	---	---	---	700,000
Propellant run tanks	---	---	---	400,000
Aspirator	---	---	---	600,000
Engine removal and access platforms	---	---	---	800,000
Mechanical	---	---	---	2,600,000
Propellant system	---	---	---	1,400,000
High pressure gas and hydraulic systems	---	---	---	600,000
Deflector water	---	---	---	400,000
Firex system	---	---	---	200,000
Electrical	---	---	---	1,100,000
Electri l po	---	---	---	500,000
Lightin ...	---	---	---	100,000
Control ive	---	---	---	400,000
Communi ior	---	---	---	100,000
Equipment... ...	---	---	---	
Fallout Shel r (	---	---	---	---
Tot al.. ...				6,500,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Advanced Technology Test Area

OTHER EOUIPMENT SUMMARY:

Run tanks, special valves, flowmeters and controls, modifications to the purge system, data systems and system activitation will be provided from R&D funds at an estimated cost of $4,500,000.

FUTURE CoF FUNDING REQUIRED TO COMPLETE PROJECT:

No future CoF funding is required to complete this project.

MARSHALL SPACE FLIGHT CENTER
FY 1986 CoF ESTIMATES
MODIFICATIONS FOR ADVANCED TECHNOLOGY ENGINE TEST STAND S-IC

ADVANCED TECHNOLOGY TEST AREA

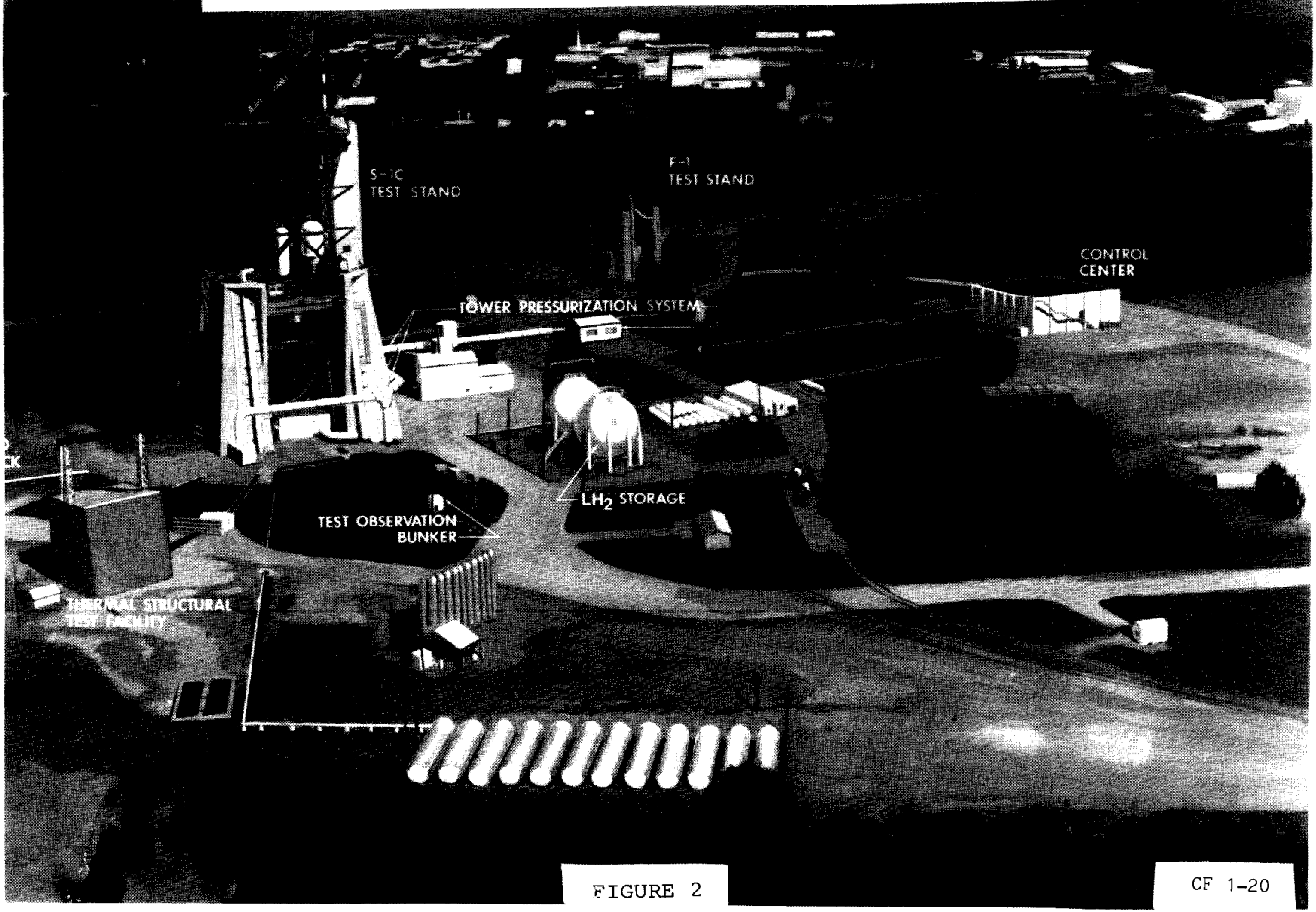
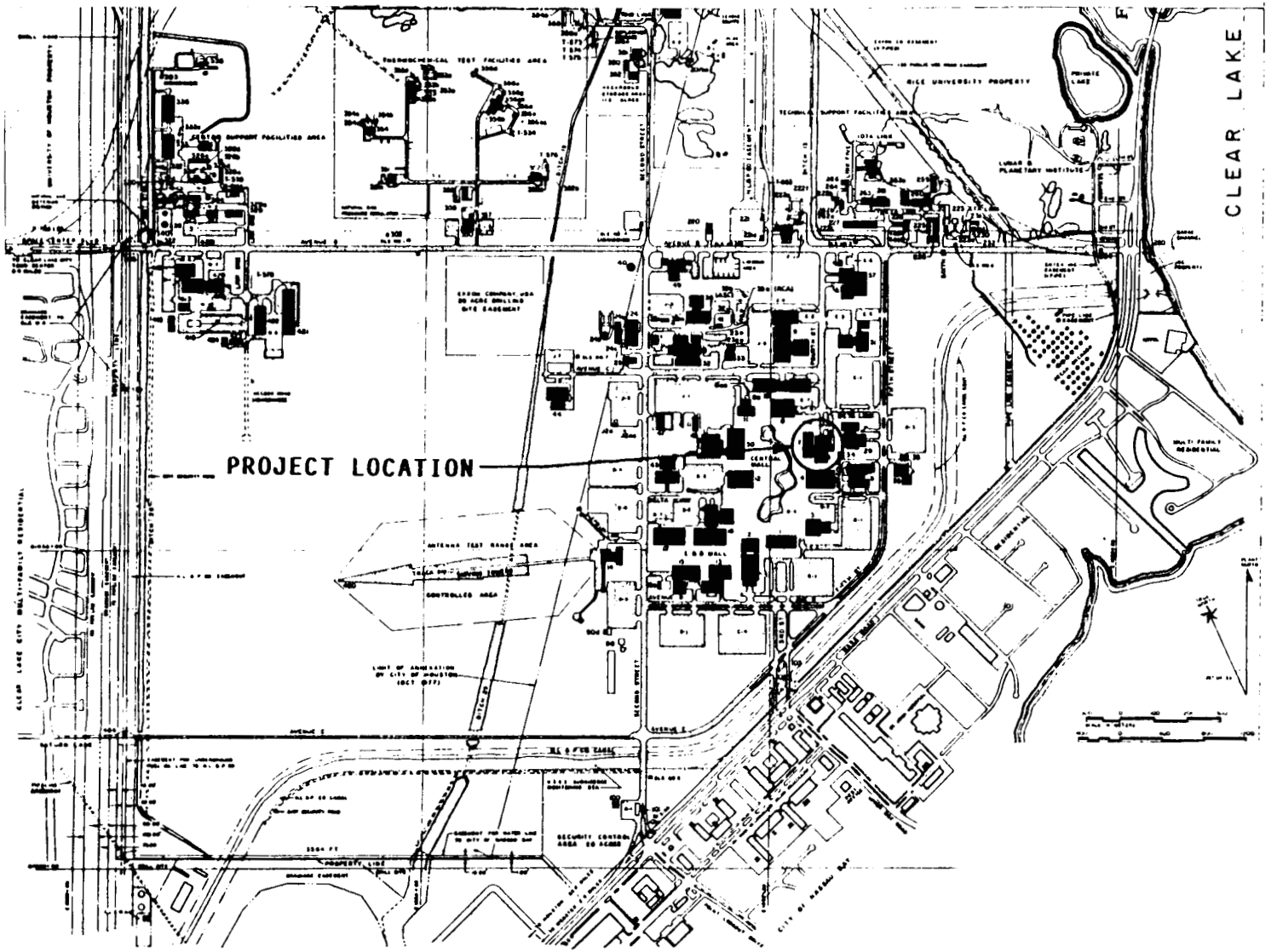


FIGURE 2

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
MODIFICATIONS FOR ENHANCED LIFE SUPPORT SYSTEMS TESTING

LOCATION **PLAN**



CF 1-21

FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE!	Modifications for Enhanced Life Support Systems Testing
INSTALLATION:	Lyndon B. Johnson Space Center
FY 1986 CoF ESTIMATE:	$1,100,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	96,000	---	96,000
Capitalized investment	N/A	7,515,571	7,515,571
Total	96,000	7,515,571	7,611,571

SUMMARY PURPOSE AND SCOPE:

This project provides enhanced testing capability for advanced environmentally controlled life support subsystems for spacecraft applications. Modifications to the test complex in Building 7 (Figure 1) are required for the development and testing of improved environmental control systems and to provide for testing pressure and gas composition control systems. The volume of the 20-foot altitude chamber will be increased and the chamber control room will be upgraded to enable more efficient testing of these improved environmental control systems for spacecraft applications.

PROJECT JUSTIFICATION:

This project is required for more efficient testing of advanced life support systems for spacecraft. Modifications to the environmental control system test complex are required for the developnent and improvement of environmental control life support system (ECLSS) hardware and for increased test support efficiency. Testing of life support systems for air revitalization and water recovery in the spacecraft habitat requires a good test module volume fidelity. This project will provide the improved fidelity and enable better testing of more advanced and efficient ECLSS. Scaled-down systems have resulted in inadequate and inaccurate test results. As crew tasks become more complex and numerous, a better ECLSS test facility is required to insure improved reliability in space.

Modifications of the 20-foot chamber will result in a larger test volume that will be used as the primary integrated ECLSS test bed. Related modification of the utility systems and the chamber control room system will permit the operation of multiple test stands and improve test monitoring and operational efficiency.

IMPACT OF DELAY:

Delay of this project will prevent the timely developnent and qualification testing of needed improved life support subsystems.

PROJECT DESCRIPTION:

This project modifies the 20-foot diameter chamber, in Building 7, to include the insertion of a 7 1/2-foot high spool piece between the chamber base and top closure and the relocation of the diaphragm (Figure 2). The control room will be modified for the installation of electronic monitoring and status systems. The chilled water and electrical power system will be modified. Also included is the enclosing of approximately 1250 square feet of area adjacent to the east side of Building 7 and installing electrical power, ventilation, and lighting systems.

PROJECT COST ESTIMATE:

This cost estimate is based on criteria and concepts only.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	1,100,000
Add spool piece to 20-foot chamber and associated modifications	LS	1	---	780,000
Monitoring and utility systems	LS	1		200,000
Enclose test article assembly area	SF	1,250	96.00	120,000
Equipment	---	---	---	
Fallout Shelter (not feasible)	---	---	---	---
Total				1,100,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - 20-Foot Chamber Modifications

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
MODIFICATIONS FOR ENHANCED LIFE SUPPORT SYSTEMS TESTING

20-FOOT CHAMBER MODIFICATIONS

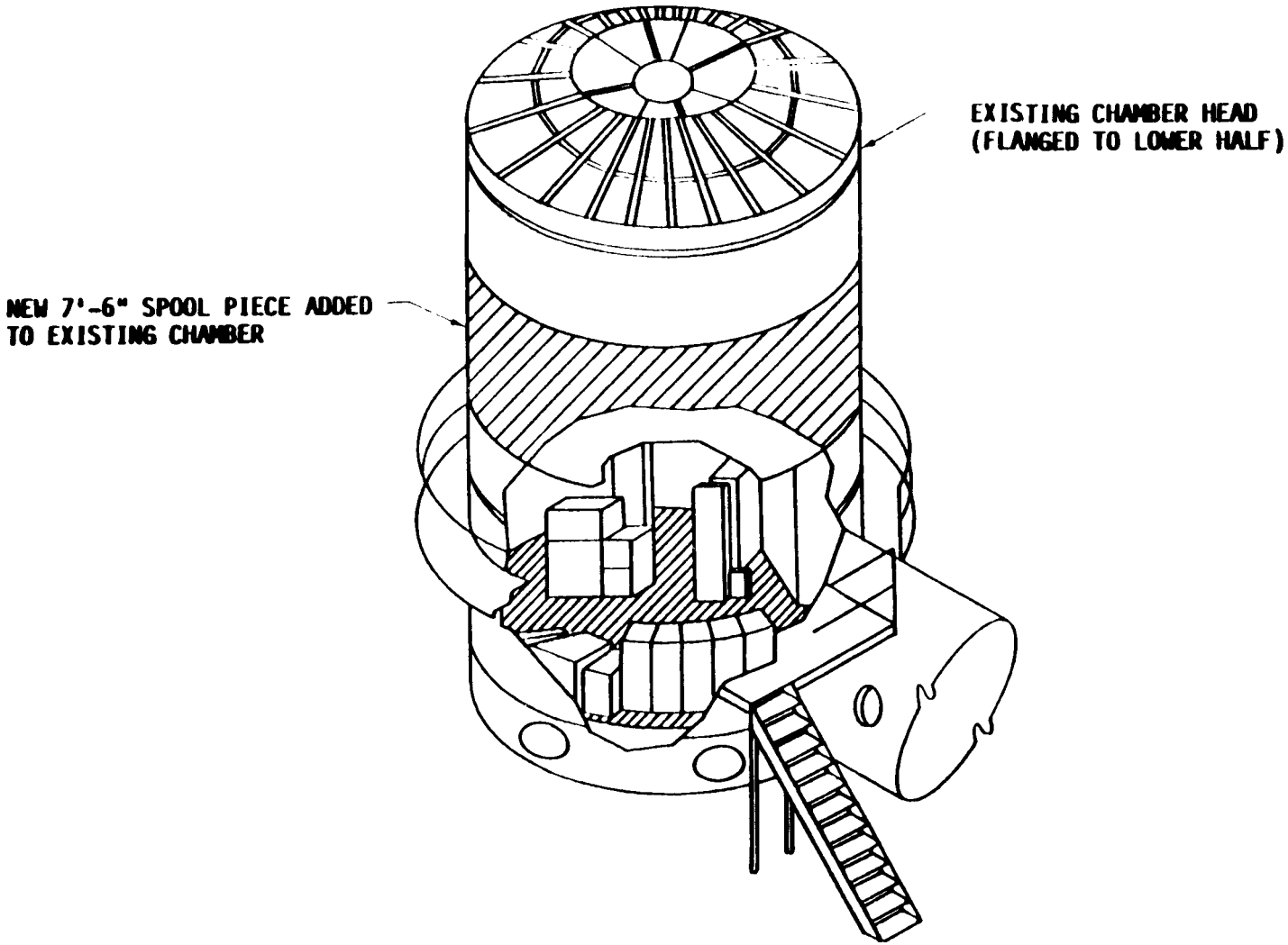


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FY 1986 CoF ESTIMATES
MCDIFICATIONS TO PAD A PAYLOAD CHANGE-OUT ROOM

LOCATICN PLAN

CF 1-26

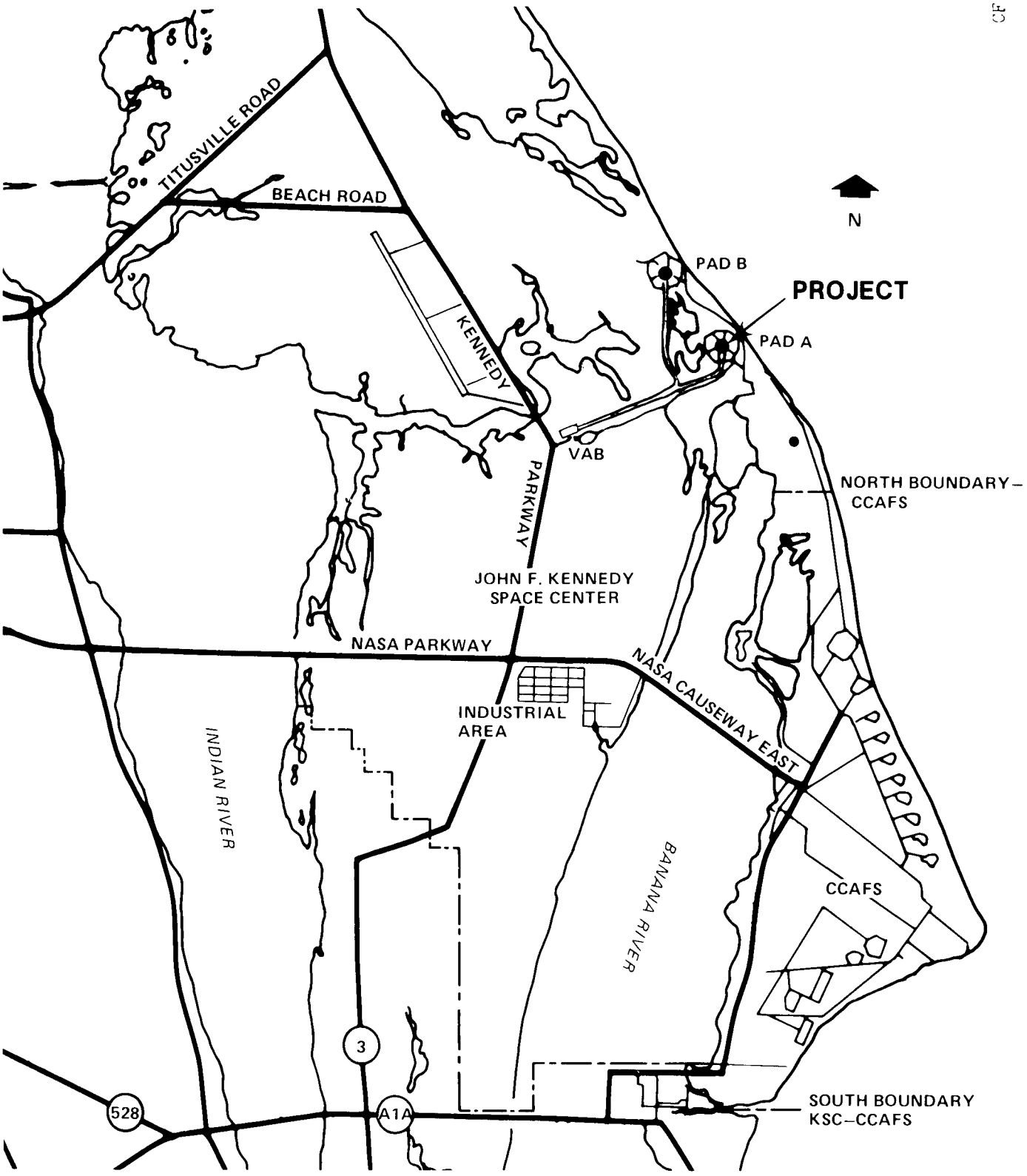


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE:	Modifications to Pad A Payload Change-Out Room
INSTALLATION:	John F. Kennedy Space Center
FY 1986 CoF ESTIMATE:	$2,200,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	132,000	---	132,000
Capitalized investment	N/A	78,649,744	78,649,744
Total	132,000	78,649,744	78,781,744

SUMMARY PURPOSE AND SCOPE:

This project provides for operational improvements in payload processing at the launch pad by constructing an environmentally controlled ground support equipment storage room on the 130-foot level of the Pad A Rotating Service Structure (RSS) at LC-39A (Figures 1 and 2). The storage room will be used to store and maintain (at optimum cleanliness levels) safety rails, handling equipment, and other tools required during cargo processing. This project also provides, at the same level, a personnel support area with restroom, security station, and a cleanroom clothing issue, change and locker area to reduce personnel fatigue and work delays, and improve security.

PROJECT JUSTIFICATION:

The processing of Shuttle payloads in the Payload Change-out Room (PCR) has revealed the requirement for stringent environmental and cleanliness controls for all tools and support equipment. Experience has shown that payload processing requires a wide variety of tools and portable equipment. Currently this equipment is transported from off-pad storage areas to various levels of the RSS/PCR for cargo processing, and returned to the storage area after the cargo is installed in the Orbiter cargo bay. This transfer in and out of the RSS/PCR compromises the cleanliness of the equipment. The new storage room will allow all tools and equipment to be maintained, at the required cleanliness, near the area of use. This will greatly reduce processing time by permitting timely deployment of the tools and equipment to the work stations and will decrease contamination. The additional storage space will also eliminate cluttered work areas and improve personnel safety.

The processing of Shuttle payloads in the PCR is a clean-room activity requiring personnel to wear special clothing and perform intricate operations. The present RSS/PCR facility does not provide a restroom and other amenities necessary for supporting personnel in this relatively remote operation. This results in personnel having to leave and re-enter the clean-room area which increases the possibility of contamination and wastes time. The new personnel support room will correct this situation by providing adequate space for the issue and control of cleanroom clothing, necessary personnel services, correct current security monitoring problems and expedite entry and exit of approximately 60 people during shift change.

IMPACT OF DELAY:

A delay in the construction of the storage room will increase the probability that a payload being processed in the PCR/Orbiter could be contaminated or delayed because of equipment transfers.

The personnel support area is required for continued efficient operations, improvement of cargo processing, morale of personnel, and a general improvement in the quality of work.

PROJECT DESCRIPTION:

This project will provide for the construction of an approximately 1,600-square foot enclosed storage room on the 130-foot level of the RSS. The structure will be steel beams welded to the RSS facility and covered with insulated metal siding. Facilities in the storage room will consist of lights, electrical outlets, telephone, HVAC, paging and area warning, firex and hypergol spill, smoke and fire alarms. A new emergency escape will be constructed from the storage room to a lower level. The structure will also consist of an enclosure around the RSS truck drive control cabinets which are located adjacent to the storage room.

This project also provides for the construction of an approximately 480-square foot, fully enclosed personnel support room at the same level. Facilities in the personnel support room will consist of lights, operational intercom, operational television, telephones, a restroom, drinking fountain, air conditioning, paging and area warning, firex and hypergol spill, smoke and fire alarms. New catwalks will be constructed around both the storage room and the personnel support room to accommodate transfer of auxilliary power unit carts.

PROJECT COST ESTIMATE:

This cost is based on an engineering study performed by an architect-engineer firm.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	2,200,000
Storage room structural	LS	---	---	529,000
Personnel support room structural	LS	---	---	408,000
APU access platform structural	LS	---	---	208,000
Firex systems	LS	---	---	122,000
Environmental control systems	LS	---	---	110,000
Piping systems (plumbing and vacuum)	LS	---	---	134,000
Electrical and communications systems	LS	---	---	689,000
Equipment	---	---	---	
Fallout Shelter (not feasible)	---	---	---	---
Total				2.200.000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Map
Figure 2 - Floor Plan

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding will be required to complete this project.

JOHN F. KENNEDY SPACE CENTER

FY 1986 CoF ESTIMATES

MODIFICATIONS TO PAD A PAYLOAD CHANGE-OUT ROOM

FLOOR PLAN

(130 FT LEVEL OF ROTATING SERVICE STRUCTURE)

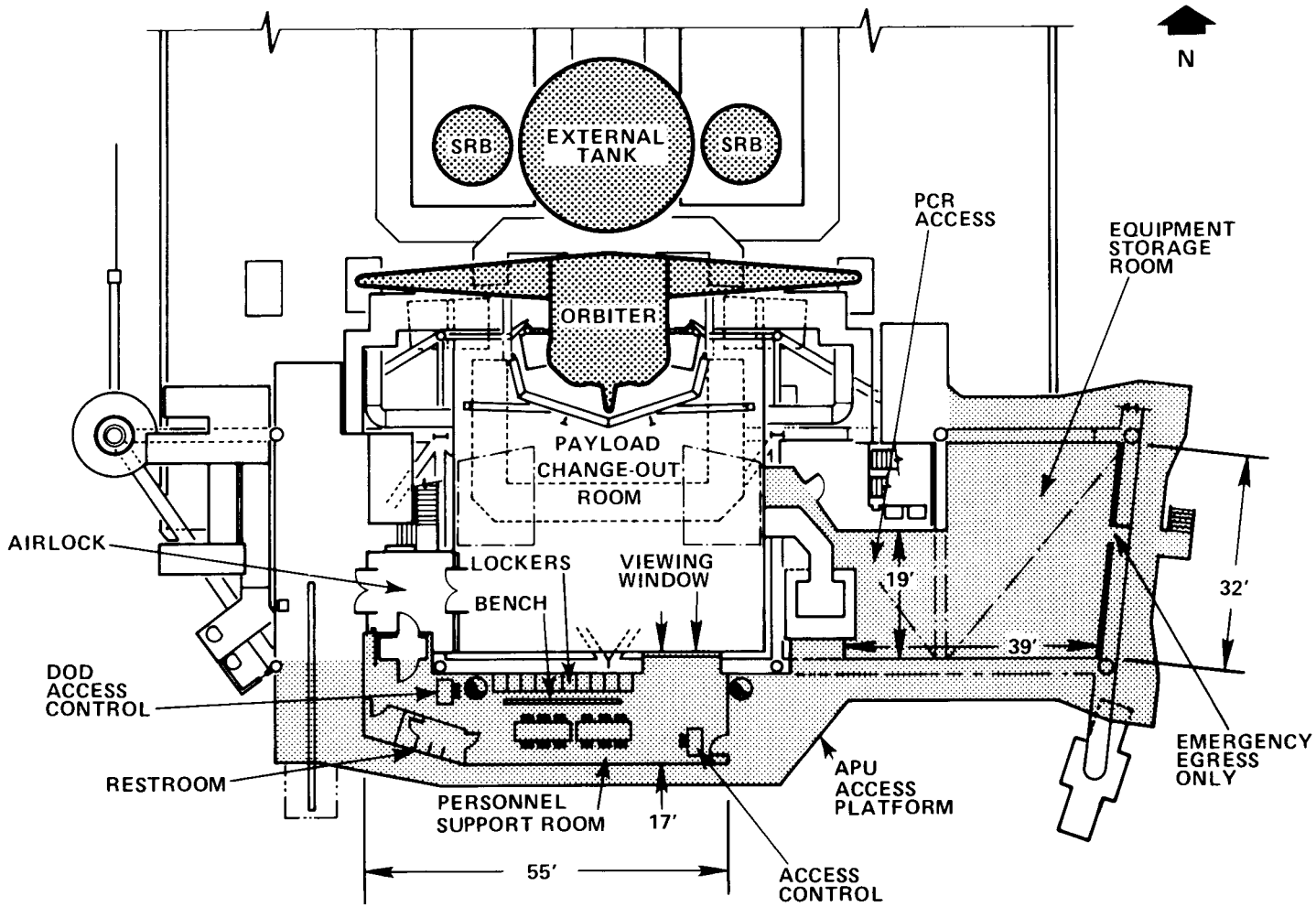


FIGURE 2

NATIONAL SPACE TECHNOLCGY LABCRATORIES
FISCAL YEAR 1986 ESTIMATES
MODIFJCATIONS TO SPACE SHUTTLE MAIN ENGINE SUPPORT SYSTEMS

LOCATION PLAN

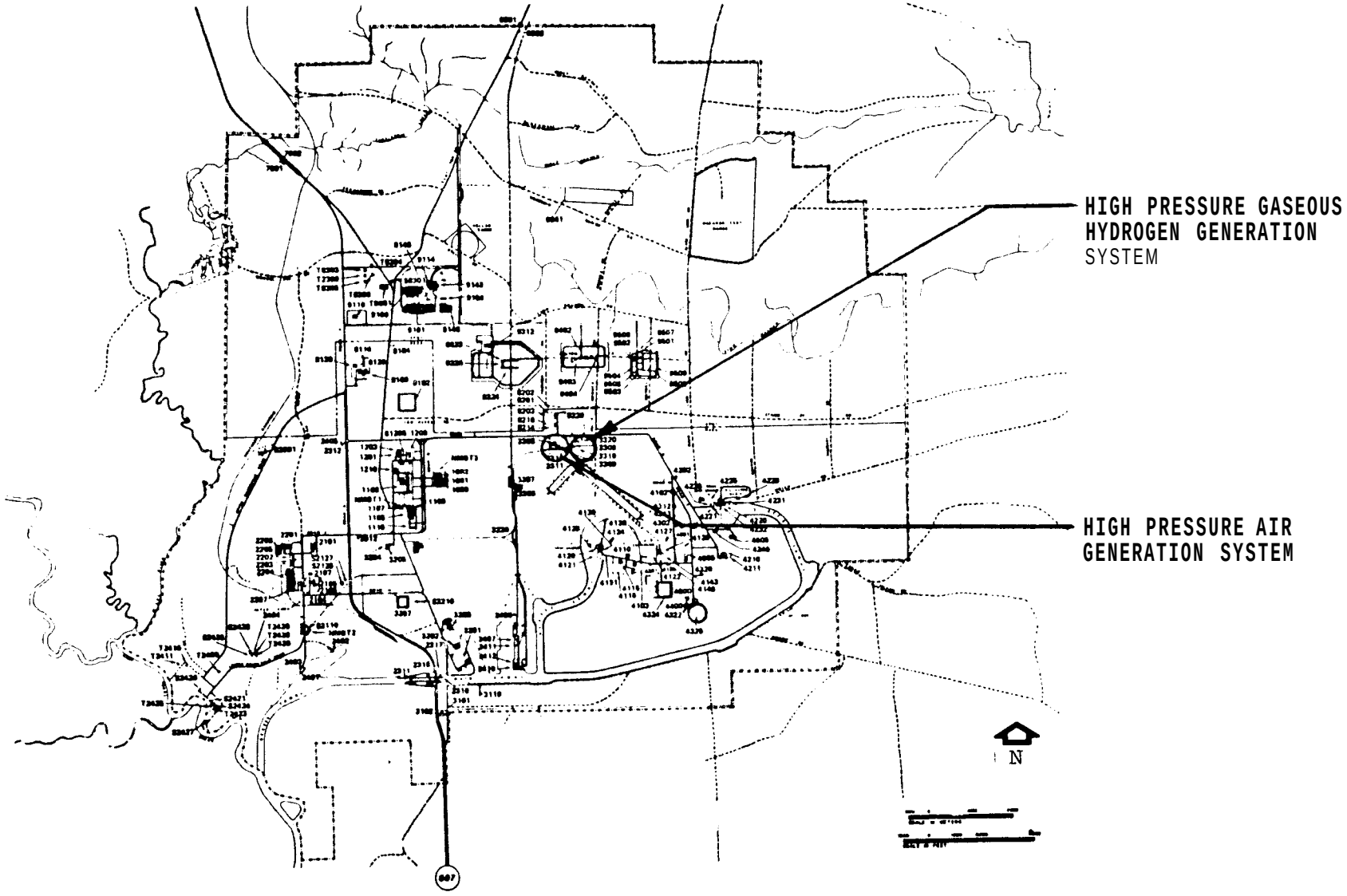


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE: Modifications to Space Shuttle Main Engine Support Systems

INSTALLATION: National Space Technology Laboratories

FY 1986 CoF ESTIMATE: $2,500,000

LOCATION OF PROJECT: National Space Technology Laboratories, Hancock County, Mississippi

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding..	166,000	N/A	166,000
Capitalized investment	N/A	2,241,200	2,241,200
Total	166,000	2,241,200	2,407,200

SUMMARY PURPOSE AND SCOPE:

Increased Space Shuttle Main Engine (SSME) test requirements at NSTL necessitate more efficient, reliable and cost-effective high pressure hydrogen and air generating systems. This project provides for the installation of a gaseous hydrogen generation system to convert liquid hydrogen to gaseous hydrogen and installation of a high pressure air generation system to generate compressed air to support the SSME test program at NSTL (Figwe 1).

PROJECT JUSTIFICATION:

To support the SSME test program, high pressure hydrogen and air are required for pressurization, purging and cleaning, and operation of valves in the SSME test complex and support facilities. These gases are generated at the high pressure gas facility and then delivered via cross-country pipelines to the test stands and related support facilities.

The existing gaseous hydrogen generation system experiences hydrogen losses in excess of 70 percent due to pump inefficiencies. The existing hydrogen pump is a one-of-a-kind unit installed in 1966. It frequently loses prime during operation and requires continuous operator attention to minimize system damage. Due to the cavitation damage sustained during the last 18 years of operation, the pump has also become a potential safety hazard. In addition, replacement parts for the pump are not available. This project will replace the existing worn out and unreliable high pressure gaseous hydrogen generation system with a new state-of-the-art system (Figure 2) that employs high pressure liquid storage and smaller pumps that will produce gaseous hydrogen with a loss of less than 10 percent. The new system will also eliminate the potential safety hazard and replacement parts problems.

The current high pressure air generation system usage rate requires operation of two existing air compressors for 12 hours each day to meet present demands. The two compressors were installed in 1965 and have been in continuous service since installation. The failure of either compressor requires that the other be operated 24 hours per day leaving no spare capacity. When the third single SSME test position is added in FY 1986, the requirements for high pressure air will increase 50 percent above present usage. It is therefore essential that a third high pressure air compressor be added to the system to meet increasing demands and provide for improved reliability.

IMPACT OF DELAY:

Delay in accomplishment of this project will result in continued expensive losses of hydrogen, inability to correct a potential safety hazard, and risk an untimely failure of either of the two existing air compressors. Any of these occurrences would adversely impact the SSME test activity at a time when continued SSME research is critical.

