U.S. NASA

National Aeronautics and Space Administration

Budget Estimates

FISCAL YEAR 1980

Volume I

Construction of Facilities

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

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VOLUME II

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

GENERAL STATEMENT

The Construction of Facilities (CoF) appropriation provides for contractual services for 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 1980 provide for: the continuation of prior years' endeavors in meeting the facilities requirements for the Space Shuttle and Space Shuttle payloads; construction and modification of large aeronautical research and development facilities; construction, repair, rehabilitation, and modification of other facilities to maintain, upgrade and improve the usefulness of the NASA physical plant; and facility planning and design activities.

The projects and amounts reflected in this budget estimate for Space Shuttle and Space Shuttle payloads are time sensitive to meet specific milestones. The program for FY 1980 includes the fourth increment of funding for two large aeronautical facilities, the construction of a National Transonic Facility at the Langley Research Center and modification of the 40- x 80-Foot Subsonic Wind Tunnel at the Ames Research Center. Requirements for these and other aeronautical research and technology facilities are outlined in detail in the justifications that follow.

The FY 1980 program continues to meet the objectives of preserving and enhancing the capabilities and usefulness of existing facilities and to ensure safe economical and efficient use of the NASA physical plant. This request continues the necessary Rehabilitation and Modification Program as in prior years and introduces a new 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. This program also includes projects which continue NASA efforts to reduce the consumption of energy.

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 drawings and bid specifications.

The request for FY 1980 is $157,600,000, an increase of $10,100,000 above the appropriation for FY 1979. Outlays are estimated to be $155,200,000 in FY 1980, an increase of $1,700,000 over the estimate for FY 1979.

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 National Aeronautics and Space Administration, and for the acquisition or condemnation of real property, as authorized by law, [$147,500,000] *$157,600,000,* to remain available until September 30, [1981] *1982*: *Provided*, That, notwithstanding the limitation on the availability of funds appropriated under this head 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. ***(42 U.S.C. 2451, et. seq.; Department of Housing and Urban Development—Independent Agencies Appropriation Act, 1979; additional authoruing legislation to be proposed.)***

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

Program and Financing (in thousands of dollars)

Identification code 80-0107-0-1-999		Budget plan (amounts for construction of facilities actions programed)			Costs and obligations		
		1978 actual	1979 estimate	1980 estimate	1978 actual	1979 estimate	1980 estimate
	Program by activities:						
	Direct program:						
	1. Space transportation systems	64,880	31,070	31.450	50,081	54,600	37,800
	2. Scientific investigations in space	6,410		4,250	8.131	5.500	3.200
	3. Space and terrestrial applications	3.100			10	1,700	
	4. Space research and technology				663	200	
	5. Aeronautical research and technology	38,400	76,530	62,500	22.951	49.800	70.500
	7. Supporting activity	49.550	39,900	59,400	39,293	47.000	54,300
	Total direct program costs, funded	162,340	147,500	157,600	121,129	158,800	165,800
	Reimbursable program:						
	7. Supporting activity (reimbursable program cost)	2.159	305		1,157	6,600	1.600
	Total program costs, funded	164,499	147,805	157,600	122,286	165,400	167,400
	Change in selected resources (undelivered orders)				35,126	3,028	−4,400
10.00	Total obligations	164,499	147.805	157,600	157,412	168,428	163,000
	Financing:						
11.00	Offsetting collections from: Federal funds	−2,159	−305		−2,159	−305	
21.40	Unobligated balance available, start of year: For completion of prior year budget plans:						
	Direct				−80,353	−93,356	−73,556
	Reimbursable				−6,942	−823	
24.40	Unobligated balance available, end of year For completion of prior year budget plan:						
	Direct				93,356	73,556	68,156
	Reimbursable				823		
25.00	Unobligated balance lapsing.				203		
	Budget authority	162,340	147,500	157,600	162.340	147,500	157,600
	Budget authority:						
40.00	Appropriation	160,940	147.500	157,600	160,940	147,500	157,600
42.00	Transferred from other accounts	1,400			1,400		
43.00	Appropriation (adjusted)	162,340	147,500	157,600	162,340	147,500	157,600
	Relation of obligations to outlays.						
71.00	Obligations incurred, net				155,253	168,123	163,000
72.40	Obligated balance, start of year				97,187	128,061	142,684
74.40	Obligated balance, end of year				−128,061	−142,684	−150,484
77.00	Adjustments in expired accounts				−121		
90.00	Outlays				124.258	153,500	155,200

Note —Reconciliation of budget plan lo obligations

	1978 actual	1979 estimate	1980 estimate
Total budget plan	164.499	147,805	157.600
Deduct portion of budget plan Io be obligated in subsequent years	65.951	36.800	38.700
Add obligations of prior year budget plans	58.864	57.423	44.100
Total obligations	157.412	168.428	163.000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY OF THE BUDGET PLAN BY LOCATION

Location	N 1978	FY 1979 (In Dollars)	FY 1980
Ames Research Center..	---	9.770.000	2.900.000
Hugh L. Dryden Flight Research Center........................	420,000	---	1.500.000
Goddard Space Flight Center................................	4.500.000	5.640.000	---
Jet Propulsion Laboratory..................................	2.830.000	4.630.000	---
Lyndon B. Johnson Space Center.............................	2.540.000	---	1.760.000
John F. Kennedy Space Center...............................	2.130.000	---	2.210.000
Langley Research Center....................................	1.770.000	6.500.000	7.980.000
Lewis Research Center......................................	860.000	6.140.000	5.720.000
George C. Marshall Space Flight Center.....................	---	---	3.540.000
National Space Technology Laboratories......................	620.000	---	---
Wallops Flight Center......................................	---	---	1.100.000
Large Aeronautical Facilities...............................	37.000.000	56,100,000	45.900.000
Various Locations..	1.750.000	---	---
Space Shuttle Facilities....................................	64.880.000	31.070,000	31.450.000
Space Shuttle Payload Facilities............................	6.410.000	---	4.250.000
Repair...	---	---	12.000.000
Rehabilitation and Modification............................	18.900.000	12.800.000	19.790.000
Minor Construction...	5.950.000	4.200.000	3.500.000
Facility Planning and Design................................	11.780.000	10.650.000	14.000.000
Total Plan..	162.340.000	147.500.000	157.600.000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY OF THE BUDGET PLAN BY COGNIZANT OFFICE

	FY 1978	FY 1979 (In Dollars)	FY 1980
Office of Space Transportation Systems	71,290,000	31,070,000	31,450,000
Office of Space Science	---	---	4,250,000
Office of Aeronautics and Space Technology	37,980,000	76,530,000	62,500,000
Office of Space Tracking and Data Systems	3,150,000	---	---
Office of Space and Terrestrial Applications	3,100,000	---	---
Office of Management Operations	10,190,000	9,190,000	---
Office of the Comptroller	36,630,000	30,710,000	59,400,000
Total Plan	162,340,000	147.500.000	157.600.000

SUMMARY OF THE BUDGET PLAN BY SUBFUNCTION

Code No.	Title	FY 1978	FY 1979	FY 1980
253	Space Flight	64,880,000	31,070,000	31,450,000
254	Space Science, Applications and Technology	9,510,000	---	4,250,000
255	Support Space Activities	49,550,000	39,900,000	59,400,000
(250)	Subtotal, General Science, Space and Technology	123,940,000	70,970,000	95,100,000
402	Air Transportation	38,400,000	76,530,000	62,500,000
	Total	162,340.000	147,500,000	157,600,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

BUDGET PLAN BY LOCATION AND PROJECT

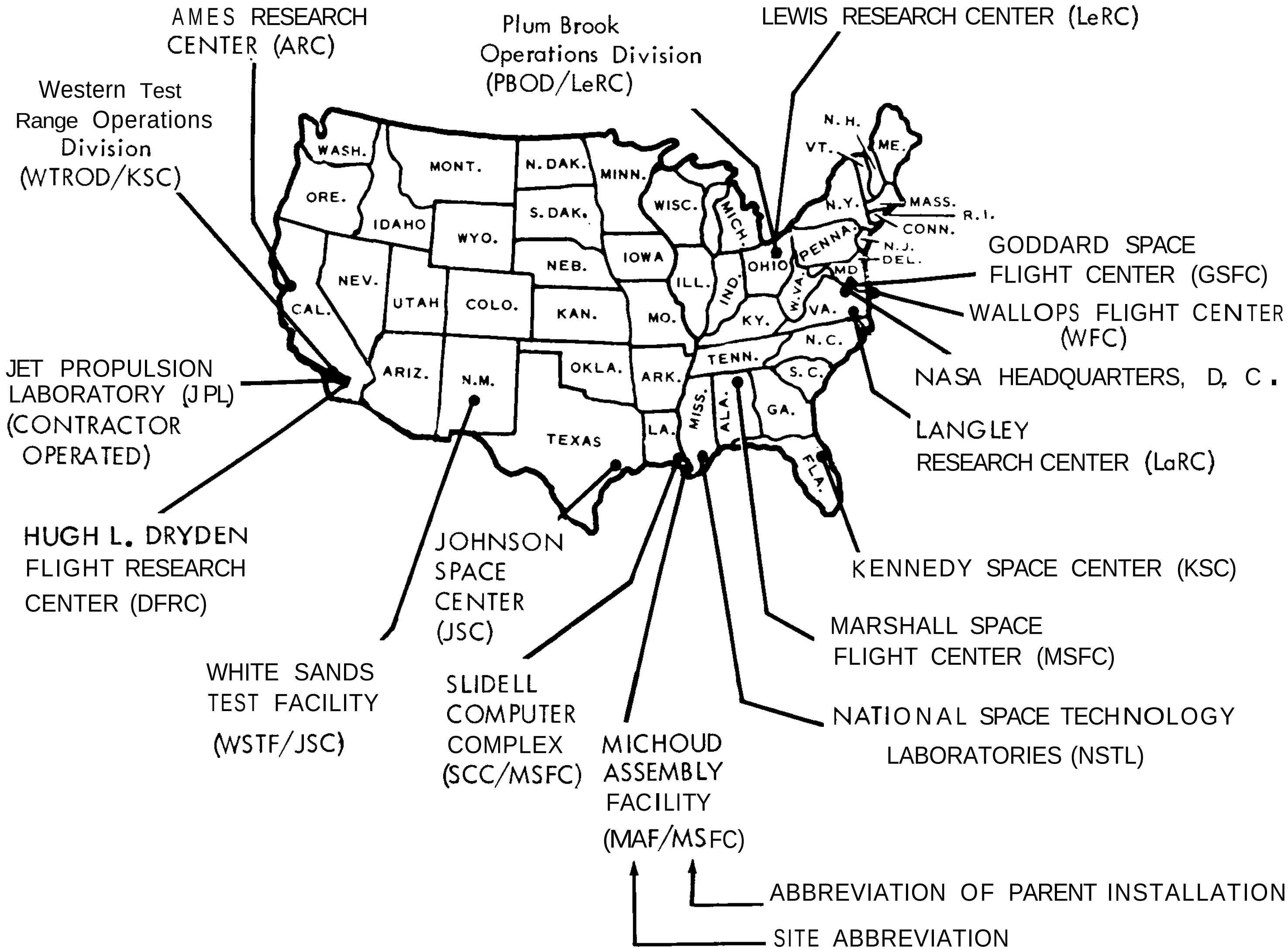
Cognizant Office	Budget Activity	Subfunction Code	Installation and Project	FY 1978	FY 1979	FY 1980	Page No.
				(In thousands of dollars)			
			Ames Research Center	---	9,770	2,900	
AST	5	402	Modification of Static Test Facility (N-249)......	---	---	2,900	CF 1-1
AST	5	402	Modification of the Unitary Plan Wind Tunnel (N-227)......................................	---	5,390	---	
AST	5	402	Modification of 3.5-Foot Wind Tunnel...........	---	1,870	---	
AST	5	402	Modification of 12-Foot Pressure Wind Tunnel....	---	2,510	---	
			Hugh L. Dryden Flight Research Center	420	---	1,500	
COMP	7	255	Construction of Large Aircraft Maintenance Dock.	---	---	1,500	CF 2-1
Mgmt Ops	5	402	Construction of Central Hydraulic System........	420	---	---	
			Goddard Space Flight Center	4,500	5,640	---	
Mgmt Ops	7	255	Modifications and Additions for Logistic and Supply Functions............................	---	5,640	---	
S&TA	3	254	Construction of Additional Technical Processing Facilities..................................	3,100	---	---	
ST&DS	7	255	Construction of an Addition to Building 14 for a Network Operations Control Center..........	1,400	---	---	
			Jet Propulsion Laboratory	2,830	4,630	---	
Mgmt Ops	7	255	Modifications to Various Buildings for Seismic Protection...........................	2,830	1,570	---	
COW	7	255	Modification to Space Flight Operations Facility......................................	---	3,060	---	

Cognizant Office	Budget Activity	Subfunction Code	Installation and Project	FY 1978	FY 1979	FY 1980	Page No.
				(In thousands of dollars)			
			Lyndon B. Johnson Space Center	2,540	---	1,760	
COMP	7	255	Rehabilitation and Modification of Flight Operations Facilities, Ellington AFB.........	---	---	1,760	CF 3-1
Mgmt Ops	7	255	Modification of Chillers in Central Heating and Cooling Plant...........................	2,540	---	---	
			John F. Kennedy Space Center	2,130	...	2,210	
COMP	7	255	Modifications to the Central Instrumentation Facility....................................	---	---	1,260	CF 4-1
COMP	7	255	Modifications to the Operations and Checkout Building....................................	---	---	950	CF 4-11
Mgmt Ops	7	255	Modifications for Utility Control System........	2,130	---	---	
			Langley Research Center	1,770	6,500	7,980	
AST	5	402	Modifications of Model Support System 8-Foot High Temperature Structures Tunnel (1265).....	---	---	1,410	CF 5-1
AST	5	402	Modifications to 8-Foot Transonic Pressure, Tunnel (640)................................	---	---	2,000	CF 5-8
AST	5	402	Modification of Transonic Dynamics Tunnel (648).	---	---	970	CF 5-16
AST	5	402	Rehabilitation and Modification of Gas Dynamics Laboratory (1247)...........................	---	---	3,600	CF 5-22
Mgmt Ops	7	255	Modifications for Utility Control System........	---	1,980	---	
AST	5	402	Rehabilitation of Unitary Plan Wind Tunnel......	980	4,520	---	
Mgmt Ops	7	255	Rehabilitation of Main Heating Plant...........	790	---	---	
			Lewis Research Center	860	6,140	5,720	
AST	5	402	Modifications to Central Air System, Various Buildings..................................	---	---	5,720	CF 6-1
AST	5	402	Construction of Research Analysis Center........	---	6,140	---	
Mgmt Ops	7	255	Modification of Central Chilled Water System....	860	---	---	

Cognizant Office	Budget Activity	Subfunction Code	Installation and Project	FY 1978	FY 1979	FY 1980	Page No.
				(In thousands of dollars)			
			George C. Marshall Space Flight Center	---	---	3,540	
COMP	7	255	Modifications to Various Buildings..............	---	---	2,640	CF 7-1
COMP	7	255	Rehabilitation of Roofs, Various Buildings......	---	---	900	CF 7-10
			National Space Technology Laboratories	620	---	---	
Mgmt Ops	7	255	Modifications for Utility Control System..... ...	620	---	---	
			Wallops Flight Center	---	---	1,100	
COMP	7	255	Construction of Facilities Operations Shop Building....................................	---	---	1,100	CF 8-1
			Various Locations	1,750	---	---	
ST&DS	7	255	Rehabilitation and Modification of 64-Meter Antenna Components...........................	1,750	---	---	
			Large Aeronautical Facilities at Various Locations as Follows:	37,000	56,100	45,900	
AST	5	402	Construction of National Transonic Facility (LaRC).......................................	23,500	24,500	12,000	CF 9-1
AST	5	402	Modification of 40- by 80-Foot Subsonic Wind Tunnel (ARC)................................	13,500	31,600	33,900	CF 9-21
			Space Shuttle Facilities at Various Locations as Follows:	64,880	31,070	31,450	
STS	1	253	Modifications to Launch Complex 39 (KSC).	40,700	13,570	17,700	CF 10-4
STS	1	253	Modifications to Crawler Transporter Maintenance Facility (KSC)...............................	---	---	1,250	CF 10-16
STS	1	253	Modification of Manufacturing and Final Assembly Facilities for External Tanks (MAF)...........	18,610	13,980	10,000	CF 10-24
STS	1	253	Minor Shuttle-Unique Projects (Various Locations)	1,750	1,600	2,500	CF 10-40

Cognizant Office	Budget Activity	Subfunction Code	Installation and Project	FY 1978	FY 1979	FY 1980	Page No.
				(In thousands of dollars)			
			Space Shuttle Facilities at Various Locations as Follows: (Cont'd)				
STS	1	253	Modifications to Solid Rocket Motor Manufacturing and Assembly Facilities, Thiokol Plant, Wasatch, Utah....................... .	---	1,920	---	
STS	1	253	Modifications to SRB Processing Facilities (KSC)	1,730	---	---	
STS	1	253	Rehabilitation of Barge Channels (KSC).	2,090	---	---	
			Space Shuttle Payloads Facilities at Various Locations as Follows:	6,410	---	4,250	
SS	2	254	Rehabilitation and Modification for Payload Ground Support Operations (KSC)...............	---	---	2,610	CF 11-1
SS	2	254	Modification of and Addition to Materials Sciences Laboratory (N240) (ARC)...............	---	---	1,640	CF 11-13
STS	2	254	Modifications and Addition for Shuttle Payload Vertical Processing (KSC)...................	6,410	---	---	
COMP	7	255	Repair of Facilities at Various Locations, Not in Excess of $500,000 per Project..................	---	---	12,000	CF 12-1
COMP	7	255	Rehabilitation and Modification of Facilities at Various Locations, Not in Excess of $500,000 per Project...................................	18,900	12,800	19,790	CF 13-1
COMP	7	255	Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations, Not in Excess of $250,000 per Project	5,950	4,200	3,500	CF 14-1
COMP	7	255	Facility Planning and Design..	11,780	10,650	14,000	CF 15-1
			TOTAL...	162,340	147.500	157,600	

LOCATION OF NASA MAJOR AND COMPONENT INSTALLATIONS



RECORDED VALUE OF CAPITAL TYPE PROPERTY
IN-HOUSE AND CONTRACTOR-HELD
AS OF SEPTEMBER 30, 1978
(DOLLARS IN THOUSANDS)

Reporting Installation	Real Property: Land	Buildings	Other Structures and Facilities	Leasehold Improvements	Total	Equipment	Fixed Assets in Progress	Grand Total
Ames Research Center	$ 2,928	$ 208,900	$ 8,313	$ 1,583	$ 221,724	$ 136,331	$ 19,108	$ 377,163
ARC - Moffett Field, CA	2,928	208,900	8,313	-0-	220,141	133,595	19,108	372,844
Various Locations (a)	-0-	-0-	-0-	1,583	1,583	2,736	-0-	4,319
Dryden Flight Research Center	-0-	12,094	3,765	-0-	15,859	62,310	2,478	80,647
DFRC - Edwards AFB, CA	-0-	12,094	3,765	-0-	15,859	58,692	2,478	77,029
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	3,618	-0-	3,618
Coddard Space Flight Center	1,675	101,115	57,840	91	160,721	521,134	19,234	701,089
GSFC - Greenbelt, MD	1,322	85,179	16,662	-0-	103,163	232,849	14,723	350,735
Tracking Stations (Networks)	353	15,935	41,133	91	57,512	262,399	4,511	324,422
Various Locations (a)	-0-	1	45	-0-	46	25,886	-0-	25,932
Jet Propulsion Laboratory	1,188	86,131	69,309	520	157,148	231,701	25,305	414,154
JPL - Pasadena, CA	1,188	76,087	10,581	520	88,376	149,326	25,305	263,007
Deep Space Network	-0-	10,044	58,728	-0-	68,772	82,375	-0-	151,147
Johnson Space Center	9,107	194,928	61,080	53	265.168	421,746	23,034	709.948
JSC - Houston, TX	5,537	159,390	35,059	-0-	199,986	336,712	17,413	554,111
White Sands Test Facility WSTF - Las Cruces, NM	-0-	9,456	20,945	-0-	30,401	22,350	-0-	52,751
Various Locations (a)	3,570	26,082	5,076	53	34,781	62,684	5,621	103,086
Kennedy Space Center	71,345	332,226	314,580	-0-	718,151	494,442	116,583	1,329,176
KSC - Cape Canaveral, FL	71,345	332,226	314,580	-0-	718,151	489,521	116,583	1,324,255
Western Test Range Operations Div. WTROD - Lompoc, CA	-0-	-0-	-0-	-0-	-0-	3,879	-0-	3,879
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	1,042	-0-	1,042
Langley Research Center	162	144,442	189,847	-0-	334,451	163,301	11.317	509.069
LARC - Hampton. VA	156	130.042	189.771	-0-	319,969	148.035	11,317	479,321
Various Locations (a)	6	14,400	76	-0-	14,482	15,266	-0-	29,748
Lewis Research Center	3,651	215,729	76,819	136	296,335	120,441	12.948	429,724
LERC - Cleveland, OH	316	131,456	57,288	136	189,196	96,830	12,948	298,974
Plumbrook Operations Division PBOD - Sandusky, OH	3,335	84,273	19,531	-0-	107,139	11,628	-0-	118,767
Various Locations	-0-	-0-	-0-	-0-	-0-	11,983	-0-	11,983
Marshall Space Flight Center	7,137	199,266	105,543	-0-	311,946	686,106	8,016	1,006,068
MSFC - Huntsville, AL	-0-	123,791	62,871	-0-	186,662	553.824	8,016	748.502
Michoud Assembly Facility MAF - New Orleans. LA	7,072	66,355	29,108	-0-	102,535	28,272	-0-	130,807
Slidell Computer Complex SCC - Slidell, LA	65	4,973	2,027	-0-	7,065	13,052	-0-	20,117
Various Locations (a)	-0-	4,147	11,537	-0-	15,684	90,958	-0-	106,642
National Space Technology Labs.	18,061	64,204	194,077	-0-	276,342	30,919	-0-	307,261
NSTL - NSTL Station, MS	18,061	64,204	194,077	-0-	276,342	30,919	-0-	307,261
Wallops Flight Center	1,283	25,769	52,295	-0-	79.347	52,826	4,505	136,678
WFC - Wallops Island, VA	1,283	25,769	52,295	-0-	79,347	50,710	4,505	134,562
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	2,116	-0-	2,116
NASA Headquarters	-0-	-0-	-0-	-0-	-0-	11,764	-0-	11,764
Washington, DC	-0-	-0-	-0-	-0-	-0-	3,727	-0-	3,727
Various Locations (a)	-0-	-0-	-0-	-0-	-0-	8,037	-0-	8,037
TOTAL	$ 116,537	$ 1,584,804	$1,133,468	$ 2,383	$ 2,837,192	$ 2,933,021	$ 242,528	$ 6,012,741

(a) Includes Property in Possession of Contractors at Various Locations.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

AMES RESEARCH CENTER

AMES RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATION OF STATIC TEST FACILITY (N-249)
LOCATION PLAN

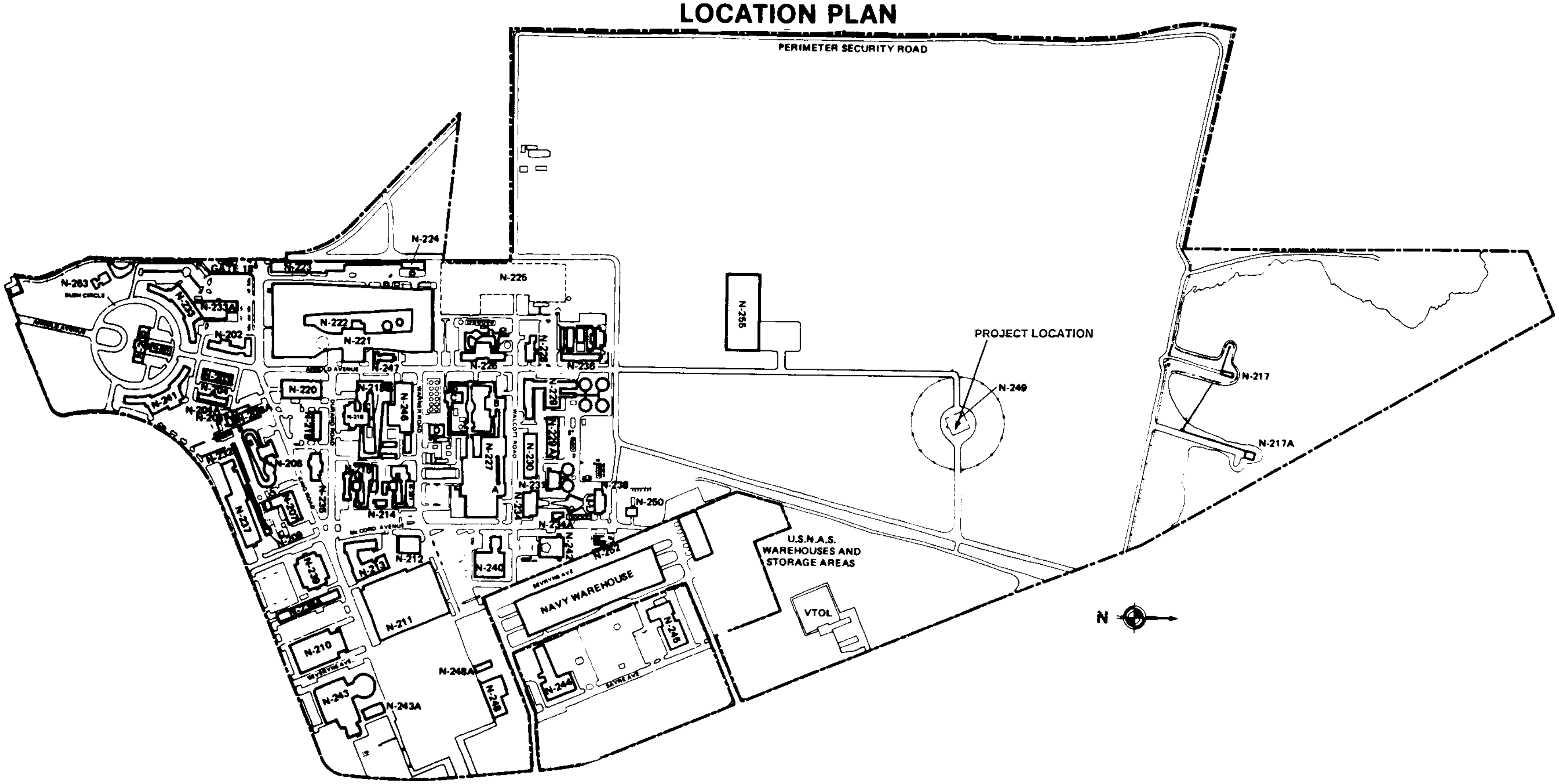


Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modification of Static Test Facility (N-249)

INSTALLATION: Ames Research Center

FY 1980 CoF ESTIMATE: $2.900.000

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

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	194,000	187,000	381,000
Capitalized investment	N/A	178,699	178,699
Total	194.000	365.699	559.699

SUMMARY PURPOSE AND SCOPE:

This project will provide unique static testing capability for rotorcraft and powered-lift aircraft at the Static Test Facility, Ames Research Center (ARC) (Figure 1). Specifically, this project will provide a variable frequency power system, a large capacity gantry crane, and a new mounting system to accommodate model or aircraft roll motion. These modifications will improve safety during model or aircraft installation, and will accommodate ground effects testing that will more closely simulate the conditions encountered during actual hover operations.

The Static Test Facility is a valuable and unique research facility for the testing and evaluation of Vertical Takeoff and Landing (VTOL) aircraft performance and for aero-propulsion noise research. In addition, significant wind tunnel occupancy time is otherwise not required by using the Static Test Facility for functionally checking out remote control operations, as well as research and safety monitoring instrumentation to ensure that the test vehicle hardware is operating correctly prior to wind tunnel installation. This facility will provide a valuable asset as increasing numbers of rotorcraft and powered-lift aircraft are tested in support of both civil and military programs.

PROJECT JUSTIFICATION:

Rotor whirl testing at the Static Test Facility is presently restricted to turbine driven models. Many current and near future models of advanced rotor systems require electronic motor drive for whirl testing. The proposed project will provide electric power suitable for driving an existing Rotor Test Apparatus which is required for testing advanced rotor systems. The alternatives to performing these whirl tests at the Static Test Facility would be to use the test section of the 40x80-Foot Wind Tunnel. This alternative has several severe disadvantages which include the tying up of a valuable test facility for work better suited to a static test facility, the introduction of wind tunnel wall effects on the aerodynamic flow fields being investigated, and the acoustic interference related to the wind tunnel structure. An even more important consideration is that of safety. With new untested rotor systems, there is the possibility of catastrophic failure occurring during the initial whirl testing which could result in destruction of valuable test equipment and model, as well as extensive damage to the wind tunnel itself.

The Static 'Test Facility is unique with regard to its capability for testing VTOL aircraft. The present method of installing a model is for a boom crane to swing the model into place over the model support system. The crane access is limited to the outside of the scale pit so that considerable boom extension is required. This severely limits the weight of models that can be safely installed at the facility. For heavier models, installation is hazardous both to equipment and the installing personnel. A gantry crane, with a structure that straddles the test pad and that runs on rails, will. allow efficient, safe installation of the model. The gantry will be sized to accept models for the 80x120-Foot Wind Tunnel test section.

The present model support system (Figure 2) at the Static Test Facility does not easily permit roll variation with models, and the force measuring system accuracy with roll is questionable. Since roll profoundly affects hover characteristics on VTOL aircraft, it is essential that a system be developed to vary roll angle easily and provide the capability of making measurements with confidence. An easily adjustable strut tip and a load cell design that will correctly measure three components with a side force preload will be developed.

IMPACT OF DELAY:

No other suitable facility exists to perform the necessary test and check-out of VTOL aircraft prior to installation of the model in either 40x80-Foot or 80x120-Foot Wind Tunnels. This is required because of the possibility of the rotor systems failing and causing damage to personnel and equipment. Delay of this project could impact existing and future programs.

PROJECT DESCRIPTION:

This project will provide a variable frequency power system consisting of a motor generator set similar to the existing system now used in the 40x80-Foot Wind Tunnel. It will be capable of providing the power and speed control to drive the existing electric motors of the Rotor Test Apparatus at power values up to 3,000 horsepower (2.2 megawatts). A pre-engineered enclosed metal building of approximately 2,000 square feet (186 square meters) will be provided to shelter the motor generator set. This building will be located west of Building N-236 on 7th Street.

The gantry crane to be provided by this project will be sized to accept models which will be tested in the 80x120-Foot Wind Tunnel. The gantry will be self-propelled and contain its own power source for the crane operation. It will be designed to maximum loads of 75 tons (68,025 kilograms) download, 30 tons (266,880 newtons) upload, 15 tons (133,440 newtons) sideload, and 30 tons (266,580 newtons) in the thrust or drag directions. Approximately 100 linear feet (30.5 meters) of track will be included to load and unload models and to store the gantry during strut-mounted model tests. ,

The new mounting provisions (Figure 3) for roll motion capability include two hydraulic jack screws mounted on top of the main struts with three component load cells and socket attachments for the models. Each jack screw and load cell will be designed for 35,000 pounds (155,680 newtons) vertical compression, 15,000 pounds (66,720 newtons) vertical tensions, 4,000 pounds (17,792 newtons) sideload, and 8,000 pounds (35,580 newtons) thrust or drag loading and linear motion of 6 feet (1.8 meters). Controls for the jack would be located in an existing underground control room. Hydraulic power units for the screwjacks also will be included in the project.

PROJECT COST ESTIMATE:

The cost estimate for this project is based on a completed Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition	---	---	---	---
Construction	---	---	---	2,900,000
Variable frequency power supply	LS	---	---	1,692,000
Transformer/motor generator set	LS	---	---	(1,125,000)
Duct bank	LS	---	---	(567,000)
Gantry crane	LS	---	---	66,000
Mounting system	LS	---	---	1,042,000
Metal building	SF	2,000	35.00	70,000
Site work and utilities	LS	---	---	30,000
Fallout Shelter (not feasible)	---	---	---	---
Total				2,900,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Schematic of Facility

OTHER EQUIPMENT SUMMARY:

None

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no future requirements to complete this project.

AMES RESEARCH FACILITY
FISCAL YEAR 1980 ESTIMATES

MODIFICATION OF STATIC TEST FACILITY (N-249)

SITE PLAN

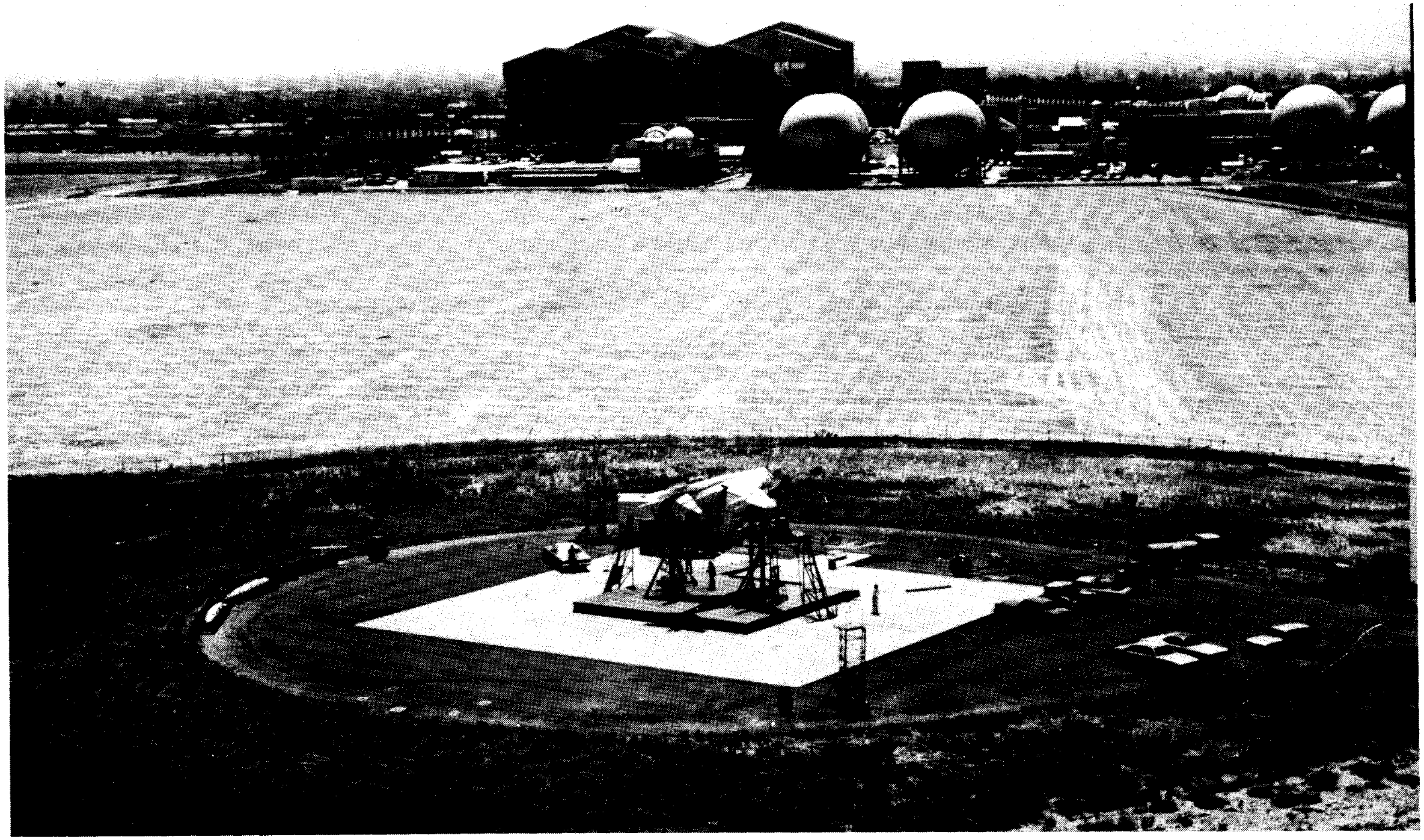


Figure 2

AMES RESEARCH CENTER
FISCAL YEAR 1980
MODIFICATION OF STATIC TEST FACILITY (N-249)

ROLL STRUTS - ELEVATION VIEW

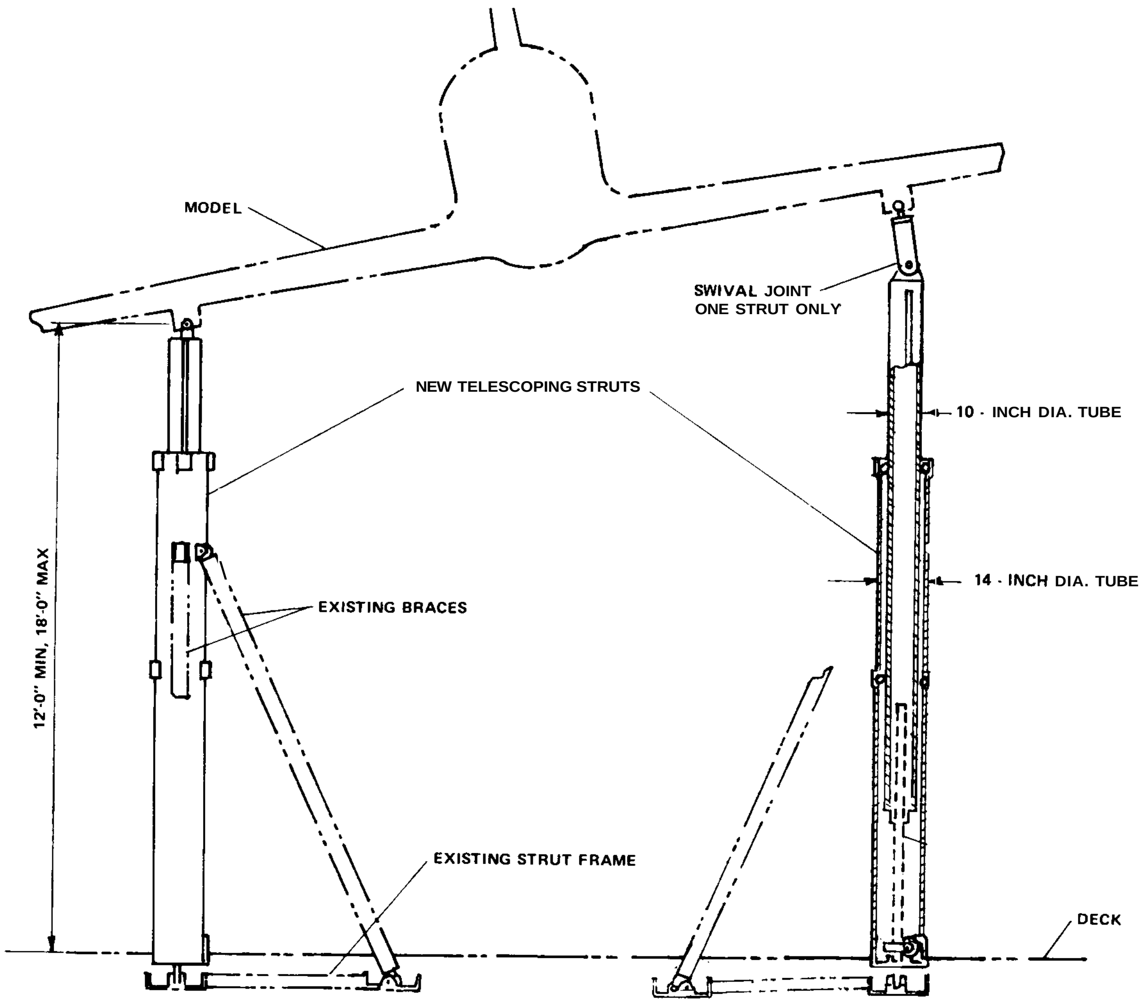


Figure 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

HUGH L. DRYDEN FLIGHT RESEARCH CENTER

	Amount	Page No.
Office of the Comptroller:		
Construction of Large Aircraft Maintenance Dock	1,500,000	CF 2-1

HUGH L. DRYDEN FLIGHT RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF LARGE AIRCRAFT MAINTENANCE DOCK

LOCATION PLAN

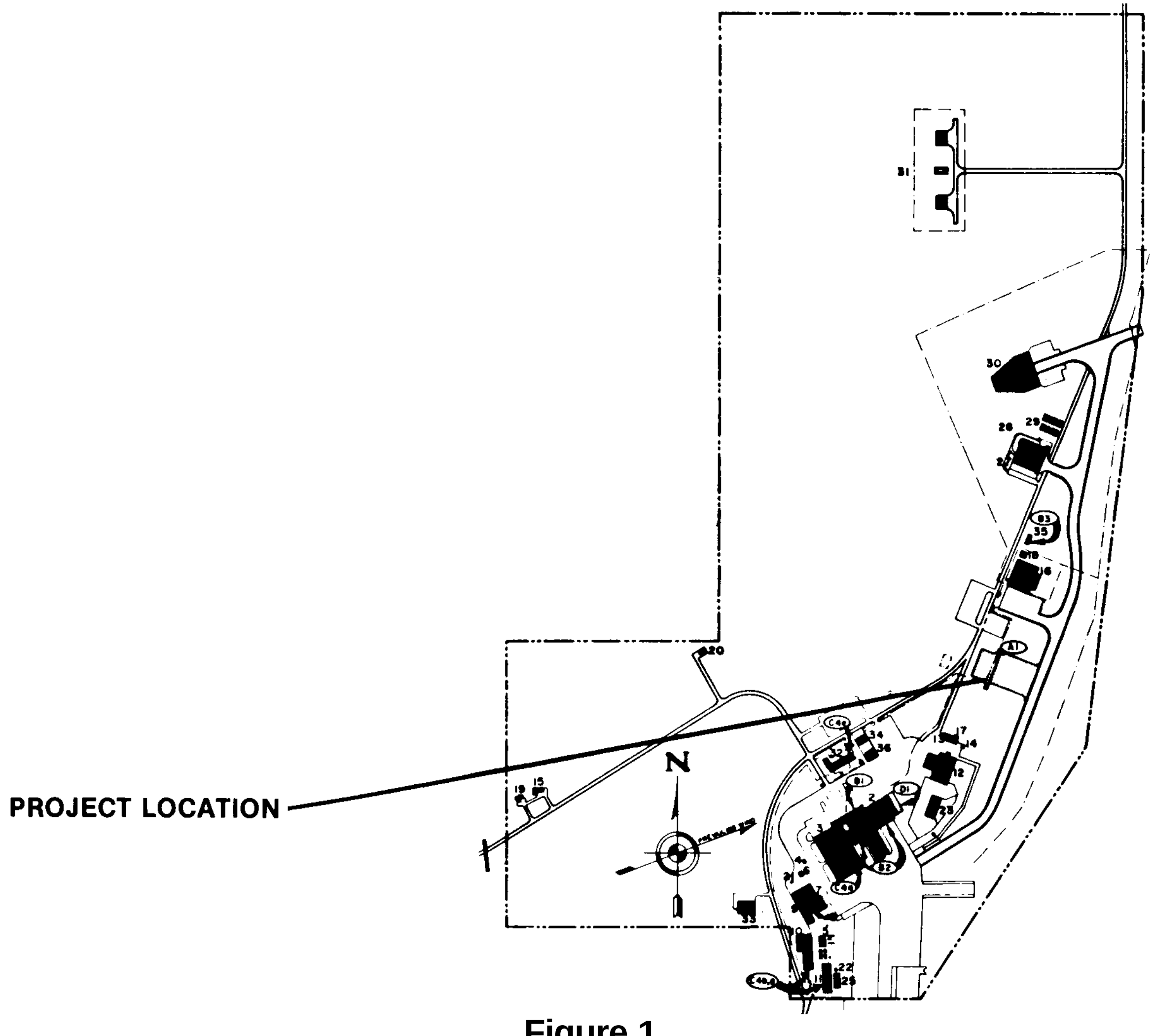


Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Construction of Larae Aircraft Maintenance Dock

INSTALLATION: Huah L. Drvden Flight Research Center

FY 1980 CoF ESTIMATE: $1.500.000

LOCATION OF PROJECT: Edwards, Kern County, California

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1979 AND PRIOR YEARS FUNDING:. The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	80,000	---	80,000
Capitalized investment...	N/A	*---	*---
Total	80,000	---	80.000

*Assessment based on todays market value indicates an equivalent worth of $1,800,000 to $2,100,000 associated with Air Force dock to be relocated.