PROJECT DESCRIPTION:

The gaseous hydrogen generation system will include a 20,000 gallon 150 psig rated liquid storage tank; two 5.2 gpm, 3,500 psig electric motor driven pumps; six ambient air vaporizers; interconnecting piping; electrical power; and instrumentation and controls for automatic operation of the system. Approximately 1,100 square

feet of paved access roadway will also be provided. The high pressure air generation system will include an 850 SCFM, 2,800 psig, electric motor driven, high pressure air compressor with pulsation dampers; an air drying and purification unit; two 2,800 psig, 750 cubic feet storage vessels; electrical power, instrumentation and controls; and interconnecting piping and valves. A sheet metal shelter with an overhead crane will also be provided adjacent to the existing high pressure air facility to house the new compressor.

PROJECT COST ESTIMATE:

This project is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	2.500.000
Gaseous hydrogen generation system	---	---	---	1,060,000
Liquid hydrogen storage tank, hydrogen pumps and vaporizers	LS	---	---	(963,000)
Site work, power, instrumentation controls and piping.	LS	---	---	(97,000)
High pressure air generation system..	---	---	---	1,440,000
Compressor and pulsation damper..	LS	---	---	(599,000)
Air dryer and purification unit	LS	---	---	(123,000)
Air storage vessels	EA	2	240,000	(480,000)
Electrical power, instrumentation and controls	LS	---	---	(88,000)
Piping and valves	LS	---	---	(75,000)
Compressor foundation and shelter..	LS	---	---	(75,000)
Equipment.	---	---	---	
Fallout Shelter (not feasible)	---	---	---	---
Total				2,500,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan/System Isometrics

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF FUNDING REQUIRED TO COMPLETE PROJECT:

No future CoF funding is required to complete this project.

NATIONAL SPACE TECHNOLOGY LABORATORIES
FISCAL YEAR 1986 ESTIMATES
MODIFICATIONS TO SPACE SHUTTLE MAIN ENGINE SUPPORT SYSTEMS

SITE PLAN/SYSTEM ISOMETRICS

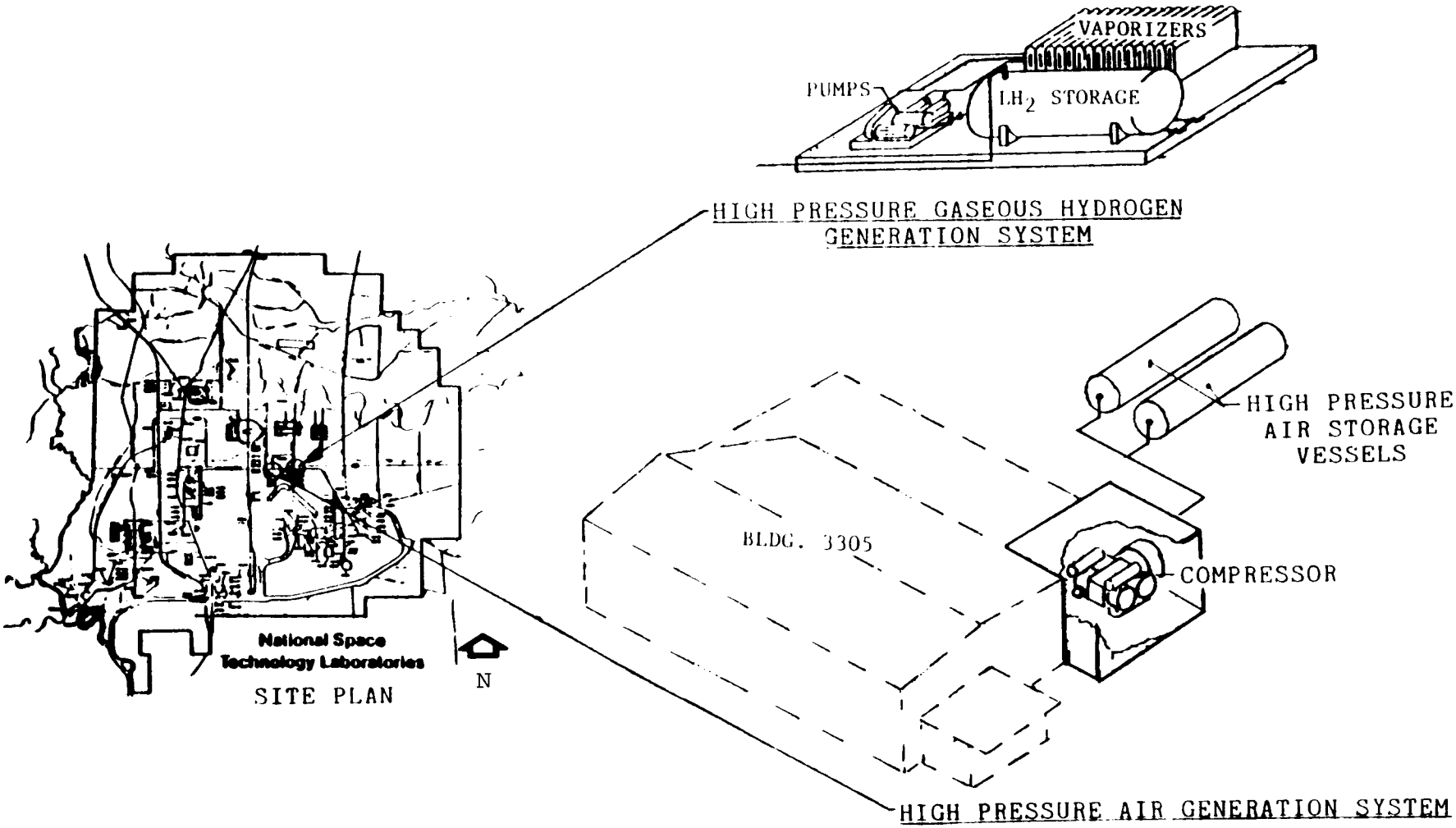


FIGURE 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

SPACE SHUTTLE PAYLOAD FACILITIES

Office of Space Flight:	Amount	Page No.
Construction of Payload Control Rooms, Kennedy Space Center.....	1,200,000	CF 2-1

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF PAYLOAD CONTROL ROOMS

LOCATION PLAN

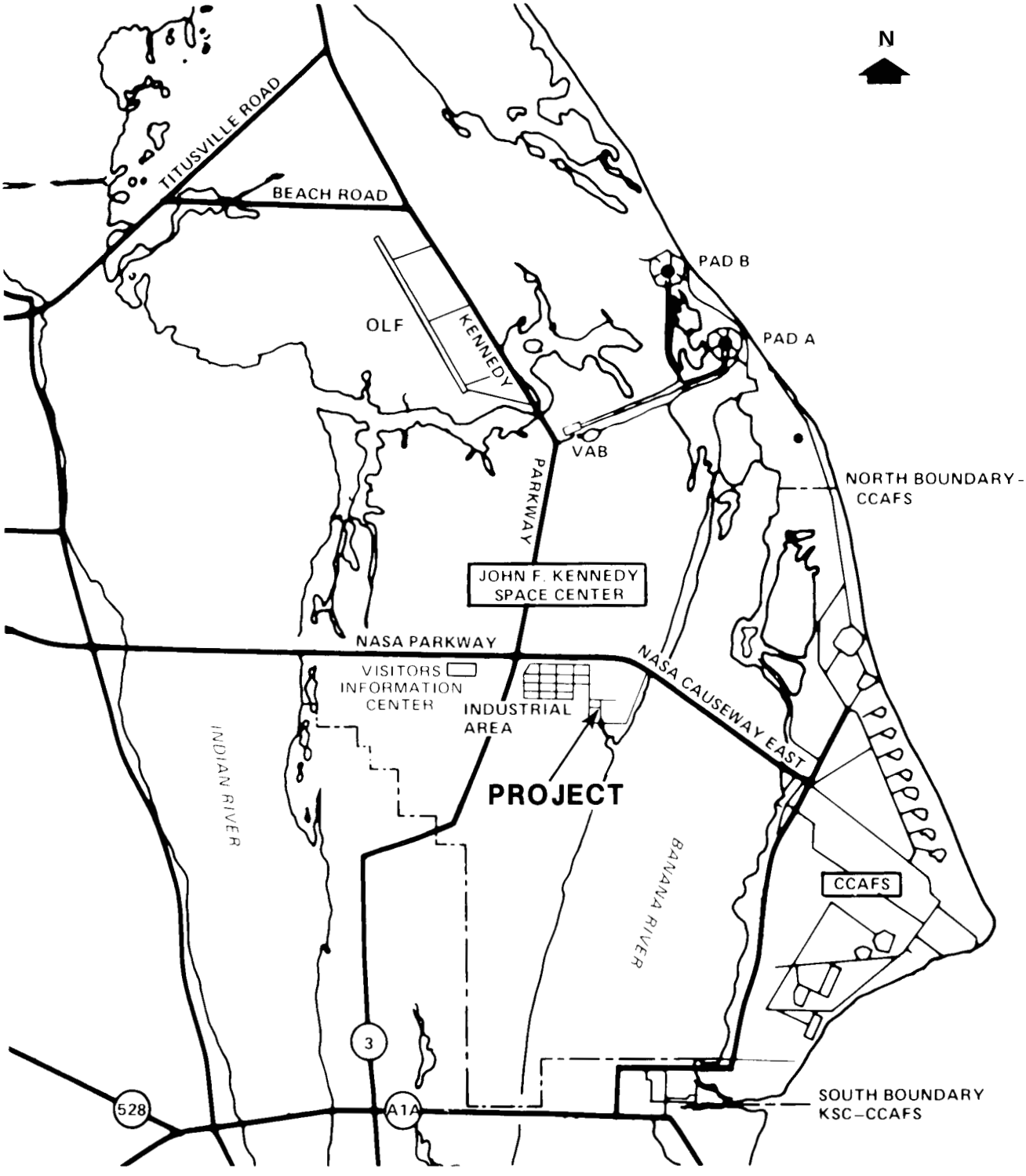


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE:	Construction of Payload Control Rooms
INSTALLATION:	John F. Kennedy Space Center
FY 1986 CoF ESTIMATE:	$1,200,000

LOCATION OF PROJECT: John F. Kennedy Space Center, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Flight

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	111,000	---	111,000
Capitalized investment	N/A	1,025,562	1,025,562
Total	111,000	1,025,562	1,136,562

SUMMARY PURPOSE AND SCOPE:

This project provides an addition to Building Mi'-1061, located in the KSC Industrial Area, for Space Transportation System (STS) payload processing (Figure 2). A pre-engineered metal building with two user payload control rooms, office and engineering space and a communications terminal room will be constructed. This facility is required for use by payload user personnel during hazardous pre-launch payload processing in the Spacecraft Assembly and Encapsulation Facility (SAEF-2). Until these payload control rooms are available

for use, payload users will continue to be located in the hazardous SAEF-2 high bay area. This project will free the high bay area of SAEF-2 for follow-on payload processing and provide a safe area for personnel during hazardous processing operations.

PROJECT JUSTIFICATION:

Presently, the number of payloads manifested for launch in 1986 and subsequent years exceeds the hazardous processing capacity of the SAEF-2 facility. This capacity is constrained because communications and control equipment must be set up and calibrated within the SAEF-2 high bay area for payload processing and then remain in SAEF-2 to continuously maintain configuration control of the payload through launch. This results in insufficient space in SAEF-2 for follow-on payloads to be processed, thereby creating a bottleneck in the payload hazardous processing flow, and exposing payload user communications personnel to the hazardous processing environment. In addition, associated engineering personnel require workspace which is not now available in the SAEF-2 area.

IMPACT OF DELAY:

Failure to provide this facility will result in processing schedule bottlenecks in the use of SAEF-2. This will severely impact KSC's ability to adequately support the FLEETSATCOM and INTELSAT, as well as other future customers.

PROJECT DESCRIPTION:

This project provides a pre-engineered metal addition to Building M7-1061 with two 30 x 60 feet user payload control rooms, each with electrically operated roll-up doors, 20 feet wide by 8 feet high (Figures 3 and 4). The control rooms will be connected by a 20 feet wide by 8 feet high interior rollup door to allow the use of both rooms by one user if required. The air conditioned building will be approximately 5,200 square feet in size and will contain engineering support areas which may be converted to control rooms if the work load exceeds the capability of the two user payload control rooms. A raised floor in the user payload control rooms will facilitate cable routing from an adjoining terminal room. Utilities and other services will be extended from the existing building.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	1,200,000
Wlilding....	SF	5,200	46.92	244,000
Sitework and cableway	LS	---	---	520,000
Mechanical	SF	5,200	36.15	188,000
Electrical	SF	5,200	38.46	200,000
Special features (raised floor)	SF	2,160	22.22	48,000
Equipment....	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				1.200.000

LIST OF RELATED GRAPHICS:

Figwe 1 - Location Plan
Figure 2 - Site Plan
Figwe 3 - Perspective
Figwe 4 - Floor Plan

OTHER EQUIPMENT SUMMARY:

Equipment to be funded with R&D resources will consist principally of data transmission and communications terminal and interface items. The estimated cost is $400,000.

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF PAYLOAD CONTROL ROOMS

SITE PLAN

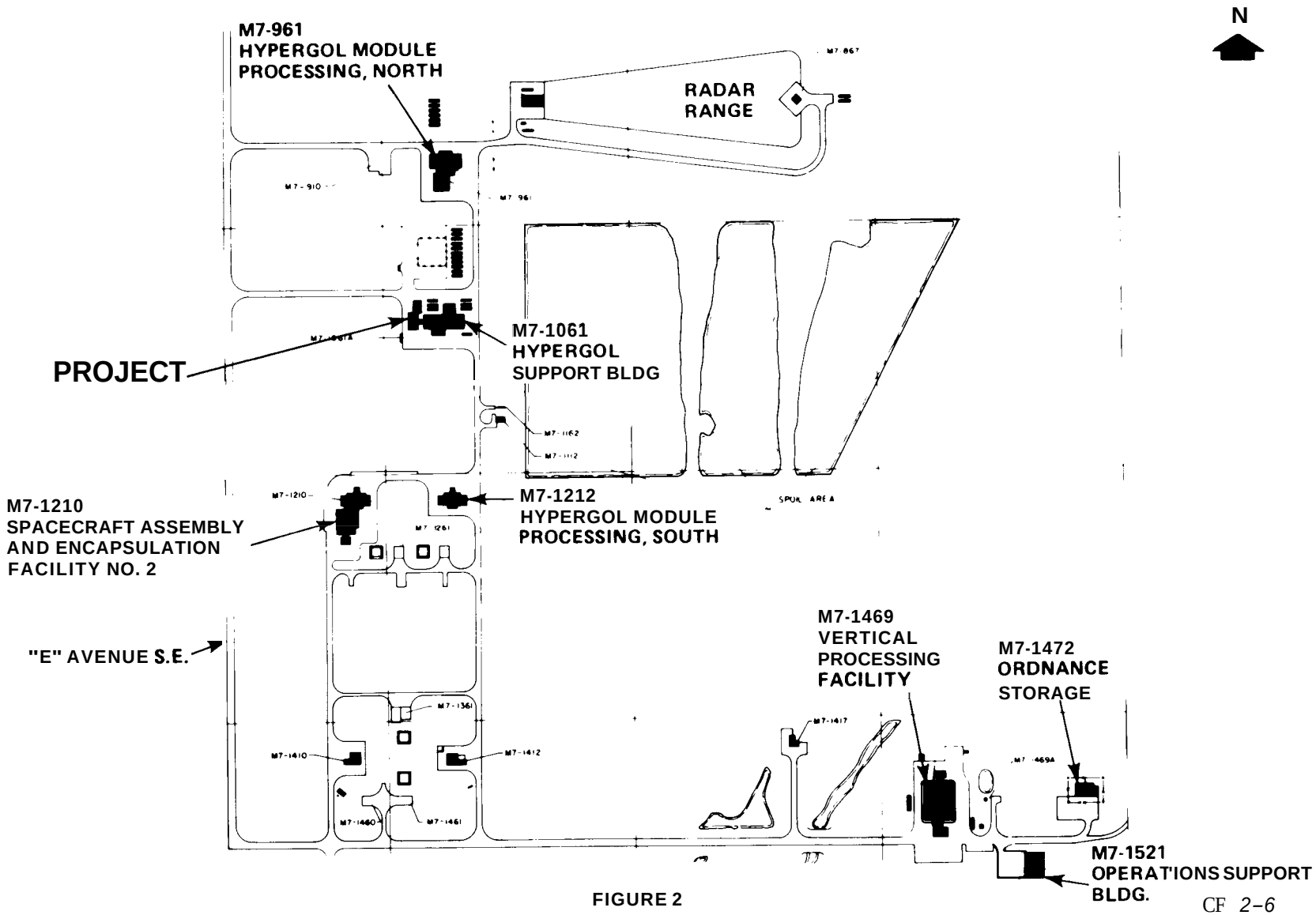


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF PAYLOAD CONTROL ROOMS

PERSPECTIVE

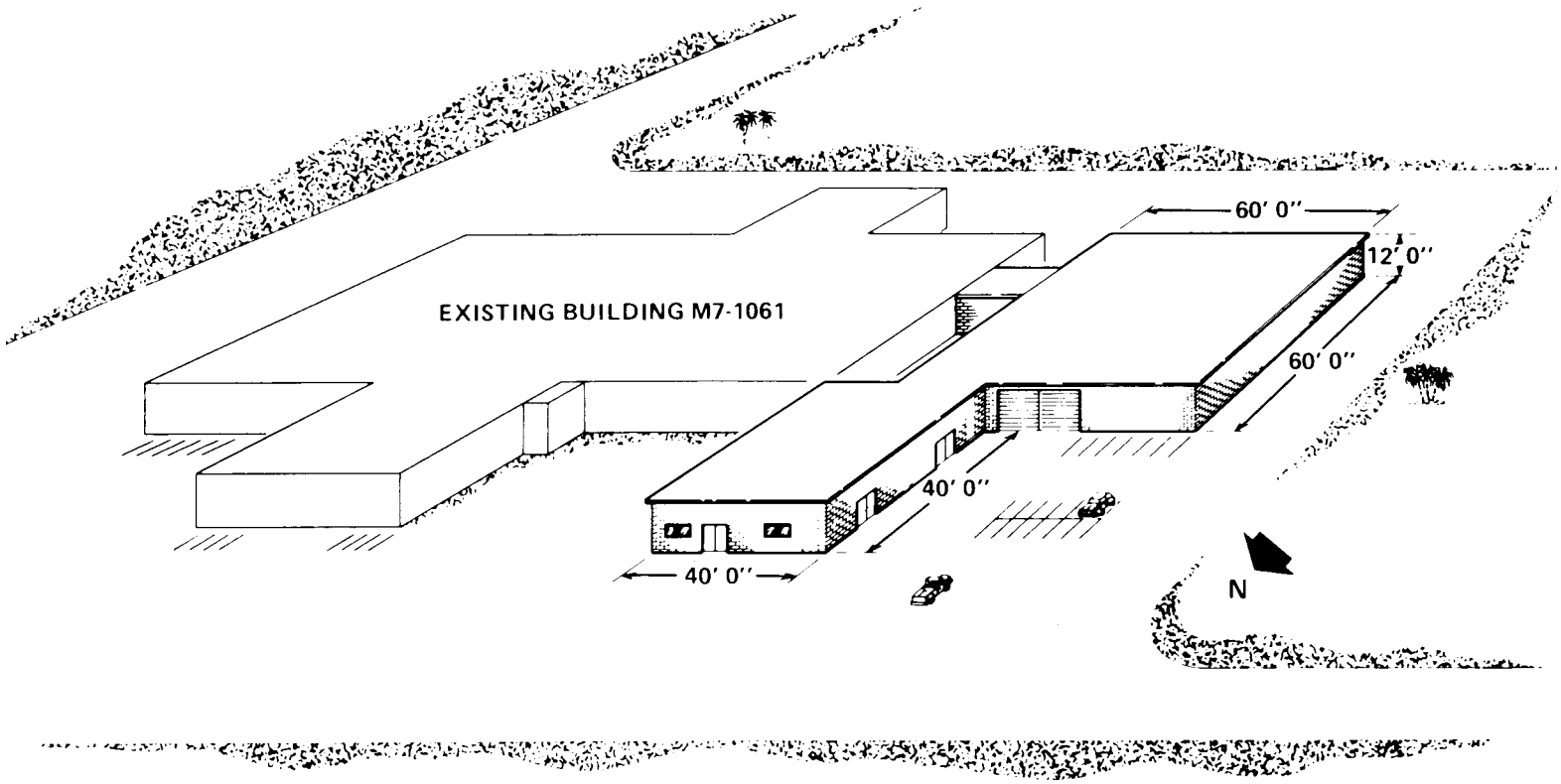


FIGURE 3

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF PAYLOAD CONTROL ROOMS

FLOOR PLAN

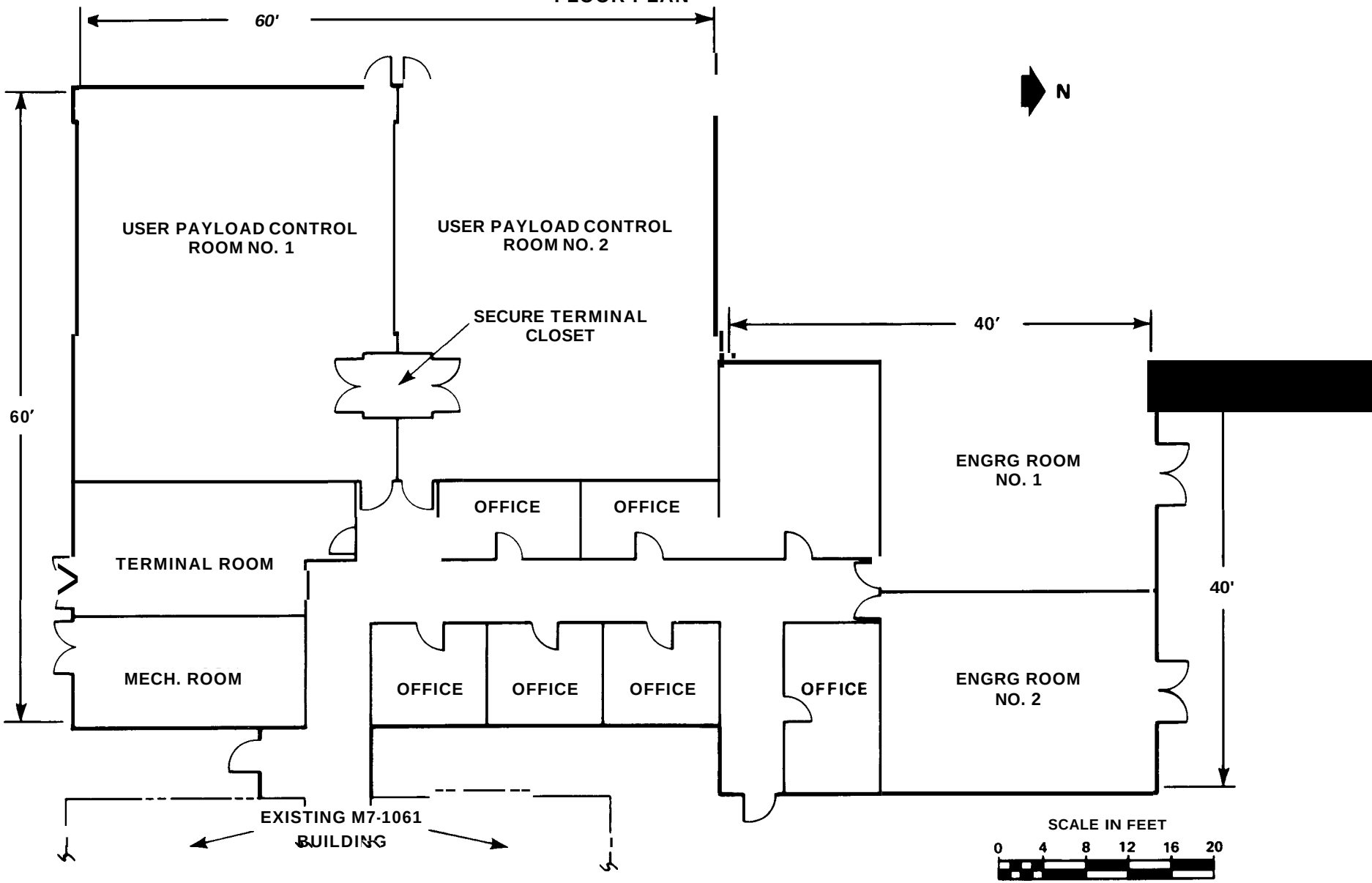


FIGURE 4

GODDARD
SPACE FLIGHT
CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

GODDARD SPACE FLIGHT CENTER

Office of Space Science and Applications:	Amount	Page No.
Construction of Additions to Research Projects Laboratory..	3,800,000	CF 3-1
Construction of Spacecraft Systems Development and Integration Facility..	8,000,000	CF 3-9
TOTAL..	11,800,000	

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF ADDITIONS TO RESEARCH PROJECTS LABORATORY

LOCATION PLAN

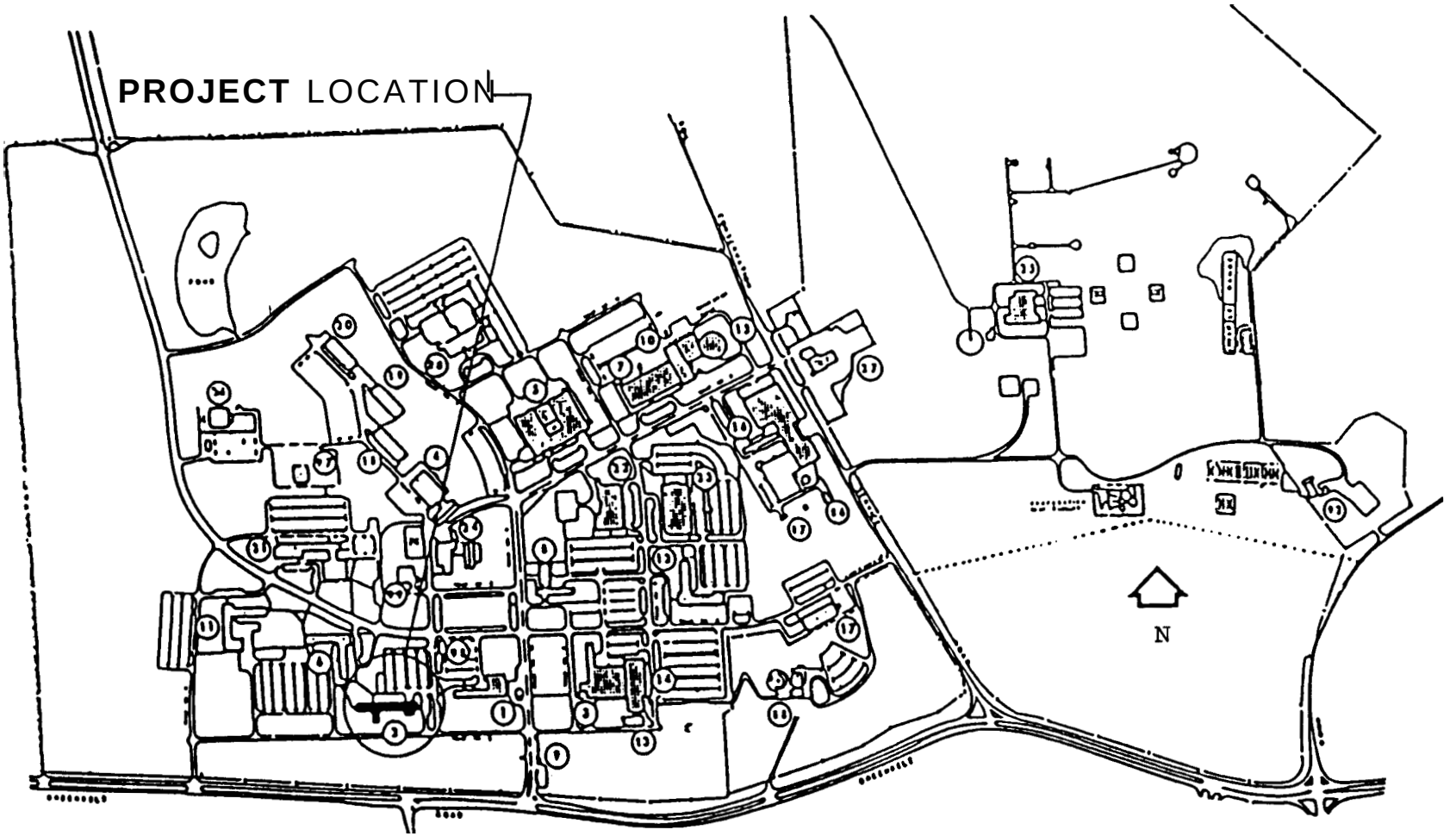


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE:	Construction of Additions to Research Proiects Laboratorv
INSTALLATION:	Goddard Space Flight Center
FY 1986 CoF ESTIMATE:	$3.800 .000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADOUARTERS OFFICE: Office of Space Science and Applications

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Desian	Construction	Total
Specific CoF funding	265,000	---	265,000
Capitalized investment	N/A	2.741 .000	2.743.000
Total	265.000	2.743.000	3.008 .000

SUMMARY PURPOSE AND SCOPE:

This project will provide for a computer systems facility addition and a gas laboratory addition to the west end of the Research Projects Laboratory (Building 2) at the Goddard Space Flight Center. The computer systems facility addition will alleviate severe overcrowding of computer equipment and associated data storage needed to support on-going and future unmanned earth orbiting satellite programs. The gas laboratory addition will isolate the area used for spectroscopy experiments. These experiments involve the use of hazardous gasses found in various planetary atmospheres. Its present location is a long term safety hazard to the occupants of Building 2.

PROJECT JUSTIFICATION:

The Research Projects Laboratory houses extraterrestrial physics and high energy astrophysics activities. This complex supports the physics and astronomy program that increases our knowledge and understanding of the origin, evolution, structure, and composition of the universe. This research requires extensive use of computers to analyze the large amounts of data generated by satellite sensors. In addition to data reduction, the computers are essential for the design of new instruments for spacecraft and shuttle. Programs such as COBE (and other Explorers) and shuttle instrumentation require the extensive use of computers. The existing facility does not adequately accommodate these computers. As a result many systems have been temporarily installed in laboratory space which then cannot be used for its original and intended purpose, the fabricating of spacecraft instrumentation. There is a particular need for additional space for testing and calibration of grazing incidence x-ray optics. Without the building addition, it will also be impossible to accommodate critically needed new equipment. Also, the nature of the work done in this lab generates large amounts of data in the form of magnetic tapes, and the lack of storage space for ready-access to these tapes by researchers and scientists is a serious problem.

The Extra Terrestrial Physics Laboratory is dedicated to the study of planetary atmospheres and interstellar clouds involving astrochemistry, ultraviolet and visable light spectroscopy, and chemical kinetics experiments using exotic gasses found or thought to be constituents of planetary atmospheres. The gases are highly toxic, (i.e., flourine, chlorine, bromine, hydrogen cyanide, and iron carbonyl), and should not be used in a building which also houses other functions. Recently, an accidental leakage of noxious hydrogen sulfide gas was drawn into the air circulation ducts requiring the evacuation of the entire building. Had a more toxic gas been leaked, a disastrous tragedy could have occurred. While short-term measures to provide safer ventilation within the building have been accomplished, it is extremely important that an adequately sized and isolated facility be provided for the astrochemistry laboratories.

IMPACT OF DELAY:

Delaying this project will result in the need to use trailers to hold data tapes that are utilized on a daily basis and many of the computer systems will have to be dispersed to other GSFC facilities. This would severely degrade the functions by prolonging inefficiencies and poor morale. Delay of construction of the Gas Laboratory addition will continue to subject building occupants to potential health and safety hazards from toxic gas leaks.

PROJECT DESCRIPTION:

The project will provide for the construction of two additions to the Research Projects Laboratory. The computer systems facility addition will be a 12,000-square foot, three-story addition to the west end of the laboratory. The first floor will be 3,400 square feet, primarily dedicated to tape storage and retrieval. The second and third floors will be above an existing first floor vault and will contain 4,300 square feet each. A total of 7,700 square feet of computer flooring will be included with these two floors. The mechanical system will provide underfloor cooling to the computer equipment and a separate air conditioning system in the personnel occupied spaces. Primary electrical power will be provided from an existing manhole on the north side of the building.

The Gas Laboratory addition will be a 15,000-square foot, two-level structure that will house the seven Infrared Spectroscopy and Kinetics and Spectroscopy Laboratories which are currently located in the existing building. The ground floor will house a mechanical equipment room and a utility service area. The first floor will be 7,800-gross square feet and will include laboratory space, loading dock and receiving/staging area, hazardous storage area and restrooms. The heating, ventilating and air-conditioning system will provide a sufficiently high number of air changes to the laboratory areas, and the exhaust air will be ducted to the chemical hoods as make-up air for economy of operations. Special laboratory equipment such as individual research hoods with sinks, counters and cabinets, plug molds, isolation concrete pads, emergency shower equipment, oxygen detectors, and water supply and drainage for equipment cooling will be provided.

The exterior of both additions will match the existing building facade and utility services and fire protection systems will be extended from the existing building. A new stairwell, elevator and outside entrance with a ramp for handicapped access will be provided. This project will also restore space currently used for gas laboratories to its original condition and add approximately 2,100 square feet of environmentally controlled space on the roof of the existing structure.

PROJECT COST ESTIMATE:

This cost estimate is based on two preliminary engineering reports.