SUMMARY PURPOSE AND SCOPE:

The installation of a large USAF surplus aircraft maintenance dock at the Dryden Flight Research Center (DFRC) is required to provide protection from temperature extremes, sand and dust to personnel and equipment involved in preflight, postflight, maintenance, and ground test operations. The aircraft maintenance dock will be used to house and protect such large aircraft as the B-52 carrier aircraft, the YC-14 and YC-15 Advanced Medium STOL Transports and other aircraft.

The facility will provide an effective means to perform preflight preparations, aircraft maintenance, research instrumentation systems checkout, postflight operations, and other ground support activity, with an enclosed service area large enough to cover the forward fuselage and wing portion of large aircraft. For example, the etructure is 241 feet (74 meters) wide with clear door opening of approximately 200 feet (61 meters) in width and 28 feet, six inches (8.7 meters) in height. This building is 28 feet (8.5 meters) deep and has provisions and space for an aircraft service area, restrooms, mechanical equipment, storage, and ground support equipment.

PROJECT JUSTIFICATION:

A hangar facility for large aircraft has been a basic requirement at DFRC for several years. Even with carefully planned procedures to limit mated ground operations, programs supported by B-52 carrier aircraft encountered serious conditions associated with weather such as summer and autumn temperatures that regularly exceed 100° Fahrenheit (38° Centigrade) resulting in aircraft skin surfaces becoming so hot that aircraft crews could not work effectively and, by contrast, winter season temperatures that drop to subfreezing levels. In addition, desert windstorms also seriously infringe upon outdoor aircraft maintenance and flight preparation work.

Within the past two years, the Center has moved intensively into a Remotely Piloted Research Vehicles (RPRV) mission. The utilization of these RPRV has introduced the application of prototype and costly electronic systems and ground support and checkout system. It is essential to assure that these systems are completely functional in a mated configuration. It is not safe or technologically acceptable to work these systems in the open, without shelter from adverse weather conditions.

Current RPRV programs within flight operations planned through FY 1983 include the F-15 Spin Research Vehicle (SRV), Firebee/DAST (Drones for Aerodynamic Structural Testing) and the HIMAT research vehicles (Highly Maneuverable Aircraft Technology). The lack of a large aircraft hangar facility at DFRC has an adverse impact on these programs.

In addition to RPRV programs that involve the P-52 carrier aircraft, the Center also has other aircraft flight research activities that require large aircraft hangar facilities. They include Advanced Medium STOL Transport investigations involving the flight operations of YC-14 and YC-15 aircraft and recurring wake vortex flight investigations that involve several large aircraft such as the DC-10 and L-1011 with research flight test operations planned test operations through FY-1983. In each of these programs the availability of a large hangar will significantly improve scheduling and performance, and avoid costly delays that will occur if there are no adequate facilities in which to perform instrumentation systems checkouts, aircraft maintenance and pre- and post- flight operations. The Center has no facility of sufficient size to accommodate a large aircraft. The Shuttle Hangar was sized specifically to accommodate the Space Shuttle. Consequently, the width of the Shuttle Hangar Door is only 137 feet (42 meters) and cannot house aircraft with large wing spans (for example, the B-52 has a wing span of 185 feet (56 meters)). More significantly, the Shuttle Hangar is heavily committed to the Shuttle Orbital Flight Test (OFT) Program. Additionally, DFRC has been designated as the secondary recovery site. This will require that the Space Shuttle facilities at DFRC be in a complete state of readiness for recovery and post-recovery operation for each Space Shuttle flight.

In summary, the need for a large aircraft maintenance dock is geared at present to existing Remotely Piloted Research Vehicle programs requiring the B-52 carrier aircraft. The installation of a large aircraft facility now will significantly enhance the Center's capability in scheduling and flight turn-around by avoiding the interruptions and problems of attempting to perform ground support operations out-of-doors. The costs in lost time due to outdoor ground support operations, or even more significant costs that would occur due to requirements for off-site maintenance repair and other ground support activities, can be avoided if the surplus Air Force maintenance dock is relocated. This proposed facility is in complete harmony with the Center's facility master planning and the facility environmental analyses.

IMPACT OF DELAY:

The delay in acquisition of this facility will result in a continuance of the present maintenance mode and mating of research vehicles with their inherent limitations and risks. The current availability of a surplus Air Force maintenance dock will provide a cost effective solution to a long standing Center need for a protective envelope for large aircraft.

PROJECT DESCRIPTION:

This project involves the dismantling, moving and re-erection of a surplus Air Force maintenance dock. The dock is presently located at Glasgow Air Force Base, Montana, and is planned for use at the Dryden Flight Research Center, Edwards, California. The facility will be located immediately adjacent to the Center's existing taxiway (Figures 1 and 2). The facility will be re-erected on a concrete hangar floor of 10-inch (25.4 Centimeters) reinforced concrete with a full width 16-inch (40.6 centimeters) reinforced concrete apron connecting with the existing taxiway.

The dock is a steel structure, 241 feet (74 meters) wide at the front, with a clear door opening of approximately 200 feet (61 meters) in width and 28 feet, six inches (9.7 meters) in height and provides a gross area of approximately 27,000 square feet (2,508 square meters) (Figure 3). It is equipped with manually operated sliding hangar doors at the front of the structure and overhead vehicle and equipment doors on each of the two sides of the building. The roofing and siding are corrugated sheet metal and will be insulated. The dock has two existing 7,000 pound (3,175 kilogram) capacity bridge cranes with all necessary structural supports. New toilet facilities, hot water heating, electrical and lighting and fire protection systems will be provided.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition	---	---	---	---
Construction	---	---	---	1,500,000
Site preparation	LS	---	---	290,000
Utilities (outside 5-foot line)	LS	---	---	120,000
Dismantling/shipping, and site restoration	LS	---	---	300,000
Architectural/structural	SF	27,000	19.45	525,000
Mechanical	SF	27,000	7-95	215,000
Electrical	SF	27,000	1.85	50,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				1,500,000

LIST OF RELATED GRAPHICS:

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

OTHER EOUIPMENT SUMMARY:

No other collateral or non-collateral equipment is involved.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no currently foreseen future funding requirements to complete this project.

HUGH L. DRYDEN FLIGHT RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF LARGE AIRCRAFT MAINTENANCE DOCK

SITE PLAN

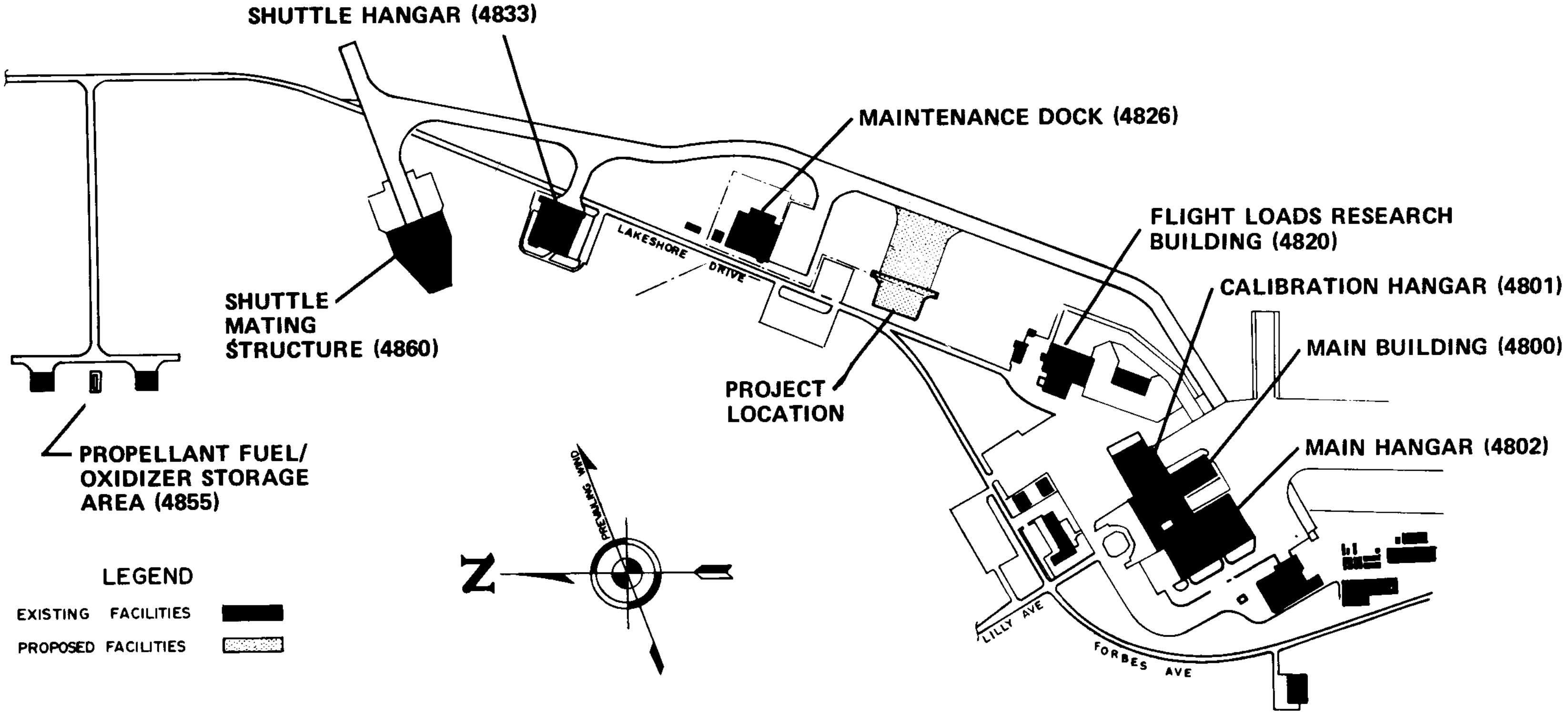
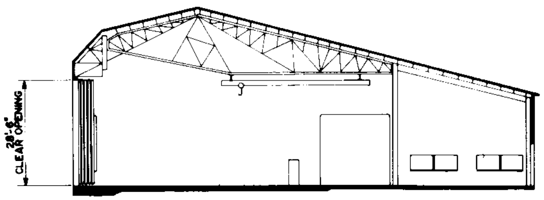
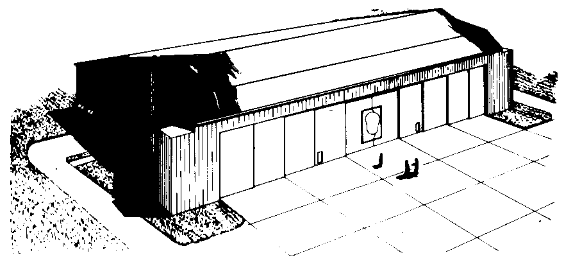


Figure 2

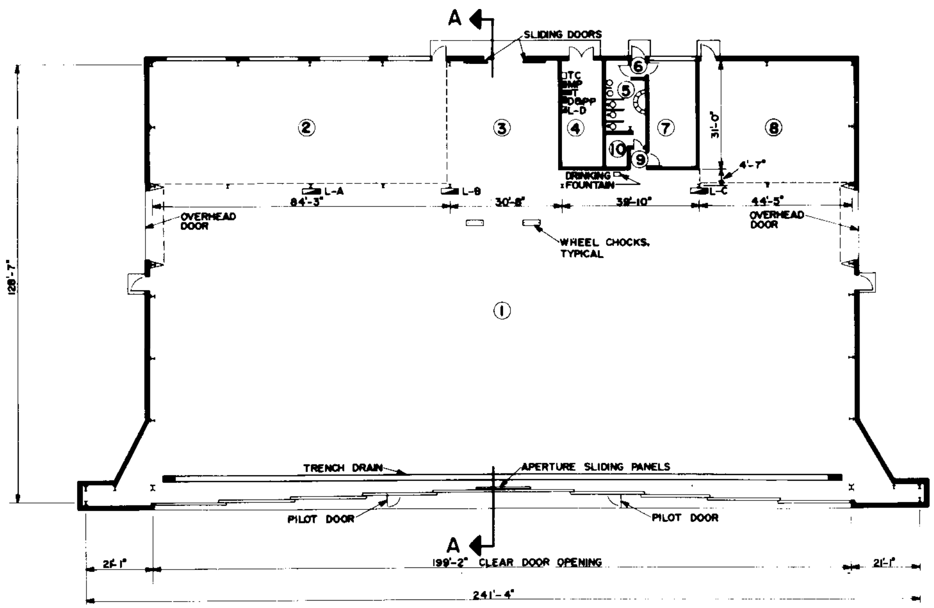
HUGH L. DRYDEN FLIGHT RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES
CONSTRUCTION OF LARGE AIRCRAFT MAINTENANCE DOCK
FLOOR PLAN



SECTION A-A



PERSPECTIVE



ROOM SCHEDULE

1. SERVICE AREA
2. SHOPS
3. NOSE AREA
4. MECH EQUIP
5. MEN'S TOILET
6. ENTRY
7. OFFICE AND TO READING
8. STORAGE AND TOOLS
9. VESTIBULE
10. LOCKERS

Figure 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

LYNDON B. JOHNSON SPACE CENTER

	Amount	Page No.
Office of the Comptroller:		
Rehabilitation and Modification of Flight Operations Facilities, Ellington Air Force Base	1,760,000	CF 3-1

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1980 ESTIMATES

REHABILITATION AND MODIFICATION OF FLIGHT OPERATIONS FACILITIES
ELLNGTON AIR FORCE BASE

LOCATION PLAN

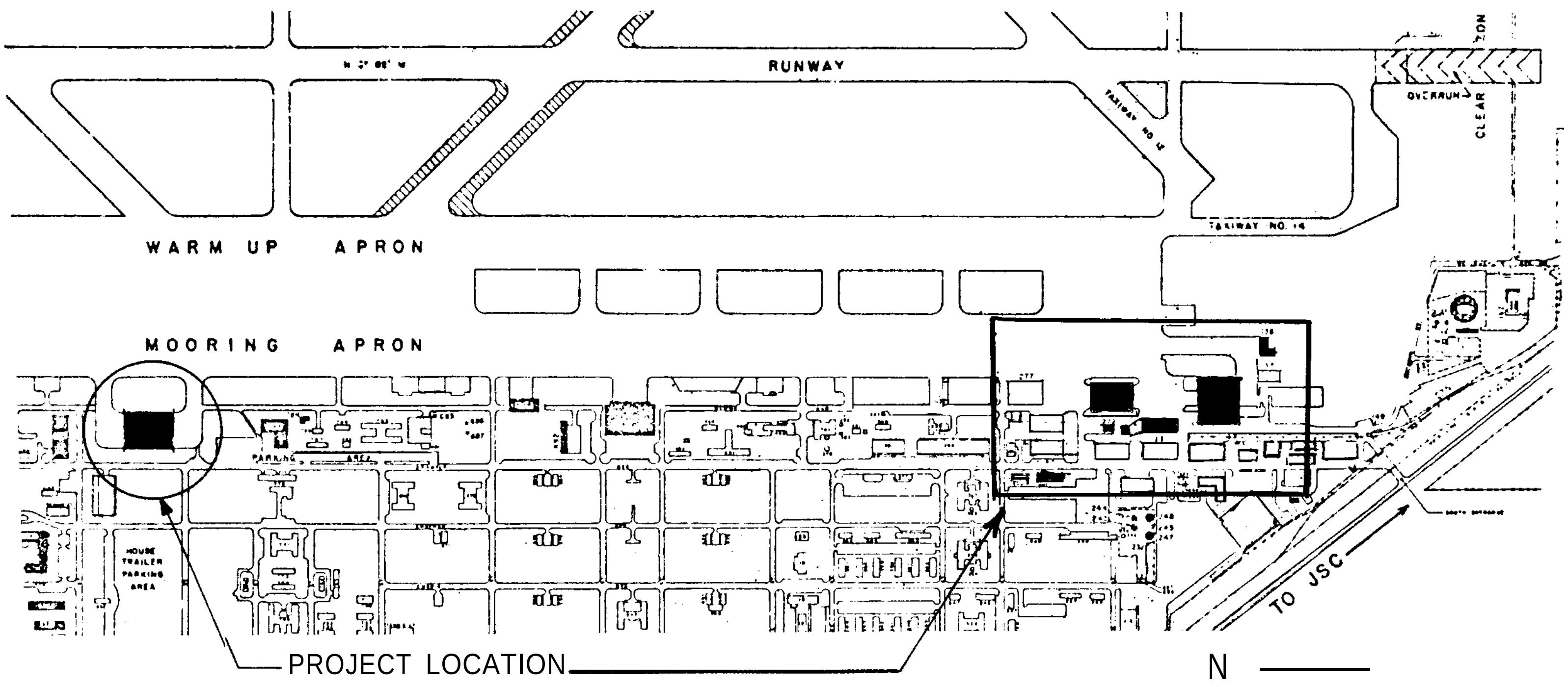


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Rehabilitation and Modification of Fliaht Operations Facilities, Ellinnton Air Force Base

INSTALLATION: Lyndon B. Johnson Space Center

FY 1980 CoF ESTIMATE: $1,760,000

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	200,000	585,000	785,000
Captalized investment	N/A	*1,994,000	1,994,000
Total	200,000	2,579,000	2,779,000

*NASA-owned facilities and facilities occupied by NASA under permit from Air Force.

SUMMARY PURPOSE AND SCOPE:

This project provides for completion of required rehabilitation and modification of NASA's flight operations facilities that support Shuttle and Earth Resources aircraft programs at Ellington Air Force Base (EAFB). These facilities were originally constructed over 24 years ago and have been in continuous use since that time. In recent years, because of the uncertain future of the facilities, only minimum maintenance has been performed to keep the facilities operational. Consequently, the general condition of facilities, especially Hangar 990, is poor. Most are in immediate need of rehabilitation, and this work is required in the FY 1980 time frame. This project consists of the general rehabilitation and modification of Hangar 990 which is to include providing a fire protection system, replacement of roofing and air-conditioning units, general painting, motorizing large hangar doors, and adding electrical power, air-conditioning in laboratories and shops, and other related work. The project also includes rehabilitation of 2 other hangars and 5 buildings as well as the completion of repairs to aircraft parking aprons. Work in the other hangars and buildings include rehabilitation of heating, ventilating, and air-conditioning systems and replacement of roofing. This project is needed to maintain the integrity of the facilities and to place them in a safe, reliable, and usable condition for aircraft operations, as well as to protect the Government's investment in the facilities.

PROJECT JUSTIFICATION:

These World War II mobilization-type facilities house aircraft flight operations and maintenance activities. They are utilized to support the Space Shuttle and Earth Resources Programs, as well as other activities essential to the mission of Johnson Space Center. These are the only available airfield facilities within 200 miles (322 kilometers) of the Center capable of providing this support. Hangar 990 was constructed in 1954, and the other NASA flight operations buildings were constructed as World War II mobilization facilities in 1942. These facilities have been in continuous use since that time. Due to the uncertain future of these facilities, since the Air Force decided in 1976 to vacate the installation, only minimum maintenance has been performed. This project is necessary to rehabilitate these facilities so they may be completely functional and usable and can be maintained in a routine manner. It is also necessary to modify the facilities to meet acceptable standards in areas of safety and fire protection. The facilities are required to accommodate research and training aircraft which provide critical support to the Space Shuttle and Earth Resources programs.