	Unit of Measure	Quantity	Unit Coat	Cost
Land Acauisition	---	---	---	---
Construction	---	---	---	3.710 ,000
Computer Systems Facility	---	---	---	2.300. 000
General requirements and sitework	---	---	---	(243,0001
Structural	---	---	---	(620. 000)
Architectural	---	---	---	(651. 000)
Elevator	---	---	---	(72. 0001
Mechanical	---	---	---	(404. 000)
Electrical	---	---	---	(310. 000)
Gas Laboratory Addition	---	---	---	1.430. 000
Site development	LS	---	---	(80. 000)
Structural	LS	---	---	(180. 000)
Architectural	LS	---	---	(420. 000)
Mechanical	LS	---	---	(490. 000)
Electrical	LS	---	---	(246. 0001
Restoration - Building 2	LS	---	---	(14. 000)
Equipment	---	---	---	70 ,000
Research hoods and other laboratory equipment	---	---	---	70. 000
Fallout Shelter (not feasible)	---	---	---	---
Total				3,800,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - First Floor Plan

OTHER EQUIPMENT SUMMARY:

Additional ADP equipment estimated to cost $3,600,000 will be purchased with R&D funds.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF ADDITIONS TO RESEARCH PROJECTS LABORATORY

SITE PLAN

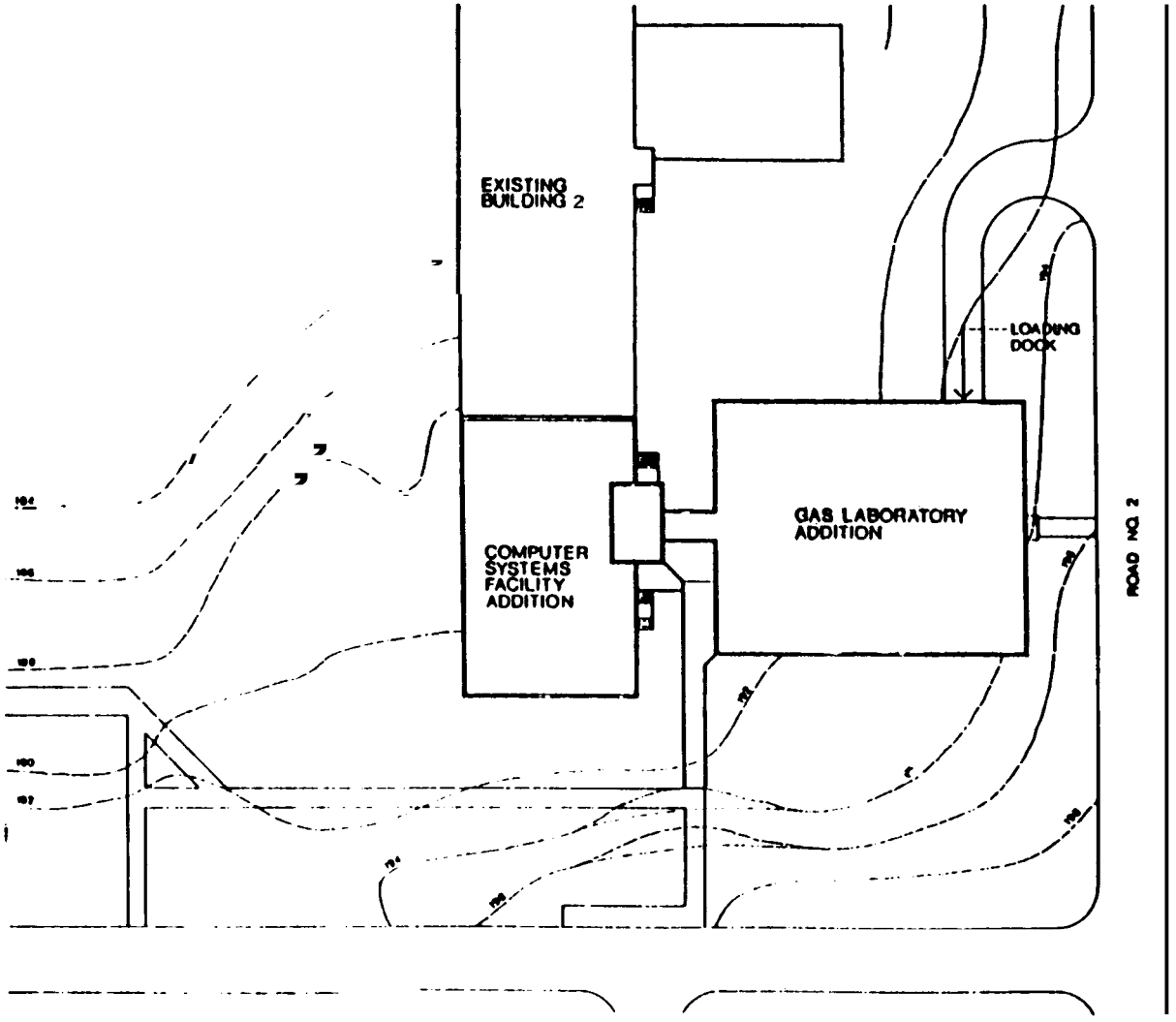


FIGURE 2

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF ADDITIONS TO RESEARCH PROJECTS LAB ATOM

FIRST FLOOR PLAN

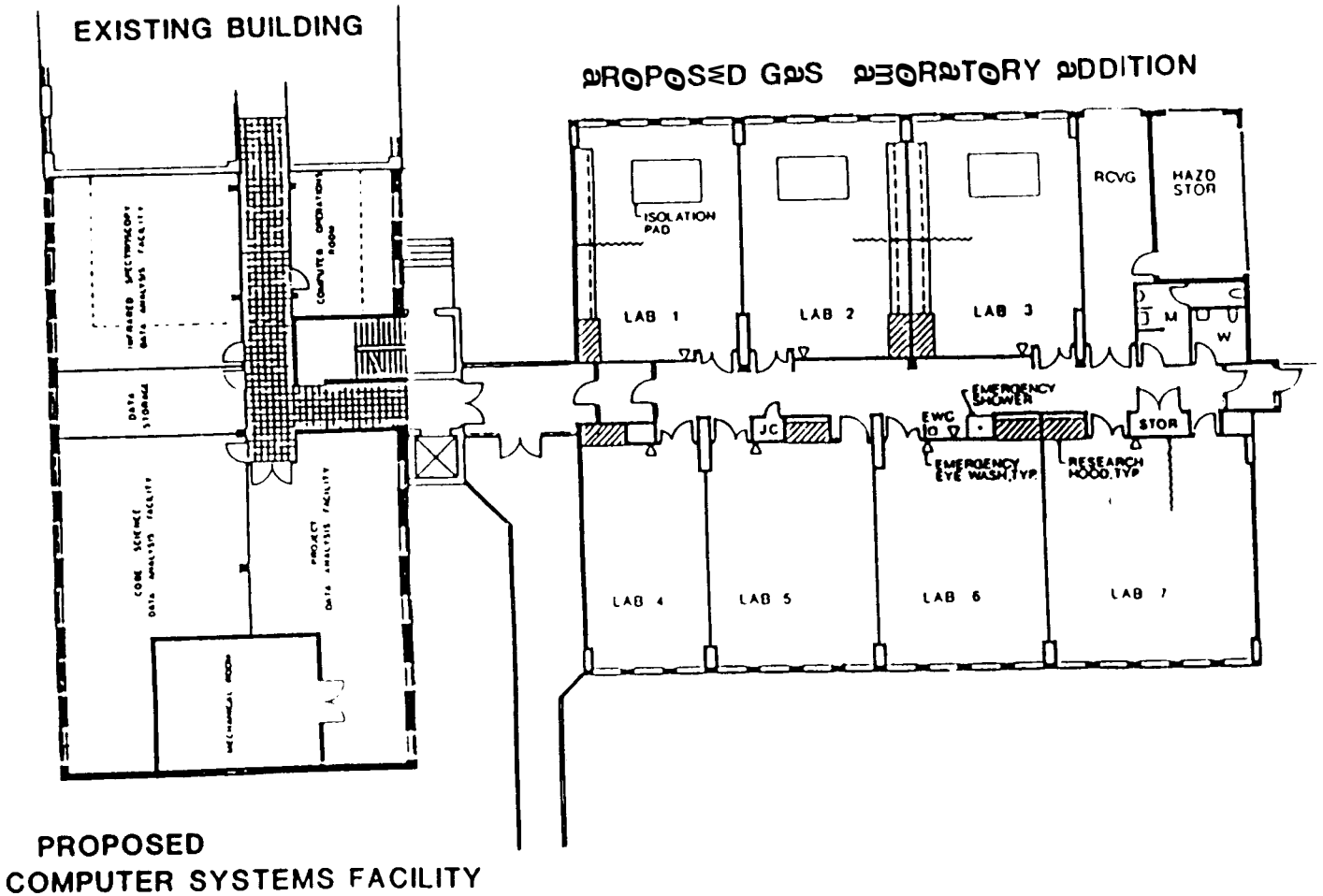
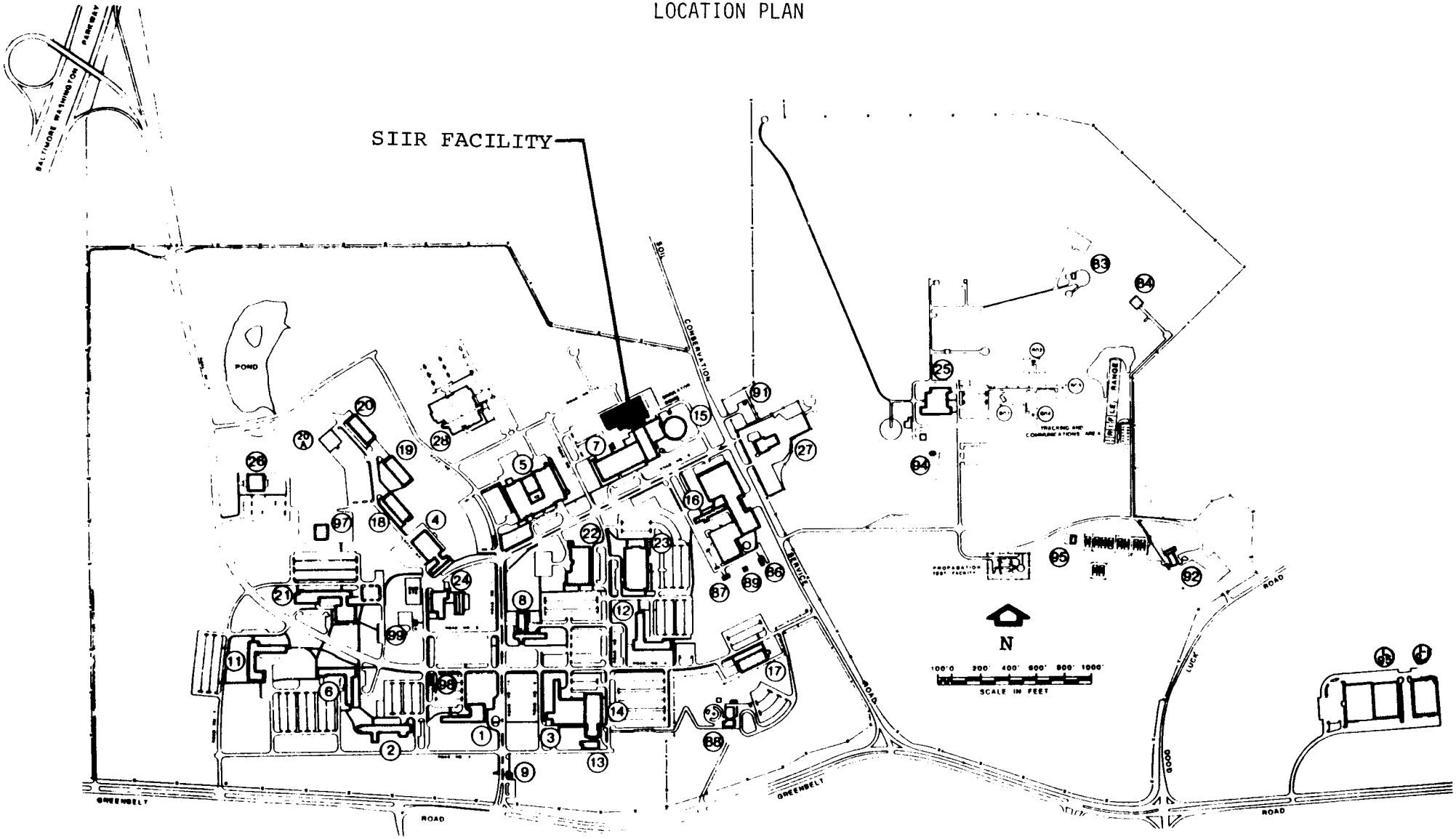


FIGURE 3

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF SPACECRAFT SYSTEMS DEVELOPMENT AND INTEGRATION FACILITY

LOCATION PLAN



FIGURE

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE: Construction of Spacecraft Systems Development and Integration Facility

INSTALLATION: Goddard Space Flight Center

FY 1986 CoF ESTIMATE: $8,000,000

LOCATION OF PROJECT: Greenbelt, Prince George's County, Maryland

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	1,100,000	---	1,100,000
Capitalized investment	N/A	---	---
Total	1,100,000	---	1,100,000

SUMMARY PURPOSE AND SCOPE:

This Project provides the first increment of construction of an addition to the Building 7/10/15 complex to provide a Spacecraft Systems Development and Integration Facility. This facility will accommodate simultaneous, multi-year development and integration, and/or major long term refurbishment of two spacecraft, each up to the size of a full shuttle payload, in a work space equipped with the requisite stringent environmental controls. Present GSFC facilities are too small for full size shuttle payloads, and the high throughput pre-launch processing facilities at the Kennedy Space Center are not intended nor available for this longer term work. A second and final increment to complete the facility is planned for FY 1987.

PROJECT JUSTIFICATION:

With the Space Shuttle now operational, full exploitation of its capabilities to support space science and applications missions is being initiated through planning and development of larger and heavier spacecraft and payloads. Shuttle-launched spacecraft with larger and expanded instrumentation are expected to play a significant role in increasing our understanding of the universe and the earth. When it is economically or scientifically advantageous, these highly instrumented spacecraft can now be designed to capitalize on the flexibility of retrieval and refurbishment for extended useful life and reuse. GSFC is the appropriate site for the development of these large instruments because it is the lead center for the development, fabrication, integration, and management of science and applications spacecraft in earth orbit. GSFC also possesses the required personnel that are skilled in the related state-of-the-art technology. To fully use this valuable and resident expertise requires the provision of an integration and fabrication facility large enough to accommodate maximum size shuttle flight hardware.

Construction of this facility as an addition to the GSFC spacecraft development complex will provide the capability for processing and integrating spacecraft up to Shuttle payload bay capacity, and take advantage of existing support systems. The first elements of the existing facility complex were designed and constructed in the early 1960s to accommodate sounding rockets, Explorers, and other small spacecraft. The facilities were expanded in 1967 to provide for integration of spacecraft for Delta and Centaur sized launch vehicles, and again in 1978 to accommodate shuttle pallet sized instruments of up to 10,000 pounds maximum weight. These GSFC integration and test facilities can be used for major component work, in support of Shuttle-size spacecraft, but current size and weight limitations prevent work on the large flight hardware that can take full advantage of the Space Shuttle's capability. A high bay, laminar flow, clean room is the most critical element of this facility requirement. To meet the stringent requirements of scientific spacecraft and instruments, it must provide a cleanliness standard of class 100 as the air enters the room in order to ensure a class 10,000 environment at the work stations. It often requires up to two years for spacecraft developmental integration, encompassing physical and electromagnetic testing, functional testing, electronic and optical adjustment, and alignment. Based on current planning, the proposed facility must be able to accommodate the simultaneous integration and/or refurbishment of two spacecraft which permits necessary program overlaps.

The payload processing facilities at the Kennedy Space Center are not designed for and cannot accommodate this type of long term work. They are fully committed to prelaunch processing of shuttle payloads. Existing development contractor facilities do not meet the cleanliness, size and scheduling criteria. This facility will also significantly enhance GSFC's ability to retain and maintain the necessary in-house expertise in research, development, integration, and test activities.

IMPACT OF DELAY:

Delay of this project would adversely impact the full exploitation of the Shuttle's capabilities for NASA research and development spacecraft, by restricting spacecraft development to the present size and weight limited facilities. This facility must be started now in order that developmental spacecraft which can take full advantage of the large Shuttle cargo bay capability can be properly supported.

PROJECT DESCRIPTION:

This project will provide the initial increment for the construction of a technical addition of approximately 78,800 gross square feet to the north side of the Wlilding 7/10/15 complex (Figure 1). Long lead structural steel, foundations, some site work and closing in of the building shell will be emphasized during this phase of work. Domestic water, sanitary and storm sewers, communications, steam, chilled water, and electrical power are available and will be extended from existing distribution systems within the appropriate increments.

The facility addition (Figure 2) when completed will include: a 12,500-square foot, 106-foot high bay, laminar flow, clean room; a 1,000-square foot change room for personnel changing into cleanroom attire; a 25,000-square foot flight hardware storage area (includes 5,000 square feet of bonded storage area for long term storage of payload components); a 10,000-square foot two-story support area (includes a 3,500-square foot automatic data processing room for simulating data flow to and from payloads); and an 11,500-square foot staging, shipping and receiving area. This facility will be supported by the existing integration, environmental test, control centers, and data processing capability located in the adjacent Building 7/10 complex and elsewhere at GSFC.

The clean room is sized to simultaneously accommodate two full shuttle bay payloads up to 60 feet long, 15 feet in diameter and maximum Shuttle cargo weight. It will also house related ground support equipment and provide adequate access aisles. Two cranes will be installed within the clean room with hoisting capacities of 35 tons each. Class 100 filtered air (90,000 cubic feet per minute) will enter the clean room at the north side through a floor-to-ceiling, wall-to-wall, high efficiency particulate air filter bank (Figure 3). This filtering system will produce a cleanliness level of at least class 10,000 within all work stations.

This facility will also include a 35-ton crane in the staging, shipping and receiving area; a passenger/freight elevator; a dual type electrical power system to provide redundancy; and a fire protection and utility control system which will be connected to the center wide utility control system.

PROJECT COST ESTIMATE:

The cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	8,000,000
Site development	LS	---	---	800,000
Demolition	LS	---	---	150,000
High bay laminar flow clean room	LS	---	---	4,000,000
Change room	LS	---	---	50,000
Flight hardware storage area	LS	---	---	900,000
Shipping, receiving, and staging area	LS	---	---	1,500,000
Automatic data processing and technical support area	LS	---	---	600,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				8,000,000

NOTE: This cost estimate provides only for the FY 1986 increment of the total facility. The total cost of the project is estimated at $16,000,000.

LIST OF RELATED GRAPHICS

Figure 1 - Location Plan
Figure 2 - Floor Plans
Figure 3 - Isometric Section
Figure 4 - GSFC Spacecraft History 1960-1992

OTHER EOUIPMENT SUMMARY:

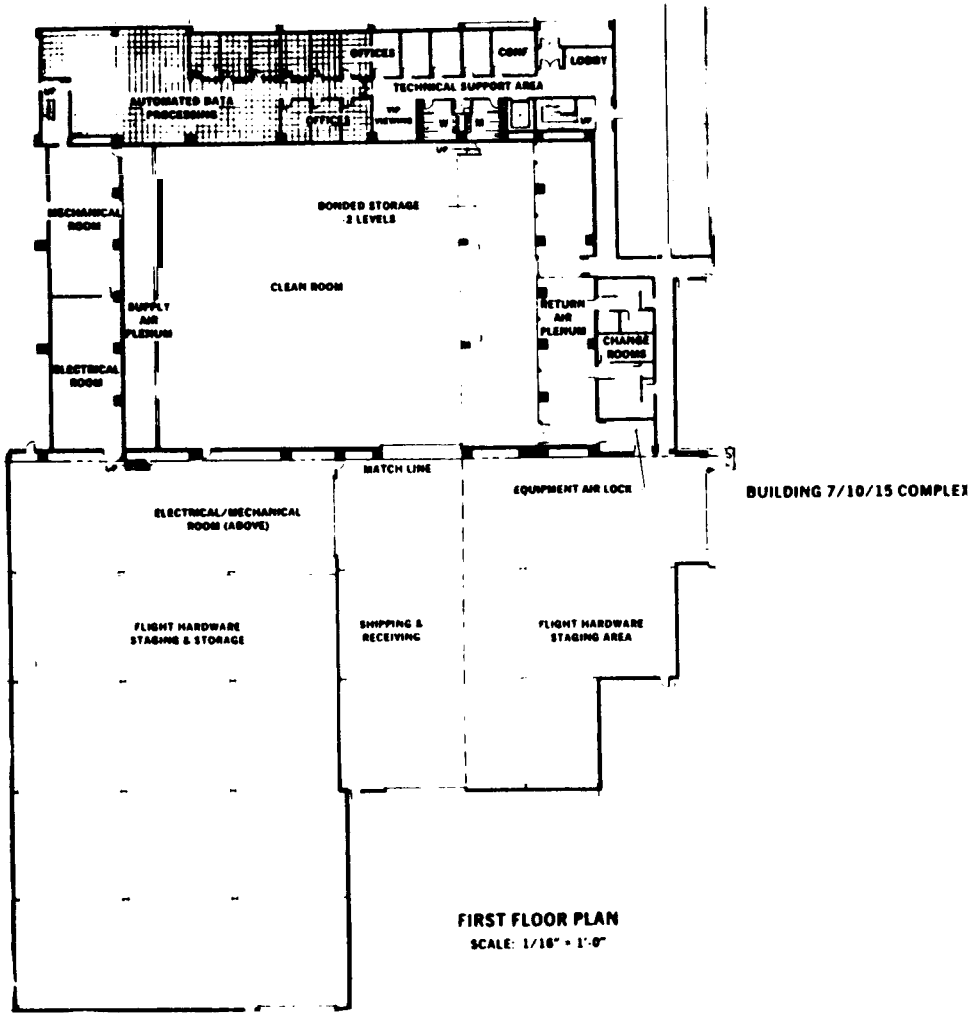
Materials handling equipment estimated to cost $50,000 will be provided from R&D resources.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

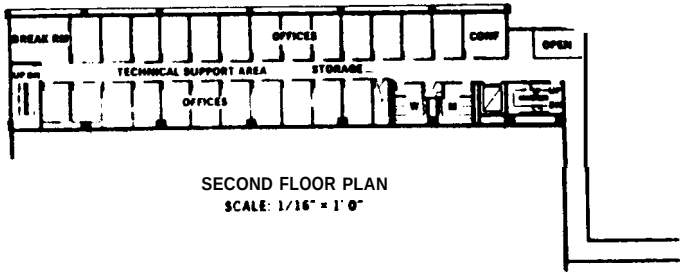
To complete this project, a second and final increment will be included in the FY 1987 budget request for an additional $8 million.

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF SPACECRAFT SYSTEMS DEVELOPMENT AND INTEGRATION FACILITY

FLOOR PLANS



FIRST FLOOR PLAN
SCALE: 1/16" = 1'-0"



SECOND FLOOR PLAN
SCALE: 1/16" = 1' 0"

COMPOSITE FLOOR PLAN

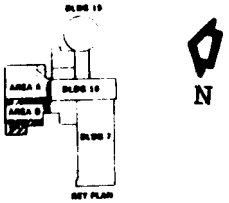


FIGURE 2

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF SPACECRAFT SYSTEMS DEVELOPMENT AND INTEGRATION FACILITY

ISOMETRIC SECTION

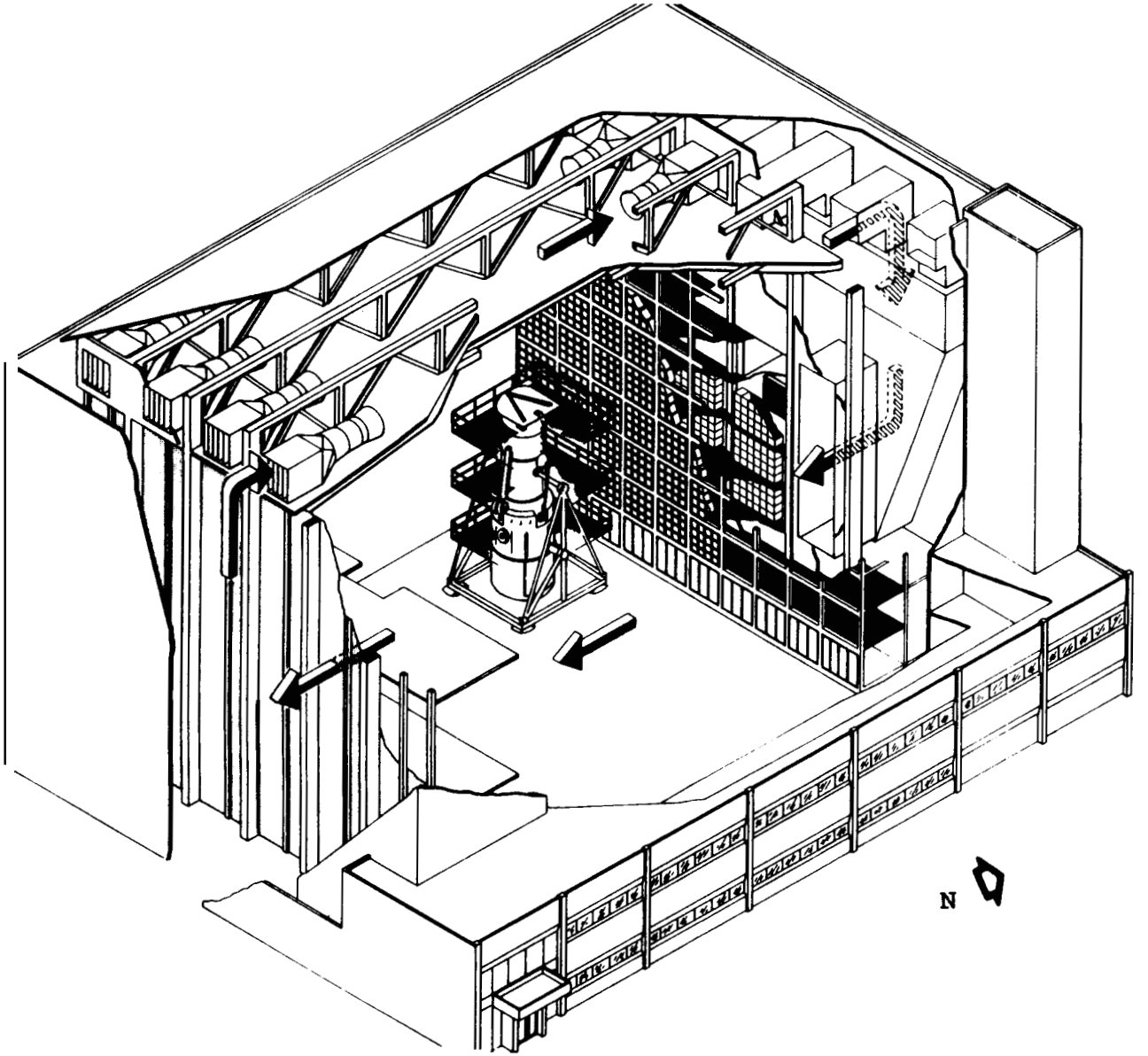


FIGURE 3

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF SPACECRAFT SYSTEMS DEVELOPMENT AND INTEGRATION FACILITY

GSFC SPACECRAFT HISTORY 1960-1992

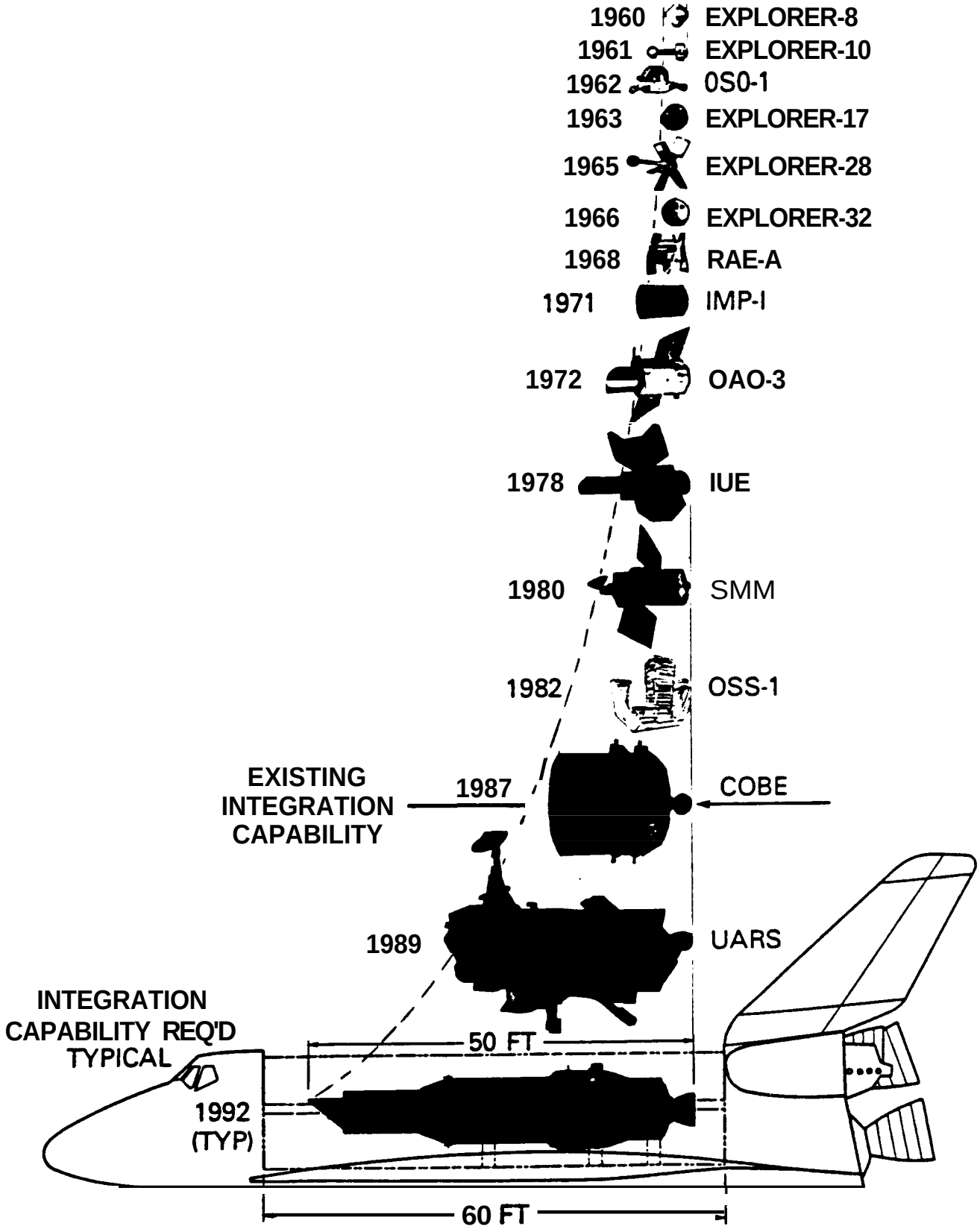


FIGURE 4

JET PROPULSION
LABORATORY

PROJECT JUSTIFICATION:

It is essential that this project be approve3 in order to complete the construction effort started with 1985 resources. This increment, along with the $11,500,000 portion of the project approved in FY 1985, will provide a complete facility suitable for its intended purpose. This project is the continuation and completion of all elements of work begun in FY 1985. Without FY 1986 funding, the building shell and basic utilities would be complete, but the mechanical and electrical systems and building finishes would not be completed. The numerical simulation computers could not be installed, and the principal purpose of the facility could not be realized.

To be successful, the NAS Processing System Network must be situated so that there is interaction between the researchers who identify and specify requirements, the development staff which translates the research requirements into machine format, the equipment operations staff, and the maintenance staff. Thus, adequate facilities must be provided for this advanced, high-speed computer system, its peripheral equipment, and the staff that use and maintain it. In addition, the computer system must be housed in a secure environment. The proposed facility will satisfy these requirements.

IMPACT OF DELAY:

Delay of the FY 1986 portion of this project would require NASA to stop work when the FY 1985 project funds are exhausted. The building would be incomplete and unsuitable for installation and activation of the complex, expensive computer system being delivered. A delayed start-up with FY 1987 or subsequent year funding would cause additional costs due to escalation and a restart of construction.

PROJECT DESCRIPTION:

The project (Figure 2) provides approximately 90,500 square feet to house the NAS Processing System Network, peripheral equipment, and secure computer equipment. Adequate special utilities and utilities management systems will be installed. A 3,000-square foot TEMPEST secure area will also be provided. Physical and fire security systems are included.

Approximately 35,000 square feet are allocated for computer systems and computer support. Research, development, operations, and maintenance functions will occupy approximately 22,000 square feet. Library, consultation, and conference rooms will require 5,000 square feet. The remainder of the building will house mechanical equipment, storage areas, corridors, restrooms, and similar space. Site development, access parking, landscaping, and utilities are included. Provisions will be made for secure computer operations and processing of classified material.

PROJECT COST ESTIMATE:

This cost estimate is based on detailed engineering estimates.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	8,200,000
Site preparation	---	---	---	---
Architectural/structural	SF	90,500	29.40	2,660,000
Mechanical	SF	90,500	18.23	1,650,000
Electrical	SF	90,500	14.25	1,290,000
Tempest security	SF	3,000	866.67	2,600,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				8,200,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY:

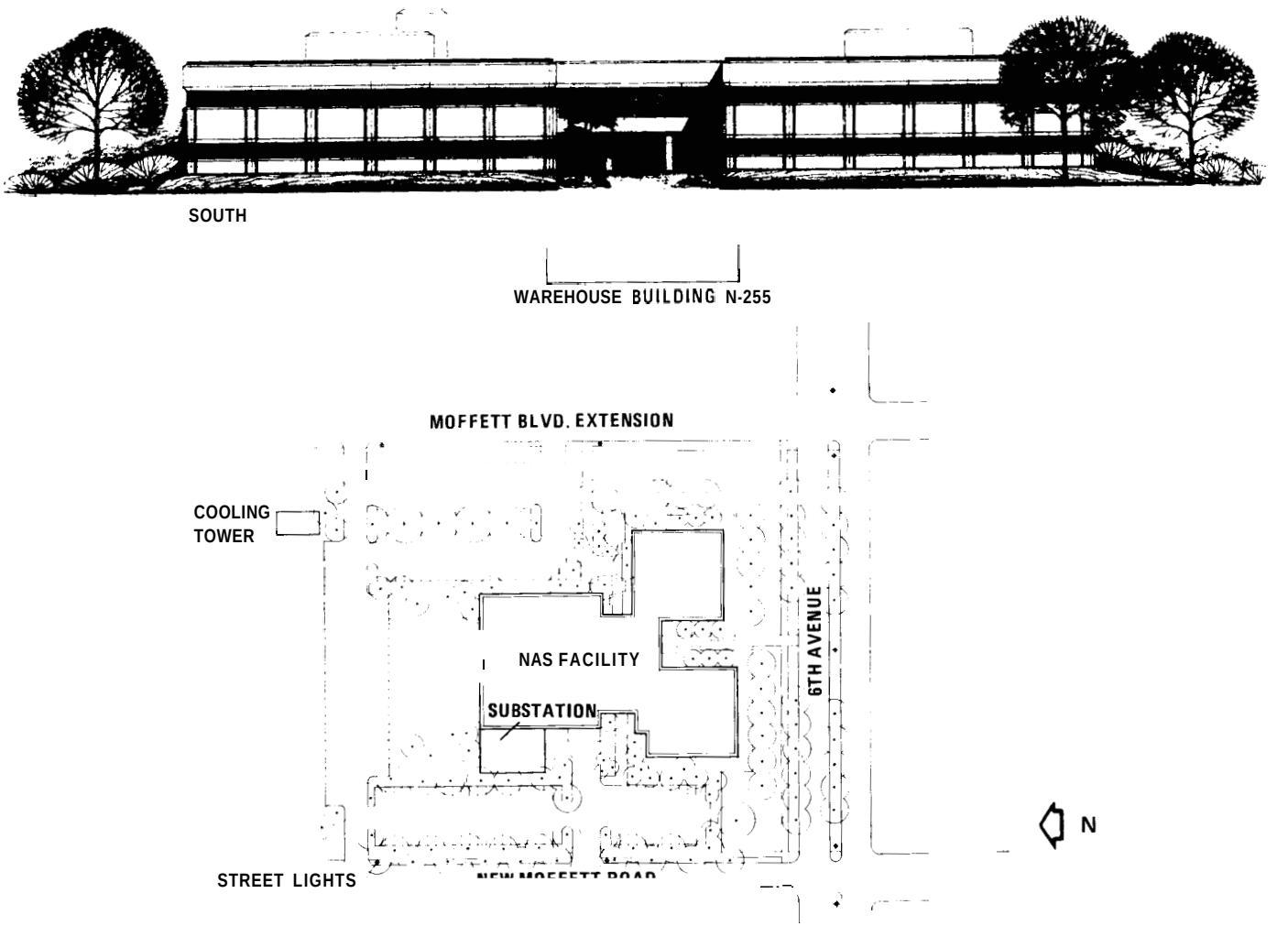
Computers and other electronic data processing equipment are being furnished with R&D funds. Office, open landscaping, and furnishings are being provided with R&PM funds.

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future Cof funding is required to complete this project at this time. Portions of the building, however, are designed for expansion should it be required.

AMES RESEARCH CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF NUMERICAL AERODYNAMIC SIMULATION FACILITY

SITE PLAN



CF 5-5

FIGURE 2

AMES
RESEARCH CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

JET PROPULSION LABORATORY

Office of Space Science and Applications:	Amount	Page No.
Construction of Microdevices Laboratory.....	8,900,000	CF 4-1

JET PROPULSION LABORATORY
FY 1986 CoF ESTIMATES
CONSTRUCTION OF MICRODEVICES LABORATORY

LOCATION PLAN

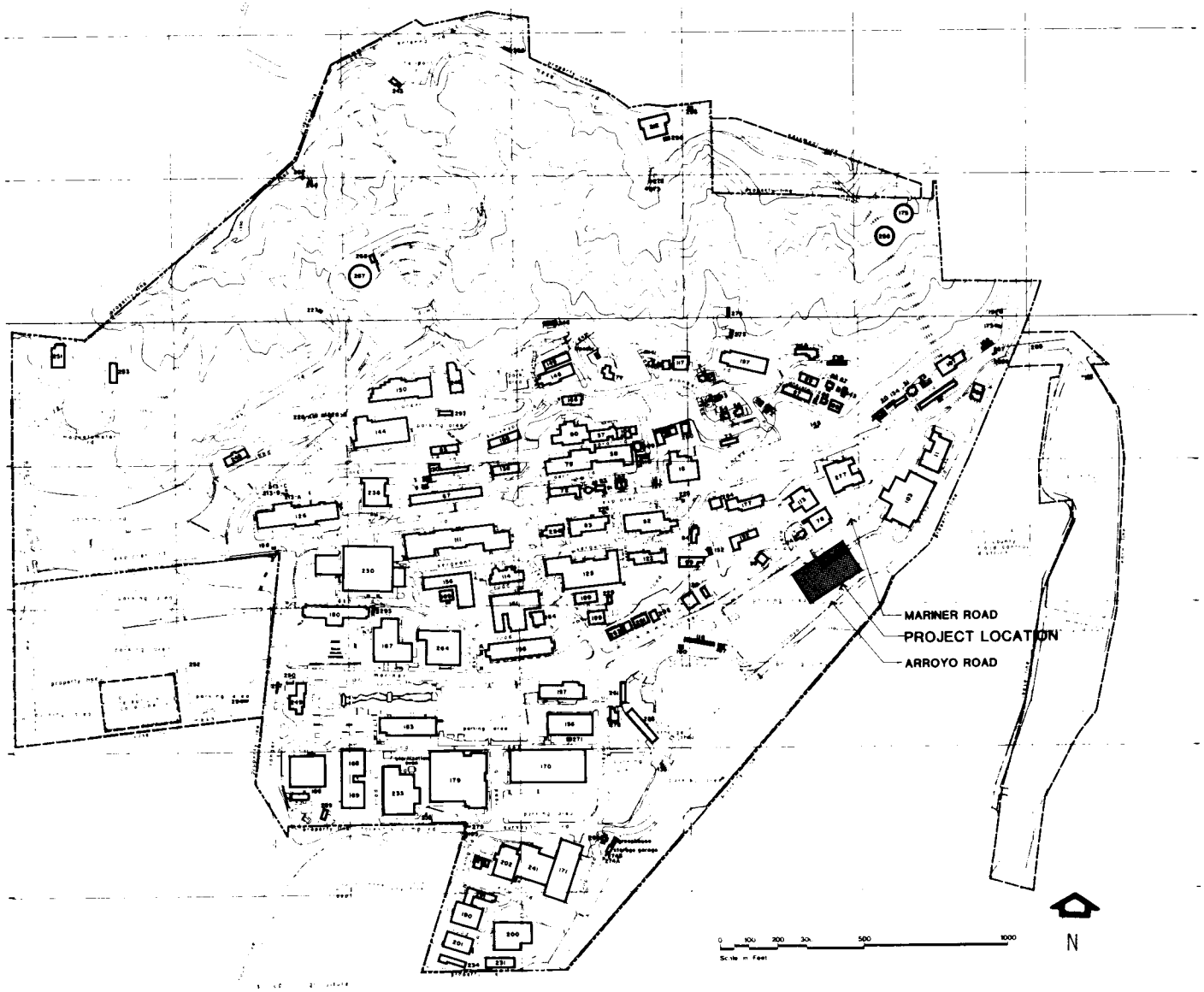


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE.: Construction of Microdevices Laboratory

INSTALLATION: Jet Propulsion Laboratory

FY 1986 CoF ESTIMATE: $8,900,000

LOCATION OF PROJECT: La Canada-Flintridge, Los Angeles County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science and Applications

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	774,000	---	774,000
Capitalized investment	N/A	---	---
Total	774,000	---	774,000

SUMMARY PURPOSE AND SCOPE:

The Microdevices Laboratory provided by this project is required for microelectronics research and technology developnent for solid-state devices, spaceborne very large scale integrated (VLSI) circuits, optoelectronics, and advanced computer architecture and subsystems. An intensified and integrated effort in these areas is necessary to achieve electronics systems performance improvements required for future spacecraft. Specialized research equipment and an increasing personnel complement involved in microelectronics research, presently dispersed in various locations at JPL in inadequate laboratories, will be relocated and consolidated in this new facility.

PROJECT JUSTIFICATION

Microelectronic devices pervade a multitude of space applications including communications, fiber optic data transmission, optical signal processors, integrated optical devices for scene correlation, pattern recognition, real-time Synthetic Aperature Radar (SAR) signal processing, imaging spectrometer data processing as well as passive and active sensing. These applications are threaded through a host of agency missions from large space structures and observations of terrestrial, planetary and galactic phenomena to aeronautics studies such as laser diagnostic wind tunnel measurements.

Microelectronics permit highly sophisticated operational reliability and analytical capability to be achieved while minimizing size, weight, power drain, and cost. A major increase in microelectronics research is needed so that future NASA systems will be "affordable" by incorporating advanced technology, customized for the unique space environment. NASA must maintain a frontier position in the exploration and utilization of new devices, components, and materials for ultimate realization in advanced missions. There is also a need to understand and model the failure mechanisms associated with the unique space environment in these advanced devices and materials.

Because of the relatively small number and the unique nature of the devices needed by NASA it is most unlikely that the electronics industry will conduct the necessary research and development that is essential for those microelectronic devices required by NASA. This forces the agency to provide its own in-house capability for research and development. JPL is the ideal, logical location for this research and development activity. JPL presently has the scientific personnel staff which can also avail themselves of the close relationship with the distinguished electronics faculty researchers at the California Institute of Technology.

The proposed Microdevices Laboratory will provide a suitable facility to conduct this vital research. The laboratory will be used primarily to perform materials and device processing, ultra-fine lithography, characterization, and secondarily for test and evaluation. Applied research and development in electronic material and devices, advancement of new concepts in electronic and optical technologies for improved sensors, high-rate information transfer, data storage, and real-time signal processing will also be carried out in this facility.

The existing facilities at JPL are totally inadequate to properly support the program requirements. Various elements of these activities are currently being accomplished in six widely scattered buildings, including off-site leased space. This physical separation of program elements compounds organizational management difficulties, and makes expansion costly and inefficient. More importantly, none of the present facilities meet the very stringent clean room requirements and none of the buildings have the vibration-free floors and freedom from electromagnetic interference that are needed to successfully perform the required microelectronics research.

IMPACT OF DELAY:

Research is needed to develop advanced microelectronic devices. There is considerable concern that scientifically and historically important space missions and applications will not be possible, within cost constraints and the forseeable future, without major utilization of microelectronics technology. Delaying this project will only aggravate and compromise NASA's ability to maintain the lead in space mission capabilities. Needed expertise may be lost and future developnent will become more costly.

PROJECT DESCRIPTION:

This project provides for the construction of a two-story, 38,000 square foot steel frame building. The first floor will contain approximately 28,000 square feet, of which 12,500 square feet are for clean rooms as follows: Class 10 (2,000 square feet), Class 100 (3,000 square feet), Class 1,000 (3,000 square feet) and Class 100,000 (4,500 square feet). Also included is 8,000 square feet of isolated space for mechanical air handling equipment; 4,700 square feet for support facilities such as gas storage, chemistry, sample preparation, data processing, assembly, and machine shop; and approximately 2,800 square feet for restrooms, corridors, and stairs. The second floor will contain approximately 10,000 square feet and will include the material and device characterization laboratory, a shielded room, program offices, a conference room, and storage, electrical, and telephone equipment rooms.

The building will be provided with the required utility services, including water, sanitary sewer, storm sewer, natural gas, high pressure GN_2 and compressed air. A deionized water system, vacuum system and LN_2 system will also be included in the project. The entire facility will have fire detectors, sprinkler and alarm systems. A new electrical substation will be provided, consisting of primary switch gear and, a 1,500 KVA dry type transformer.

PROJECT COST ESTIMATE:

This cost estimate is based on a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition	---	---	---	---
Construction	---	---	---	8.900 ,000
Sitework	LS	---	---	585,000
Architectural/Structural	SF	38,000	102.24	3,885,000
Mechanical	SF	38,000	88.16	3 ,350 ,000
Electrical	SF	38,000	28.42	1,080,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				8.900 ,000

LIST OF RELATED GRAPHICS:

Figure 1 - Project Location Plan
Figure 2 - Project Rendering
Figure 3 - Project Site

OTHER EQUIPMENT SUMMARY:

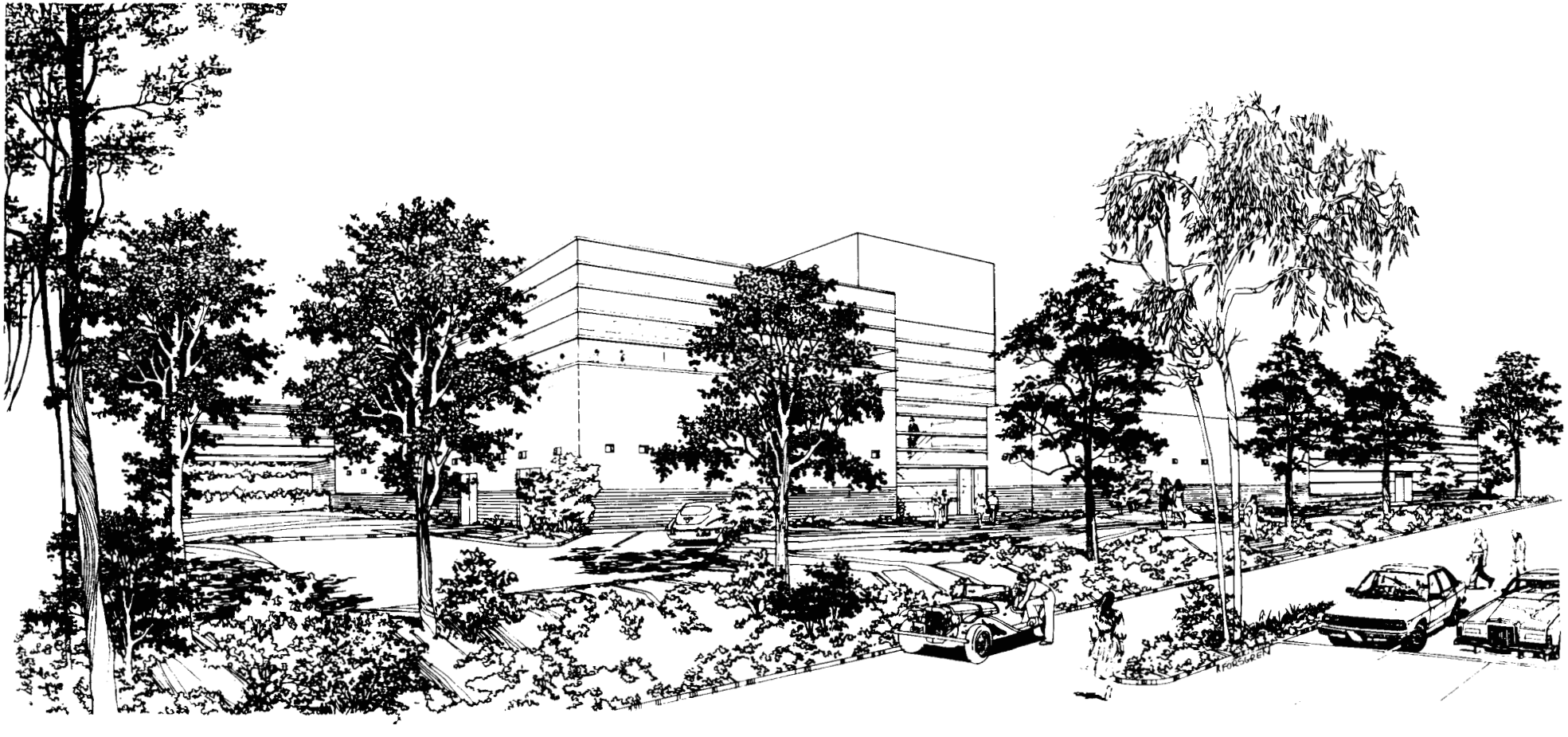
Most of the major research equipment presently exists at JPL and will be relocated to the new facility. However, there is a requirement for additional equipment valued at approximately $3.0 million to be funded from R&D resources.

FUTURE CoF ESTIMATE FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

JET PROPULSION LABORATORY
FY 1986 CoF ESTIMATES
CONSTRUCTION CF MICRODEVICES LABORATORY

PROJECT RENDERING

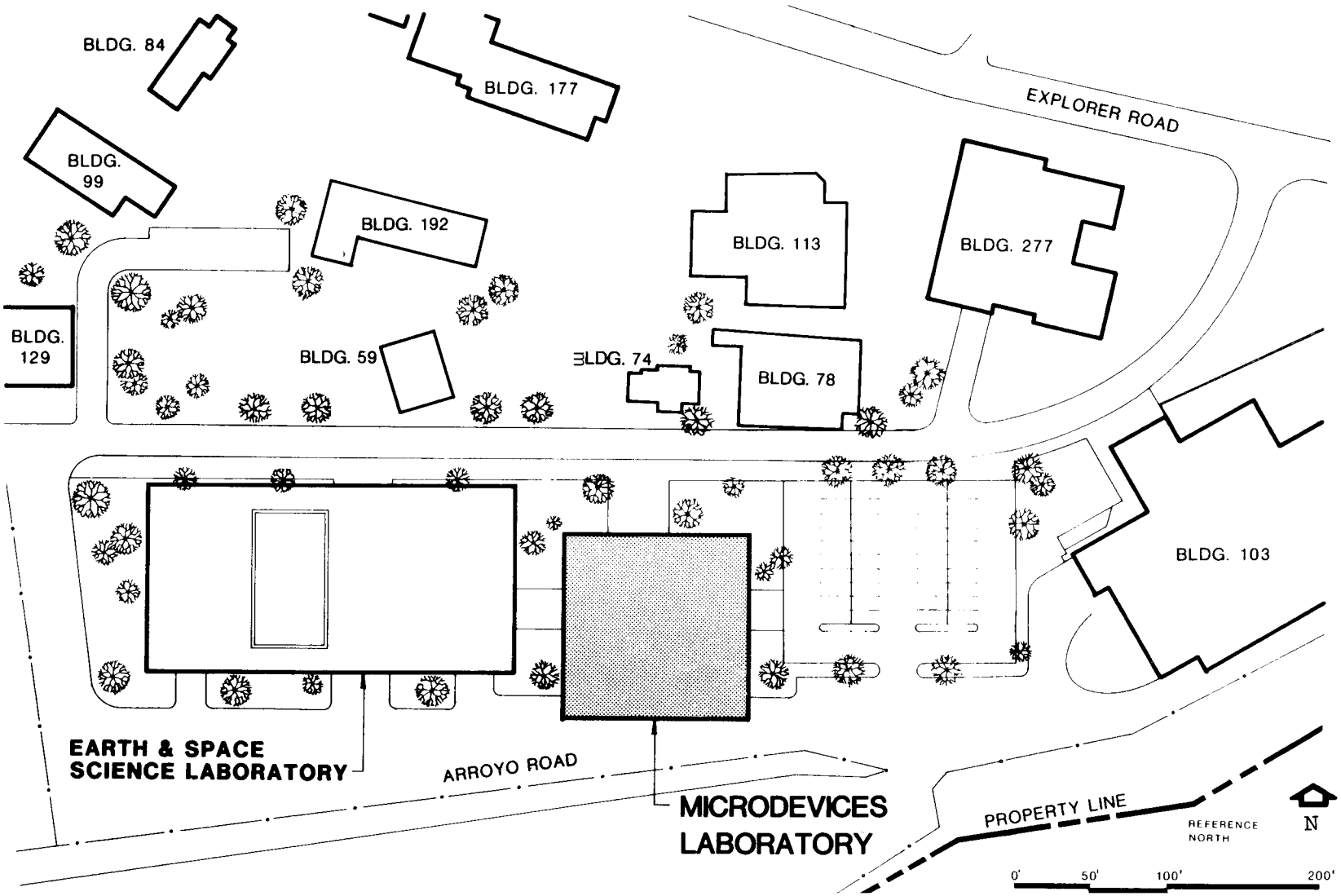


CF 4-6

FIGURE 2

JET PROPULSION LABORATORY
FY 1986 CoF ESTIMATES
CONSTRUCTION OF MICRODEVICES LABORATORY

SITE PLAN



CF 4-7

FIGURE 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

AMES RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Construction of Numerical Aerodynamic Simulation Facility,.....	8,200,000	CF 5-1

AMES RESEARCH CENTER
FISCAL YEAR 1986 ESTIMATES
CONSTRUCTION OF NUMERICAL AERODYNAMIC SIMULATION FACILITY

LOCATION PLAN

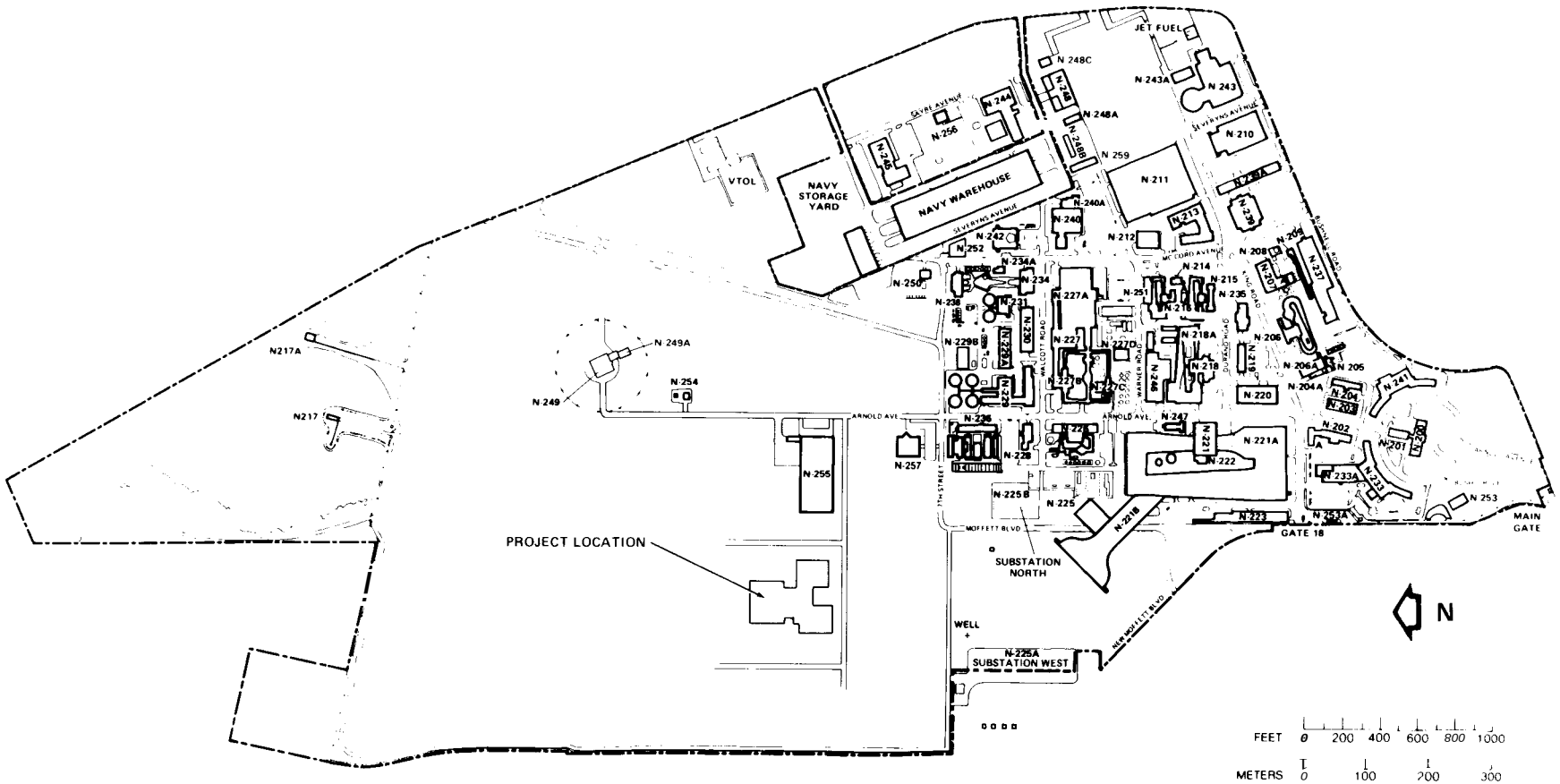


FIGURE 1

CF 5-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE: Construction of Numerical Aerodynamic Simulation Facility

INSTALLATION: Ames Research Center

FY 1986 CoF ESTIMATE: $8,200,000

LOCATION OF PROJECT: Moffett Field, Santa Clara County, California

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	1,040,000	11,500,000	12,540,000
Capitalized investment	N/A	---	---
Total	1,040,000	11,500,000	12,540,000

SUMMARY PURPOSE AND SCOPE:

The Numerical Aerodynamic Simulation (NAS) program is an integral element of NASA's aerodynamic research and development capability. The NAS activity provides a leading national capability of high speed computation for aerodynamic research, aeroelastic simulation, viscous three dimensional fluid flow equations, and advanced fluid physics research. The facility to house this computational system was requested in the FY 1985 CoF Program at $16,500,000 and was authorized by P.L. 98-361 at $11,500,000. NASA was directed to reschedule construction for completion with FY 1986 funds. This requested funding will enable completion of the original scope as proposed in FY 1985 and will provide a required secure data processing area.

LANGLEY
RESEARCH CENTER

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

LANGLEY RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Modifications to 16-Foot Transonic Tunnel for Improved Productivity and Research Capability	4,900,000	CF 6-1

LANGLEY RESEARCH CENTER
FISCAL YEAR 1986 ESTIMATES
MODIFICATIONS TO 16-FOOT TRANSONIC TUNNEL FOR IMPROVED
PRODUCTIVITY AND RESEARCH CAPABILITY
LOCATION PLAN

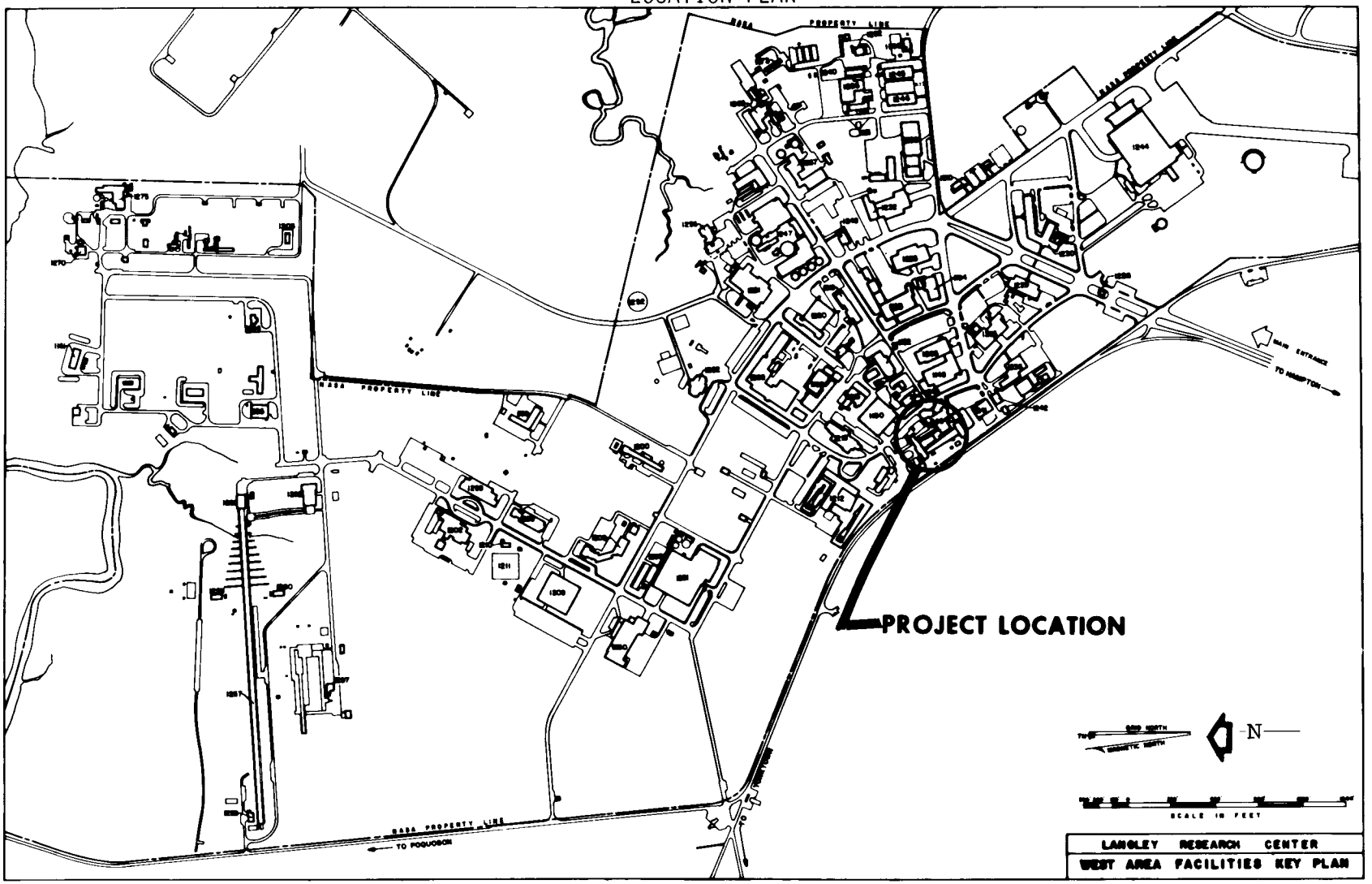


FIGURE 1

CF 6-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE:. Modifications to 16-Foot Transonic Tunnel for Improved Productivity and Research Capability

INSTALLATION: Langley Research Center

FY 1986 CoF ESTIMATE: $4,900,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	473,500	---	473,500
Capitalized investment	N/A	18,717,429	18,717,429
Total	473,500	18,717,429	19,190,929

SUMMARY PURPOSE AND SCOPE:

The 16-Foot Transonic Tunnel is dedicated to airframe/propulsion integration research. New aircraft propulsion systems, utilizing complex engines such as variable stream, variable cycle and dual flow, are being developed. Adequate propulsion integration testing for these engines requires larger models, simulation of dual exhaust flows, and increased angle-of-attack. This project will provide a new model preparation area, semi-span model support system, dual air-flow propulsion testing capability, enhanced pitch and roll angle control, and a new drive system liquid rheostat.

PROJECT JUSTIFICATION:

Under the current mode of operation and facility configuration, approximately 30 percent of available wind tunnel occupancy time is consumed by installing and calibrating models in the test section. A new model preparation area is required to permit model preparation to be accomplished outside the test section, thereby freeing the tunnel for other research runs. In addition, a remote model preparation area can accommodate the solving of unforeseen problems encountered when developing new propulsion system models without interfering with other scheduled tunnel research.

Semi-span models (models cut in half lengthwise) cost less because only one half the total number of engine simulators are needed. These simulators cost approximately $60,000 each and have an average life span of 100 hours of testing. Wind tunnel models often cost as much as several hundred thousand dollars each due to the complexity of the controls and special materials used; therefore, the use of half models (semi-span) can provide significant cost savings. The project will modify the test section to provide this capability.

In addition, the model support will be modified to provide for increasing the pitch rate, angle of attack range, roll-angle capability, and testing with dual air flow propulsion systems. This expanded capability is needed to simulate flight envelopes of future aircraft. For example, future aircraft will require superior handling qualities at higher angles of attack and sideslip than previously required. Propulsion systems with new and complex engines (such as the variable stream, variable cycle, and dual flow) are being developed for future aircraft. The complexities of dual propulsion systems requires simulation of more than typical single stream exhaust for adequate propulsion integration testing. These modifications will enable the 16-Foot Transonic Tunnel to test these advances for future aircraft. This project will also add a liquid rheostat to the speed control circuitry which will significantly increase the running time at higher power settings.

IMPACT OF DELAY:

Delay of this project would have a strong adverse effect on airframe/propulsion integration research. Research planned on new and innovative concepts would be delayed and thereby compromise national needs. Concepts impacted would be, for example: inlet integration for wing/nacelle/pylon integration for reduced fuel consumption and nacelle integration for supersonic cruise transports. In addition, a current two-year backlog of tests will continue to constrain important research. Productivity improvements provided by this project are necessary to reduce this backlog.

PROJECT DESCRIPTION:

This project provides a new model support system for the 16-Foot Transonic Tunnel (1146) and a model preparation and calibration area. Providing the new model support system will permit an increased pitch rate from the current 0.07 degrees per second to 1.0 to 2.0 degrees per second, increasing the angle-of-attack range from the current -5 degrees/15 degrees to -10 degrees/25 degrees. A dual airflow propulsion testing capability and an automated roll-angle control capability will also be provided. Installation of these systems requires increases in the size of the strut system, strut track, and supporting structure to support the increased loads and angle-of-attack range as well as to provide larger internal space for the additional airflow lines. Increasing the pitch rate requires a new model support system drive motor and supporting structure which can withstand the starting loads and the continual adjustments that are required during testing. Automated control of the roll angle during testing requires construction of a roll coupling sufficiently strong to withstand the high loads encountered during wind tunnel testing as well as a roll drive system capable of providing roll angles of plus or minus 180 degrees. The test section will also be modified to provide a supporting mechanism for testing semi-span models.

The model preparation and calibration area will be constructed below the test section in a bay of the lower level of the support building. Modifications will include installation of structural, mechanical, and electrical systems required to operate the model test stand and the load application frame. Acoustic treatment will be provided to limit sound transmission through the walls and roof during tunnel operation or model calibration. In addition, a separate control room will be provided adjacent to the preparation and calibration room to permit propulsion testing and calibration, and to provide isolation of personnel from the test area. Also, a motor control system will be added to the speed control circuitry. It will consist of a liquiid rheostat assembly and an electrolyte cooling system including a water cooled heat exchanger, electrolyte circulating pump, interconnecting cooling water and electrolyte piping, and controls.