NASA began to use Hangar 990 in 1975. Since that time, NASA has performed only minimum maintenance of the facility to keep it operational. General rehabilitation of the hangar will bring it up to minimum standards for its current utilization as an aircraft operations and maintenance hangar for the Earth Resources Program. The facility houses three WB-57F's, a NC-130B and a KC-135 aircraft as well 'is two helicopters, which are maintained by 20 civil service and 20 contractor personnel. Also located in this hangar are an aircraft pressure suit laboratory, a pallet laboratory, nondestructive inspection equipment and instrumentation. These aircraft are associated with the Airborne Instrumentation Research, the Atmospheric Research, and the Reduced Gravity Flight Test Programs. The aircraft and their associated instrumentation pallets are valued at approximately $40,000,000. Hangar 990 is a single story facility with a two-story lean-to and adjacent concrete mooring apron and access pavement,. The total value of this facility is approximately $6 million.

The remaining flight operations facilities were occupied by NASA in 1962. Shuttle training aircraft, administrative aircraft, and astronaut flight proficiency aircraft are operated and maintained from these hangars. Buildings 136, 239, 270, 271, and 272 house various activities associated with all NASA flight operations and maintenance activities at the Base. Most of these facilities contain costly, delicate equipment and instrumentation. A project in NASA's FY 1979 budget provided for the most urgent rehabilitation work required in these and other facilities at EAFB. This project will complete that rehabilitation effort. The aircraft operated and maintained from these facilities are valued at $50,000,000, and associated spare parts are valued at $4,500,000. The estimated replacement value of the hangars and support buildings is approximately $5,000,000, not including the aircraft parking aprons. The rehabilitation of aircraft parking aprons is necessary since they have cracked and settled in many places due to failure of the base material. Spalling of the apron concrete where cracks have occurred and movement of aircraft across these areas are factors which result in excessive wear and costly maintenance on the aircraft.

IMPACT OF DELAY:

In general, rehabilitation of these facilities is required because of age (obsolete equipment) and past austere maintenance efforts. It is now essential that rehabilitation be accomplished to maintain the integrity of the facilities and place them in a safe, reliable, usable condition for aircraft operations and to protect the Government's investment in the facilities. Failure to implement this project will result in further deterioration of facilities and equipment, less reliability and safety in operations, and increased future costs for maintenance and operations, as well as for any subsequent rehabilitation and modification.

PROJECT DESCRIPTION:

This project provides for the rehabilitation of aircraft maintenance Hangars 990, 135, and 276 and support Buildings 136, 239, 270, 271, and 272 located at EAFB. The general rehabilitation and modification of Hangar 990 includes installing automatic high expansion foam and manual aqueous film-forming, foam dispensing, fire protection systems in the area; replacing approximately 51,100 square feet (4,747 square meters) of built-up roofing over the high bay and office areas; replacing two air-conditioning units, one 20-ton and one 25-ton, including ducts and controls; replacing substandard interior walls, ceilings, and doors; adding fire doors and panic hardware, electrical service and lighting, and air-conditioning ducts and controls to first floor laboratories and shops; repainting the interior and exterior of the hangar; resealing joints in the concrete apron and access pavement adjacent to the hangar; and motorizing the existing large rolling doors located on the north and south ends of the hangar.

Also included in the project is the rehabilitation of heating, ventilating, and air-conditioning systems of Buildings 135, 136, 239, 270, 271, 272, and 276. This includes the repair of air handler casings and structures, valves, pumps, fan and scroll assemblies, dampers, and ducts; cleaning coils; replacing pipe suspension; calibrating instrumentation; and insulating and painting all components and ancillary equipment. The work includes the replacement of 20 direct expansion air-conditioning units ranging in size from 1.5 tons to 25 tons. Also included is the replacement of the supply and exhaust ventilation units with modifications to the ventilation plenums and controls for the Corrosion Control Facility, Building 136. In addition, the project includes the replacement of approximately 12,000 square feet (1,115 square meters) of built-up roofing on portions of Hangars 135 and 276. The rehabilitation of aircraft parking aprons consists of replacing approximately 1,200 square feet (111 square meters) of concrete slab, including base material and tie-down anchors.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition	---	---	---	---
Construction	---	---	---	1,760,000
Hangar 990	---	---	---	1,460,000
Repair aprons and access drive	LS	---	---	(27,400)
Replace roofing	SF	51,100	3.74	(191,100)
Painting (interior and exterior)	SF	89,000	0.60	(48,000)
Install motorized hangar doors	EA	4	34,400.00	(137,600)
Install fire protection systems	LS	---	---	(527,400)
Mechanical and plumbing	LS	---	---	(177,600)
Electrical	LS	---	---	(252,500)
Architectural and structural	LS	---	---	(98,400)
Hangar 135	---	---	---	42,000
Repair roofing	SF	5,000	312.00	(15,600)
Replace air-conditioning				
7.5 ton units	EA	6	4,400.00	(26,400)
Hangar 276	---	---	---	36,300
Repair roofing	SF	7,000	312.00	(21,800)
Replace air-conditioning				
7.5 ton units	EA	2	4,400.00	(8,800)
1.5 ton units	EA	3	1,900.00	(5,700)

	Unit of Measure	Quantity	Unit cost	cost
Building 136, air-conditioning..........................	LS	---	---	87,000
Building 239, air-conditioning..........................	LS	---	---	28,400
Buildings 270, 271, 272................................. Replace air-conditioning, 1.5 ton units.....	EA	3	1,900.00	5,700
Repair aprons....................................... ...	SF	1,200	83.80	100,600
Equipment....	---	---	---	---
Fallout Shelter (not feasible).........................	---	---	---	---
Total...				1.760.000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Photograph of Hangar 990 w/B57 inside
Figure 3 - Photograph of Interior, Hangar 990
Figure 4 - Photograph of Roof, Hangar 990

OTHER EQUIPMENT SUMMARY:

No other equipment is required.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There may be a requirement for some storm sewer and drainage **work** in the future. Total scope and cost are presently unknown.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
REHABILITATION & MODIFICATION OF FLIGHT OPERATIONS FACILITIES,
ELLINGTON AIR FORCE BASE

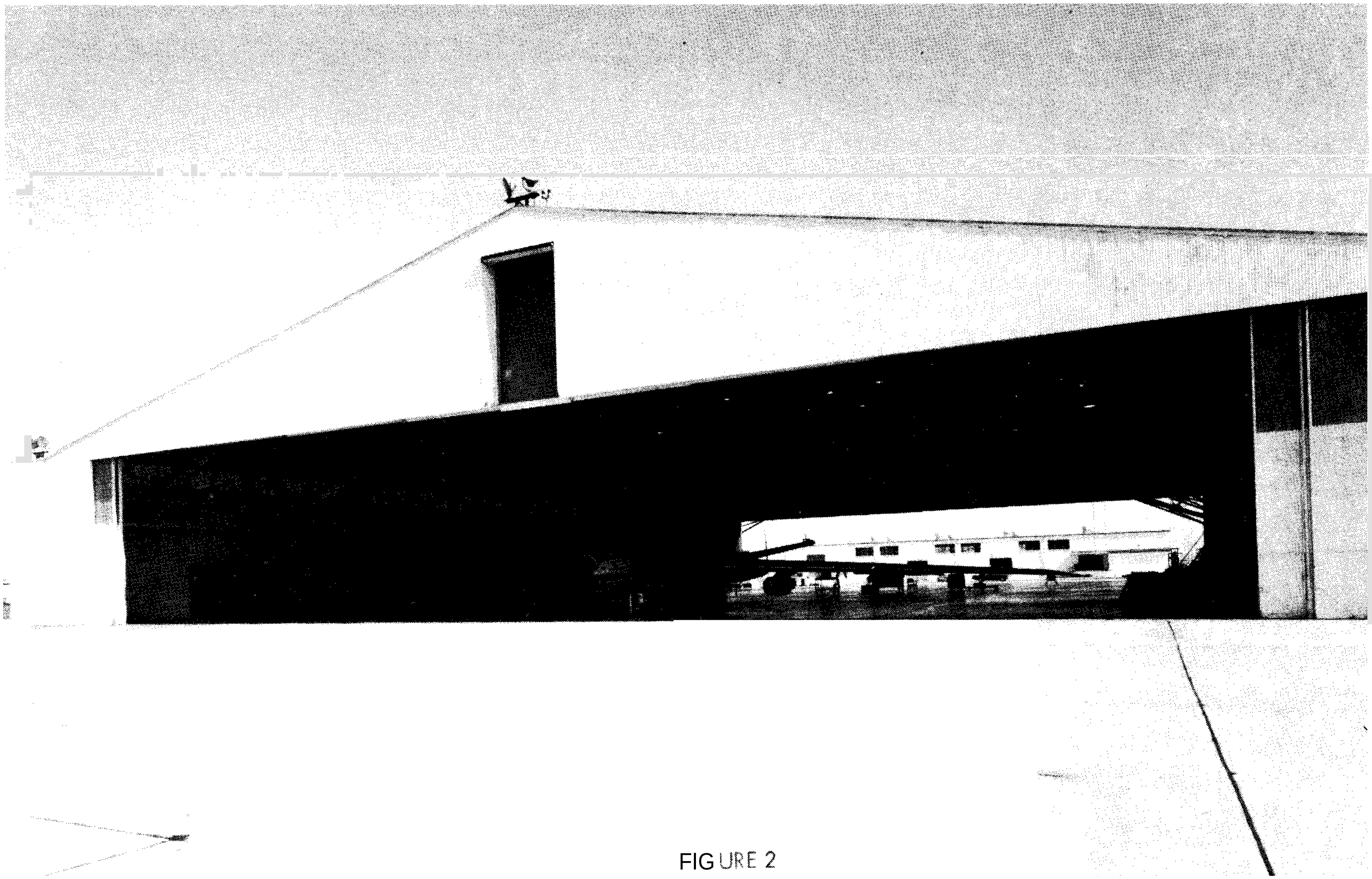


FIGURE 2

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
REHABILITATION & MODIFICATION OF FLIGHT OPERATIONS FACILITIES,
ELLINGTON AIR FORCE BASE

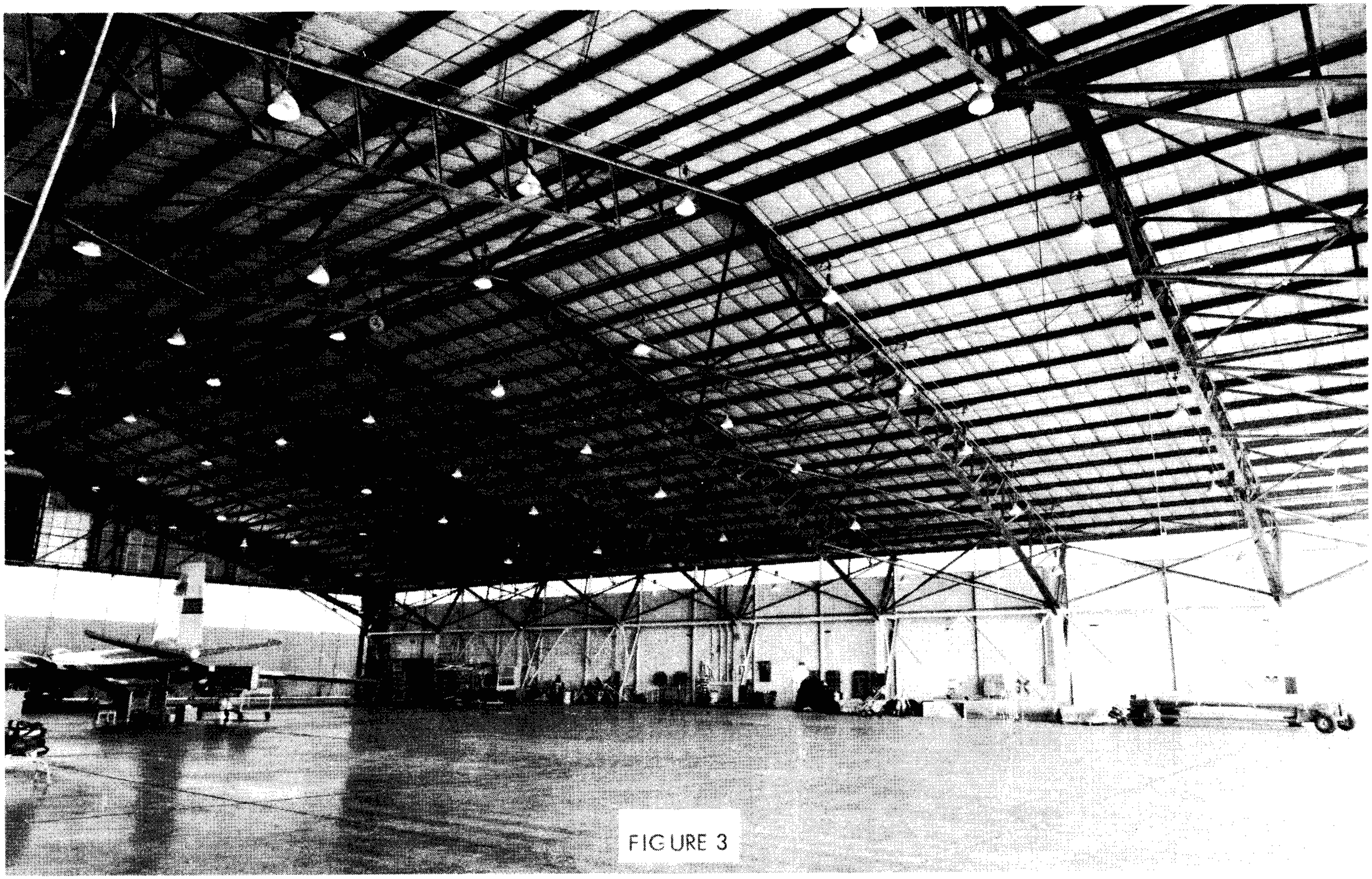


FIGURE 3

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1980 ESTIMATES

REHABILITATION & MODIFICATION OF FLIGHT OPERATIONS FACILITIES, ELLINGTON AIR FORCE BASE

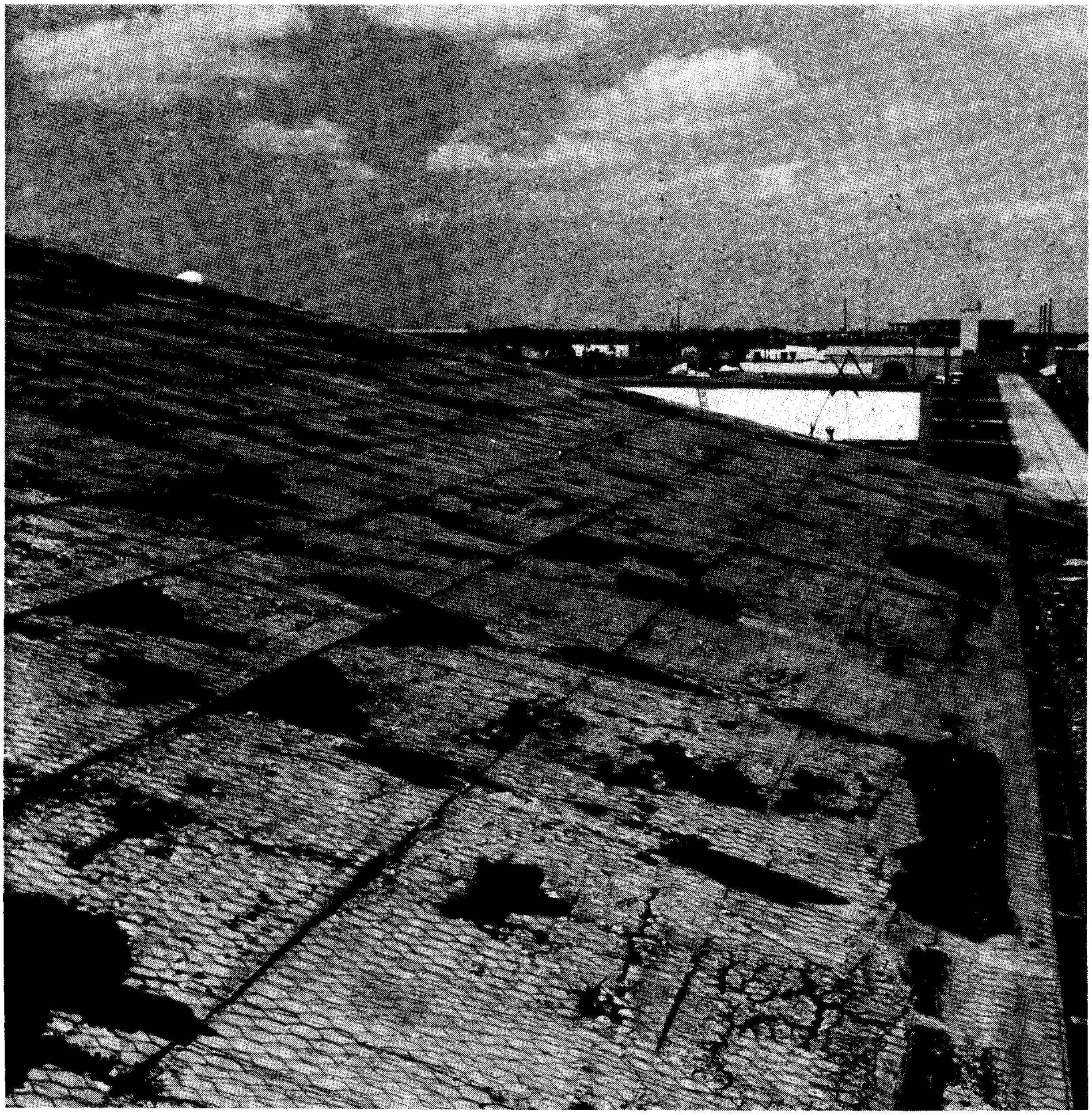


FIGURE 4

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

JOHN F. KENNEDY SPACE CENTER

	Amount	Page No.
Office of the Comptroller:		
Modifications to the Central Instrumentation Facility	1,260,000	CF 4-1
Modifications to the Operations and Checkout Building	950,000	CF 4-11
Total	2,210,000	

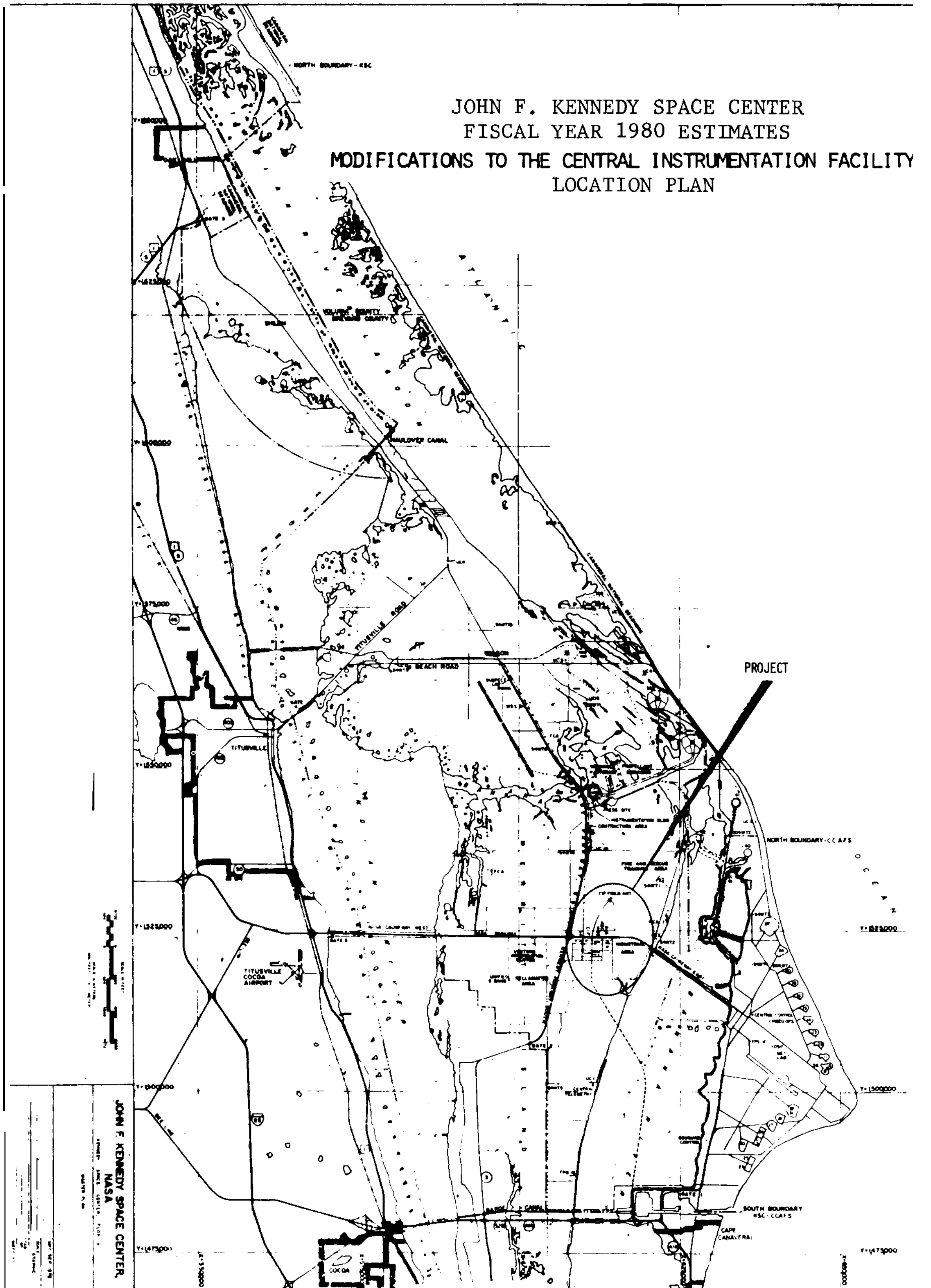

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO THE CENTRAL INSTRUMENTATION FACILITY
LOCATION PLAN
PROJECT
NORTH BOUNDARY - KSC
HAULOVER CANAL
TITUSVILLE
TITUSVILLE COCOA AIRPORT
NORTH BOUNDARY - CC AFS
SOUTH BOUNDARY KSC - CCAFS
CAPE CANAVERAL
COCOA
JOHN F. KENNEDY SPACE CENTER, NASA

Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE:	Modifications to the Central Instrumentation Facility
INSTALLATION:	John F. Kennedy Space Center
FY 1980 CoF ESTIMATE:	$1,260,000

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	143,000	---	143,000
Capitalized investment	N/A	7,917,655	7,917,655
Total	143,000	7,917,655	8,060,655

SUMMARY PURPOSE AND SCOPE:

This project will provide for a substantial reduction in energy and associated costs by reducing the capacity of the heating, ventilating and air-conditioning (HVAC) system and refixturing the lighting system to support the Space Shuttle Transportation System at the 136,378 square foot (12,670 square meters) Central Instrumentation Facility (CIF), Building M6-342

The planned modifications to the HVAC system include the replacement of the existing air handling units on the roof which serve both overhead and underfloor systems. The new air handlers will be properly sized and those to be installed on the roof will support the overhead systems, while the new bottom discharge floor-mounted units will be installed within the building to meet each computer room's underfloor cooling requirements. The lighting modifications will consist of replacing approximately 2,680 300-watt incandescent fixtures with more energy efficient fluorescent fixtures.