PROJECT COST ESTIMATE:

This is a cost estimate based upon a preliminary engineering report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acquisition	—	---	---	---
Construction	---	---	---	4,900,000
Model support system for tunnel	LS	---	---	1,655,000
Semi-span model support system for tunnel	LS	---	---	365,000
Model support system for model prep area	LS	---	---	340,000
Model support cart	LS	---	---	70,000
Model load application frame	LS	---	---	45,000
Model preparation and calibration area	LS	---	---	345,000
Sting servomechanism	LS	---	---	290,000
Sting control system modifications	LS	---	---	945,000
Modifications to existing tunnel fan drive	LS	---	---	845,000
Equipment	—	---	---	---
Fallout Shelter (not feasible)	—	---	---	---
Total				4,900,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figwe 3 - Tunnel Schematic

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1986 ESTIMATES
MODIFICATIONS TO 16-FOOT TRANSONIC TUNNEL FOR IMPROVED
PRODUCTIVITY AND RESEARCH CAPABILITY
SITE PLAN

FIGURE

LANGLEY RESEARCH CENTER
FY 1986 CoF ESTIMATES
MODIFICATIONS TO 16-FOOT TRANSONIC TUNNEL
FOR IMPROVED PRODUCTIVITY AND RESEARCH CAPABILITY
TUNNEL SCHEMATIC

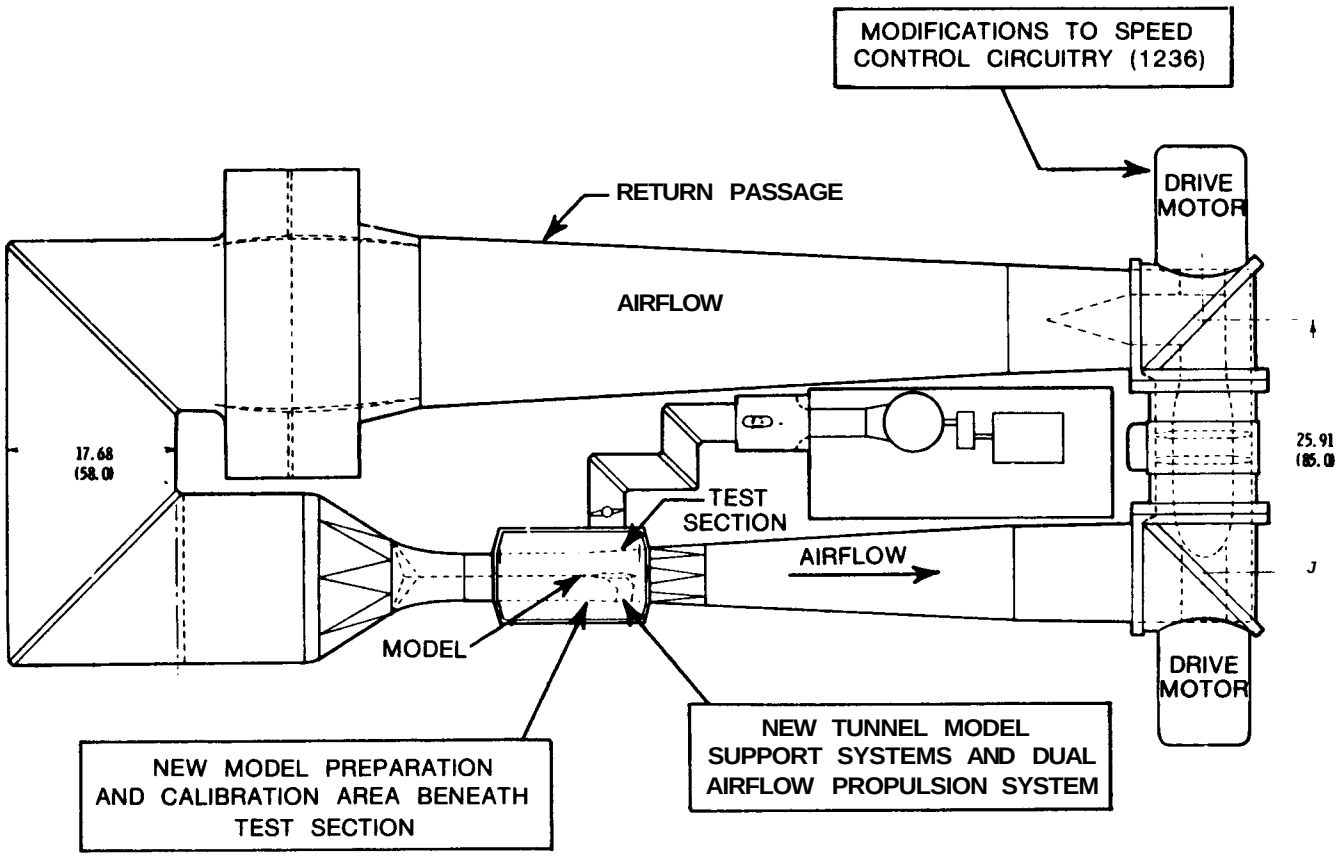


FIGURE 3

VARIOUS
LOCATIONS

VARIOUS LOCATIONS
FISCAL YEAR 1986 ESTIMATES
MODIFICATION OF 64-METER ANTENNA DSS-14, GOLDSTONE, CALIFORNIA

LOCATION PLAN

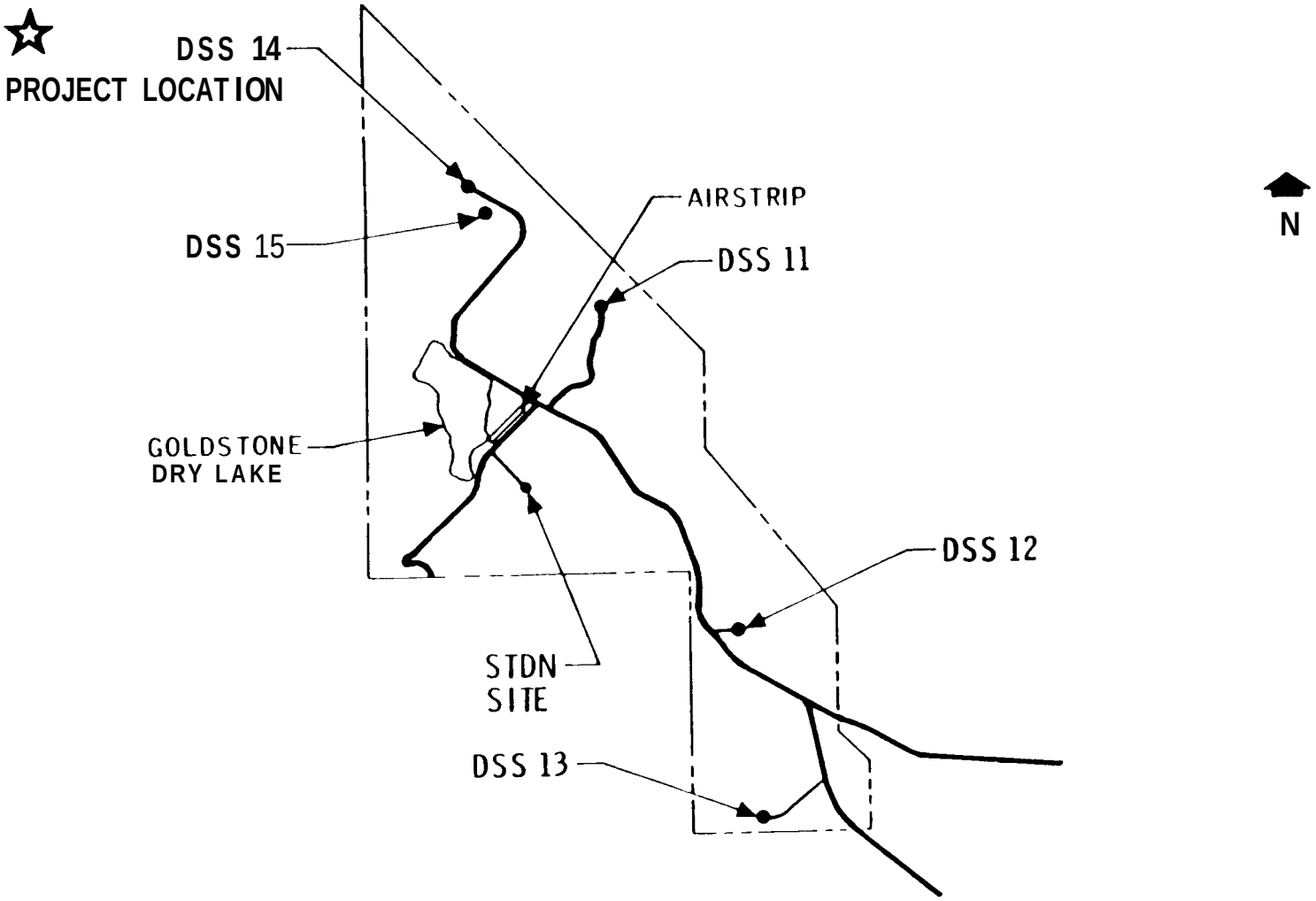


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE: Modification of 64-Meter Antenna DSS-14, Goldstone, California

INSTALLATION: Jet Propulsion Laboratory

FY 1986 CoF ESTIMATE: $8,500,000

LOCATION OF PROJECT: Goldstone, California

COGNIZANT HEADQUARTERS OFFICE: Office of Space Tracking and Data Systems

FY 1985 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	28,000	---	28,000
Capitalized investment	N/A	5,152,963	5,152,963
Total	28,000	5,152,963	5,180,963

SUMMARY PURPOSE AND SCOPE:

This project provides modifications for upgrading the 64-meter, DSS-14 antenna at the Deep Space Network (DSN) complex in Goldstone, California (Figures 1 and 2), to a 70-meter diameter, higher efficiency antenna. The upgrading improves by 45 percent the communication capability in support of scientific data gathering for deep space missions, including Galileo, Venus Radar Mapper, Voyager 2 - Neptune encounter, and spacecraft traveling beyond the outer planets.

PROJECT JUSTIFICATION:

The Deep Space Network (DSN) provides tracking and two-way communications with unmanned planetary spacecraft, and supports various deep space science experiments. Spacecraft operating at increasingly greater distances from earth require additional effective ground-based antenna aperture for meeting communication thresholds and data communication capacity requirements. Upgrading to a 70-meter diameter and incorporating today's technology to increase efficiency will improve this antenna's capability for very long baseline interferometry (VLBI), radio science, radio astronomy, emergency spacecraft command transmitting, and spacecraft data telemetry. For Galileo and the Venus Radar Mapper, better VLBI improves navigation, and improved telementry provides needed support coverage and reliability for science data return. Similar modifications are planned for the 64-meter antenna at Canberra, Australia in this fiscal year's program. The 64-meter antenna at Madrid, Spain is being modified to a 70-meter diameter by an FY 1985 CoF project.

Using the baseband arraying techniques, signals from different antennae can be combined to increase the effective aperture. One antenna must be above the communication threshold (the 70-meter in this case) before the technique can be applied. For the Voyager 2 - Neptune encounter in 1989, the effective aperture required for receiving images at the Goldstone, California DSN Complex in the northern hemisphere requires arraying one 70-meter diameter antenna and two existing 34-meter diameter antennas at X-band radio frequencies. The aperture improvement resulting from this project is also necessary for reducing losses of non-imaging science and engineering data at antenna pointing angles near the earth's horizon, and for obtaining high data rates. Upgrading this 64-meter antenna to a 70-meter diameter will also enable it to independently support spacecraft that previously would have required arraying it with a 34-meter antenna. This will reduce the overload on the 34-meter antennae. In addition, improved ground-based support capability will also reduce on-board communications design requirements and costs for new spacecraft.

IMPACT OF DELAY:

This antenna at Goldstone must be modified as an FY 1986 project so that it can be returned to operation in time for Galileo support in 1988. The work will be phased sequentially with the modification of the 64-meter antennae in Spain and Australia in time for supporting Galileo and the Voyager 2 - Neptune encounter without removing more than one antenna at a time from spacecraft support. Delay would preclude the availability of a 70-meter antenna at Goldstone, which is necessary for these missions.

PROJECT DESCRIPTION:

The modifications (Figure 3) will incorporate state-of-the-art technology for antenna component design, fabrication, and alignment. High efficiency X-band panels will be installed over the full reflector surface. The reflector backup structure will be enlarged to a 70-meter diameter and modified for increased strength and stiffness. A new quadripod and high precision subreflector compatible with the 70-meter reflector will be installed. The elevation wheel will be reinforced for strength and stiffness and increased in weight to balance the modified reflector-subreflector assembly. A new drive and control system for the new subreflector is also included.

PROJECT COST ESTIMATE:

This cost is based on preliminary engineering and related studies.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acauisition	---	---	---	---
Construction	---	---	---	8.500 ,000
Reflector panels	LS	---	---	3,800,000
Quadripod	LS	---	---	750,000
Subreflector	LS	---	---	880,000
Reflector structure and elevation wheel modifications	LS	---	---	2,700,000
Subreflector drive and control system	LS	---	---	370,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				8.500 ,000

LIST OF RELATED GRAPHICS

Figure 1 - Location Plan
Figure 2 - Site Plan'
Figure 3 - General Arrangement

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REOUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project, however, similar upgrading of the 64-meter antenna at Australia is also planned for this fiscal year.

VARIOUS LOCATIONS
FISCAL YEAR 1986 ESTIMATES
MODIFICATION OF 64-METER ANTENNA DSS-14, GOLDSTONE, CALIFORNIA

SITE PLAN

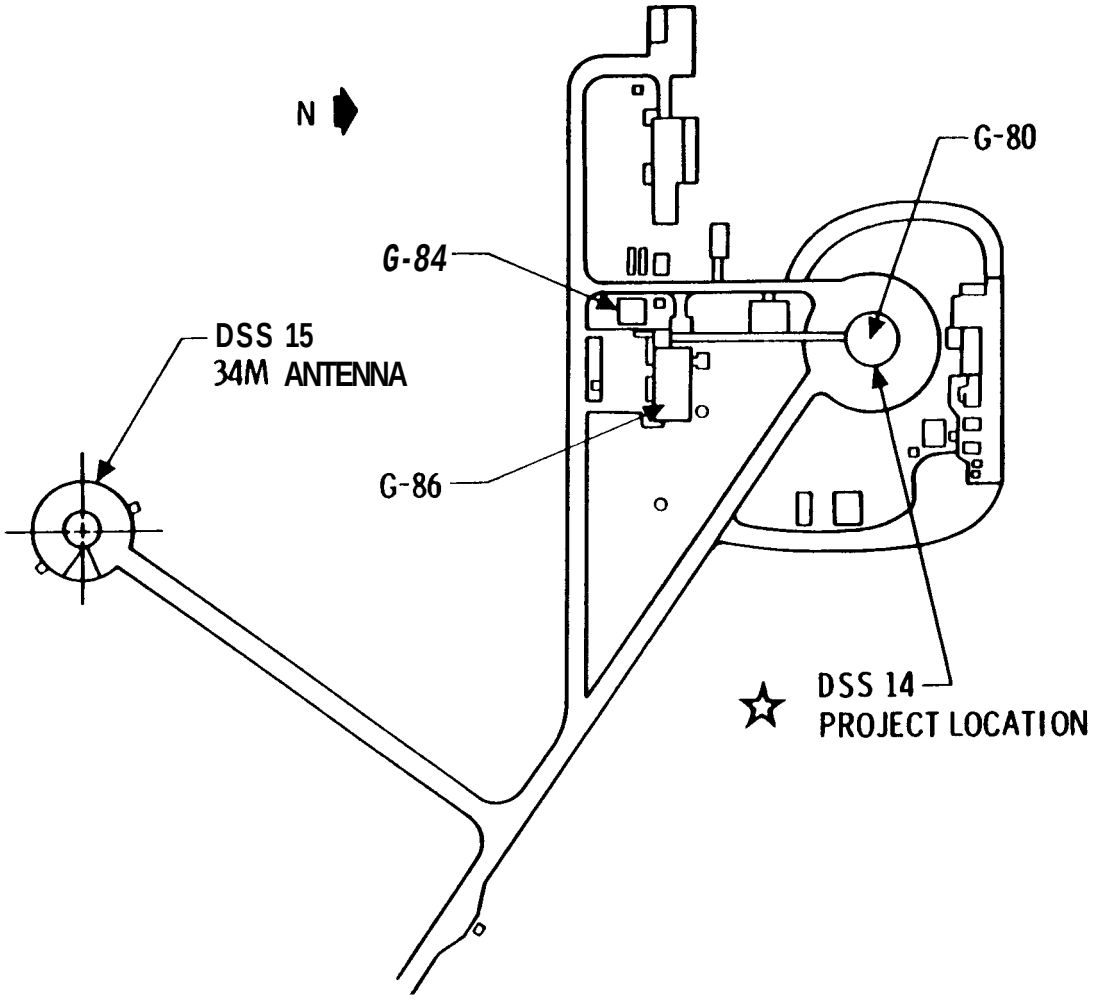


FIGURE 2

VARIOUS LOCATIONS
FISCAL YEAR **1986** ESTIMATES
MODIFICATION OF 64-METER ANTENNA DSS-14, GOLDSTONE, CALIFORNIA

GENERAL ARRANGEMENT

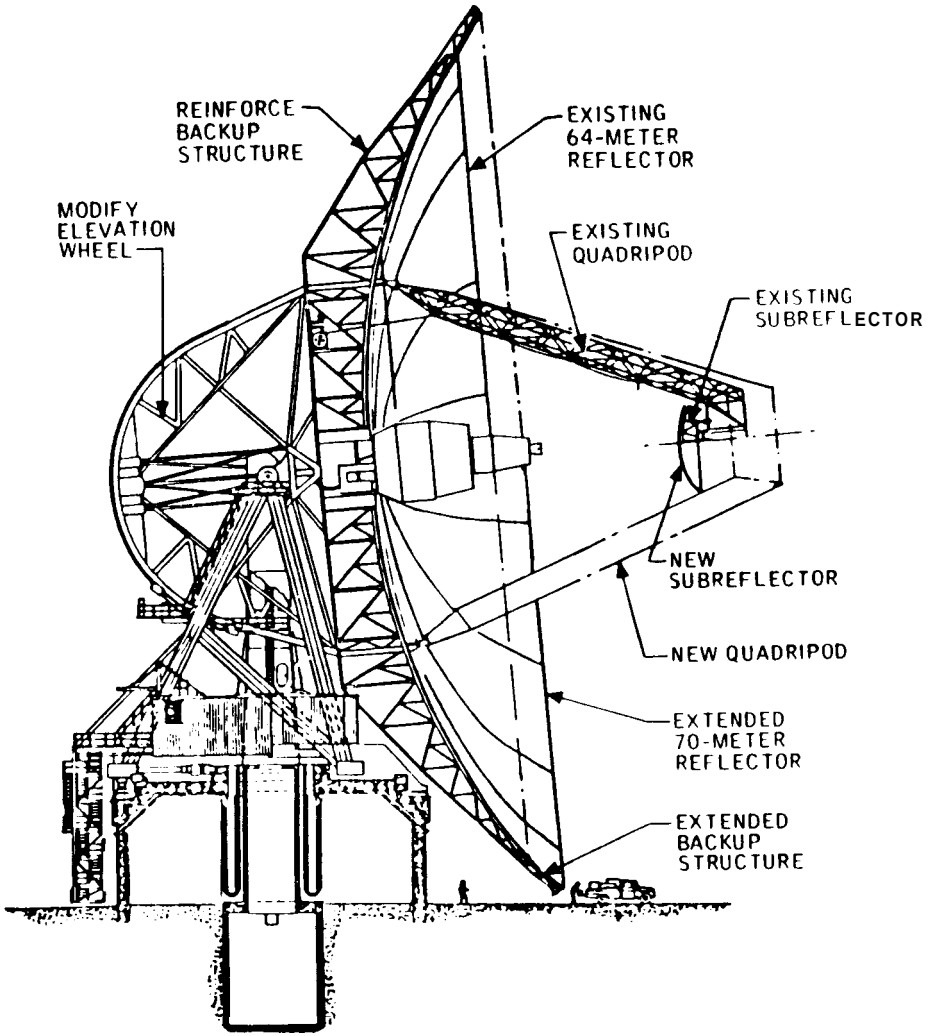


FIGURE **3**

VARIOUS LOCATIONS
FISCAL YEAR 1986 ESTIMATES
MODIFICATION OF 64-METER ANTENNA DSS-43, CANBERRA, AUSTRALIA
LOCATION PLAN

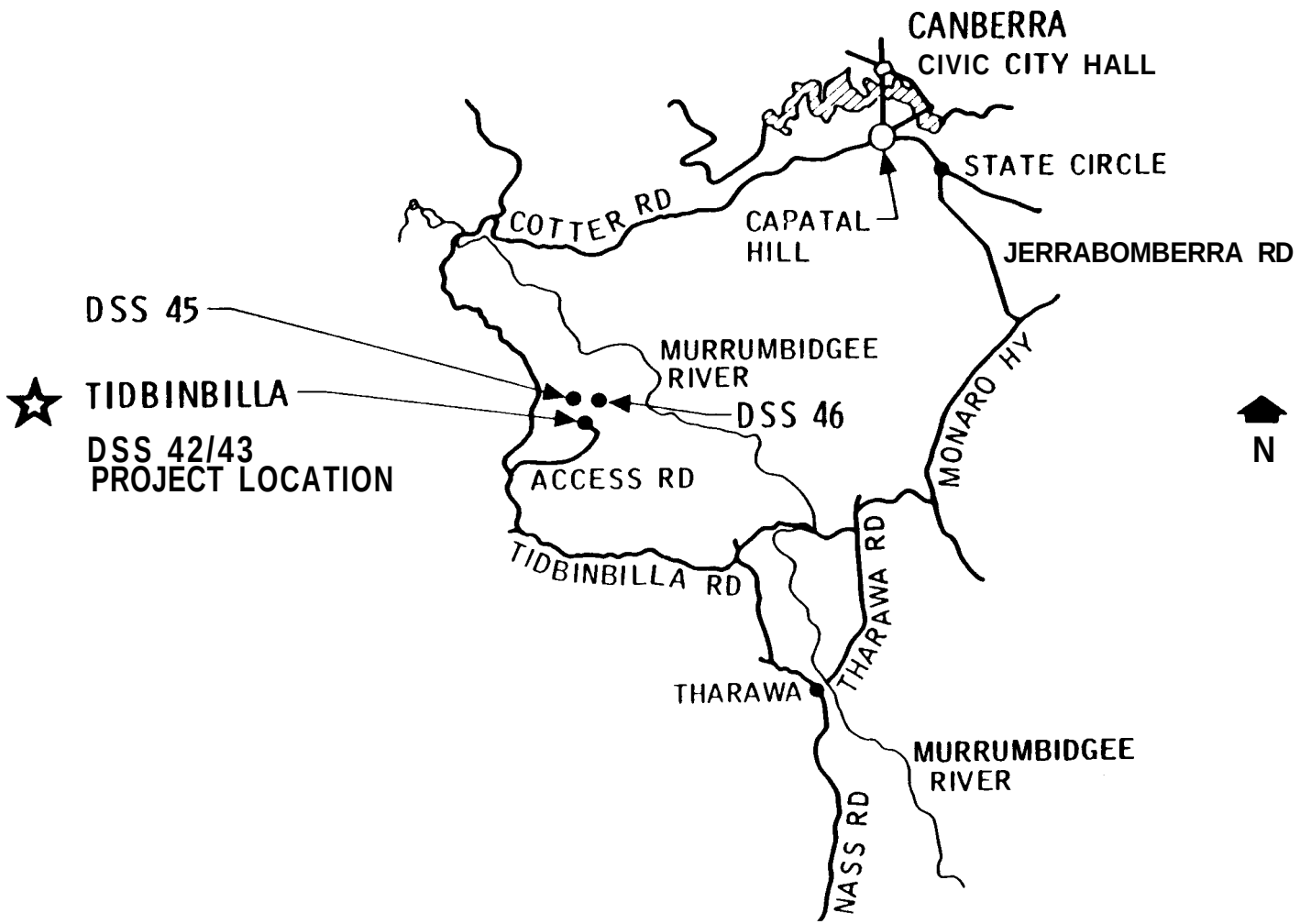


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE:	Modification of 64-Meter Antenna DSS-43, Canberra, Australia
INSTALLATION:	Jet Propulsion Laboratory
FY 1986 CoF ESTIMATE:	$8,900,000

LOCATION OF PROJECT: Canberra, Australia

COGNIZANT HEADQUARTERS OFFICE: Office of Space Tracking and Data Systems

FY 1984 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	28,000	160,000	188,000
Capitalized investment	N/A	15,558,078	15,558,078
Total	28,000	15,718,078	15,746,078

SUMMARY PURPOSE AND SCOPE:

This project provides modifications for upgrading the 64-meter, DSS-43 antenna at the Deep Space Network (DSN) complex in Canberra, Australia (Figures 1 and 2), to a 70-meter diameter, higher efficiency antenna. This upgrading improves by 45 percent the communication capability in support of scientific data gathering for deep space missions, including Galileo, Venus Radar Mapper, Voyager 2 - Neptune encounter, and spacecraft traveling beyond the outer planets.

PROJECT JUSTIFICATION:

The Deep Space Network (DSN) provides tracking and two-way communications with unmanned planetary spacecraft, and supports various deep space science experiments. Spacecraft operating at increasingly greater distances from earth require additional effective ground-based antenna aperture for meeting communication thresholds and data communication capacity requirements. Upgrading to a 70-meter diameter and incorporating today's technology to increase efficiency will improve this antenna's capability for very long baseline interferometry (VLBI), radio science, radio astronomy, emergency spacecraft command transmitting, and spacecraft data telemetry. For Galileo and the Venus Radar Mapper, better VLBI improves navigation, and improved telementry provides needed support coverage and reliability for science data return. Similar modifications are planned for the 64-meter antenna at Goldstone, California in this year's program. The 64-meter antenna at Madrid, Spain is being modified to a 70-meter diameter by an FY 1985 CoF project.

Using the baseband arraying techniques, signals from different antennae can be combined to increase the effective aperture. One antenna must be above the communication threshold (the 70-meter in this case) before the technique can be applied. For the Voyager 2 - Neptune encounter in 1989, the effective aperture required for receiving images at the Canberra, Australia DSN complex in the southern hemisphere requires arraying one 70-meter diameter antenna and two existing 34-meter diameter antennas at X-band radio frequencies. The aperture improvement resulting from this project is also necessary for reducing losses of non-imaging science and engineering data at antenna pointing angles near the earth's horizon, and for obtaining high data rates. Upgrading this 64-meter antenna to a 70-meter diameter will also enable it to independently support spacecraft that previously would have required arraying it with a 34-meter antenna. This will reduce the overload on the 34-meter antennae. In addition, improved ground-based support capability will also reduce on-board communications des-ign requirements and costs for new spacecraft.

IMPACT OF DELAY:

This antenna in Australia must be modified as an FY 1986 project so that it can be returned to operation in time for Galileo support in 1988. The work will be phased sequentially with the modification of the 64-meter antennae at Goldstone and Spain in time for Galileo and the Voyager 2 - Neptune encounter without removing more than one antenna at a time from spacecraft support. Delay would preclude the availability of a 70-meter antenna in Australia which is necessary for these missions.

PROJECT DESCRIPTION:

The modifications (Figure 3) will incorporate state-of-the-art technology for antenna component design, fabrication, and alignment. High efficiency X-band panels will be installed over the full reflector surface. The reflector backup structure will be enlarged to a 70-meter diameter and modified for increased strength and stiffness. A new quadripod and high precision subreflector compatible with the 70-meter reflector will be installed. The elevation wheel will be reinforced for strength and stiffness and increased in weight to balance the modified reflector-subreflector assembly. A new drive and control system for the new subreflector is also included.

PROJECT COST ESTIMATE:

This cost is based on preliminary engineering and related studies.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition	---	---	---	---
Construction	---	---	---	8,900,000
Reflector panels	LS	---	---	4,000,000
Quadripod	LS	---	---	800,000
Subreflector	LS	---	---	900,000
Reflector structure and elevation wheel modifications	LS	---	---	2,800,000
Subreflector drive and control system	LS	---	---	400,000
EauiDment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				8,900,000

LIST OF RELATED GRAPHICS

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - General Arrangement

OTHER EQUIPMENT SUMMARY:

No other equipment is required to complete this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future CoF funding is required to complete this project; however, similar upgrading of the 64-meter antenna at Goldstone is also planned for this fiscal year.

VARIOUS LOCATIONS
FISCAL, YEAR 1986 ESTIMATES
MODIFICATION OF 64-METER ANTENNA DSS-43, CANBERRA, AUSTRALIA

SITE PLAN

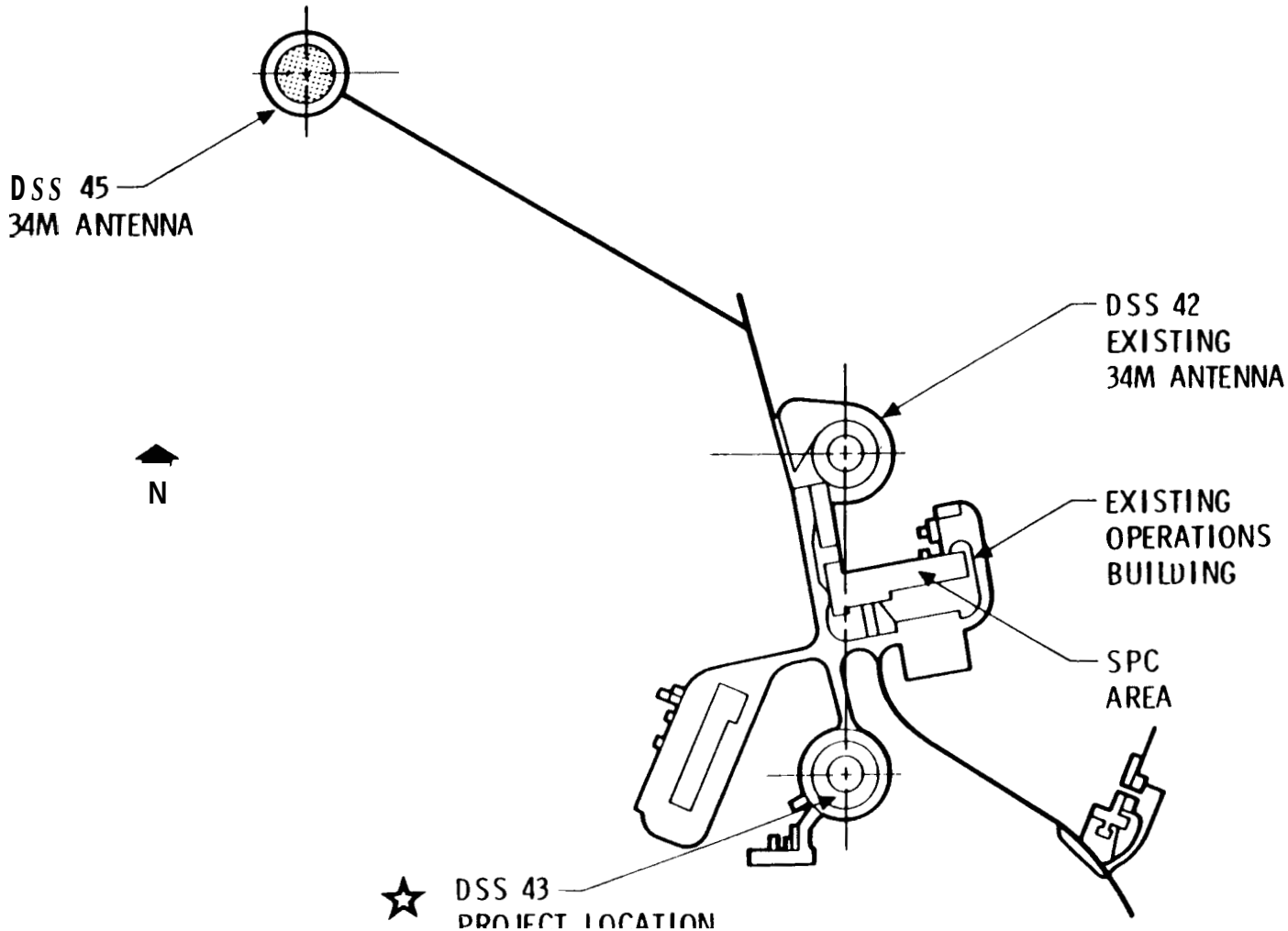


FIGURE 2

VARIOUS LOCATIONS
FISCAL YEAR 1986 ESTIMATES
MODIFICATION OF 64-METER ANTENNA DSS-43, CANBERRA, AUSTRALIA

GENERAL ARRANGEMENT

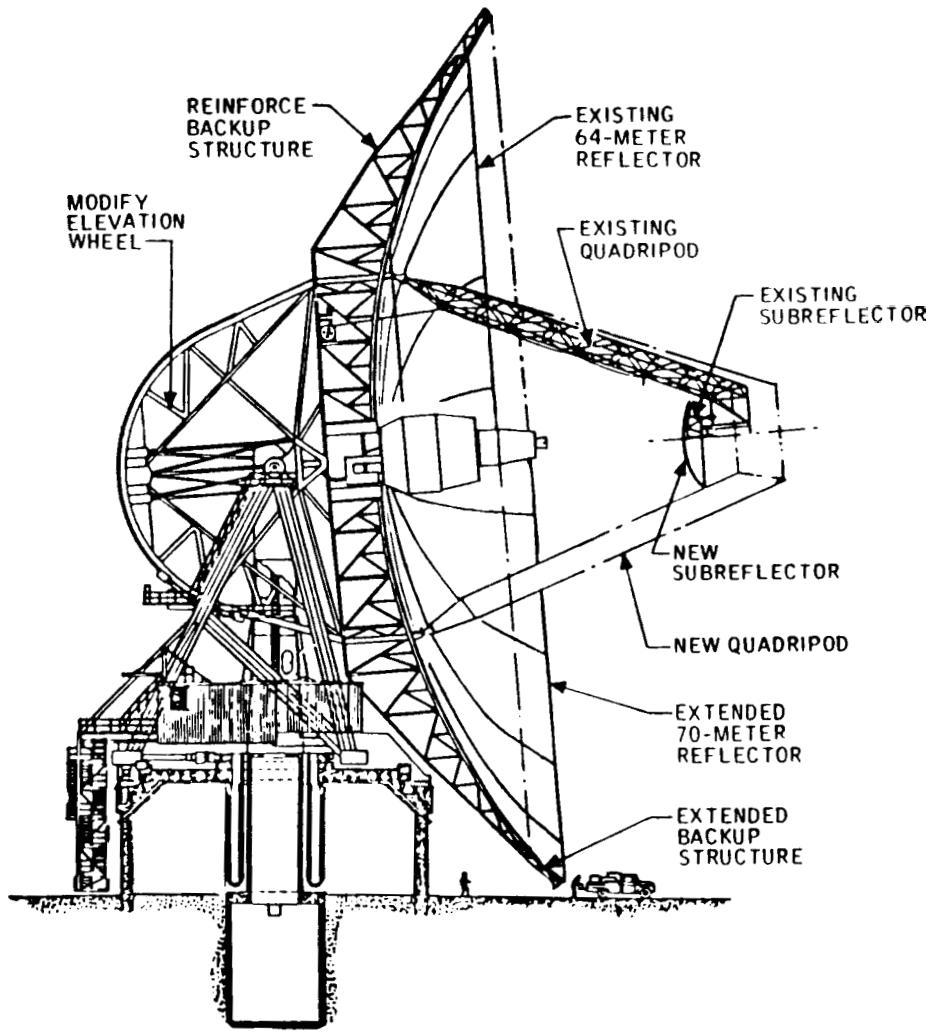


FIGURE 3

REPAIR

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

VARIOUS LOCATIONS

	Amount	Page No.
Office of Space Tracking and Data Systems:		
Modification of 64-Meter Antenna DSS-14, Goldstone, California (JPL)	8,500,000	CF 7-1
Modification of 64-Meter Antenna DSS-43, Canberra, Australia (JPL)	8,900,000	CF 7-8
Total	17,400,000	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

REPAIR

Summary of Project Amounts by Location:	Amount	Page No.
Ames Research Center	1.640. 000	CF 8-3
Dryden Flight Research Facility	430,000	CF 8-4
Goddard Space Flight Center	1.750. 000	CF 8-4
Jet Propulsion Laboratory	1.255. 000	CF 8-5
Johnson Space Center	2.105. 000	CF 8-7
Kennedy Space Center	2.245. 000	CF 8-8
Langley Research Center	3.160. 000	CF 8-10
Lewis Research Center	2.650. 000	CF 8-12
Marshall Space Flight Center	1.830. 000	CF 8-13
Michoud Assembly Facility	720. 000	CF 8-14
National Space Technology Laboratories	1.825. 000	CF 8-15
Wallops Flight Facility	2.120. 000	CF 8-16
Miscellaneous Projects Not Exceeding $150. 000 Each	270.000	CF 8-18
Total	22,000,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE:	Repair of Facilities. Not In Excess Of $750.000 Per Project
INSTALLATION:	Various Locations
	FY 1986 CoF ESTIMATE: $22,000,000
FY 1984: $17,500,000	FY 1985: $18,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for large repairs to facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in the request are those facility repair needs for FY 1986 that can be foreseen at the time of the submission of these estimates, and are not to exceed $750,000 per project. The thrust of this program is to provide a means to restore facilities or components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. The request includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown. This work also includes major preventive measures which are normally accomplished on a cyclic schedule of greater than 1 year.

PROJECT JUSTIFICATION:

A major portion of the Agency's facilities exceeds 20 years in age, and increases in repair requirements are to be expected. Maintenance and repair costs for mechanical and electrical systems in a typical building are almost three times higher during the 16- to 30-year period of a building's life than they are during the initial

15 years of beneficial occupancy. At about the 15-year point, many electrical and mechanical components reach the end of their serviceable or economic life and should be replaced in the interest of long-term economy. Continued piecemeal repair of these components usually requires more resources in the long run than replacement after the end of the economic life of the original components. Approximately 75 percent of the physical plant is in the 16- to 30-year old category.

The major thrust of this repair program, as well as the rehabilitation and modification program, is to preserve the Agency's $3.4 billion (as of September 30, 1984) physical plant. The major distinction between these classes of work is whether or not the intended work is to bring the facility and its components to a condition substantially equivalent to its designed capacity, efficiency, and capabilities. If such is the case, the work is classified as repair. An analysis of each of the projects for which funds are requested indicates that this work must be addressed and progressively accomplished. Otherwise, risks are increased and future costs of the specific work will be greater. More importantly, there will be increased breakdowns and costly unscheduled repairs required.

This program includes only facility repair work having an estimated cost not in excess of $750,000 per project. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance and repair activities, or by related routine facility work efforts that are provided for in other than CoF estimates. A repair project, estimated to cost more than $750,000, would be reflected elsewhere as a separate major line item project.

PROJECT DESCRIPTION-:

Proposed repair projects for FY 1986 totaling $22,000,000 are described under "PROJECT COST ESTIMATE." Projects estimated to cost not in excess of $150,000 have not been individually described or identified by Center, and the total request for these projects is $270,000. This repair program has been distilled from requests for FY 1986 exceeding $29,000,000, and thus represents a modest request in relation to the continuing backlog of this type of work. Based on relative urgency and expected return on investment, the projects which comprise this request are of the highest priority. Deferral of this mission-essential work would adversely impact the availability of critical facilities 2nd program schedules.

During the course of the year, it is recognized that some rearrangement of priority may be necessary. This may force a change in some of the items to be accomplished. Any such change, however, will be accomplished within total available repair resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE":

a.	Utility Systems...	10,615,000
b.	General Purpose Buildings	3,915,000
c.	Technical Buildings/Structures	2,130,000
d.	Pavements and Drainage	1,080,000
e.	Building Exteriors and Roofs	4,260,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC)..... 1,640,000

1. Repair of High Pressure Systems... ..... 720, 000

This project provides for repairs to the 3,000 psi high pressure air system, the 140 psi vacuum network, and the N-229 high pressure air storage system. Required repairs include pipe replacement, rewelding, valve replacement or repair, addition of pipe supports and anchors, and repair or replacement of controls. Failure to correct these safety deficiencies will adversely affect operation of many of the important research facilities at Ames and will allow potentially dangerous conditions to remain unattended.

2. Repair Cooling Towers N-229A and N-234A 420,000

The cooling towers to be repaired have been in operation for 25 years with only minor routine maintenance and repairs. Much of the mechanical equipment is in need of major overhaul. Structural elements are deteriorated and require major repairs or replacement. Included in this project is the repair or replacement of structural members, fill material, drift eliminators, and supports. The rotating equipment, drive trains, shafts, couplings, and other mechanical and electrical components will be overhauled. Repairs cannot be deferred without the possibility of major breakdown of the cooling towers.

3. Repair of Unitary Plan Wind Tunnel (UPWT) 500,000

This project provides for repair of various subsystems associated with the Unitary Plan Wind Tunnel (UPWT). Many of these elements are simply worn-out from 30 years of operation, and repairs are necessary to insure continued reliable facility operation. Elements to be repaired or replaced include: instrumentation including flow meters, alarms, monitors, and recorders; 3,000 psi flexible joint replacement; replacement of seven Schlieren windows in the 8 x 7 foot and 9 x 7 foot test sections; cooling water heat exchanger tubes for the main drive motors; and upgrading of the electric air heater and associated controls.

B. Dryden Flight Research Facility (DFRF)..... 430,000

1. Repair of Roofs, Various Buildings 430,000

The harsh desert environment has caused deterioration of 135,000 square feet of 20-year old roofs on eight buildings, causing numerous leaks and resulting in the need for massive repairs. Spot repairs are no longer effective nor economical. This project will provide an elastomeric protective coating on the roofs; uninsulated roofs (38,000 square feet) will receive spray urethane foam insulation, saving about one billion BTU's of energy per year. Other trim, flashing, and gutter repairs will be made as necessary.

C. Goddard Space Flight Center (GSFC)....., 1,750,000

1. Repair Electrical Distribution System 195,000

This project provides for the replacement of four obsolete, unreliable main breakers; two tie breakers; and the installation of an automatic switching system for the Logistic and Supply Facility (Building 16) and the Space and Terrestrial Applications Facility (Building 22). The electrical main breakers were installed in 1962 and 1965 and are wearing out. This worn condition could plunge the breaker into the closed position without warning. Operational problems have already occurred resulting in down-time and frequent emergency repairs. The breaker manufacturer has ceased production of replacement parts due to equipment obsolescence. Therefore, the replacement of the entire breaker unit is necessary. The installation of an automatic switching system between the 480-volt switchgears will provide interruption free power service to the computer facilities located in Building 16W.

2. Replace Roof, Logistics and Supply Facility..... 745,000

This project provides for the replacement of the roof on the Logistics and Supply Facility (Building 16W). Total roof area is approximately 105,000 square feet. Coping, flashing, gravel stop and other accessories

will be replaced as part of the project. The roof is more than 20 years old and contains numerous patches and temporary repairs. It is showing signs of general age deterioration. The proposed work will restore facility integrity and minimize potential property loss due to water damage.

3. Repair Air Handling Units..... 590,000

This project provides for the repair/replacement of 14 air handling units as follows: Research Projects Laboratory (Building 2), AHU - 1, 2, and 3; Instrument Construction and Installation Laboratory (Building 5), AHU - 1, 2, 4, 6, 8, 18, and 33; the Administration Building (Building 8), AHU 1, 2, 4, and 5. Work also includes the repair of deteriorated insulation, replacement of the associated corroded plenum, ductwork, piping, and defective dampers as necessary within the immediate vicinity of the air handling eqiupment. The existing package/built-up air handling units have been in operation since the early 1960s. Due to deterioration and corrosion resulting from their age and extensive operations, replacement of equipment components or the entire unit has become necessary. The proposed work will improve operational efficiency, reduce maintenance cost and enhance system reliability.

4. Repair Road 12 and Parking Lots... 220,000

This project provides for the repair of 4,700 square yards of deteriorated Road 12 shoulders to increase carry-off capacity of drainage swales, and to install two culverts at stragegic locations to direct storm water drainage; and for the resurfacing of the north parking lot of the Central Flight Control and Range Operations Building (Building 3), and the south parking lots of the Space and Terrestrial Applications Facility (Building 22). The existing Road 12 shoulders have been deteriorating due to poor area water drainage. The proposed work will correct the errosion problem and contain the heavy storm water run-off in the proper drainage channel. The complete re-surfacing of the parking lots is required to preclude extensive patching and maintenance. The parking areas were originally constructed with a minimal depth of asphalt and have deteriorated due to heavy usage and weathering.

D. Jet Propulsion Laboratory (JPL) 1,255,000

1. Repair Water System, Edwards Test Station (ETS)..... 230,000

This project provides for the replacement of approximately 2,135 feet of 6-inch water main. The existing 6-inch and 4-inch lines serving the domestic and fire needs in the test stand area will be replaced with 700 feet of 8-inch line to meet the fire requirements for the buildings as well as the fire hydrants in the central control building area, three of which will be replaced.

Edwards Air Force Base provides water to the ETS through a service line that loops the perimeter road of ET'S. The southern edge of this loop is undersized and the quantity of water which can be delivered to the test stand area is not adequate to meet fire safety requirements. The existing galvanized piping is over twenty-five years old and has reached the end of its design life. Three leaks in the Edwards Test Station's water system have occurred within the last year. These leaks had to be repaired using sleeves because the remaining wall material was too fragile for normal spot patching.

2. Replace Lighting, Various Buildings 365,000

This project provides for the replacement of approximately 900 obsolete, inefficient and deteriorated light fixtures at JPL. The work will standardize the light fixture types and improve the lighting levels in Buildings 85, 111, 185, and 198. These fixtures will be replaced with new single and double lamp, direct type fluorescent light fixtures with clear acrylic prismatic lenses, and energy saving ballasts and lamps. Other fixtures in these buildings will be repaired as required.

The existing fixtures are 25 to 30 years old; the plastic lenses are discolored from age; the ballasts are deteriorated; and the associated wiring and insulation in the lamps are brittle. Because these fixtures are no longer manufactured, parts are expensive and difficult to obtain. In addition, they are indirect, ceiling-reflected type lighting fixtures providing low illumination levels. The new fixtures will increase illumination levels and decrease maintenance costs, power consumption and air conditioning loads.

3. Repair Exteriors, Various Buildings 480,000

This project provides for the exterior repair and sealing of Buildings 150, 158, 238, and the south and east walls and all trim areas of Building 125. The work includes the exterior waterproofing, caulking, and flashing around doors, windows, and other openings in these buildings. Exterior sealing of these buildings last occurred 9-16 years *ago.* The present deteriorated surfaces are overdue for recoating, repairing and other procedures necessary to restore them to a satisfactory weatherproof condition. Flashing and caulking around openings have dried out and cracked, permitting the entrance of rain water into the buildings.

4. Repair Mechanical Equipment, Space Simulator Building 180,000

This project will provide for the replacement of the existing 900 MBH boiler and 60 ton chiller of the 10-Foot Space Simulator Euilding (248) to restore the heating and cooling equipment to safe and efficient operation. The equipment is over twenty years old and is at the end of its expected useful life. Replacement parts are difficult to obtain; repairs are tedious and expensive to perform. In addition, the location of the existing boiler and chiller do not conform with the current Uniform Mechanical Code. The replacement boiler

and chiller will therefore, be housed in a new mechanical room addition with proper fire rated separations, adequate combustion air and energy saving controls.

E. Johnson Space Center (JSC) 2,105,000

1. Repair of Utility Generation and Distribution Systems 450,000

This project is part of a planned program to repair the utility systems in the Central Heating and Cooling Plant (Euilding 24), Mission Control Center (Building 30), and the Emergency Power Building (Building 48). This work includes the repair or replacement of 25 valves, 1 boiler, 2 chillers, 2 engine generators, 6 air handlers, 1 heat exchanger, and the related mechanical and electrical work. The timely repair of these generation and distribution systems is essential to maintain the reliability, efficiency, and safety of the basic site and mission support utilities of the center.

2. Repair of Heating, Ventilating, and Air Conditioning Systems, Various Buildings 475,000

This project is part of a planned program to repair heating and cooling equipment in various buildings at JSC. This work includes the repair or replacement of 40 chilled water air handler units, 10 direct expansion air handlers, 3 steam stations, 5 control air compressors, 2 condensate units, and fan assemblies. Also included are coil cleaning, damper and duct repair, suspension replacement, piping replacement, instrumentation calibration, insulating and painting of all components and ancillary equipment. The area of concentration will include Buildings 3, 13, 15, 17, 25, 32a, 33, 36, and the Thermochemical Test Area.

3. Repair of 15-kV Power Cable, Utility Tunnel System 500,000

This project provides for the repair by replacement of electric power feeder 1-7 in the utility tunnel system. The work includes the replacement of approximately 6,100 linear feet of 15-kV cable servicing buildings 1, 2, 3, 13, 14, 15, 16, 16a, and 17. This electrical power cable has been in continuous operation for the past 20 years. Recently, unscheduled outages have occurred because of faults in these cables. The defective condition of the cables indicates that replacement is required to assure electrical power reliability to the center's critical facilities.

4. Repair of Various Facilities, NASA Industrial Plant, Downey, California 480,000

This project provides for the repair of worn and obsolete facility equipment in various buildings at the NASA Industrial Plant, Downey, California, as follows: the replacement of the air conditioning equipment serving Building 061 clean room with a 30 ton unit and air distribution system; the repair of the electrical

power system in Building 001 by replacing eight electrical power panels, and the replacement of two 1,600 cubic feet per minute air compressors in Building 119. This work is required for continued manufacturing support of the Space Shuttle program. The equipment has been in service over twenty years, and now causes virtually continuous maintenance problems. Repair is necessary to maintain a reliable basic facility operation.

5. Repair Central Emergency Lighting, Various Buildings 200,000

This project is part of a phased program to replace the central station and emergency lighting systems at JSC. It includes the replacement of the deteriorated central stations and emergency lighting fixtures in buildings 5, 10, 17, 36, 44, and 49. The replacement of the emergency lighting system is necessary because the present system is over 20 years old and as evidenced during a recent unscheduled site power outage did not operate reliably. Replacement is necessary or the reliability will deteriorate to the point where personnel safety will be adversely affected.

F. Kennedy Space Center (KSC) 2,245,000

1. Repair 13.2 KV Powerline - VIC to FCA..... 300,000

This project consists of replacing 12,000 feet of' 13.2 KV cable between the Visitor Information Center (VIC) and the Frequency Control and Analysis (FCA) buildings and relocating load breaker switch 55 and oil circuit breaker 9/10. The VIC to FCA aerial cable was previously repaired in 1977 with old cable to connect the VIC and the Unified S-Band (USB) sites to a backup source of power. This cable is now unreliable and could cause serious disruptions in electrical service. Repairing this power line will provide more reliable backup to feeder 206 to prevent loss of data transmission from Houston to Firing Room-1 through USB during both testing and Shuttle operations. The heavily used VIC will also benefit by having a more reliable service.

2. Repair East 3-Cell Cooling Tower at Operations and Checkout (O&C) 535,000

This project replaces the 3-cell air conditioning cooling tower at the east end of the O&C Building. The existing 20-year old wood supports, deck, and fill have deteriorated and are too weak for normal maintenance to be effective. In addition, all the bolts holding the structure together are heavily oxidized. These repairs are necessary to maintain the critical environmental conditions necessary for cargo processing, computer support, and laboratory facilities.

3. Replace Air Handling Units and Associated Piping at the Launch Equipment Shop..... 265,000

This project provides for the replacement of six air handling units along with associated piping and two 130 ton air-cooled condensors at the Launch Equipment Shop (LES) at LC-39. The existing units in the LES have been in use since 1965 and are corroded, inefficient, unreliable and no longer capable of meeting the needs of this critical facility which is dedicated to Shuttle launch operations.

4. Repair LC-39 Press Site ~andstand..... 210,000

This project will replace wood decking; news media counters; and wood stringers with pressure treated lumber ; apply wood primers and top-coatings; sandblast steel components; apply steel primers and top-coatings and replace deteriorated electrical conduits. Weather has caused deterioration from excess moisture and subsequent dry rot. Corrosive elements have accelerated deterioration of steel components which could cause the steel structure to fail, causing possible injury to media personnel.

5. Repair Hangar "S", CCAFS..... 735,000

This project provides for the replacement/refurbishment of approximately 40,000 square feet of built-up roof, the refurbishment and upgrading of the HVAC systems, the installation of approximately 46,000 square feet of antistatic flooring in rooms 20 and 21, the refurbishment of about 5,000 square feet of other flooring, the replacement of about 25,000 square feet of ceiling, and the patching and painting of about 225,000 square feet of interior/exterior walls at Hangar "S". This hangar is over 25 years old and has deteriorated below acceptable standards. Repair is required in order to maintain the current environmental requirements of the Space Shuttle cargo processors and to extend the life of the facility.

6. Repair KSC Headquarters and O&C Building Window Seals and Precast Panel Seals.. 200,000

This project will remove exterior trim, remove old caulking, recaulk and replace trim; remove window glazing, remove rock hard putty and recaulk with new resilient glazing compound; caulk to seal and prevent opening of operable windows in both buildings. The Operations and Checkout (O&C) building will also have the tops and sides of the precast wall panels caulked as necessary to eliminate seepage. The deterioration has been caused by the sun and weather conditions causing caulking to harden, crack and pull away from window frame materials thus allowing water intrusion to the building interior and structural components from one third of the windows. All operable windows have deteriorated seals and will be sealed shut to prevent loss of conditioned air.

G. Lannley Research Center (LaRC) 3,160,000

1. Repairs to High Pressure Air and Hydraulic Piping in the Unitary Wind Tunnel..... 500,000

This project provides for repairs to the high pressure air and hydraulic piping and system components which serve the Unitary Wind Tunnel (Building 1251). These systems include the 300 psi and 1800 psi air systems, the 600 psi and 2000 psi hydraulic systems, and the tunnel shell. The work includes replacement of all defective components, radiographic inspection of welds, and repair of defective welds that were identified under LaRC's pressure system recertification program.

2. Replace Transformer "M" in Taylor Road Substation.... 170,000

This project provides for the replacement of transformer "M" with a new transformer of a similar design. The work includes removal of existing equipment, terminations, furnishing and installing the new transformer and necessary testing after the installation is completed. Dielectric tests indicate that the existing transformer is weak and no longer reliable enough to satisfy load requirements.

3. Repairs to the 7-Inch High Temperature Tunnel..... 175,000

This project provides for repairs to the 7-Inch High Temperature Tunnel. The work to be accomplished under this project includes: repairs to the windows, doors, and roof of the building housing the 7-inch tunnel; replacement of' the high pressure air and fuel storage bottles and bottle foundations; and installing a new high pressure methane supply line. The existing facility and systems are over 25 years old and major repair or replacement is needed to restore to original capabilities. Efficiency levels will be improved from current derated values.

4. Repair Potable Water Piping, West Area, Phase VI. 450,000

This project provides for the replacement of approximately 9,100 linear feet of existing 8-inch and 6-inch cast iron water piping with PVC pipe. The lines to be replaced are as follows: 8-inch line running north on Freeman Road from Ames Road to Bush Road; 8-inch line running east from Freeman Road to point of tie-in near Building 1199; 8-inch line running from Doolittle Road, east and north, on Bush Road to Hunsaker Road, and west and south on Hunsaker Road back to the point of the tie-in near Building 1155; and 8-inch line from an existing back-flow preventer behind Building 114G running to Building 1215. After 25 years of operation, corrosion has caused many leaks to develop past the point of minor spot repair, and public health limits are often exceeded due to the pipe corrosion levels.

5. Replace Air-conditioning Systems, Various Facilities..... 590,000

This project provides for the replacement of HVAC systems in Buildings 1201, 1212, 1213, 1230 and 1232. The work to be accomplished includes replacement of absorption chillers, seven HVAC units ranging from 12 to 45 tons, and two 100 ton chiller systems. The existing equipment will be removed, interconnecting piping, wiring, controls, and ductwork will be modified and new units installed. The equipment to be replaced is becoming more of a maintenance burden with each passing year; parts are hard to find, and downtime is expensive as well as disruptive to operations. New equipment will be more efficient and state-of-the-art.

6. Repairs to High Pressure Air Piping in the Building 1221 Complex 450,000

This project provides for the repair of high pressure air distribution piping in Building 1221. The work to be accomplished includes the radiographic inspection and repair of defective welds, piping, and fittings. The piping and components to be replaced were identified as defective under LaRC's pressure recertification program.

7. Repair Exterior Walls and Windows, Various Facilities..... 515,000

This project will repair the exterior walls and windows of Buildings 1244, 1225, and 1232A. These buildings will be repaired with spandrel glass insulated panels, metal insulated panels, and insulating windows with a thermal break. Water and air leakage have reduced each facility's effectiveness and repair is needed to make each more weathertight and more energy efficient.

8. Repairs to Pavement, West Area 310,000

This project provides for repairs to the following paved areas: Ames Road from Durand Road to Freeman Road; Freeman Road from Stratton Road to Hunsaker Road; Moffett Road from Marvin Road to Ames Road and 600 feet running east of Taylor Road; Taylor Road from Stratton Road to Ames Road; and Doolittle Road from Ames Road to Bush Road. Typical repairs consist of cutting out badly deteriorated areas and repaving with portland cement concrete, cleaning, filling and sealing open joints and cracks, and completely replacing areas where base failure has occurred. Natural aging of the asphalt due to cyclic weather conditions has caused progressive deterioration over the years. This repair will restore the roadways to safe highway conditions.

H. Lewis Research Center (LeRC) 2,650,000

1. Repair of Plum Brook Reactor Complex Facilities..... 340,000

This project provides for the repair of approximately 66,000 square feet of roof on six buildings at the Plum Brook Reactor Complex. The work also includes the tuckpointing, waterproofing and painting of the exterior surfaces for these buildings. The exterior repair of the various buildings in the Reactor Complex is critically important to the safe containment of radioactivity on site resulting from over 10 years of nuclear reactor operation.

2. Repair of the 150 PSIG Combustion Air System 400,000

This project will provide major repairs to components of the 150 psig combustion air system at Lewis. The work involves demolition of the deteriorated piping between Refrigeration Building 9 and Icing Research Tunnel Buiding 11 and the replacement of new 150 psig piping and valves. Also to be accomplished are repairs of the air inlet structure in the Central Air Equipment Building 64 and repair of piping supports for the 150 psig line between Engine Research building 5 and Central Air Equipment Building 64. Components of this air system have been in use for approximately 30 years. Normal wear/corrosion of piping and components in the 150 psig combustion air system has created conditions which require major repairs/replacement to assure structural adequacy and continued safe operating conditions. This system is necessary to supply process fluids which are critical to accomplishment of research tasks throughout the Center. The repair work will also recertify the pressure vessels and pressurized systems. This work is necessary to preserve system safety, integrity, reliability, and availability.

3. Repair of Water Distribution System 460,000

This project provides for the repair of the existing domestic water distribution systems in the central/western portion of the Lewis complex to insure separation of potable and non-potable water systems. The work includes the removal of the domestic water system and installation of new pipe, valves, fittings, insulation, and backflow prevention devices. In order to maintain a safe and protected potable water distribution system it is essential to keep the two systems separate. The project will remove the potential hazard created by cross-connections between the two water systems and the possibility of back-siphoning.

4. Repair of Combustion Air System at Central Air Equipment Building (64) 700,000

This project consists of the repair and replacement of deteriorated combustion air systems including 1350 linear feet of damaged thermal insulation for 24- to 48-inch distribution piping and four large diameter

(36- to 48-inch) valves. This work corrects deteriorated conditions and restores required performance characteristics to the combustion air system. Stringent operating requirements have made it necessary to provide a more positive isolation between sections of air lines that are operating under different conditions. Damaged insulation permits moisture and oil saturation, thereby reducing insulation effectiveness and creating a potential fire hazard. This repair work will improve safety posture and reduce system power consumption.

5. Repair Roofs, Various Buildings 350,000

This project consists of the repair of 46,000 square feet of roofing on Flight Research Building 4, 21,000 square feet of roof on Engine Test Building 125, and 4,000 square feet on Heater Building 126 at the Lewis Research Center. The work includes removal of some portions of roofs down to the roof deck and replacement as required. Roof penetrations will be reconstructed to meet current standards. Obsolete roof equipment, out of service and no longer needed, will be removed. A Class A Fire Underwriters approved roofing system will be installed with the necessary roof insulation to meet ASHRE standards. Roof surfaces in pedestrian traffic areas will be protected with roof walkways. These roofs, despite periodic routine maintenance, have now deteriorated to a point where extensive repair is necessary. The roofs are over 20 years old and repairs are required to prevent damage to the building structures and equipment.

6. Repair of Emergency Isolation Valves... 400,000

This project provides for repair of isolation valves in the utility service systems at Lewis Research Center to minimize the extent of system shut-downs. These valves are critical to systems operations and must be closed to isolate various sections of the systems. This isolation is necessary to permit servicing of portions of the system without shutting the entire system down. Recent incidents which required closing of several 40-year old isolation valves revealed that the values did not stop the flow. This required the closing of many more valves than should have been necessary to isolate the area, thereby shutting down a much larger segment of the overall utility service system. This problem will be solved by repairing 17 distribution routing valves ranging in size from IO-inch to 36-inch for the altitude exhaust and cooling tower water systems.

I. Marshall Space Flight Center (MSFC) 1.830.000

1. Repair Pressure Vessels. 665,000

This project provides for repair of pressure vessel defects identified during a center survey of the pressure systems. Two large gaseous nitrogen pressure vessels (one 5,000 PSI and the other 8,000 PSI) and one high pressure air vessel will be repaired. These pressure vessels store a large volume of high pressure gases that suppport test programs such as Shuttle turbine blade testing, Space Shuttle Main Engine (SSME) chamber

life verification, and high pressure combustion technology. This is the initial phase of a planned program to repair the high pressure storage systems at MSFC.

2. Repair High Pressure Piping 735,000

This project provides for the replacement of old high pressure piping systems. Work includes the replacement of approximately 2,000 linear feet of 1 1/2 inch pressure gaseous nitrogen (GN_2) pipelines serving industrial buildings 4705, 4707, and 4747. Also included is the replacement of 4,000 linear feet of high pressure GH_2 pipelines serving Test Stands 116 and 500. This project is part of a plan to repair deteriorating pipeline systems which support vital laboratory and testing activities at the center. This effort will eliminate potential hazards due to corrosion and possible leakage that can occur adjacent to inhabited buildings. These 25 to 30 year old systems are exceeding their design life and increasing failure rates are being experienced.

3. Repair Roof, Various Buildings 430,000

This project is part of a planned roof repair program to rectify blistering soft spots, drying out and deteriorated insulation. These roof repairs are essential to protect and preserve facility capability and to remove the threat of unscheduled interruption to MSFC operations. Work includes the repair of 116,500 square feet of roofing for buildings 4312, 4487, 4498, 4499, 4707, 4715, 4723, 4727, 4734, and 4752. This includes replacing roofs, insulation, damaged flashing; and resaturating roof surfaces to a firm smooth final finish.

J. Michoud Assembly Facility (MAF) 720,000

1. Repair Electrical Feeder #7 290,000

This project provides for the replacement of approximately 2,200 feet of underground electrical feeder cable from the East Master Substation to Substation 17B. Substation 17B supplies electrical service to the machine shop, tube fabrication area and the raw material storage area in the Main Manufacturing Building 103. The 13,800 volt feeder cable is approximately 40 years old, deteriorating, and has exceeded its expected useful life. The new feeder cable will be ethylene propylene rubber insulated cable shielded with a polyvinyl chloride jacket.

2. Repair Roadways and Parking Lots..... 430,000

This project provides a two-coat application of sealant to approximately 230,000 square yards of bituminous asphalt roadways and various parking lots. Roads to be repaired are Jupiter, Mars, Saturn, Uranus and Venus Drives. The seal coat is required to maintain usable surface conditions, lessen corrective maintenance problems, and preserve surface life cycle. In addition, improvements to the main gate access will be made to provide more efficient and safe traffic flow. This work includes providing a U-turn path through the median on the public side of the guard house and creating an additional outbound right turn lane.

K. National Space Technolony Laboratories (NSTL) 1.825.000

1. Repair of High-Pressure Gas (HPG) and Cryogenic Distribution System Components 450,000

This project provides for continuation of a multiyear plan to repair the HPG and cryogenic system components within the Space Shuttle Main Engine (SSME) complex, cross-country HPG systems, and base facilities. Many components in the HPG and cryogenic systems are over 20 years old and have been subjected to severe use and stress, including submersion, electrolytic corrosion, and periodic removal and chemical cleaning during system maintenance. Many of the components are obsolete and spare parts which cannot be acquired must be fabricated. With the extremely high operating pressures, in addition to normal wear and tear, continued deterioration constitutes a safety hazard to both personnel and equipment. The work will include the following: component disassembly, cleaning and repair; reassembly and installation; and system certification on completion of installation activities. Obsolete and unserviceable valves and regulators will be replaced. The components to be repaired include 20 pressure regulator valves, 50 relief valves, 36 miscellaneous valves, and other related components.

2. Repair of High Pressure Industrial Water (HPIW) and Electrical Power Generator Diesel System 330,000

This project provides for the inspection and overhaul of eight of the ten 4660 horse power - 16 cylinder diesel engines that drive the HPIW pumps and the four diesel engines on the electric power generators that support the Space Shuttle Main Engine test area. Work will include engine diagnostic testing and servicing to the injector systems, bearing, driver, coupling and valves. The HPIW pump housing and impellers will also be inspected and repaired as required. The diesel engines will require a 1,000 hour inspection in 1986. Recent inspection of three HPIW diesels indicated excessive wear in two of the diesels which resulted in the replacement of two sets of crank shaft main bearings.

3. Repair of SSME Test Facility Water Chilling System 455,000

This project provides for replacing existing high temperature hot water absorption chillers with two electrically driven chillers. The chillers provide environmental cooling to the Space Shuttle Main Engine (SSME) test stands and control center. The absorption units which have been in continuous use for approximately twenty years, are approaching the end of their economic life, are deteriorated, and have required extensive repairs during the last five years. Work includes the installation of two 150 ton refrigeration capacity chiller units and associated plumbing, piping, and electrical power systems modifications.

4. Replacement of Chiller Units..... 590,000

This project provides for the replacement of two 225-ton absorption chiller units in Building 1105 (the Environmental Laboratory) with two 225-ton electrically driven chiller units. Necessary pumping, piping and control systems to accommodate the new chiller units will also be provided. The chillers provide environmental cooling to the laboratory spaces, the photo services laboratory, and office space within Building 1105. The absorption units have been in continuous use for more than eighteen years. Significant repairs and modifications have been made during the last five years to maintain them in satisfactry operating condition. Two similar units in other buildings have failed in the last three years because of deterioration due to age. Replacement of the absorption units with electrical driven units will provide an energy efficient and cost effective system in providing the services to mission support facilities.

L. Wallops Fliaht Facility (WFF) 2.120.000

1. Repair of Electrical Distribution System 400,000

This project will correct environmental deterioration of the electrical distribution system on the Main Base and the Island. The work includes cleaning, lubrication and instrument calibration of the main switchgear; replacement of poles, insulators, and lightning arrestors; cleaning, repair of cases, filtering and dielectric testing of oil and replacement of old and dangerously weather damaged transformers; and installation of sectionalizing switches. This electrical system provides the distribution, protection and control of electrical power for the entire Wallops Flight Facility. Dust and dirt and the salt air weathering has caused excessive deterioration. This work will increase the efficiency of the electrical system and existing "Y" splices to allow isolation of primary cables.

2. Repair Air Handling Units... 260,000

This project provides for the upgrading and repair of the heating, ventilating, and air-conditioning system (HVAC) serving Building W-100; replacement of the HVAC equipment in Building 2-43; repair and modification to Hangar F-10, and D-1 HVAC equipment; and new ventilation and heating/cooling equipment in the presently underserved second floor office areas of Buildings F-10 and D-1. This work will increase personnel comfort, reduce the current high level of maintenance required to keep the existing systems operational, reduce energy costs by the use of energy efficient equipment, and bring the office areas of Building F-10 and D-1 into compliance with current ventilation standards. The HVAC systems serving Building 2-43 and W-100 are 15 and 20 years old, respectively, and have deteriorated past the point of repair due to corrosive salt atmosphere. These systems must also be reinforced to take advantage of current conservation techniques. The air handling units serving the hangar area of Building D-1 are 40 years old and must be modified and upgraded to meet the minimum environmental control requirements associated with the exacting work of aircraft maintenance. Controls must also be redesigned for increased energy efficiency. The HVAC systems serving the office areas of Building D-1 and the north wing of building F-10 do not meet current ventilation standards and new air handling systems must be installed to satisfy the requirements.