The present HVAC systems were designed with larger than presently necessary capacities to maintain low humidity levels and for flexibility to support computer use. They were operated during the Apollo program 24 hours a day, 7 days a week. The existing HVAC equipment is old and requires constant maintenance and should now be replaced. Additionally, this equipment is not energy efficient. The new units will significantly increase the reliability of operation. Also, replacing these air-handler units with smaller capacity units will simplify control and maintenance and conserve energy. The incandescent lighting fixtures were originally necessary to provide a radio frequency-free environment for instrumentation and equipment in the facility. Now, radio frequency-free fluorescent fixtures are available which consume less energy, improve lighting, and create less heat, and the present equipment and instrumentation in this facility is less sensitive to radio frequency emanations.

PROJECT JUSTIFICATION:

The CIF is the prime control and instrumentation center for the Space Shuttle and Expendable Vehicles space missions. The facility houses computers for space missions and automatic data processing for administrative purposes. These computers are sensitive to temperature and humidity and, therefore, must operate in a controlled environment, but current equipment and related environmental requirements have reduced the once very stringent earlier requirement.

As previously described, the HVAC system was originally over-designed by intent. With energy now critical in terms of cost and availability, this unnecessary added capability is an unwanted burden. In addition, the conversion of incandescent lighting to fluorescent will greatly reduce the heat load. As a result, the necessary capacity of the cooling system can be reduced by some 89x109 Btu per year and still meet the HVAC needs in this facility. Regardless of the energy conservation requirements, replacement of many components of the HVAC system would be necessary, in any event, to keep the system operating. This is especially true of such elements as exterior piping insulation, coil manifolds, and valves.

The replacement of the incandescent fixtures by fluorescent fixtures will result in a savings of some 23x109 Btu per year due to the reduced energy required per lumen. In addition, this will result in a reduction of light levels in certain areas, and also reduces the heat load on the HVAC system. The installation of discriminatory controls has the future advantage of resulting in an annual manpower savings of 2 man-years through the elimination of manual control.

IMPACT OF DELAY:

Implementation of this project will produce energy savings of 9,500,000 kWh/yr of electricity, and 11,000 gallons of oil per year, yielding a total energy savings of 112×10^9 Btu per year, and a reduction of 2 man-years in manpower. These reductions will result in a payback period of less than 3 years. Failure to implement this project will not allow this cost savings to be realized and, as pointed out, the existing system requires extensive, continual maintenance.

PROJECT DESCRIPTION:

This project provides for the modifications and replacement of major components of the HVAC system in the CIF. The work will involve removing the existing air handlers, plenums, ductwork, chilled and hot water piping, motors, starters and disconnects. It will also involve removing all of the existing recessed incandescent lighting fixtures and replacing them with fluorescent fixtures on all three floors. Six new air handlers, filters, economizer assemblies, and return air blowers, including all ductwork, piping, motors, and controls for the building overhead system will be installed on the roof. Twenty-four floor mounted air handlers including all ductwork, piping motors and controls will be installed in all three floors for the equipment underfloor system. The existing Utility Control System data sensors will be relocated to the new systems. The existing variable air volume induction terminal units will be rebalanced. The room thermostats will be adjusted and new high-capacity air filters will be installed. New surface mounted 2- or 4-lamp (as required) fluorescent fixtures will be installed in the ceiling grid and electricity connected to the existing incandescent light circuits.

PROJECT COST ESTIMATE:

The bases of this cost estimate are Preliminary Engineering Reports and related studies.

	Unit of Measure	Quantity	Unit cost	cost
Land Acquisition...	---	---	---	---
Construction....	---	---	---	1,260,000
Demolition and rework HVAC..	LS	---	---	59,000
Overhead HVAC system....................................	LS	---	---	384,000
Underfloor HVAC system..................................	LS	---	---	440,000
Demolition and repair electrical system..................	LS	---	---	132,000
Lighting fixtures....................................	EA	2,680	89.93	241,000
UCS data sensors....................................	LS	---	---	4,000
Equipment..	---	---	---	---
Fallout Shelter (not feasible)...........................	---	---	---	---
Total...				1,260,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Typical Floor Plan
Figure 4 - HVAC Schematics
Figure 5 - Central Instrumentation Facility Lighting

OTHER EQUIPMENT SUMMARY:

There is no other equipment required to be used with this facility project.

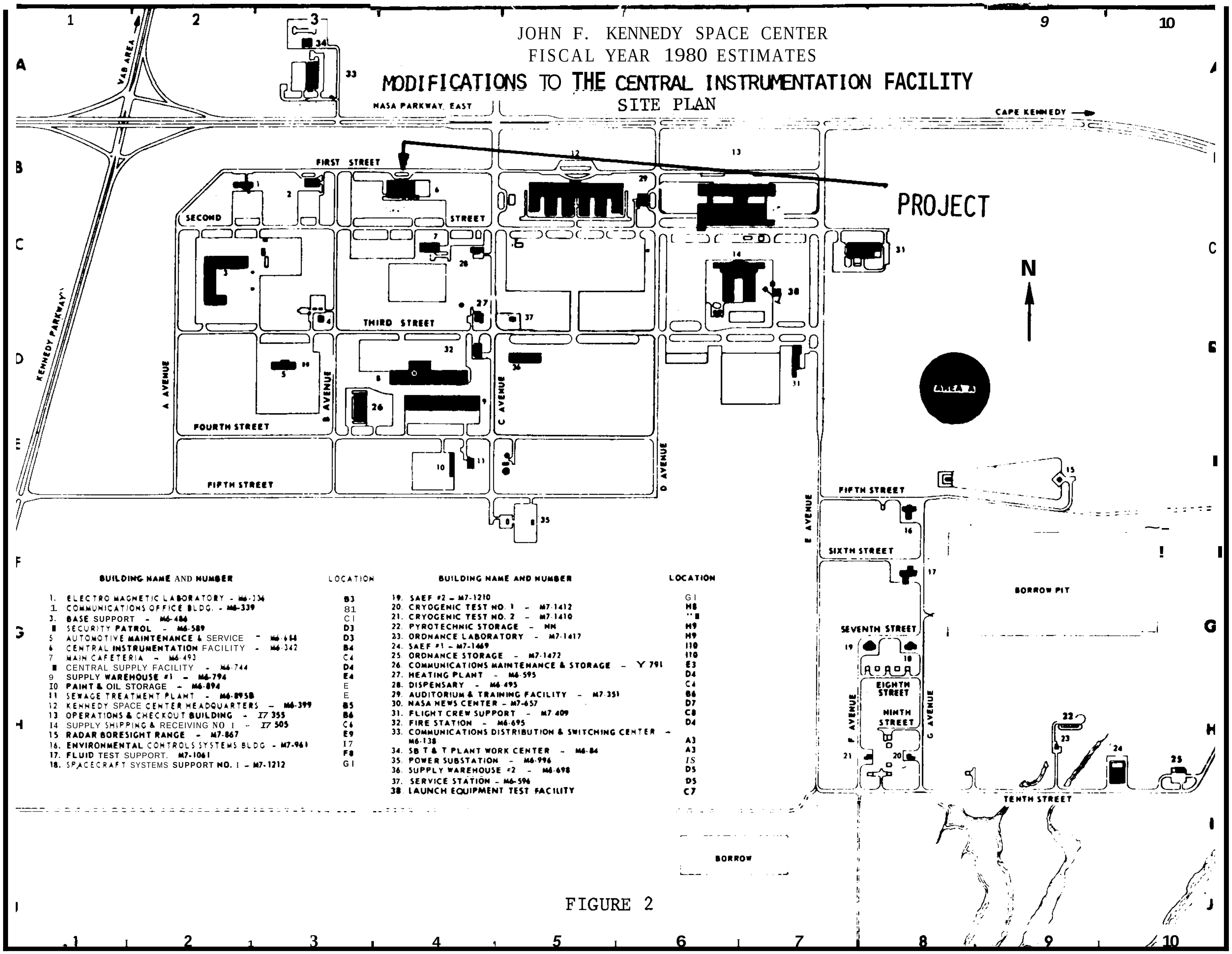
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There is no future estimated funding required for this facility project.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS TO THE CENTRAL INSTRUMENTATION FACILITY

SITE PLAN



BUILDING NAME AND NUMBER	LOCATION
1. ELECTRO MAGNETIC LABORATORY - M6-336	B3
2. COMMUNICATIONS OFFICE BLDG. - M6-339	81
3. BASE SUPPORT - M6-486	C1
4 SECURITY PATROL - M6-589	D3
5 AUTOMOTIVE MAINTENANCE & SERVICE - M6-614	D3
6 CENTRAL INSTRUMENTATION FACILITY - M6-342	B4
7 MAIN CAFETERIA - M6-493	C4
8 CENTRAL SUPPLY FACILITY - M6-744	D4
9 SUPPLY WAREHOUSE #1 - M6-794	E4
10 PAINT & OIL STORAGE - M6-894	E
11 SEWAGE TREATMENT PLANT - M6-895B	E
12 KENNEDY SPACE CENTER HEADQUARTERS - M6-399	B5
13 OPERATIONS & CHECKOUT BUILDING - I7 355	B6
14 SUPPLY SHIPPING & RECEIVING NO I - I7 505	C6
15 RADAR BORESIGHT RANGE - M7-867	E9
16. ENVIRONMENTAL CONTROLS SYSTEMS BLDG - M7-961	I7
17. FLUID TEST SUPPORT. M7-1061	F8
18. SPACECRAFT SYSTEMS SUPPORT NO. I - M7-1212	G1

BUILDING NAME AND NUMBER	LOCATION
19. SAEF #2 - M7-1210	G1
20. CRYOGENIC TEST NO. 1 - M7-1412	H8
21. CRYOGENIC TEST NO. 2 - M7-1410	[illegible]
22. PYROTECHNIC STORAGE - NN	H9
23. ORDNANCE LABORATORY - M7-1417	H9
24. SAEF #1 - M7-1469	I10
25. ORDNANCE STORAGE - M7-1472	I10
26. COMMUNICATIONS MAINTENANCE & STORAGE - Y 791	E3
27. HEATING PLANT - M6-595	D4
28. DISPENSARY - M6-495	C4
29. AUDITORIUM & TRAINING FACILITY - M7-351	B6
30. NASA NEWS CENTER - M7-657	D7
31. FLIGHT CREW SUPPORT - M7-409	C8
32. FIRE STATION - M6-695	D4
33. COMMUNICATIONS DISTRIBUTION & SWITCHING CENTER - M6-138	A3
34. SB T & T PLANT WORK CENTER - M6-84	A3
35. POWER SUBSTATION - M6-996	IS
36. SUPPLY WAREHOUSE #2 - M6-698	D5
37. SERVICE STATION - M6-596	D5
38. LAUNCH EQUIPMENT TEST FACILITY	C7

FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS TO THE CENTRAL INSTRUMENTATION FACILITY

TYPICAL FLOOR PLAN

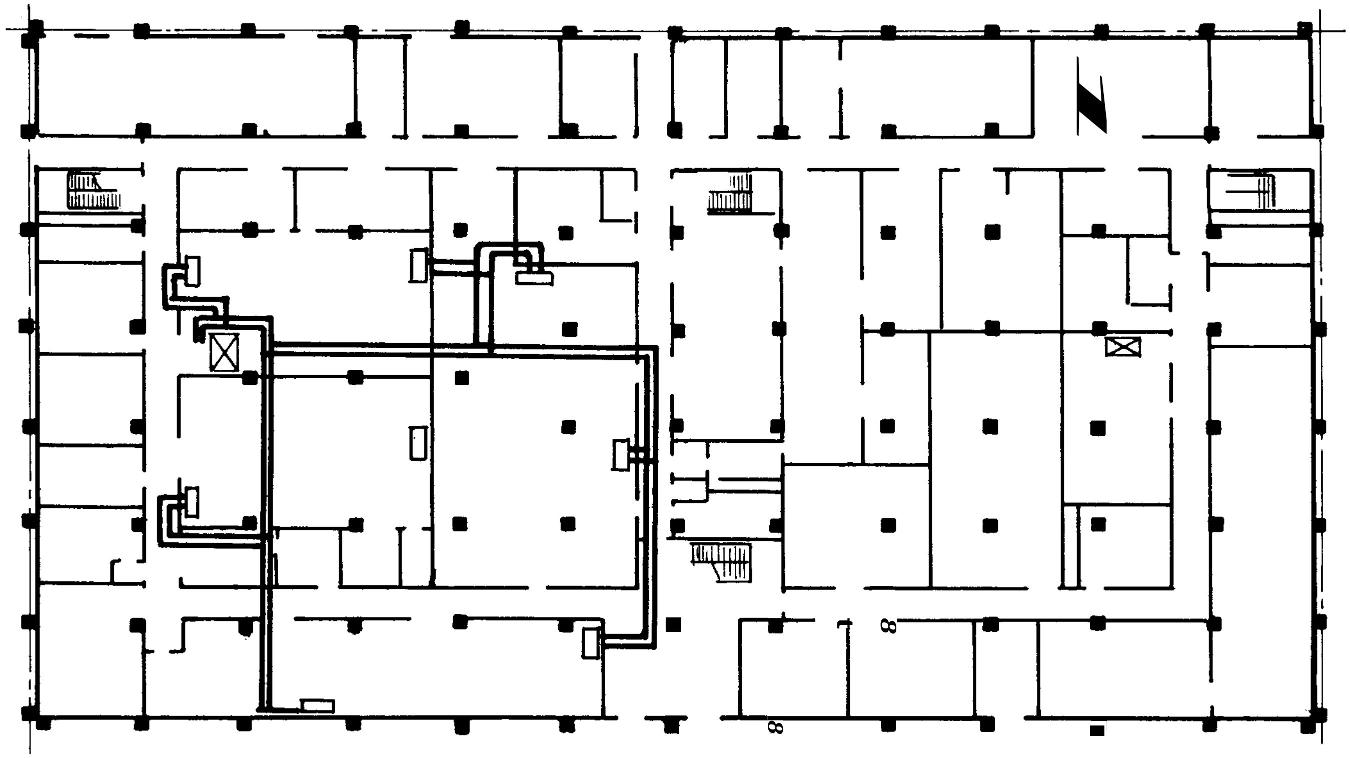


FIGURE 3

JOHN F. KENNEDY SPACE CENTER

FISCAL YEAR 1960 ESTIMATES

MODIFICATIONS TO THE CENTRAL INSTRUMENTATION FACILITY

HVAC SCHEMATICS

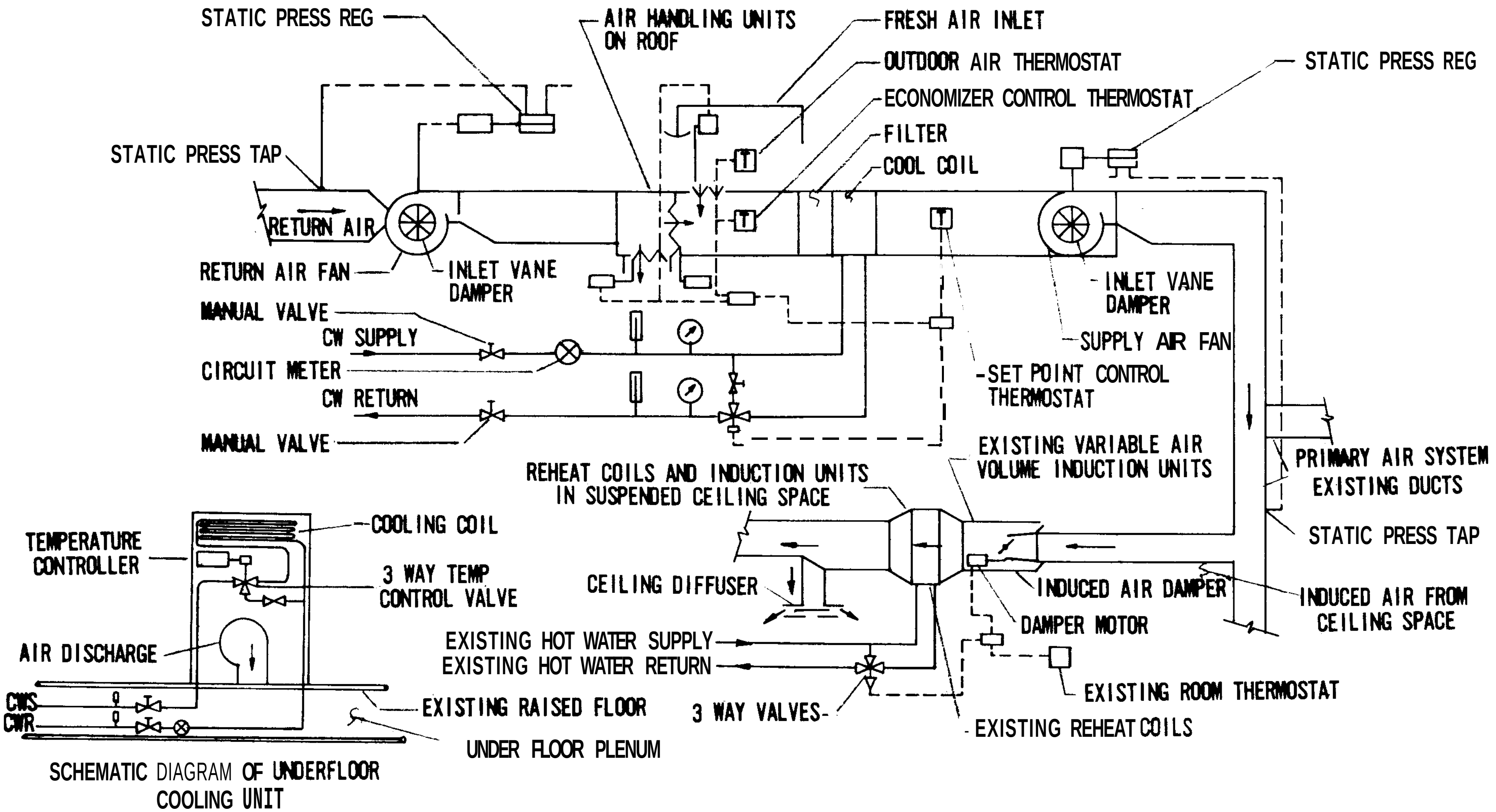
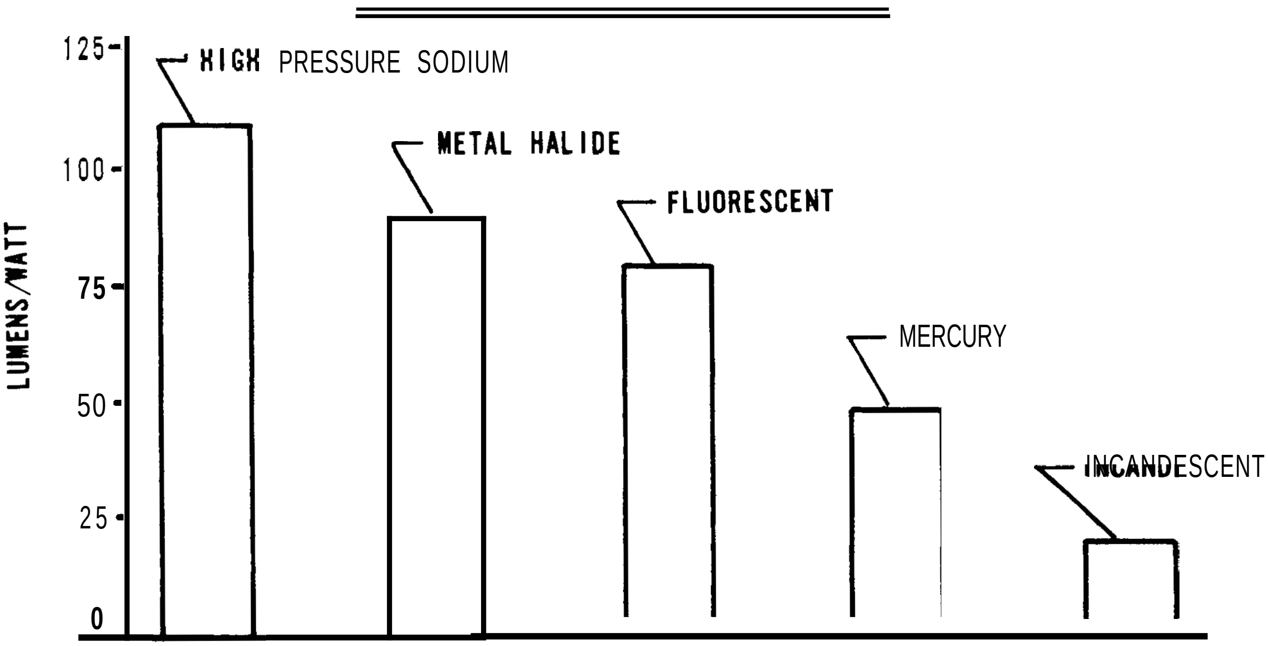