3. Repair of Airfield Lighting System 360,000

This project provides for the repair and upgrading of the existing lighting systems on runways 10-28 and 04-22. The existing system on runway 10-28 is 20 years old and has direct burial cables and transformers. The system on runway 04-22 is 12 years old with direct burial cables and transformers in the light bases. One-third of the cable on runway 10-28 has already been replaced and the balance on both runways has deteriorated to the extent that it cannot be maintained without replacement. This project provides for the removal of the direct burial cables and replacement with cables installed in buried, rigid non-metallic conduit. This will facilitate access to the underground lighting cables and provide for increased protection.

4. Repair of Hangar Doors and Roof of the Range Control Evaluation Facilities... 550,000

This project provides for the replacement of the hangar door and area roof (approximately 40,000 square feet) including coping, flashing, downspouts and other accessories of the Range Control Facility N-159. Also included is the repair of the hangar doors on Buildings D-1. Door repairs consist of replacement of weatherseals, reworking of the drive and rail systems, and refinishing the doors and adjacent wall surfaces within the hangar. The existing roof of N-159 is over 20 years old and contains numerous patches and temporary repairs. The heavy traffic associated with maintenance work on the roof has resulted in frequent leaks and deterioration. The

hangar doors on Building D-1 were installed in 1945 and in 1959 on Building N-159. The mechanical closure systems malfunction frequently and are hard to maintain. The door seals have deteriorated to the point where the environment necessary for critical aircraft maintenance work cannot be sustained. Resultant energy costs are excessive and will be substantially reduced by this **work.**

5. Repair of Roads and Paved Surfaces..... 550,000

This project provides for the repair of existing pavement deficiencies on both Wallops Island and Main Base streets, and paved areas. The project consists of the site and civil work necessary to repair the existing spalling, broken pavement slabs, potholes, failed pavement slab joints; to correct poor drainage and to clean and seal joints and cracks. When the repairs to the pavement are complete, the repaired portions of pavement will receive a bituminous overlay of a leveling course and wear course. The project also includes the earthwork and landscaping necessary to provide drainage swails and ditches adjacent to the repaired pavement areas. These repairs are necessary to correct settlement, protect the pavement base, prevent water penetration, and provide acceptable riding surfaces.

MISCELLANEOUS PROJECTS LESS THAN $150.000 EACH..... 270,000

TOTAL..... 22,000,000

FUTURE CoF ESTIMATED FUNDING REOUIRED TO COMPLETE THIS PROJECT:

An estimated $20,000,000 to $25,000,000 per year will be rquired for the continuation of this essential repair program.

REHABILITATION
AND MODIFICATION
OF FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

REHABILITATION AND MODIFICATION

Summary of Project Amounts by Location:	Amount	Pane No.
Ames Research Center	2.250. 000	CF 9–3
Dryden Flight Research Facility	635. 000	CF 9–4
Goddard Space Flight Center	1.295. 000	CF 9–5
Jet Propulsion Laboratory	2.440. 000	CF 9–6
Johnson Space Center	2.650. 000	CF 9–9
Kennedy Space Center	2.380. 000	CF 9–10
Langley Research Center	2.050. 000	CF 9–12
Lewis Research Center	2.840. 000	CF 9–14
Marshall Space Flight Center	2.755. 000	CF 9–16
Michoud Assembly Facility	1.875. 000	CF 9–17
National Space Technology Laboratories	1.415. 000	CF 9–18
Wallops Flight Facility	2.085. 000	CF 9–19
Various Locations	660. 000	CF 9–22
Miscellaneous Projects Not Exceeding $150, 000 Each	1.670 .000	CF 9–22
Total	27 ,000 .000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE:	Rehabilitation and Modification of Facilities at Various Locations, Not In Excess Of $750,000 Per Project
INSTALLATION:	Various Locations
	FY 1986 CoF ESTIMATE: $27,000,000

FY 1984: $21,500,000	FY 1985: $22,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for the rehabilitation and modification of facilities at NASA field installations and Government-owned industrial plants supporting NASA activities. Included in this request are those facility rehabilitation and modification needs for FY 1986 that have been fully identified at the time of the submission of these estimates, and are estimated not to exceed $750,000 per project. The purpose of this program is to restore or enhance the condition of a facility so that it can more effectively accomplish its designated purpose or increase its functional capability.

PROJECT JUSTIFICATION:

Based on the initial investment costs, the NASA Capital Type Property totals approximately $6.9 billion (September 30, 1984), of which the physical plant comprises some $3.4 billion. A continuing program of rehabilitation and modification of these facilities is required to:

a. Protect the capital investment in these facilities by minimizing the cumulative effects of wear and deterioration.

b. Ensure that these facilities are continuously available and that they operate at peak efficiency.

c. Improve the capabilities and usefulness of these facilities and thereby mitigate the effects of obsolescence.

d. Provide a better and safer environment for all personnel.

This program includes only facility rehabilitation and modification work having an estimated cost not in excess of $750,000. The work is of such a nature and magnitude that it cannot be accomplished by routine day-to-day facility maintenance or by related routine facility work efforts that are provided for in other than CoF estimates.

PROJECT:

Proposed rehabilitation and modification projects for FY 1986 totaling $27,000,000 are described under "PROJECT COST ESTIMATE." Only' those projects estimated to cost less than $150,000 have not been individually described or identified by Center. The total cost for these miscellaneous projects is $1,670,000. The total program of $27,000,000 has been distilled from requests of approximately $39,000,000 and represents only a modest request in relation to the backlog of this type of work. Based on relative urgency and expected return on investment, the projects which comprise this request are the highest priority requirements. Deferral of this mission-essential work would adversely impact the availability of critical facilities, program schedules, and energy conservation objectives.

During the course of the year, some rearrangement of priorities may be necessary. This may force a change in some of the items to be accomplished. Any such change will be accomplished within available resources. The following broad categories of work are described further in the "PROJECT COST ESTIMATE:"

a.	Utility Systems....	4,530,000
b.	Fire Detection/Protection Systems	2,910,000
c.	General Purpose Buildings....	4,440,000
d.	Technical Buildings/Structures	15,120,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC) 2,250,000

1. Modify High Pressure Air Distribution System. 730,000

The high pressure air distribution system was built 25 years ago and serves all major research facilities at the center. Largely through piecemeal additions and modifications over the years, the present system has no central monitoring and control station, no method to centrally control access to the system, and no way to determine the status of pressure in the overall system. This constitutes a grave safety concern. It is also a very inefficient and unreliable system. Funding of this project is the first of several increments required to modify the high pressure air system so that it will be a safe and highly reliable research support tool. This increment addresses the highest priority items and will provide a central control and monitoring station, selected critical valves, and safety oriented automatic controls for remote isolation and venting of segments of the system. Future work will provide additional valves, instrumentation, and valve control automation.

2. Modification of Mechanical Systems in 6x6-Foot Wind Tunnels 230, 000

This project will provide vibration sensors on the wind tunnel main drive motors and various compressors in the 6 X 6-foot and 14-foot wind tunnels. These sensors will detect equipment vibrations that can create a dangerous imbalance to the rotating machinery which could lead to major equipment failure. Presently, the operators rely only on manual detection of vibrations. This methold is imprecise and cannot provide the

efficiency of detection that continuous monitors can provide for early warning of potentially destructive vibrations.

3. Modifications for Safety, Various Buildings... 550,000

Seven buildings at Ames have serious fire safety deficiencies according to current National Life Safety Code requirements. Specifically, these buildings will be modified by this project to provide fire resistant enclosures and electrically actuated fire rated doors at stairwells; personnel and equipment ingress and egress; and illuminated exit signs at the stairwells, exits, and elsewhere as needed. The buildings to be modified are N-201, 202, 202A, 203, 211, 227, and 243.

4. Rehabilitation of Electrical Distribution System..... 740,000

This project will provide an additional 10 MVA, 13.8 KV transformer at the north substation with all necessary support equipment, including a 1,200-foot concrete encased duct bank, and 15 KV cable, switches and manholes. This installation will complete an electrical feeder loop to service the north end of the center, and will provide the necessary alternate looping and transfer switching required to provide back-up power in case of power interruptions caused by system maintenance, or unscheduled line failures.

B. Dryden Flight Research Facility (DFRF)..... 635,000

1. Rehabilitation of Fire Protection System 450,000

The thirty-five year old water storage and distribution system at Dryden consists of two large storage tanks, 18 and 20-inch cast iron water lines to the individual buildings, and associated valves. Severe corrosion and residue buildup has been found in the tanks. This project provides for the rehabilitation and upgrading of this existing system. Work includes total cleaning of the two existing storage tanks with replacement of failed components including major structural members, modification or replacement of two existing post indicator gate valves, installation of new concrete vaults around these gate valves, addition of new components and controls to modernize the system and provide for increased reliability, and replacement or relining of 6,200 lineal feet of pipe that has deteriorated to the point of failure.

2. Rehabilitation of Tracking Site Number 1..... 185,000

This project will provide for rehabilitation of Building 4982. The modifications are required to restore the systems and building to an acceptable level to support Shuttle operations. Modifications include refurbishment of the restrooms and several storage/fabrication areas, replacement of the roof, widening of

the existing access road to the facility, installation of a new suspended ceiling, replacement of the existing air-conditioning system with a new highly efficient heat pump system including new ductwork, installation of a new automatic power shut-off system, installation of a new fire suppression system, refurbishment of the existing fire water storage and sprinkler system, replacement of weather stripping, general replacement of floors and cabinets throughout the facility, and additional parking.

C. Goddard Space Flight Center (GSFC) 1,295,000

1. Modifications for Scientific Spacecraft Systems Data Capture and Central Data Handling Facility (23) 300,000

This project provides for the modification of 10,000 square feet of space on the fourth floor of the Data Interpretation Laboratory (Building 23). This project will provide modifications for centralized major data capture, data processing, and data storage elements to support the UARS and ISTP projects. These R&D projects require new computer equipment that cannot be accommodated without these modifications. The work includes demolition of all drywall and movable interior partitions; repair of existing raised flooring; installation of a new suspended ceiling; modification of fire detection, sprinkler, and HVAC systems; replacement of lighting fixtures to increase lighting efficiency and lighting levels; and provision of power to new computer hardware.

2. Modify the Environmental Test Laboratory (ETL) (7) 250,000

This project provides for the removal of five under utilized environmental test chambers; removal and relocation of a sixth existing environmental test chamber; removal, relocation and modification of a seventh environmental test chamber; and implementation of miscellaneous modifications to approximately 5,000 square feet of floor as required by the facility removals. The Environmental Test Laboratory was completed in 1962 with most of the thermal-vacuum chambers purchased at that time. Five of these chambers were designed based on the first generation of spacecraft with relatively simple instruments that could tolerate oil contaminated air. Hydraulic pumps are used in these chambers to create the required atmospheric conditions. These pumps are responsible for the oil contaminated atmosphere. Current and future requirements however, are for chambers that are oil-free and will not contaminate systems containing optics. After the removal of the five chambers and relocation of the other two, approximately 5,000 square feet of floor space will have been made available for pre-cleaning equipment entering the adjacent Spacecraft Checkout Area (Class 10,000 clean room), thermal-vacuum test preparations and for locating electrical and mechanical ground support equipment utilized during integrations and testing.

3. Rehabilitate and Modify Center Steam Distribution System 495,000

This project will increase the diameter of the 900 linear feet of bypass main pipe between manhole 174 to manhole 91 from a 6-inch steam/4-inch condensate to a 10-inch steam/5-inch condensate; installation of 300 linear feet of 4-inch steam/2-inch Condensate pipe between the Spacecraft Operations Facility (14) from manhole 9A; and modification to manhole 10. Portions of the existing steam distribution system are not adequately sized to provide for the increased steam demands caused by the continuing growth of the center. The expanded complex of Building 3, 13, and 14 has resulted in a need for additional steam service necessitating the installation of the new line. Additionally, the entry to steam manhole 10 has a very restrictive opening, making it a dangerous situation for workmen in this manhole. A properly sized opening with provisions for adequate personnel access and ventilation is required to eliminate this safety hazard.

4. Rehabilitate and Modify Mission Operations Computing Division (MOCD) Facility (3) 250,000

This project provides a 75-KW Power Distribution Unit (PDU) and the modification of the MOCD Computer Room 103C, and adjacent corridor N103 in the Central Flight control and Range Operations Building (3). The work includes replacement of approximately 6,800 square feet of 1' x 2' metal pan ceiling with 2' x 4' acoustic ceiling; modification of the existing sprinkler system to accommodate the new ceiling; replacement of the smoke detection system at ceiling, above ceiling, and under raised floor; replacement of the existing lighting fixtures with high efficiency type fixtures; replacement of existing emergency lighting fixtures, and modification of' overhead air distribution. The ceiling tiles in room 103C need replacement due to roof leaking for the past three years. The roof of this building is scheduled to receive major repair work prior to execution of this project. The replacement/upgrading of related systems at the ceiling level are required to improve systems reliability and to reduce maintenance costs. Computer system enhancements and new equipment require an upgraded power distribution unit to accommodate the changes.

D. Jet Propulsion Laboratory (JPL) 7,440,000

1. Modification of Multi-Mission Photographic Support Facilities 745,000

The project provides for the modification of the existing Multi-Mission Photographic Support Facilities housed on the second floor of Building 230 and in the west basement of Building 111, and the modification of the second floor of Building 156 to house expanded functions of the photographic support facilities. The existing photographic support facilities are inadequate to meet the combined demands of the upcoming Galileo project and current on-going activities. This project will increase the size and capability of the photographic processing operations at JPL to handle the Galileo project in 1987 and other photo processing programs into

the 1990s (i.e., Voyager/Uranus-Neptune, Venus Radar Mapper and Shuttle Imaging Radar). These programs require a precision photographic processing facility capable of quickly producing large quantities of photographic products to rigorus quality control standards.

Work on Euilding 230 will include improving the plumbing system in support of six Versamat automatic film processing units, upgrading the existing HVAC to provide a cleaner operating environment, and installing new cabinetry. Selected activities will be relocated to Building 156 and Building 111 will be reconfigured to develop a more functional layout of activities. The electrical and HVAC systems will be modified and rehabilitated to support specific laboratory equipment. The second floor of Building 156 will be modified to house a studio with a high ceiling, and various editing, sorting, mounting, and storage spaces for materials and equipment. A new main building entrance will also be provided.

2. Modifications for Pointing Systems and Inertial Sensors Laboratory (251)..... 180,000

This project provides for the modifications of the Pointing Systems and Inertial Sensors Laboratory, Building 251, to support the development, assembly and testing of precision pointing systems such as the Mariner Mark II Micro-step Actuator. The nitrogen gas supply system will be upgraded to allow for simultaneous line and reserve bottle usage, and a new piping distribution system installed, To serve four additional laboratories, oxygen depletion alarms and exhaust fans will be installed to remove any ambient nitrogen gas. Existing concrete pedestals will be saw-cut below the finished floor level to remove them as optical obstructions and openings will be installed in the walls to permit long baseline optical measurements. The concrete floor slab and the exterior walls will be water-proofed, and all exterior doors, windows and openings will be sealed with caulking. The HVAC lighting and other support systems will be modified to provide a vibration free area with proper temperature and humidity contamination controls, some of which are needed to support the Advanced Development Test Bed Program and the Mariner Mark II Micro-Step Actuator (pointing system) program.

3. Modification of Electrical Transformer Eianks..... 630,000

This project provides for the replacement of the 2.4 KV transformer Banks 10, 20, 34, 70, and 71, and related cables serving Buildings 74, 78, 103, 113, and 126. This is a continuing effort to further upgrade the on-site electrical distribution system by replacing sections of the obsolete 2.4 KV system with the more efficient and reliable 16.5 KV system. The existing transformers are not compatible with the overall system, have limited capacity, reduce the reliability of the networks, and jeopardize continuous service to the users. This project will replace the old equipment and minimize the downtime of unscheduled power outages and increase the system reliability. The new transformers will be sized to pick up current loads, allow the removal of existing Bank 70 (which serves Buildings 74, 78, and 113), and provide for expansion to handle future development in the area.

4. Rehabilitation of Air-conditioning System (183)..... 185,000

This project provides for modifications to the air-conditioning system in the Physical Sciences Laboratory (Building 183). This nine-story building was originally constructed as a chemistry laboratory, but now houses many diverse activities including computer equipment. The chilled water air-conditioning system is marginal as it was not designed to adequately handle the office and computer cooling loads that are now generated. The chilled water circulating system will be converted from a constant to a variable flow system, and old equipment will be replaced and/or rehabilitated. These modifications will upgrade the air-conditioning system to match the current loads and make the system more efficient and economical to maintain and operate.

5. Modification of Fire Protection Systems, Various Buildings.. 470,000

This project will provide automatic fire sprinklers and evacuation alarm systems in Buildings 149, 199, 170, 79, 80, 268, 253 and fire sprinkler systems only in Buildings 186 and 148. Each of these individual building systems will be connected to the alarm console in the fire and guard headquarters in Building 281. These proposed fire protection systems are necessary to protect approximately 130 building occupants and over $48,000,000 worth of building and equipment. Without these proposed fire protection systems to help control fire and to promptly alert occupants and fire fighting personnel, a fire in any one of these buildings could endanger the safety of the occupants and delay or destroy on-going research project work.

6. Modifications to Install Thermal Radiation Shields in Vacuum Chambers (150 & 248)..... 230,000

This project provides for the installation of thermal radiation shields between the inner cryogenic surfaces and the outer chamber walls of JPL's thermal vacuum chambers and the 25-Foot Space Simulator in Building 150, and the IO-Foot Space Simulator in Building 248. The differential temperature between the inner cryogenic surfaces and the ambient chamber wall is 390°F. This temperature difference causes excessive heat flow that is accommodated by evaporating cryogenic fluid. This evaporation wastes liquid nitrogen and raises the operating costs of the simulators. This project will reduce these losses and save $91,000 per year, resulting in a payback period of just over two years. The thermal radiation shields that will be installed will consist of 10 layers of reflective aluminized mylar with veil insulation between each layer, sewn into blankets with reflective binding material around the edges. The blankets will form a continuous reflective shield of insulation between the cryogenic surfaces and the ambient temperature chamber walls.

E. Johnson Space Center (JSC) 2.650.000

1. Modifications for Flight Control Room... 700,000

This project provides for modifications of 4,700 square feet of the second floor of the Mission Operations Wing (MOW), Building 30, for an additional flight control room. The work includes the installation of raised computer floor, as well as modifications to the electrical power, lighting, HVAC, and fire protection systems. Installation of new partitions, doors, suspended ceiling, display screens, and projection platforms is also included. These modifications are necessary to provide an additional flight control room with full mission support capability including large display screens and a tiered console area. As the flight rate increases, the new flight control room is needed to accommodate simultaneous support of multiple Shuttle flights and flight simulations.

2. Modification of Software Production and Flight Design Systems, Building 30 600,000

This project provides for modifications to the Software Production Facility (SPF) and Flight Design System (FDS) areas in Building 30 to support the installation of additional computer systems. The modification work will include partitions, raised computer floor, air-conditioning and fire protection systems. Electrical power modifications include the installation of a building transformer, conduits, grounding and related equipment. The capability of the SPF and FDS must be increased to support the increased mission rates of the Space shuttle. Additional computer equipment will be installed in these areas to provide an automated mass data storage and retrival system. The modification to the computer areas in Building 30 must be accomplished with minimal impact on the operational computer systems and be completed in time to support the installation of the additional computers in 1987.

3. Rehabilitation of Chamber B Control and Data Systems 425,000

This project provides for the rehabilitation of the 20-foot diameter Chamber B vacuum and cryogenic controls and the data acquisition system in the Space Environment Simulation Laboratory, Building 32. The rehabilitation includes replacing obsolete controllers, sensors, and transmitters required to regulate temperature and flow for the liquid nitrogen shrouds of Chamber B. Also included are electrical, mechanical, and related modifications to support the installation of a new data acquisition and control computer system. This project is required to rehabilitate the control and data system of Chamber B which supports Shuttle component and payload testing. The existing systems are obsolete and have deteriorated to a point where they are inefficient. This rehabilitation will reduce maintenance costs, equipment failure rates, and operational manpower requirements.

4. Rehabilitation of Space Environment Test Systems.. 225,000

This project provides for the rehabilitation of the space environment test systems in the Space Environment Effect Laboratory, Building 33. The rehabilitation includes the installation of a liquid nitrogen cooled shroud and controls and cryogenic pumping for Chamber D. Liquid nitrogen flow controls will be provided for Chamber E. The work also includes replacing the insulation and protective covering for cryogenic lines and related modifications to support the installation of computer for data analysis. This project is required to rehabilitate critical systems in support of Shuttle component and payload testing. The Chamber D cryogenic shroud has frequent leaks and excessive downtime. The system rehabilitation will significantly enhance the quality and efficiency of thermal vacuum testing for Shuttle and space station.

5. Modification for Data Tape Recertification..... 250,000

This project provides for the rehabilitation of approximately 720 square feet of space in the Spacecraft Systems Laboratory, Building 16 for data tape recertification. The work includes the installation of air-conditioning, electrical power, lighting, mechanical, and fire protection systems. This project is required to provide for data tape recertification in support of the Shuttle avionics and integration laboratory. Tape cleaning, evaluation, and recertification are required before tape reuse is permitted. Recertifying computer tapes at this laboratory will result in substantial savings in material and manpower.

6. Rehabilitation of Aircraft Operations Facilities, Ellington Field.. 450,000

This project is part of a planned program for the rehabilitation of aircraft operation support facilities at Ellington Field, Texas. This rehabilitation includes the replacing of transformers, panels, and related electrical power systems. The mechanical work includes replacing air handlers, boilers, air compressors, and exhaust fans. Also included is the rehabilitation of two warehouses, installation of fire protection systems and the relocation of the aircraft washrack. This project is needed because these facilities have been in continuous use since 1942 with minimal maintenance. It is now necessary to upgrade these facilities so that they can be used to support manned spaceflight programs.

F. Kennedy Space Center (KSC)..... 2,380,000

1. Operations and Checkout (O&C) Vacuum Pump Room Modifications 730,000

To accommodate currently manifested horizontally processed payloads, additional space is required in the O&C Building assembly and test (A&T) area for storage of ground support equipment and flight hardware. This project provides for modification of the vacuum pump room located on the south side of the O&C Building

A&T area to provide approximately 4,200 square feet of storage space immediately adjacent to the A&T area. The project includes raising the ceiling, removal of all apparatus in the pump room associated with the altitude chambers, providing a Class 100,000 cleanroom environment, removing non-load bearing walls between columns facing the A&T area, and leveling and sealing floors.

2. Modifications to Warehouse #2 220,000

This project provides for modifications to Warehouse 82 to accommodate selected larger items of ground support equipment (GSE) supporting horizontally processed payloads. Approximately 9,000 square feet of non-air-conditioned space is required for storage of large GSE items stored in Hangar J, Cape Canaveral Air Force Station (CCAFS). When Hangar J was assigned to the Centaur program the GSE stored there was relocated to various temporary locations on CCAFS and KSC. Now, the availability of Warehouse 82 will permit storage of the GSE in a single location near the operational area. The project includes construction of an 800-square foot loading dock and an 18-foot x 18-foot door on the east side of the building and installation of a 10-ton crane.

3. Modify Existing Launch Complex 39 Parking Area. 360,000

This project provides improvements to the LC-39 parking areas in the vicinity of the Vehicle Assembly Building (VAB) and Orbiter Processing Facility (OPF). The parking areas east and west of the OPF will be paved and improved. These parking areas are presently undrained, unpaved, and unlighted. Vehicular traffic in these areas defeat recently completed contamination control modifications and cleanliness measures that were instituted to assure compliance with established OPF High Bay cleanliness standards. These improvements will remedy this unsatisfactory situation.

4. Rehabilitate Utility Annex Chillers. 720,000

This project provides for overhauling chiller units 1 and 2 in the Utility Annex which provides air conditioning to program critical facilities such as the VAB, OPF, and the Launch Control Center (LCC). The need for this overhaul became apparent when unit 3, in continuous service since 1967 and overhauled in 1982, was found to be in very poor condition. Because the other units are the same age and have experienced the same operating times, it is anticipated that most of the evaporator tubes and condenser tubes will require replacement. Many of the replacement parts for the control panels are no longer available. The project provides for the complete overhaul of refrigeration units 1 and 2, and includes rehabilitation of the 2790 HP motors, motor control center and exciter, disassembly and cleaning of gearboxes, cleaning/inspection of heat exchangers, retubing of evaporators, compressor overhaul and part replacement as necessary and updating of control panels.

5. Rehabilitate Hangar "M" at Cape Canaveral Air Force Station..... 350,000

This project provides for the refurbishment and upgrade of existing Hangar M HVAC systems; the cleaning, sealing and painting of exterior walls; rehabilitation of mechanical systems including piping drains, collection tank, firex lines, restroom fixtures and water system; rehabilitation of electrical systems including exit signs, equipment grounding and lightning protection. This facility is over 20 years old and has deteriorated to levels beyond the capability of ordinary maintenance. This refurbishment and upgrading will achieve environmental and operational standards necessary for continued space vehicles processing.

G. Langley Research Center (LaRC) 2,050,000

1. Modifications to the 0.3 Meter Transonic Cryogenic Tunnel for Flow Quality Improvements 420,000

This project provides for a new contraction section and a three-dimensional model support system for the 0.3-meter Transonic Cryogenic Tunnel. The new contraction section will include a 14-inch long rapid diffuser, a 47-inch, two-piece cylindrical settling chamber which includes pressure-drop baffle plates, honeycomb, and screens, and a 76-inch contoured contraction cone. The incorporation of the rapid diffuser and new contraction cone will increase the contraction ratio from its present value of 9.4 to 15. Provisions are also made for the future addition of a water/air heat exchanger for ambient temperature operation of the facility. The three-dimensional model support system will include modifications to the diffuser transition section, and an angle-of-attack arc sector with appropriate drive and control system. These modifications will improve the flow quality of the tunnel and increase the research data obtainable.

2. Rehabilitation of the Aerothermal Arc Tunnels.... 500,000

This project provides for modifications to the valving and piping for each of the two 60-foot vacuum spheres and for replacement of two 3400/4250 KVA D.C. control reactors. The two 48-inch diameter vacuum valves will be replaced with valves of an improved design. The vacuum piping to each sphere will be modified to facilitate a series installation of additional valves. The function of the 3400/4250 KVA D.C. control reactors is to provide a stable power source to the arc heaters. Two of the four existing reactors are defective, difficult to maintain and cannot provide stable power.

3. Modifications to the Computer Complex and Flight Control Research Laboratory.. 415,000

This project provides for modifications to the Building 1268 Complex. These modifications include: upgrading the fire protection system in Buildings 1268, 1268A, and 1268B; installing an alternate power source

for the automatic-data-processing facilities in building 1268B; and facility modifications in Building 1268A to accommodate a computer-generated image (CGI) system. The modifications to the fire protection system includes: conversion of the sprinkler system serving Building 1268B from a dry pipe system to a wet pipe system with automatic sprinkler heads; rezoning the power control system with the fire protection system serving the computer rooms to allow for shutting off selected air handling during a fire; and upgrading the fire system annunciator panels and control sequences. The electrical switchgear serving Building 1268B will be connected to the 2.3 KV bus serving Buildings 1268 and 1268A to provide an alternate power source for the computers in Building 1268B. This modification will require the installation of a disconnect switch in the substation behind Building 1268A, a circuit breaker in the substation behind Building 1268B, and a 350-foot cable run between the two substations. Two rooms in the simulator area of Building 1268A will be modified to accommodate a new CGI system, by relocating walls, raising suspended ceilings, relocating lights, routing sprinkler piping, and upgrading the HVAC system.

4. Modifications to the Low Turbulance Pressure Tunnel..... 450,000

This project provides for modifications to the Low Turbulance Pressure Tunnel (LTPT), Building 582. The proposed modifications include the fabrication and installation of a support structure for a laser velocimetry system and the installation of a Schlieren quality window. The support structure will be installed in the plenum of the LTPT and will include a remote-controlled traversing mechanism capable of surveying a vertical and horizontal region of approxmately 16 square feet (4-feet by 4-feet). A pressure and temperature-controlled container will be installed on the support mechanism to house the laser and its optics. The new laser velocimeter system will allow for a nonintrusive instrument measuring system to measure flow properties within laminar boundary layers.

5. Rehabilitation of the Technical Library (1194)..... 265,000

This project provides for the rehabilitation of the Technical Library, Building 1194 which includes the installation of a 2,000-pound capacity elevator conforming to handicap access standards and the up-grading of two HVAC systems. Modifications to walls, floors, ceiling, and electrical service will be required to facilitate elevator installation. The second floor area of the facility will be modified for installation of insulated walls, vapor barriers, and a HVAC system designed to maintain the proper temperature and humidity conditions for a library operation.

H. Lewis Research Center (LeRC) 2,840,000

1. Modifications for Fire Protection Systems, Various Buildings 370,000

This project provides for modifications to various **buildings** for installation of smoke detection systems. The installation of smoke detection systems in these buildings will provide early warning of fires in the incipient stages, thereby enhancing fire safety and reducing fire and smoke damage. The systems will be installed in the Engine Research Complex (Buildings 5, 23, 37) and in the High Pressure Facility, Building 38. The work includes installation of detector heads and associated controls, transmitter and display panels, and emergency power backup together with necessary conduit and wire. Alarm signals will be connected to the central station protective signaling system to alert the LeRC fire station.

2. Modifications to Instrument Research Building (77) and Development Engineering Building (501) 300,000

This project provides for modifications to Buildings 77 and 501 for the installation of safety items to meet life safety requirements. Building 77 has a total floor area of 94,710 square feet on its three floors and a basement. Building 501 has a total area of 43,260 square feet on three floors plus a basement. A recent study at Lewis indicated that these buildings do not meet current building codes and standards and have many fire safety deficiencies. The modifications will provide one hour fire rated stairwell enclosures, ceiling modifications, new emergency doors, exits and lighting.

3. Modification for Fire Protection of Cooling Towers (70 & 126) 440,000

This project will provide fire protection to cooling water towers, No. 3 and No. 6 (Buildings 70 and 126) by installing a multiple zone, dry pipe, pumped sprinkler system. The cooling towers are of redwood construction and are located near other structures and buildings housing research test facilities. The proximity to other buildings and flammable construction materials make the towers susceptible to fire. Should fire occur, vital service would be disrupted to research and equipment in the Combustion Air Equipment Building Complex (Buildings 64, 65, 66, 124, and 125) and research operations in the Electric Propulsion Research Facility (Building 16). The sprinkler system **will** greatly reduce the adverse impact of any fire.

4. Modification for Master Control Facility Building (55) 240,000

This project provides for the modification of approximately 2,100 square feet of the second floor of Building 55 for use as a satellite control center. The work consists of modifications to walls, floors, ceilings and associated mechanical/electrical changes to convert the space for use as a master control station.

This facility is required to house personnel and equipment for the control and evaluations of the Advanced Communications Technology Satellite (ACTS) of the 30/20 GHz Satellite System. The scheduled launch of the ACTS requires that the construction of this facility be completed by the spring of 1987 to allow adequate time for installation, checkout and testing of equipment.

5. Rehabilitation of Exterior of Fabrication Shop (50)..... 670,000

This project provides for the rehabilitation of the exterior of the Fabrication Shop, Building 50. The work includes replacement of the corrogated asbestos siding with prefinished insulated metal panels and the replacement of the high and low bay windows with a combination of prefinished insulated metal panels and insulated fire resistive translucent panels. Fans will be installed for warm weather ventilation. The Building 50 Shop was built in 1949 and encloses approximately 40,760 square feet of floor space. The structure leaks, causing discomfort and inconvenience to the occupants and damage to the building interior and equipment. Doors are worn and are no longer weather tight. This rehabilitation will improve the overall thermal efficiencies of the building and will effectively/reduce energy consumption costs.

6. Rehabilitation of Exterior of Engineering and Supply Building (21)..... 360,000

This project provides for the rehabilitation of the exterior of Building 21. The work consists of removal of wood windows and steel sash and their replacement with opaque insulation panels or double galzed aluminum windows. Outside emergency lighting will also be added. This building houses offices located on the east side (annex) and west side of a central warehouse. The warehouse and the first floor of the west area offices of Building 21 were constructed in 1944. In 1962, a second floor was added to the west office area and the east annex added to the warehouse. The building has a gross floor area of 73,490 square feet. Exterior window rehabilitation is required to correct deteriorated conditions which are beyond normal maintenance repair. These modifications will greatly improve the overall thermal efficiency of the building and will effectively reduce energy consumption costs.

7. Rehabilitation of the Icing Research Tunnel Office and Shop Area, Building (11)..... 460,000

This project provides for the rehabilitation of the interior of the Icing Research Tunnel (IRT) Office and Shop Area, Building 11. This interior work includes the replacement of the existing air handlers, duct work and other interior mechanical systems; providing new lighting, fixtures and associated electric services; communications and safety systems; replacement of interior wood partitions with drywall; repair of interior walls; installing new ceiling and flooring systems and providing new interior finishes. Other miscellaneous rehabilitation work essential to the operational integrity of the building will also be provided. This building

is over 40 years old and has deteriorated to levels beyond the capability of ordinary maintenance. This rehabilitation work will achieve present day building standards considered necessary to effectively support IRT tunnel operations.

I. Marshall Space Flight Center..... 2,755,000

1. Rehabilitation of Automation Checkout Building.. 650,000

This project provides for rehabilitation of the 9,000-square foot of Automation Checkout Building (4436) to be used as a simulation laboratory for computer-operated hardware. The existing SSME hardware simulation laboratory located in Building 4487 is overcrowded and work space is inadequate. This project will permit consolidation of three computer systems (the Flight Cross-Assembler System, the Digital Verification System, and the SSME-HSL system) and will provide a centralized work area, improving communications and data output, minimize errors being introduced into flight software test programs, and restore efficiency to flight software verification tasks.