FIGURE 4

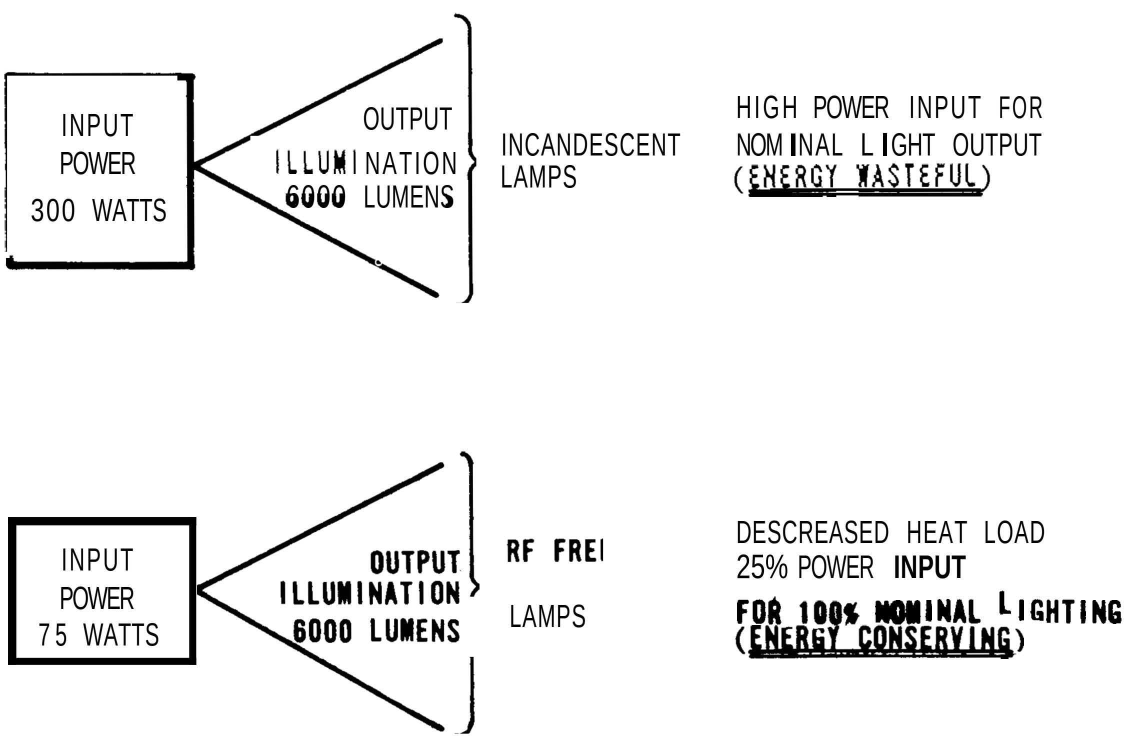
CF 4-10

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS TO THE CENTRAL INSTRUMENTATION FACILITY



CENTRAL INSTRUMENTRTION FACILITY LIGHTING (KSC)



~ 2680 LAMPS -225W/LAMP SAVING-TOTAL SAVING 603,000 WATTS

FIGURE 5

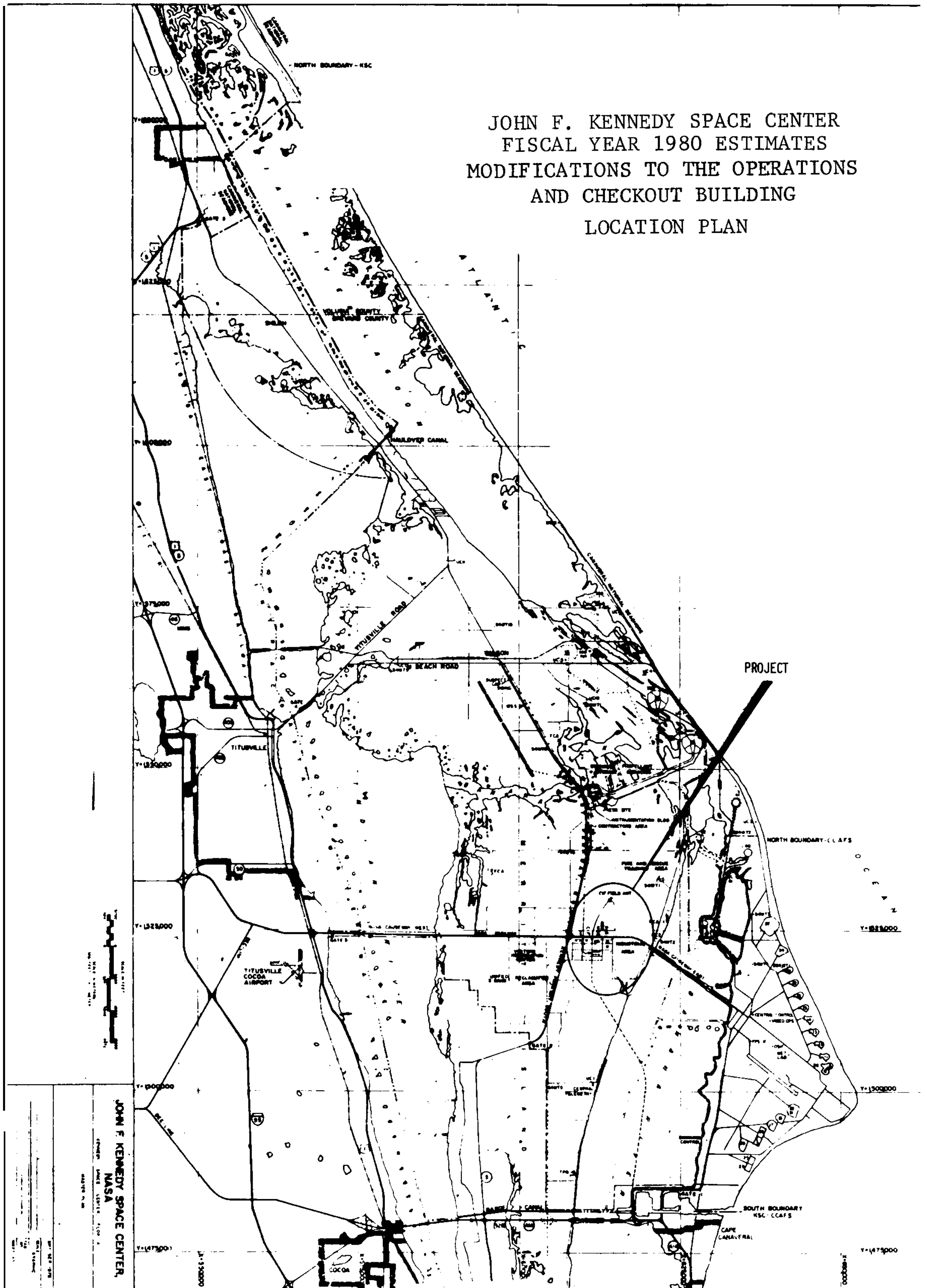

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO THE OPERATIONS
AND CHECKOUT BUILDING
LOCATION PLAN
PROJECT
NORTH BOUNDARY - KSC
TITUSVILLE
HAULOVER CANAL
NORTH BOUNDARY-CCAFS
SOUTH BOUNDARY KSC-CCAFS
CAPE CANAVERAL
COCOA
TITUSVILLE COCOA AIRPORT
JOHN F KENNEDY SPACE CENTER, NASA

Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modifications to the Operations and Checkout Building

INSTALLATION: John F. Kennedy Space Center

FY 1980 CoF ESTIMATE: $950,000

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	105,000	65,000	170,000
Capitalized investment	N/A	42,637,353	42,637,353
Total	105,000	42,702,353	42,807,353

SUMMARY PURPOSE AND SCOPE:

This project will provide for a reduction in the capacity of the heating, ventilating, and air-conditioning (HVAC) system in the Operations and Checkout (O&C) Building (M7-355) to obtain the maximum conservation of energy without degradation of the systems. The modifications to the HVAC system will include the conversion of the dual duct and single duct reheat systems to an efficient system incorporating Variable Air Volume (VAV) and/or bypass features, modifications to air supply and exhaust systems in intermitted use spaces, modification to controls, reduction of air through ventilation systems, reduction of air volume to actual cooling/heating loads, and adjustment of fresh, exhaust, and relief air for infiltration control. Also included in the project will be the treatment of all windows with low-cost triple glazing systems for conductive/radiative control.

PROJECT JUSTIFICATION:

The O&C Building is the prime center for Space Shuttle Payload activities including the Spacelab missions. The building houses a large office area, laboratory and control area with monitoring and control equipment sensitive to temperature and humidity, and the assembly and test area which is maintained as a semi-clean room for work on payloads. The HVAC systems currently installed in the O&C Building exceed the capacity required to support current and future programs. Significant energy and cost savings in the operation of this building can be achieved through conversion to VAV systems, addition of discriminatory controls to the remainder of the building (the administration and office area will have discriminatory controls added in a prior year project), modifications to the zones and systems to allow shutdown of selected areas and reduction in the heating and cooling loads, and modifications to the air circulation system.

There are periods in the spring and fall when the single and double duct and multizone HVAC systems heat and cool at the same time in an effort to provide comfort. These systems were designed and installed at a time when energy was considered plentiful and cheap. The principal criteria at that time was to attain a low-cost initial installation. Though the systems are performing well, this concept is costly to operate and wastes energy. Modifying to VAV will reduce the energy required when only the actual air volume necessary to condition the inside air is used.

Installation of discriminatory and anticipatory controls will result in savings in use of heating oil and refrigeration power since it will result in a more efficient and timely conditioning of the air throughout the building.

A significant reduction in electric power and oil consumption can be achieved if the air circulation in each individual air handling system is adjusted to that required to satisfy each particular zone heating/cooling load. The required flow rates vary from 20 percent to 110 percent of the original design loading.

The treatment of the windows will reduce the heating and cooling load on the HVAC system. Several options were reviewed and the triple glazing proved to be the optimum since it results in significant energy savings, is simple to install, and is cheaper than other effective methods.

The implementation of this project will result in energy savings totalling 46 x 109 BTU's/year. This provides a less than 6-year payback period making it a very effective and attractive investment.

IMPACT OF DELAY:

Failure to implement this project will not allow this attractive cost savings to be realized on a timely basis.

PROJECT DESCRIPTION:

This work within the O&C Building will involve modifying the existing hot and cold air mixing boxes in the Administration and Engineering area to convert them to VAV, and modifying the associated blowers. Discriminatory and anticipatory controls will be added to the existing environmental control systems. These controls, used in conjunction with the Utilities Control System (UCS), will provide responsive changes in air handlers, hot decks, cold decks, chilled and hot water temperatures to automatically meet changing load requirements. Controls for the dual duct systems and multizone systems will consist of new room thermostats, master and slow controls, sensors, transmitters, receivers, controllers, cold deck and hot deck thermostats, return air humidistats, hardware interface modules and connections to the UCS. The reduction in air circulation will be accomplished by replacing pulleys and belts on supply air fans with appropriate sized units; removing the return air fan wheels, scrolls, shafts and motors from the fan housing where the supply fan can deliver the reduced flow rate; installing blanking plates in ceiling diffusers sized to obtain minimum acceptable air distribution; reducing exhaust and outside air to the appropriate rates; and reducing fan motor sizes in conjunction as appropriate.

In addition, modifications to the 21,415 square feet (1990 square meters) of existing window installations from single glazing to triple glazing will be accomplished by installing a pre-fabricated plastic frame covered on both sides by an inhibited polyester film.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	950,000
Variable air volume mixing box conversions	EA	547	903.00	494,000
Discriminatory controls	LS	---	---	280,000
Reduce air circulation	LS	---	---	140,000
Window treatment	SF	21,415	1.68	36,000
Equipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total				950,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Operations and Checkout Building

OTHER EQUIPMENT SUMMARY:

There is no other equipment required for this facility project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There is no future funding required for this facility project.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO THE OPERATIONS AND CHECKOUT BUILDING

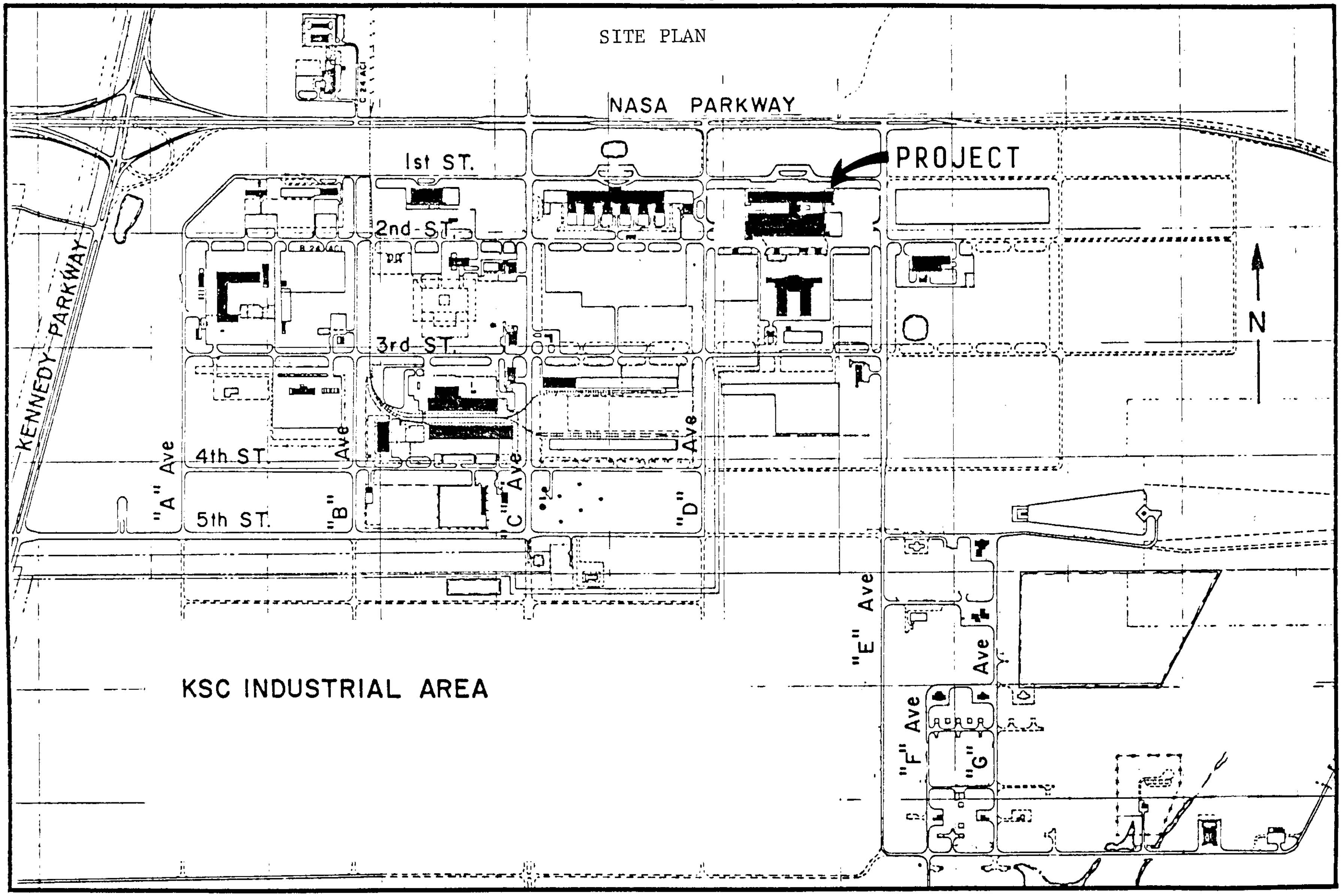


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO THE OPERATIONS AND CHECKOUT BUILDING

OPERATIONS AND CHECKOUT BUILDING ARRANGEMENT

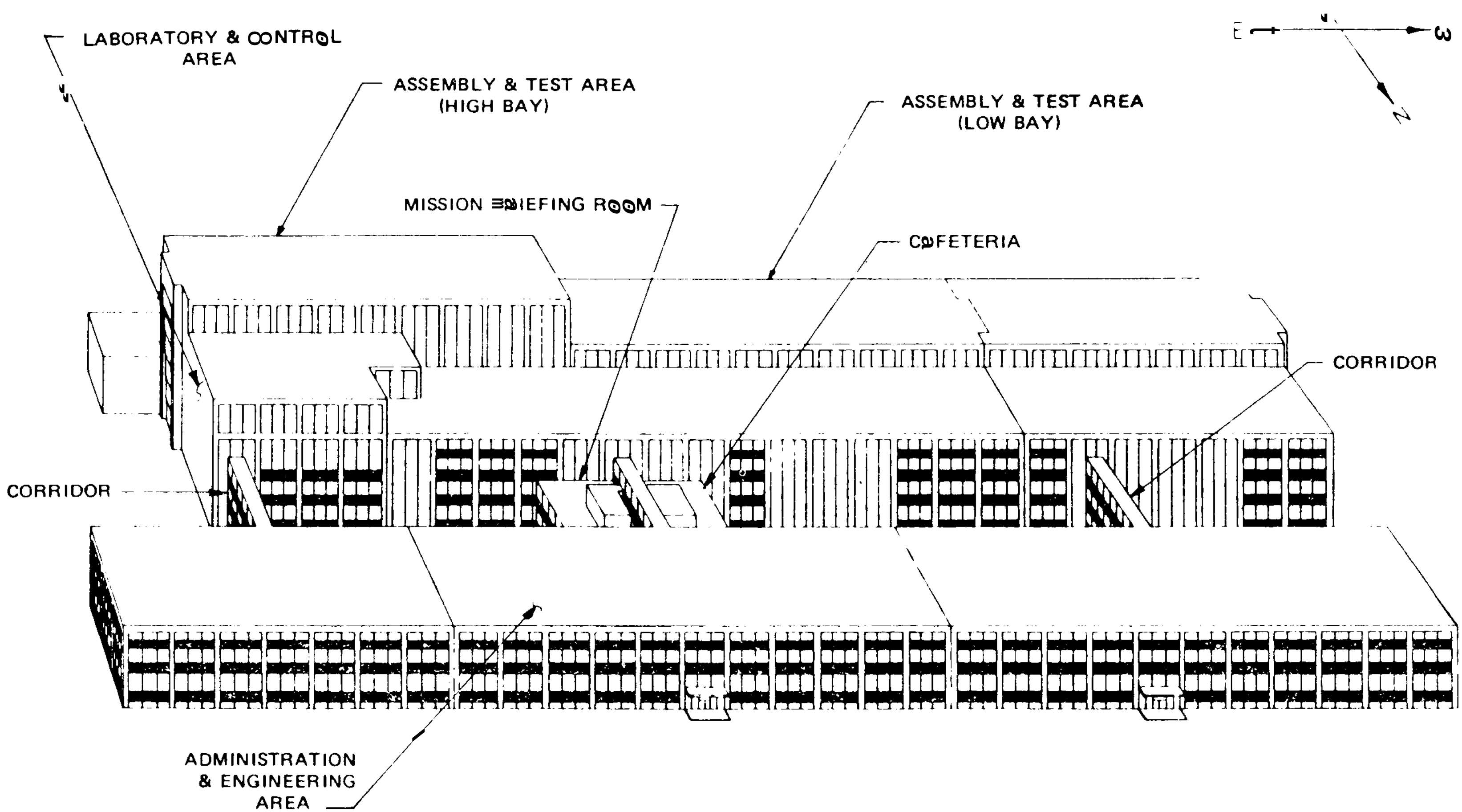


FIGURE 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

LANGLEY RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Modifications of Model Support System 8-Foot High Temperature Structures Tunnel...	1,410,000	CF 5-1
Modifications to 8-Foot Transonic Pressure Tunnel...	2,000,000	CF 5-8
Modification of Transonic Dynamics Tunnel...	970,000	CF 5-16
Rehabilitation and Modification of Gas Dynamics Laboratory...	3,600,000	CF 5-22
Total...	7,980,000	

LANGLEY RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS OF MODEL SUPPORT SYSTEM 8' HIGH TEMPERATURE STRUCTURES TUNNEL (1265)

LOCATION PLAN

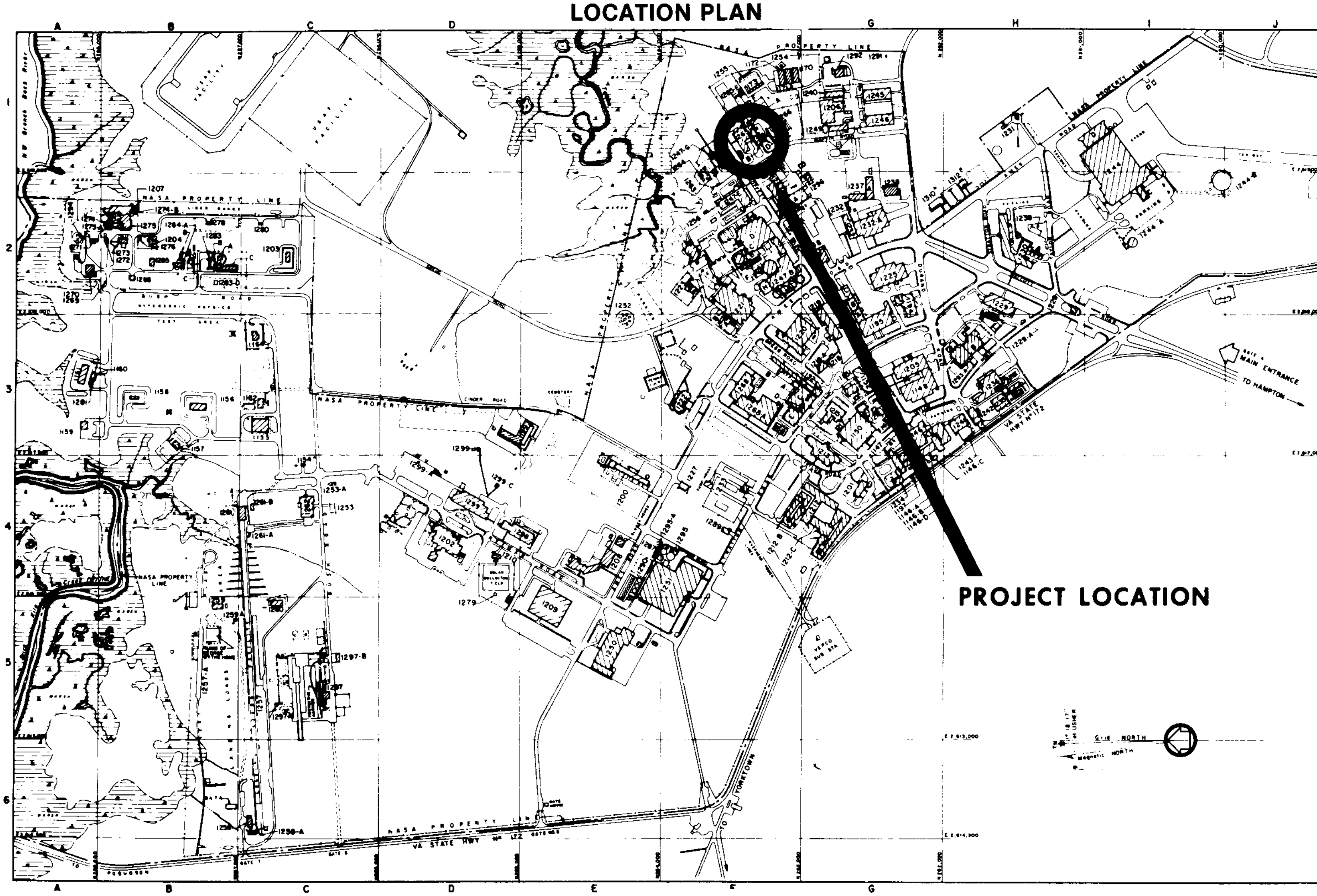


Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modifications of Model Support Svstem 8-Foot High Temperature Structures Tunnel (1265)

INSTALLATION: Lanalev Research Center

FY 1980 CoF ESTIMATE: $1.410.000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	126,000	---	126,000
Capitalized investment	N/A	16,209,432	16,209,432
Total.	126,000	16,209,432	16,335,432

SUMMARY PURPOSE AND SCOPE:

The modifications of the Model Support System 8-Foot High Temperature Structures Tunnel (HTST), Building 1265, (Figures 1 and 2) provide for the addition of: (1) a Lifting-Surface Test Apparatus (LSTA), for simulating the tip portion of a wing-elevon or a complete fin of a hypersonic vehicle; (2) a new first minimum section for the wind tunnel made of a material such as silicon nitride; and, (3) a sweep-type pressure-temperature calibration mechanism. Since the late 1960's, the 8-Foot HTST has provided the only capability for large scale testing in realistic hypersonic flows. However, an aerothermodynamic data base necessary for the assessment of the behavior of critical structural interface regions has not been available due to the lack of the above modifications. The only practicable method for obtaining this data base is through the use of a wind tunnel. This facility is unique in this field.

PROJECT JUSTIFICATION:

The LSTA, the new, first minimum section and the calibration mechanism will provide the proper flow and known flow conditions needed to investigate and resolve critical design problems for hypersonic vehicles and space transportation systems. These problems involve interactions of different thermostructural concepts at interface regions (leading edge/wing box) and local areas of high heating due to complex structure/flow interactions. These cannot be adequately predicted by analysis or simulated in small scale wind tunnel tests. Proof that these deficiencies can lead to problems in flight is evidenced by the buckling of the X-15 leading edges, which is attributed to inadequate knowledge of interference heating and the resultant thermal stress in the leading edge segments. These modifications to the 8-Foot HTST will provide the ground-based testing capability required to obtain the necessary aerothermodynamic data base and, permit the structural concept studies and evaluations needed to develop confidence in the design of wing-elevon structures for possible Shuttle component retrofit and for future hypersonic aircraft-type vehicles.

The LSTA provides the best feasible approach to correlation of ground-based data with flight data obtained from the Shuttle and future hypersonic vehicles and, in addition, would readily permit ground-based studies of any anomalous behavior observed in flight. The modified radiant heater configuration will provide needed test capability (preheat and extended trajectory) in the 8-Foot HTST for the other large wing-type components. Only a limited area of a large model can now be heated with the existing equipment.

The ceramic first minimum section, as shown in Figure 3 - Schematic Variations in Hot Core Size, will eliminate several disadvantages of the existing first minimum metal section, including the requirement to monitor and limit the maximum surface temperature during each run, repair of cracks which develop after only a few runs, and polishing the surface (which discolors after each high-energy run), in order to minimize the heat transfer during the next run. In addition, the metal component must be film cooled with cold air, which reduces the hot core diameter in the test section region from a potential six feet (1.8 meters) to about four feet (1.2 meters). Since the film cooling will be minimized and possibly eliminated, the silicon nitride first minimum section will provide a larger, more uniform, hot gas test core. The larger test core will allow simultaneous testing of the entire surface of a large model or apparatus, such as the LSTA.

The calibration mechanism will provide a means of obtaining a measurement of the free stream flow conditions in the test section just prior to model insertion during each tunnel run. These measurements will provide direct information on the flow environment of the model needed to produce more accurate research data than using measured settling chamber flow conditions and relying on the settling chamber-to-test section calibration to predict the model fiow environment. The mechanism will also be used to directly assess the effects of changes in tunnel component Configuration which are intended to improve both the flow conditions and facility operation. In addition, it will provide a means of early detection of even minor unexpected changes, in the tunnel operating configuration, before they become major repair problems.

IMPACT OF DELAY:

This is the only facility in the "free world" capable of obtaining data using large to full scale test specimens. Because ,wind tunnel testing is the only practical method of effectively obtaining a data base for this kind of work, further research could become cost prohibitive.

PROJECT DESCRIPTION:

This project provides for LSTA and model support system modifications, a new, first minimum section, and a sweep-type pressure-temperature calibration mechanism. The LSTA will consist of a rigid internal structure of ribs and spars with replaceable boiler plate leading edge, surface structure, wing tip closure, and elevon. The apparatus will have a minimal six-foot (1.8 meter) span and six-foot chord, and will be designed to allow for variation in pitch, yaw, control-surface angle, variation in leading-edge sweep and radius, and variation in lifting surface tip contour and closure. The model support system modifications include adding the capability for varying the yaw angle and repositioning and installing the two large heater panels for preheating each model run prior to insertion in the tunnel test stream.

The ceramic first minimum section, as shown in Figure 3 - Schematic Variations in Hot Core Size, will be similar to the existing section, but fabricated of a material such as silicon nitride which can withstand extremely high temperatures and thermal shock without deterioration. The calibration mechanism will be pneumatically-operated and installed permanently in the test section pod. The mechanism will be designed with the capability for both variable longitudinal and vertical positioning in the test section allowing measurements at arbitrary model locations.

PROJECT COST ESTIMATE:

The project cost estinate is based on an updated Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition...	---	---	---	---
Construction...	---	---	---	---
EauiDment...	---	---	---	1,410,000
New lifting surface test apparatus (LSTA)...............	LS	---	---	300,000
Installation of model support system...................	LS	---	---	555,000
Replacement of first minimum section...........	LS	---	---	275,000
Installation of pressure calibration mechanism.........	LS	---	---	280,000
Fallout Shelter (not feasible)...........................	---	---	---	---
Total..			....	1,410,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Schematic Variations in Hot Core Size - Minimum Sections

OTHER EQUIPMENT SUMMARY:

At present, there is no foreseen requirement.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There is no foreseen requirement for future CoF funding for this project.

LANGLEY RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS OF MODEL SUPPORT SYSTEM 8' HIGH TEMPERATURE STRUCTURES TUNNEL (1265)

SITE PLAN

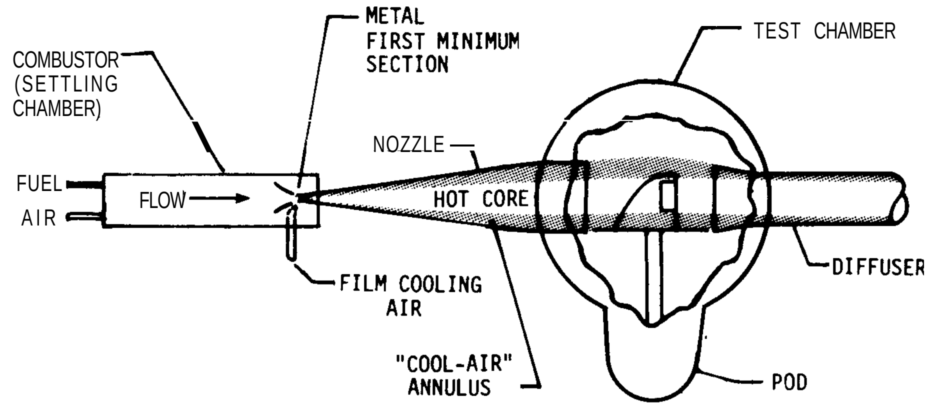
FIGURE 2

LANGLEY RESEARCH CENTER

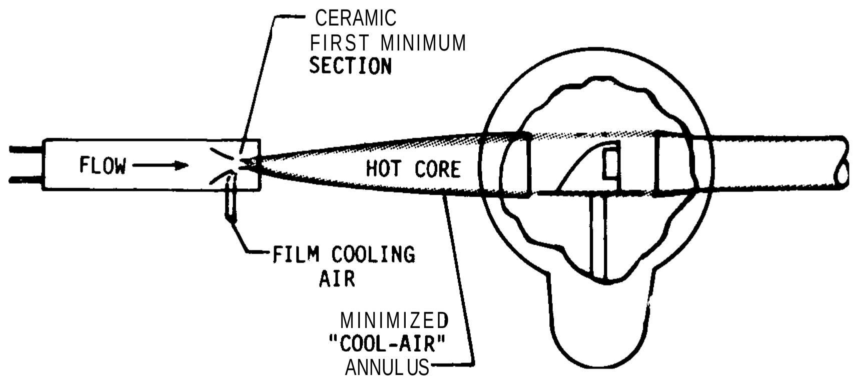
FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS OF MODEL SUPPORT SYSTEM 8' HIGH TEMPERATURE STRUCTURES TUNNEL (1265)

SCHEMATIC VARIATIONS IN HOT CORE SIZE



HOT CORE WITH EXISTING METAL FIRST MINIMUM SECTION



ADVANTAGES

BIGGER CORE
LESS MAINTENANCE
FEWER SHORT RUNS

HOT CORE WITH NEW CERAMIC FIRST MINIMUM SECTION

Figure 3

LANGLEY RESEARCH CENTER

FISCAL YEAR **1980** ESTIMATES

MODIFICATION OF 8' TRANSONIC PRESSURE TUNNEL (640)

LOCATION PLAN

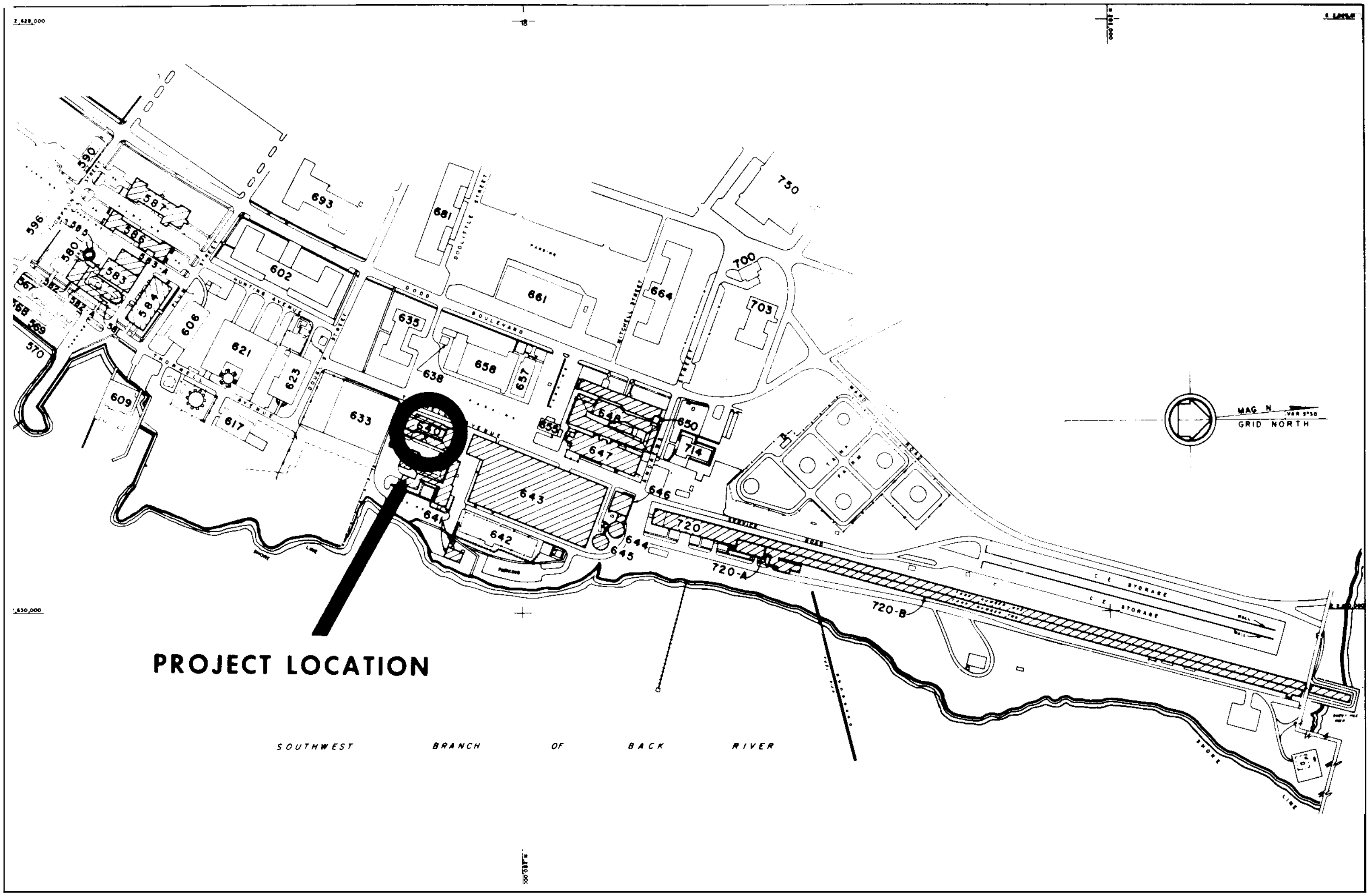


Figure 1

PROJECT TITLE: Modification to 8-Foot Transonic Pressure Tunnel (640)

INSTALLATION: Lannlev Research Center

FY 1980 CoF ESTIMATE: $2,000,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding..	188,000	---	188,000
Capitalized investment.......	N/A	8,901,719	8,901,719
Total..........	188,000	8,901,719	9,089,719

SUMMARY PURPOSE AND SCOPE:

This provides for modification to the 8-Foot Transonic Pressure Tunnel (TPT), Building 640, Langley Research Center (LaRC) (Figure 1). This work includes the following: (1) installation of low-turbulence screens, honeycomb, and noise baffles to reduce the levels of turbulence and noise in the test section to the low levels required for laminar flow research; (2) replacement of the existing 32 fan blade retaining boxes with ones of a new design to reduce the maintenance downtime and cost experienced with the present boxes. The TPT has been in operation since 1953 and is considered to have good flow quality and low turbulence characteristics. LaRC has been assigned the mission to develop the broad aerodynamic systems technology for long haul aircraft.

Specifically, viscous drag reduction through laminar flow control is required to provide for improved efficiency (20-30 percent) in fuel consumption for long haul aircraft in the 1990 time frame and beyond. In support of this development, the TPT has been selected as the best NASA candidate for laminar flow research when equipped with honeycomb screens to reduce strong turbulence, and acoustic treatment to decrease noise disturbances to acceptable levels. This project is, therefore, in direct support of the Aircraft Energy Efficiency (ACEE) Program. In order to fulfill this role, it is necessary that Langley research staff have available a transonic wind tunnel of appropriate size and flow quality for the extensive periods of time required for the meticulous and time consuming boundary layer experiments required for the laminar flow research program. Research in this facility will be directed at developing methods of improving the aerodynamics efficiency of both civil and military aircraft configurations for flight at high subsonic and transonic speeds.

PROJECT JUSTIFICATION:

The 8-Foot Transonic Pressure Tunnel (TPT) is a prime tool used in the development of advanced technologies and supercritical wing aerodynamics, and winglets and propulsion system integration. This work is necessary to support the development of efficient aircraft configurations intended for flight at high subsonic and transonic speeds. The more basic aerodynamic research required for the design and optimization of aircraft to achieve the economic benefits of extensive laminar flow has proceeded and will continue to proceed at a slow pace until a suitably equipped wind tunnel becomes available. Because of the aerodynamics design of the 8-Foot TPT circuit, and its larger contraction ratio (20 to 1), it has at present, as verified by extensive recent measurements, excellent flow quality characteristics which, when enhanced by the proposed addition of low turbulence screens and honeycomb and noise baffles, will meet the extreme flow quality essential for this very important laminar flow research.

Improvements in aircraft manufacturing techniques, together with the development of means of keeping the leading edge of a wing free of bug deposits and possibly ice, would seem to make possible the achievement in practice of extensive laminar flow, with a consequent large reduction in drag and fuel consumption which has been theoretically possible, but not practical, in the past. To most effectively capitalize on this possibility, however, considerable aerodynamic research is required to improve the understanding of the basic mechanisms, to extend previous work to high subsonic speeds, and to combine both supercritical and laminar flow principles. This research requires a large wind tunnel with high subsonic speed capability, low turbulence and noise levels, reasonable Reynolds number capability, close control of test conditions, and the long run times necessary for wind tunnel flow stabilization, and for running boundary layer experiments.

The replacement of the existing fan blade boxes (Figure 2) is essential because the boxes are approaching their fatigue limit. This is evidenced by the magnetic particle inspection of each box on an annual basis since 1976. To date, these non-destructive tests have revealed that 30 of the 32 boxes have had fatigue cracks requiring repair. Because of the continuing occurrence of these cracks, there is a possibility of the fan blades separating from the blade boxes. If this were to occur, extensive damage could be done to the facility.

IMPACT OF DELAY:

If this project is not implemented in the 1980 timeframe, critical research in support of the ACEE Program will be delayed by the lack of a suitable facility. At the present time, this testing is envisioned as being conducted in CY 1981. Because this ground facility research is a needed prerequisite to a planned flight investigation, any delay beyond an FY 1980 start for this project will seriously impair the probability for successful accomplishment of the flight test program and hence the timely introduction into new generation commercial aircraft development.

PROJECT DESCRIPTION:

The basic elements of the modification to the 8-Foot Transonic Pressure Tunnel are the low turbulence screens and honeycomb, noise baffles (Figure 3) for flow quality improvement, and blade retaining boxes for increased efficiency of operation.

1. Screens and Honeycomb

Low turbulence screens and honeycomb will be placed across the stilling chamber just downstream of the cooling coils and turning vanes. Three additional 36-foot (11 meters) diameter screens will be placed across the stilling chamber just ahead of the contraction section. (Aerodynamic fairings are required over the screen support beams.)