The work includes installing of insulation, raised floors, a ceiling, HVAC, a sprinkler system, painting, and an electrical power system. Additional space is also required for the Space Shuttle main flight engine controller hardware which will be available in 1986 as well as for future functions in support of the Space Telescope.

2. Modification to Test Stand 500..... 505,000

This project provides for the modificatons to Test Stand 500, Building 4523 and related equipment to provide for propulsion subsystem test facility. Modifications include the installation of a propulsion test bed, thrust measuring system and propellant systems. A heat exchanger will be installed to simulate waste heat in space. Also included are related modifications to the test control center, Wlilding 4561 with connecting controls and instrumentation lines. These modifications are required to support the development of hydrogen/oxygen propulsion systems. Test Stand 500 was restored to its original test capability to support technology development in engine propulsion by a prior project. This modification will tailor the test stand for sea level testing of hydrogen-oxygen engines.

3. Rehabilitate Uninterruptible Power Source, SCC..... 655,000

This project provides for the rehabilitation of the Uninterruptible Power Source (UPS) at the Slidell Computer Complex (SCC). The existing UPS system will be eleven years old and is presently a high maintenance problem because repair parts are either obsolete or difficult to obtain. The work will consist of removal of

the existing UPS system and installation of three 250 KVA UPS modules, central control panel, and interconnecting cabling to the existing battery circuit and critical bus. Related modifications will be made to the electrical power system.

4. Modification to Structures and Mechanics Laboratory 345,000

This project provides for the installation of an overhead bridge crane along with the supporting structure in the Structures and Mechanics Laboratory, Building 4619. The 5,000 pound capacity crane will support a pedestal and robotic arm that will operate over the Teleoperator/Robotics System. The crane will support the robotic arm for producing complex target motions, and assembling structures to develop a capability necessary for evaluating docking/berthing requirements in space. The robotic arm will be purchased with R&D resources. This modification is needed to support Orbital Maneuvering rendevous, Spacelab and Space Transportation Systems.

5. Modifications for Sunspot Thermal Vacuum Test Facility.. 600,000

This project provides for the modifications of the Sunspot Thermal Vacuum Test Facility in the west end of Structures and Mechanical Laboratory, Building 4619. Work includes the replacement of a LN_2 storage system to permit delivery from supplier trucks. The 10-foot diameter vacuum chamber and supporting equipment will also be modified. The Sunspot test facility is used for thermal vacuum tests of large components, systems and payloads. The chamber and supporting equipment is now 18 years old and deterioration has resulted in wasteful operation due to excessive transfer losses of LN_2 and repeated equipment failure. This project will reduce the transfer losses of LN_2 by approximately $150,000 per year.

J. Michoud Assembly Facility (MAF) 1,875,000

1. Modifications to Substation #21. 450,000

Substation #21 supplies the electrical power to Building 420 which houses the central External Tank test and checkout activities. The activities in this building require controlled temperature, humidty, and cleanliness conditions, which in turn require reliable electrical power. The existing 20-year old PCB 2,000 KVA transformer is overloaded and operates ten degrees hotter than design temperature. Its associated switchgear is very sensitive to mechanical shocks which result in frequent tripping of circuit breakers. To correct this unreliable power supply situation to Building 420, a parallel 2,000 KVA transformer with appropriate switchgear will be installed to provide an alternate power source and aleviate the overload condition.

2. Strengthen Columns, West Side Main Manufacturing Building 700,000

Recent studies indicate that during high wind conditions, a significant number of columns in the Main Manufacturing Building 103 are overstressed according to contemporary structural design standards. The studies indicate that Building 103 is "safe" below 80 mph winds; however, the American National Standards Institute (ANSI) code requires a 100 mph design standard. This project will upgrade the column system to these standards. Work includes installing steel cover plates on columns and cross bracing in several locations. Rerouting of utilities and other structual modifications will also be accomplished as necessary. Work must also be phased for minimal impact to on-going External Tank (ET) production activities.

3. Modifications for Communication Network System.. 725,000

This project will modify approximately 6,000 square feet in Wlilding 320 to accommodate communication equipment required to support the Program Support Communication Network (PSCN) and the Private Automated Branch Exchange (PABX). The PSCN includes computer data transfer, voice and viedo teleconferencing, FTC communications and fascimile services between MAF and other NASA installations. The PABX is a local area network providing telephone and data transmission within the MAF complex. Work includes providing approximately 3,200 square feet of computer type flooring, rearrangement of interior walls and related electrical, lighting, and HVAC modifications. Construction of an exterior concrete pad with electrical utilities for a satellite earth station will also be provided.

K. National Space Technology Laboratories (NSTL) 1,415,000

1. Modification to Wlilding 3202 for SSME Support. 375,000

The Space Shuttle Main Engines (SSME) are serviced and inspected in Building 3202 prior to and after each test firing on the engine test stands. Present vertical engine servicing platforms and associated services are temporary and are inadequate for long-term use. This project provides for the fabrication and installation of an elevated work station to accommodate servicing of three SSME's. The work station will be out-fitted with three service panels supplying electrical power, hydraulic fluid, helium, gaseous nitrogen and compress air.

2. Modifications to A-2 Test Stand Propellant System 685,000

This project improves the liquid hydrogen flow rates from the barge supply to the Space Shuttle Main Engine (SSME) A-2 test stand by replacing approximately 200 feet of 8-inch vacuum jacketed piping with 10-inch vacuum jacketed piping and the replacement of three motor-operated glove valves with butterfly valves. Current

piping configuration requires the use of two liquid hydrogen barges simultaneously when test durations exceed 300 seconds. These modifications will permit a single barge to support a test duration up to 510 seconds. This increased capacity is needed to accommodate new engine test requirements.

3. Modification to Various Buildings for Fire Protection..... 185,000

This project will correct present fire protection deficiencies in 14 buildings located throughout NSTL. Work includes installation of fire detection devices beneath computer raised floor areas, installation of sprinkler systems in designated locations to extend fire protection coverage, and installation of vertical and horizontal fire barriers in cable towers and tunnels. This project will provide the degree of fire protection necessary for life safety, property protection and continuity of operations in accordance with current National Fire Protection Association Code requirements.

4. Rehabilitation of Cooling Towers, Various Buildings..... 170,000

This project provides for the replacement of five air-conditioning system cooling towers with packaged cooling towers constructed of non-combustible material. The cooling towers located at Buildings 2102, 3202, 3203, 3204, and 4995 were installed during construction of the buildings in the 1963 to 1965 time period. These units are approaching the end of their economic life, are deteriorated, and require extensive repairs. In addition, the existing wood fill system in the cooling tower at Building 1200 which presents a potential fire hazard will be replaced with fire-retardant material.

L. Wallops Flight Facility (WFF)..... 2.085.000

1. Rehabilitation of Field Development Branch Laboratories (E-106)..... 420,000

Building E-106 contains the laboratories and offices of the Field Development Branch which provides the engineering and development of instruments for research applications such as laser development and ozone studies in support of a variety of space science programs. The building is over 30 years old and in very poor condition. Rehabilitation is required to stop water infiltration, reduce energy losses, provide more efficient operation of the HVAC systems, provide outside air to meet health standards, provide fire protection and handicapped access. This project will install an exterior water resistant insulation siding system, replace exterior windows with smaller thermal window units, replace exterior doors, install a fire detection and suppression system, modify the HVAC systems, and reconfigure interior partitions.

2. Rehabilitation and Modifiction of Various Towers..... 380,000

This project provides for the rehabilitation and modification of Collimation Beacon and Tower U-60, meteorological tower W-80 and construction of a 150 foot galvanized steel free-standing tower near Launch Pad No. 2 to replace a 250-foot meteorological tower that has deteriorated and is no longer usable, The rehabilitation of U-60 and W-80 includes replacement of corroded structral members, sand blasting, painting, and replacement of the deteriorated electrical service. Also included is demolition of towers Y-5 and Y-85 whose functions will be incorporated in the new meteorological tower. Tower U-60 is used in orientation of AN/FPQ-6 Radar for precision missile tracking. W-80 is used to collect high altitude wind data essential for sounding rocket launch operations at WFF. The new 150 foot tower will replace Y-85 and be equipped with three work platforms which will enable it to be used for low altitude wind measurements as well as orientation of the AN-FPQ-16 antenna. Tower Y-5 currently supports this antenna but it has deteriorated to the point where repair is no longer feasible.

3. Rehabilitation of Blockhouse No. 3 (W-20)..... 240,000

This project provides for the rehabilitation of the 25-year old concrete Blockhouse No. 3 (Building W-20). The work involved includes the replacement of main and support area roofs, rehabilitation of mechanical and lighting systems, replacement of deteriorated ceilings, interior and exterior painting, and the installation of sound proof partitions around excessively noisy mechanical equipment. Although the building is structurally sound, it does not meet environmental control and safety standards. This blockhouse must be rehabilitated to allow this facility to continue support of launches from the north launch areas, including the vandal rockets, scout launch, and sounding rocket overflow and to economically correct accelerating deterioration of building systems.

4. Rehabilitation of Radar Facility (Y-60)..... 250,000

This project provides for the rehabilitation of Radar Control Building Y-60. The work includes replacing corroded windows and exterior doors, installing insulation on all exterior walls, installing a ladies restroom, repairing damage to the concrete deck, replacing 1,000 square feet of built-up roofing, and rehabilitation of the facilities HVAC systems. Rehabilitation of this facility is required to provide adequate, watertight housing for the radar instrumentation and launch range support activities. This project is needed to prevent further corrosion of building systems, which could result in shutdown or damage to the radar system utilized in payload tracking and data acquisition.

5. Rehabilitation and Modification of Dining Facility (E-2)..... 350,000

This project provides for modifications to the Cafeteria and the Management Education Facility (MEF) dining area in Euilding E-2. Modifications will include expansion of the main dining area by 1,100 square feet into a current storage area; modifying the present serving line; altering the mechanical equipment room to accommodate expanding kitchen facilities and catering areas; and rehabilitation of the interior finishes and windows in the MEF dining area. Expansion of the main dining area is required to accommodate an increase in the personnel at WFF. Exterior windows will be replaced as an energy and maintenance conservation effort.

6. Rehabilitation of Logistics Support Facilities... 445,000

This project provides for the rehabilitation of the Program Stock Warehouse B-31 (7,400 square feet); and the Property and Supply Building F-7 (13,000 square feet); the Storage Warehouse and Sounding Rocket Cleaning Laboratory Building F-8 (11,000 square feet). The project includes replacing windows and exterior doors, refinishing interior and exterior walls, and upgrading existing mechanical and plumbing systems. Also included is the installation of new partitions and ceilings in the east office area of Building F-7, and the installation of new heating and ventilating systems in Building B-31. The exterior walls are to be insulated where economically justified and the roofing on Building B-31 is to be replaced. These 25+-year-old buildings which house the logistics operations for the WFF are deteriorating rapidly due to age and the harsh coastal environment. Rehabilitation is necessary to prevent further aging of the building systems which, in turn, would permit damage to the materials stored in these areas.

M. Various Locations 660,000

1. Modification of Power Distribution System, Goldstone, CA 660,000

This project provides diesel-generated power from the DSS-14/15 power plant to the Goldstone STDN station to enable placing the STDN power plant in standby. This reduces the operating costs through reductions in power plant staffing and more efficient use of diesel-generated power at the Goldstone complex. Further, this avoids the rehabilitation work that would otherwise be necessary to keep the STDN power plant systems operating. This work includes installation of a seven mile 12.5 KV power line between the two sites, complete with the necessary site interface equipment and controls. Critical spacecraft tracking support requires the use of diesel-generated power, because the reliability of the commercial power at this remote site in the Mojave Desert is not sufficient for this purpose. The STDN power plant will remain operable, but unattended, for providing power in emergencies if required. The estimated payback for this project is less than two years.

MISCELLANEOUS PROJECTS LESS THAN $150.000 EACH 1,670,000

TOTAL..... ..... 27.000.000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated $25,000,000 to $30,000,000 per year will be required for continuing rehabilitation and modification needs.

MINOR
CONSTRUCTION
OF FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

SUMMARY

MINOR CONSTRUCTION

Summary of Project Amounts by Location:	Amount	Pane No.
Ames Research Center	400,000	CF 10-2
Dyrden Flight Research Facility	480,000	CF 10-2
Goddard Space Flight Center,	200,000	CF 10-3
Jet Propulsion Laboratory	450,000	CF 10-3
Johnson Space Center	495,000	CF 10-4
Kennedy Space Center	2,155,000	CF 10-4
Langley Research Center	490,000	CF 10-6
Lewis Research Center	480,000	CF 10-6
Wallops Flight Facility	850,000	CF 10-7
Total	6.000 ,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE:	Minor Construction of New Facilities and Additions to Facilities. Not In Excess Of $500.000 Per Proiect
INSTALLATION:	Various Locations
	FY 1986 CoF ESTIMATE: $6,000,000
FY 1984: $4,800,000	FY 1985: $5,000,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Management

SUMMARY PURPOSE AND SCOPE:

These resources will provide for minor facility construction at NASA field installations and Government-owned industrial plants supporting NASA activities. Each project included in this program is estimated to cost not more than $500,000 and involves either the construction of new facilities or additions to facilities. The FY 1986 request of $6,000,000 will improve the usefulness of NASA's physical plant by changing the utilization of or augmenting the capabilities of various facilities. Included in this request are those programmatic and institutional projects that are essential to the accomplishment of mission objectives.

PROJECT JUSTIFICATION:

The configuration of NASA's physical plant necessarily must respond to changes in utilization and adaptations required by changes in technology or in mission needs. Demands are generated by research, development, test, and similar activities. Specific justification for each minor construction project is provided under "PROJECT COST ESTIMATE."

PROJECT DESCRIPTION:

Included in the FY 1986 minor construction program are those facility projects for institutional or technical facility needs which could be fully identified at the time of submission of this budget estimate. Items of work totalling $6,000,000 are included in this resource request and have been distilled from a list totalling over $11,000,000. Projects were selected on the basis of the relative urgency of each item and the expected return on the investment. During the course of the year, rearrangement of priorities may require changes in some of the items to be accomplished. Such changes will be accommodated within the resources allocated.

These projects represent requirements that must be met in this time frame to support institutional needs and programmatic objectives. The following listing summarizes the cost distribution by category of work:

a. Utility Systems	480,000
b. General Purpose Buildings	1,340,000
c. Technical Buildings/Structures	4,180,000

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC)	400,000
1. Construction of Addition to Cafeteria	400,000

The cafeteria at Ames Research Center is too small to adequately serve its 1,500 to 1,800 customers per day. The overcrowding and inefficient operation caused by its inadequate size and layout has contributed to adverse employee morale. This project will increase the size of the cafeteria by 5,000 square feet. The expansion will be in the food preparation, dining, serving, and storage areas which will also be modernized. The addition will permit increased quality and efficiency of food services, reduce waiting time for service, and will accommodate service to an increased number of patrons.

B. Dryden Flight Research Facility (DFRF)	480,000
1. Construction of Addition for Telemetry Processing Building (4800)	480,000

This project will provide environmentally controlled space necessary for storing magnetic data tapes and spare data processing equipment components and for development, integration, and testing of new data systems

for the aeronautical tracking range. This building houses the control rooms and data processing systems used in support of the aeronautical research flight testing experiments at DFRF. Because there is a lack of suitable storage space and data must be readily accessible for post flight mission analysis and subsequent reference, data tapes containing information from flight tests are being stored in the plenum space under the raised computer flooring in the data processing areas. Similarly, electronic spare parts are being stored in the building's air handler housings on the roof to preserve them while having them quickly available when needed. This construction adds a second floor for engineering laboratories and a third floor for operational support storage over the one-story part of the existing building. Each new floor will be 2,300 square feet. A freight elevator is to be included for safe handling of large data processing equipment including central processing units, mass storage devices, electronics racks, and other peripheral equipment now handled through building windows using cranes. A stairwell included in this addition will also improve the egress safety of areas in the existing building. This project will substantially improve the utility of this building for flight testing support.

C. Goddard Space Flight Center 200,000

1. Construction of an Addition to the Instrument Construction and Installation Lab (5)..... 200,000

The SPARTAN is a low cost, self contained, autonomous, scientific payload which will be deployed to conduct 40-hour scientific missions, and then be retrieved and returned for refurbishment and reuse. Existing facilities in Building 5 cannot handle the proposed five or more SPARTAN payloads planned for the late 1980's/early 1990's time-frame. This facility addition will provide the proper environment for integration and refurbishment of equipment. This project provides for the construction of a 2,000-square foot class 100,000 clean room addition to the north west corner of the Instrument Construction and Installation Laboratory, Building 5. The work will include required demolition, building foundations, walls to match existing walls, installation of necessary HVAC equipment, electrical distribution system, and lighting.

D. Jet Propulsion Laboratory (JPL) 450,000

1. Construction of Space Flight Hardware Storage Facility 450,000

This project provides for the construction of a 4,500-square foot storage building north of Pioneer Road, between Buildings 117 and 148. The construction will be a one-story high bay steel frame structure on a concrete floor slab with insulated, prefinished metal exterior walls and roof. The building will be equipped with a HVAC system, humidity control, lighting and fire sprinklers. A retaining wall and grade level access road are also included. This facility will be used for the on-site storage of valuable residual space flight hardware and selected ground support equipment for use on future projects. The saving and reuse of this

hardware and equipment results in significant program cost savings. As an example, residual hardware from Mariner, Viking and Voyager which is in storage, is currently planned for Venus Radar Mapper (VRM) use. JPL must now utilize high cost commercial storage facilities to meet this need.

E. Johnson Space Center (JSC) 495.000

1. Construction of Addition to Mission Control Center (30) 495,000

This project provides for the construction of a four-level addition to the northwest corner of the Mission Control Center (30) for an equipment support area. The addition will be approximately 3,500 square feet and will match the existing architecture of the building. Work includes installation of partitions, flooring, ceilings, electrical power, lighting, air-conditioning, and fire protection systems. This addition is needed to provide material and equipment, shipping, receiving, preparation, and repair support area for the Mission Operations Wing (MOW) of Building 30. The full mission utilization of the MOW has resulted in heavy use of hallways for material and equipment staging. This is operationally inefficient and is developing into a safety hazard.

F. Kennedy Space Center (KSC) 2.155.000

1. Construction of Additions to Parachute Refurbishment Facility 255,000

This project provides additions to the Parachute Refurbishment Facility, Bldg. M7-657, for additional packing and storage area. This will enable the facility to accommodate the new, larger (136-foot diameter) solid rocket booster main parachutes and also provide general improvements for other major deceleration subsystem components used on the STS. The two building additions consist of a 120-square foot addition to the east wall of the packing area to provide room for reefing line installation on the large main parachutes; and a 3,000-square foot addition with sprinklers to the southwest corner for storage, including a controlled access cage for small parts. An additional 1,900-square feet of concrete slab along the north side of the present unloading area will be provided to accommodate main parachute crane off-loading from vehicles.

2. Construction of LC-39 Preclean Area..... 165,000

This project provides for the construction of a 2,500-square foot prefabricated metal shed addition to the Propellant Laboratory and High Pressure Gas Maintenance Facility at LC-39. The preclean area is used to reclaim freon and process sampling equipment for the LC-39 high pressure gas systems. A larger precleaning area is needed to accommodate a 30 percent increase in freon recovery activity over the next two years. This requires additional freon tankage and relocation of the sampling equipment purging area. These additions are

also needed to accommodate the larger components that will be processed, such as valves measuring 6 feet by 3 feet. The project consists of enlarging and enclosing the preclean area, relocating the sampling equipment and extending the existing overhead hoist into the new area.

3. Construct Prototype Facility 425,000

This project provides for the construction of a 100-foot by 200-foot by 16-foot high pre-engineered metal building in the KSC industrial area to provide fabrication, assembly, and test areas for technology development, research and prototype project models. Presently, this work is being accomplished in an exterior area in the rear of the O&C Building designated as the Launch Equipment Test Facility (LETF). New technology, including robotics, and increased work loads require some of the assembly, fabrication and tests to be moved inside. Location of this new building must be near the LETF so that model fabrication, modification, and testing can be accomplished with ready access between LETF and engineering personnel. Project models to be developed include the Remote Umbilical and several heat transfer devices.

4. Construction of Hangar AF North Berthing Wharf.. 455,000

This project provides for an extension of the Hangar AF berthing wharf at Cape Canaveral Air Force Station (CCAFS) to permit mooring of both Solid Rocket Motor (SRM) retrieval vessels in a configuration which will allow parallel loading and off-loading activities. Presently only one vessel can be loaded or off-loaded at one time. In order to support higher launch rates it will be necessary to have simultaneous access to both vessels. The new wharf will extend north approximately 90 feet and will include an adjacent turn around area to accommodate a 60-foot long flat bed truck. A new 14-foot wide access road will be built on the north side of the Thrust Vector Control facility connecting the new wharf extension to the existing industrial bypass road.

5. Construct Robotic Addition to High Pressure Wash Facility 405,000

This project will provide an approximately 3,025-square foot addition to the existing High Pressure Wash Facility located west of Hangar AF in the industrial area of Cape Canaveral Air Force Station. A government-furnished computer controlled robot will be installed to automate the water blast process used to remove the Thermal Protection System (TPS), paint primer and sealant from Solid Rocket Booster (SRB) forward/aft skirt assemblies. The cost savings resulting from the use of the robot compared to the current manual removal method is estimated at $42,000 per Space Transportation System (STS) flight. The project includes construction of a water blast room 40-feet square and 30-feet high, contiguous support areas including a control room and mechanical room housing the high pressure pumps, 20,000 psi water pumping system, deionized water system, and a 10-ton jib crane for handling the SRB skirt assemblies.

6. Construction of Ordnance Storage Facility 450,000

This project provides for the construction of an environmentally controlled storage building to store partially built-up solid upper-stages, such as Payload Assist Modules (PAM's) and ordnances required for the Transfer Orbit Stage program. Presently, this storage is done in USAF facilities. NASA has been advised that the USAF needs these facilities for future Air Force requirements. In addition, the present USAF facilities are too small to support an increasing mission rate. This project will construct a 4,550-square foot building with two service/storage bays, each being 35 feet by 64 feet and 20 feet in height.

G. Langley Research Center (LaRC) 490.000

1. Construction of Addition to Systems Engineering Building 490,000

This project provides for the construction of a one-story addition on the north side of Building 1209. The addition consisting of approximately 8,800 square feet will provide additional office and laboratory space. Exterior finish materials will match existing face brick and window design. Necessary heating, air-conditioning, and electrical requirements will be provided. The existing office and conference space in Building 1209 is fully utilized and additional space is needed to alleviate overcrowding.

H. Lewis Research Center (LeRC) 480.000

1. Construction of Addition to Cooling Water Distribution System 480,000

This project provides for the additions to the cooling tower water distribution systems that will transfer the heating loads of the Research Analysis Laboratory (Building 42), Back Leg Cooler Facility (Building 39), and the Vertical Lift Fan Facility (Building 135) from the 10 x 10 Cooling Tower No. 5 (Building 93) to the Propulsion System Laboratory (PSL) Cooling Towers (Building 70 and 126). The work includes the installation of 1400 linear feet of 24-inch diameter piping and four (4) 24-inch diameter motor-operated valves. The present load on the 10 x 10 cooling tower water system utilizes its full capability and under certain ambient weather conditions exceeds it. This project will transfer some of the 10 x 10 Cooling Tower load to the spare capacity of the PSL cooling tower water system. This will also alleviate the present operating restrictions that must be imposed on the 10 X 10 SWT research operations.

I. Wallops Fliaht Facility (WFF) 850.000

1. Addition for Attitude Control System (ACS) Laboratory 400,GOO

This project provides for construction of 7,500 square feet of building area to house the ACS Laboratory and a payload integration area. The payload integration area will contain a positive pressure air filtration system and a monorail hoist with an approximate 30-foot hook height. The addition will be constructed using a pre-engineered metal building and will include all required electrical, HVAC, and fire protection systems. The construction of this addition will eliminate the need to transport partially integrated, sensitive payload packages and personnel to other WFF locations to complete integration. Transporting these delicate payloads subject them to dirt, vibration and increases risk of damage.

2. Construction of Mobile Equipment Refurbishment Facility 450,000

This project provides for the construction of a 6,000-square foot addition to Building F-10 and an approximate 7-foot extension to Building F-9. The F-10 addition will be a pre-engineered metal structure with one wall common to a new curtain wall to be constructed over the existing Building F-10 west hangar door. The Building F-9 extension will be to this same curtain wall and will form a total F-9/F-10 integrated structure. The new addition will include all required heating, ventilation, and electrical services. This work is necessary to provide space to maintain and perform modifications on the mobile equipment that is required to support remote range launch activities. This mobile equipment includes the telemetry, radar, and instrumentation vans, launchers, and electrical generators. This maintenance and modification function creates a high dirt content environment and is primarily performed in areas of F-10 that are also used for sounding rocket fabrication and assembly of delicate scientific payloads. These operations are incompatable. The new facility will provide increased space and a better environment within F-10 for sounding rocket fabrication and a more suitable area for mobile equipment maintenance.

TOTAL..... ..... 6.000.000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An estimated $5,000,000 to $7,000,GOO per year will be required for continuing rehabilitation and modification needs.

FACILITY PLANNING
AND
DESIGN

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1966 ESTIMATES

SUMMARY

FACILITY PLANNING & DESIGN

	Amount	Page No.
Regular Requirements:	8,150,000	
Master Planning....	250,000	CF 11-2
Sustaining Engineering Support	750,000	CF 11-2
Preliminary Engineering Reports and Related Special Engineering Support...	2,450,000	CF 11-5
Final Design.....	4,700,000	CF 11-6
Other Requirements.....	3,850,000	CF 11-6
Total.....	12,000,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1986 ESTIMATES

PROJECT TITLE: Facility Planninn and Design			
		FY 1986 CoF ESTIMATE:	12,000,000
FY 1984:	$8,600,000	FY 1985:	$12,000,000

The funds requested in this estimate are required to provide for the following advance planning and design activities related to facilities activities and projects:

a. The accomplishment of necessary development and master planning for field installations and, where not otherwise provided for, the provision of continuing engineering support and special engineering management and other services.

b. The preparation of preliminary engineering reports, cost estimates, and design and construction schedules.

c. The preparation of final construction plans, specifications, and associated cost estimates and schedules required to implement construction projects.

d. The accomplishment of facilities siting and other investigations, studies and reports.

Regular requirements encompass the basic purposes outlined above. The "other requirements," while also in support of "regular" purposes, cover those special needs related to large, complex projects or specific programs considered to represent high potential future construction requirements for which early definition is essential. The large projects require more planning and longer lead time. Much of this planning must be completed prior to inclusion of the project in a budget request.

1. REGULAR REQUIREMENTS..... 8.150.000

A. Master Planning..... 250.000

Provides for the update and development of existing master plans for the field installations. Included are facility studies, site investigations and utility services. These documents will be updated where deviations from previous plans were not recorded. Also included is the updating of the five year plan as a baseline for engineering efforts for future development.

The master plans for the NASA field centers are generally updated at four to five year intervals; the agency-wide effort is, therefore, relatively modest but constant. The master plans are invaluable as a reference document for orderly allocation of real property resources, physical correlation, and proper orientation and arrangement of land areas and facilities. Representative master planning candidates for FY 1986 are:

(1) Ames Research Center

An update of the facilities inventory base to reflect new construction, current five year planning, revisions to utility systems, and changes caused by recent reorganizations.

(2) Goddard Space Flight Center

An update of the facilities inventory base to include current use with emphasis on changes caused by recent facility planning, construction and modifications.

B. Sustaining Ennineerinn Support..... 750,000

Provisions for facility studies and specific engineering support continue in importance as evidenced in recent years, and must be given high priority throughout FY 1986. These efforts are important due to changing cost trends in construction materials and fuels; the continuing importance of energy conservation and efficiency; and the operation and maintenance costs for the physical plant.

The following items are included in the FY 1986 requirements:

(1) Advisory Board on the Built Environment

Covers annual support to the Federal Construction Council's (FCC) operations and provides for special studies that the Council will perform throughout FY 1986 to help advance the science and technology of Federal Government building and construction. The FCC is subordinate to the Advisory Board for the Built Environment, National Academy of Sciences, and its activities are supported by several Federal agencies including NASA.

(2) Utilities Services/Rates Analysis

Provides resources for the support of utilities procurement and utilities control systems. This includes, but is not limited to, technical assistance, surveillance, and recommendations with regard to utility rates, contract negotiations, systems operations, and utilities control systems. Because of the great magnitude of energy costs, these services are an annual requirement and continue to be essential.

These resources enable the Agency to insure that fair and reasonable rates are charged under its major utility contracts. Essential and valuable technical assistance is provided to our field installations so that effective negotiations can be conducted with utility companies. Several major utility contracts per year require technical assistance as utility contracts are renewed throughout the Agency.

NASA's significant ongoing investment in utility control and management systems requires a high level of technical maintenance and support. The proper function and operation of the equipment are essential in order to realize the benefits. These resources provide the high technical capabilities needed to manage the system and insure proper operation and use.

These resources will provide for an updating of our system for forecasting utility costs and rates, so that better and more reliable utility budget requirements can be established. The accuracy and credibility of forecasts impact the Agency's planning for other resources.

These and other similar utility system services are provided for by the requested resources in order to ensure technical competence and properly manage this function.

(3) Facility Operation and Maintenance Analysis

Provides for continued engineering support for implementing improvements at NASA field installations relative to manpower utilization, work control systems, preventive maintenance, facilities management and reporting systems. Improvements will also involve techniques to identify where and how increases in productivity are possible. Included in this activity are field surveys to be conducted on a priority basis at selected NASA field installations to evaluate the effectiveness of the operations and maintenance management systems.

(4) Value Engineering Cost Validations and Analyses

Provides for engineering services to improve cost-effectiveness of facility projects by subjecting project design criteria, specifications and working drawings for specific material components and systems to a detailed independent review by engineering specialists in the particular area of involvement. Also provides services necessary to accurately predict and validate facility costs which will aid in resources planning for the various field installations.

(5) Facilities Utilization Analyses

Provides for the analyses of Agency-wide facilities utilization data covering: (1) office and other types of building space; (2) designated major technical facilities; and (3) special studies comparing the utilization of technical facilities which are similar in type or capability, such as wind tunnels. Such analyses provide for: (1) insights into and development of better methods of identifying underutilized facilities; (2) improved techniques to quantify level of facilities use; and, (3) actions to improve facilities utilization. Work provides for review of each installation's inventory data base in support of the facilities utilization program. Surveys are necessary to validate the reported data in relation to a specific problem or need, and to assist in providing a credible foundation for plans to improve the utilization of facilities.

(6) Environmental Studies

Provides for the identification of potential environmental problems or the quick resolution of any related controversies at the NASA field installations. These conditions may be brought about by:

- New federal, state and local environmental regulations, emission standards and environmental manageaent planning programs that must be considered at various installations;

- Changes resulting from new or expanded program activities, new facilities, or major site expansions at NASA installations; and,

- Changes that take place in the external environmental conditions at NASA installations.

Early identification of potential environmental problems and quick resolution of these and related controversies at the installations are important. Project managers and facility planners require up-to-date, accurate information to comply with legal and regulatory requirements. For example, NASA will implement a multi-year, multi-phase, agency-wide program that will be responsive to the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and its applications to federal agencies (E.O. 12088). The program will consist of initial assessment studies, confirmation and remedial action engineering investigations, as well as the execution of the most efficient and effective remedial actions, as required.

C. Preliminary Engineering Reports and Related Special Engineering Support. 2,450,000

(1) Preliminary Engineering Reports (PER's) ..... (1,950,000)

Preparation of PER's, investigations, and project studies related to proposed facility projects in the FY 1988 and FY 1989 Construction of Facilities programs are provided for by this estimate. These reports are required to permit the early and timely developnent of the most suitable project to meet the stated programmatic and functional needs. Reports provide basic data, cost estimates and schedules relating to future budgetary proposals. This request provides for PER's; associated with proposed construction except as provided for in other requirements (paragraph 2) for Shuttle, Space Station, and Payload initiatives.

The estimated cost of PER support for FY 1988 construction projects is $1,300,000 which will permit updating of PERs for $30-35 million in construction, and the developnent of new PERs for an additional $40-50 million in projects.

An additional $650,000 has been included in this line for the completion of new PER's for approximately $30-35 million of construction projects which will be high priority candidates for inclusion in the FY 1989 Construction of Facilities program. The activity associated with FY 1989 will be confined to the highest priority candidates.

(2) Related Special Engineering Support ..... (500,000)

Investigations and project studies related to proposed facility projects to be included in the subsequent Construction of Facilities programs are provided for by this estimate. Such studies involve

documentation and validation of "as built" conditions, survey/study of present condition of such items as roofing and cooling towers, utility plant condition and operational modes, analysis and support of environmental impact assessnents and statements, and other like studies. These studies are required to allow for the timely development of projects to meet the stated functional needs and to provide basic data, cost estimates and schedules for related future budgetary proposals.

D. Final Desian..... 4,700,000

The amount requested will provide for the preparation of designs, plans, drawings, and specifications necessary for the accomplishment of projects other than Space Shuttle, Spacelab, and Payloads and the Space Station. Amounts required for those efforts are included under other requirements (paragraph 2). Projects involved are planned for inclusion in the FY 1987 and FY 1988 programs. The goal is to obtain better facilities on line earlier at a lower cost.

The request will provide for final design work associated with construction proposed for the FY 1987 Program, estimated to cost $60 to $65 million, and for $10 to $15 million of high potential projects proposed for the FY 1988 program. The amount included for FY 1987 candidates and for residual requirements of this nature which have accumulated from prior years' final design activities is $3,800,000. For FY 1988, $900,000 is included and the supporting rationale is much the same as that set out in the PER estimate.

2. OTHER REQUIREMENTS..... 3,850,000

Other facilities planning and design requirements primarily associated with specific space programs characterized by large size, long planning cycle, and/or complexity of scope are included in this particular request. These programs require a level of planning effort and length of design time beyond the more routine facility projects. These requirements must be provided beyond the regular and most recurrent facility planning and design needs.

Total. 12,000,000

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