2. Noise Baffles

Two sets of noise baffles will be installed, one ahead of, and one behind the tunnel fan section. These baffles will consist of structural support members wrapped with an outer covering of perforated metal and the interior filled with an acoustic material. These members will transmit the aerodynamic drag and static loads from the baffles to the tunnel shell.

3. Blade Retaining Boxes:

The 32 existing blade retaining boxes will be replaced with boxes of a new design. This design with improved materials, fabrication techniques, and inspection procedures will alleviate fatigue failure by a uniform distribution of the blade loads transmitted to the boxes.

PROJECT COST ESTIMATE:

This project cost estimate is based on a completed Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition..	---	---	---	---
Construction..	---	---	---	---
Equipment...	---	---	---	2,000,000
Modification for low turbulence screens and honeycomb..	LS	---	---	700,000
Modification for noise baffles..........................	EA	2	450,000	900,000
Replacement of fan blade boxes..........................	EA	32	12,500	400,000
Fallout Shelter (not feasible)..........................	---	---	---	---
Total				2,000,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Fan Blade Box
Figure 3 - Low Turbulence Screen and Baffles

OTHER EQUIPMENT SUMMARY:

Approximately $1.9 million of other associated equipment is involved in this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

An automated model support system is being investigated for future incorporation in the 8-Foot TPT. Such a system would provide an energy savings which would permit a payback in less than five (5) years.

LANGLEY RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATION OF 8' TRANSONIC PRESSURE TUNNEL

(640)

ASSEMBLED VIEW OF BLADE AND BLADE BOX

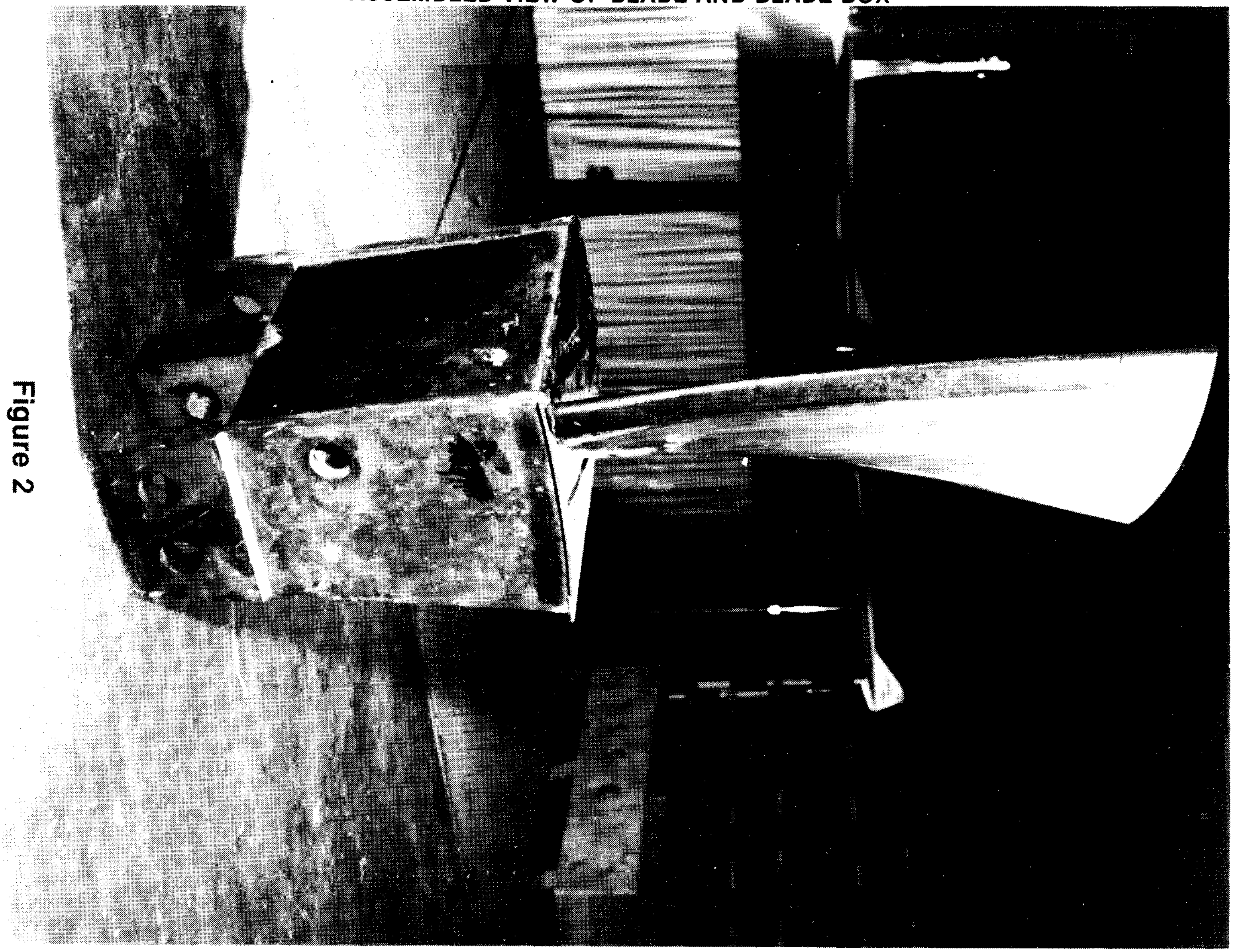


Figure 2

LANGLEY RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATPON OF 8’ TRANSONIC PRESSURE TUNNEL (640) LOW TURBULENCE SCREENS AND NOISE BAFFLES

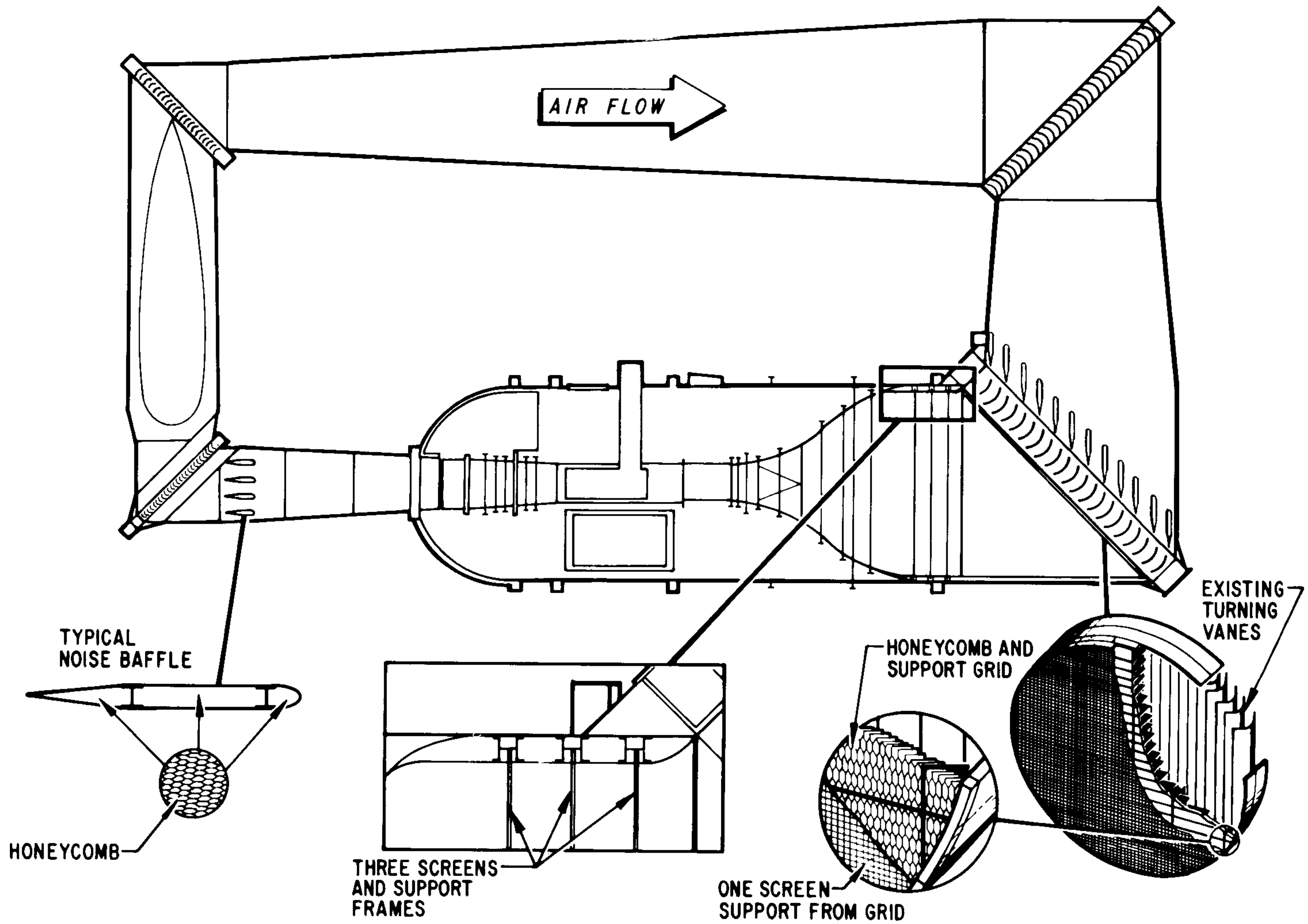


Figure 3

LANGLEY RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATION OF TRANSONIC DYNAMIC TUNNEL (648)

LOCATION PLAN

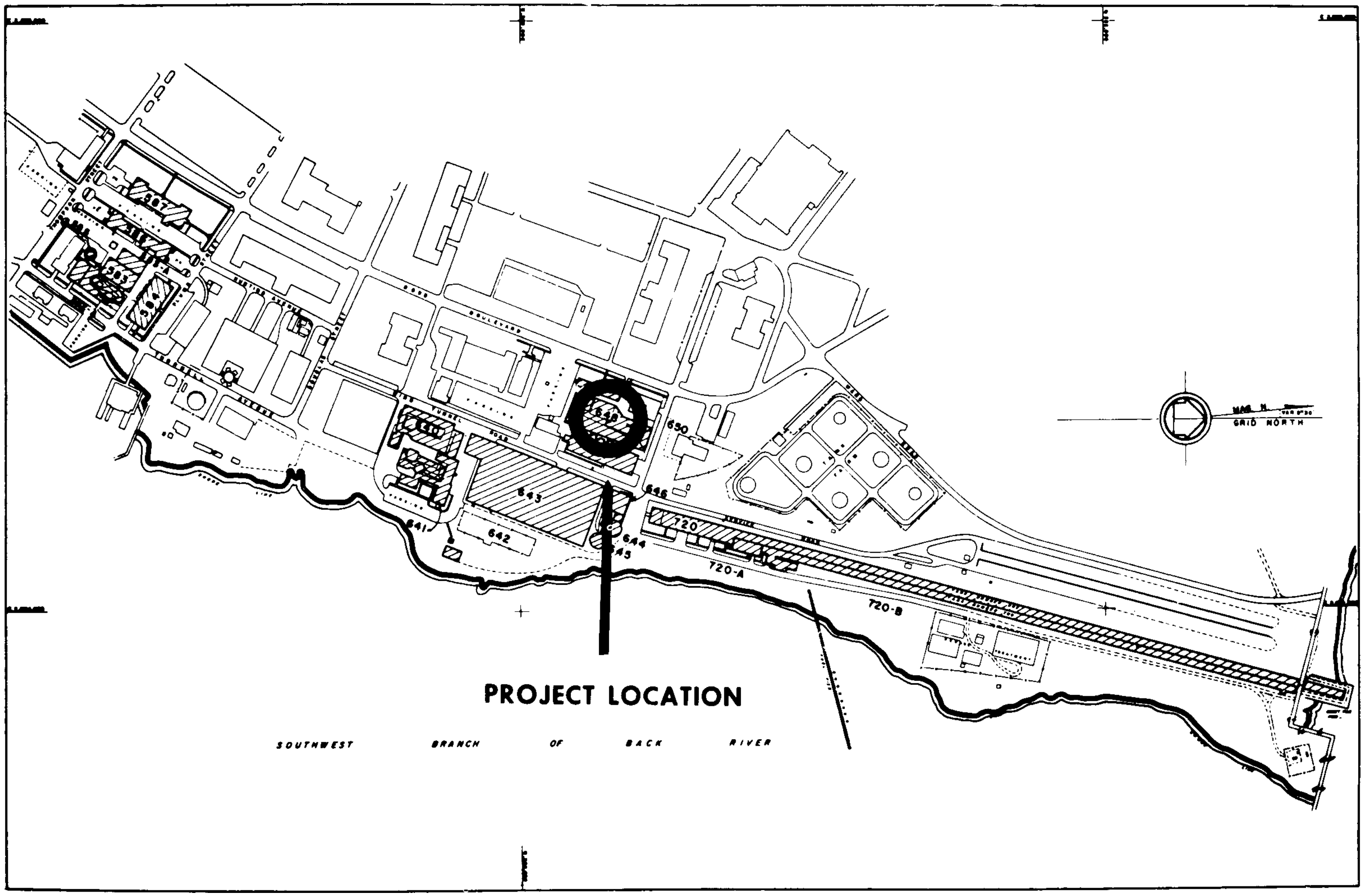


Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modification of Transonic Dynamics Tunnel (648)

INSTALLATION: Langley Research Center

FY 1980 CoF ESTIMATE: $970,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Desinn	Construction	Total
Specific CoF funding..	50,000	---	50,000
Capitalized investment..................................	N/A	14,530,794	14,530,794
Total....	50,000	14,530,794	14,580,794

SUMMARY PURPOSE AND SCOPE:

The Langley Research Center's (LaRC) Transonic Dynamics Tunnel (TDT) facility is a unique National facility which is dedicated to work in the field of aeroelasticity (Figure 1). The facility is used to verify the flutter and aeroelastic characteristics of most U.S. high-speed aircraft designs; for active controls, and rotorcraft aeroelastic research; for flutter, buffet and ground-wind loads testing of Shuttle and other launch vehicles; and, for confirmation of unsteady transonic flow theory. The primary purpose of this project is to provide for the replacement of the cooling tower. This is necessary due to the existing safety hazard presented by its age and continued use.

PROJECT JUSTIFICATION:

The LaRC Transonic Dynamics Tunnel (Figure 2) has characteristics and features which make it a unique and much used (over two-year backlog of tests) National facility for work in the field of aeroelasticity. Salient characteristics are its transonic, continuous and variable-density flow, snd 16-foot x 16-foot (4.9 meters x 4.9 meters) test section. Unique features are the ability to use Freon-12 gas or air as a test medium, a computerized data acquisition system designed for multi-channel dynamics data, special model cable mount systems, a "flutter stopper," safety screens, and good visibility of the model during tests. The facility is used to verify, through tests of aeroelastically-scaled models, the flutter and aeroelastic characteristics of most high-speed U.S. aircraft, including the F-15, F-16, F-111, F-111 TACT 11, and the B-52 multimode flutter suppression test vehicle. It is used for active control and rotorcraft research programs such as Aircraft Energy Efficiency (ACEE), Supersonic Cruise Aircraft Research (SCAR), Drones for Aerodynamic Testing (DAST), and Rotor Systems Research Aircraft (RSRA). In addition, it is used for flutter, buffet and ground-wind loads testing on Shuttle, and for verification of unsteady transonic flow theory.

The existing 10,000 gallon-per-minute tower (37,850 liters per minute) is 25 years old, and the structural members, tower fill water distribution systems, eliminators, fans, fan stacks, decks and deck joists are badly deteriorated. Replacement of the cooling tower is required to provide the capability of handling a cooling capacity of 15,000 gpm (56,775 liters per minute). This is necessary to accommodate future requirements to handle the repowering of the drive system and other tunnel components. The structure of the tower has deteriorated and could present a hazard since the structure is elevated approximately 35 feet above ground. Although the storage basin is underground and is covered, rehabilitation is necessary to prevent the entrance and accumulation of debris.

IMPACT OF DELAY:

The cooling tower is 25 years old and requires replacement. Failure to replace it could seriously impact the safety, as well as the operation, of the facility.

PROJECT DESCRIPTION:

The new cooling tower will be constructed in the existing parking lot adjacent to the TDT. It will have a three (3) cell, elevated basin with each cell providing 5,000 gpm (18,925 liters per minute) cooling capacity. The project provides for the completion of two cells which will supply 10,000 gpm (37,850 liters per minute) cooling capacity for the TDT. The third cell will be completed when the TDT power is increased, which will be in the future.

The return lines will be sized to accommodate the increased capacity. Demolition of the existing tower, steel support structures, and associated systems will commence after the new tower is in operation.

PROJECT COST ESTIMATE:

The project cost estimate is based on an updated Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition.	---	---	---	---
Construction.	---	---	---	---
EauiDment	---	---	---	970,000
Cooling tower installation	LS	---	---	804,000
Electrical installation.	LS	---	---	50,000
Piping installation	LS	---	---	96,000
Demolition.	LS	---	---	20,000
Fallout Shelter (not feasible)	---	---	---	---
Total				970,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY:

No other collateral or non-collateral equipment is involved.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Future requirements to complete this project, as currently planned, include rehabilitation of the freon reclamation system and the repowering of the tunnel in order to increase the density of the test medium. In addition, a model deformation measurement system is planned. The cost estimate for this work is approximately $8–10 million.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES

MODIFICATION OF TRANSONIC DYNAMICS TUNNEL (648)

SITE PLAN

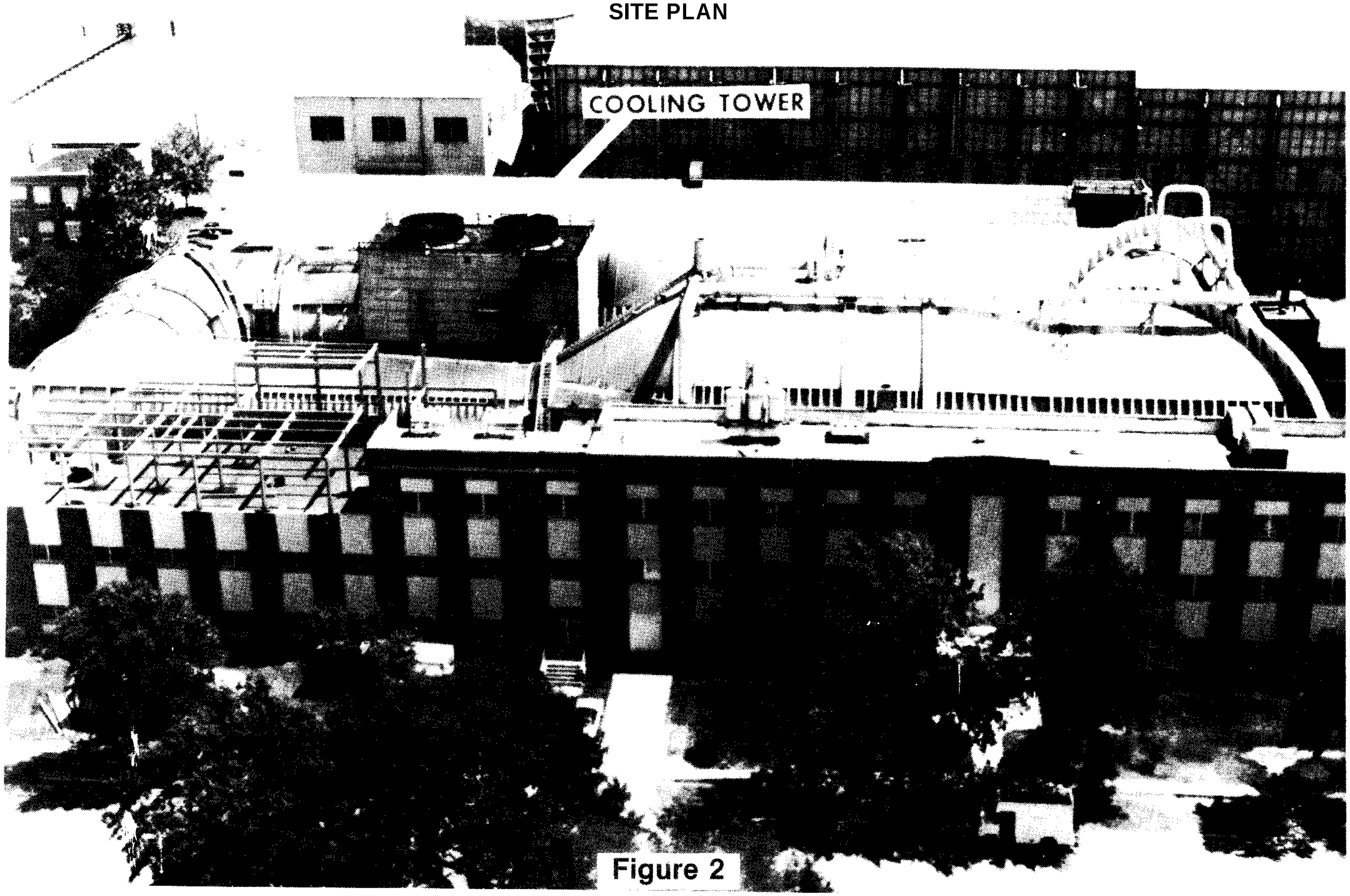


Figure 2

LANGLEY RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

REHABILITATION AND MODIFICATION OF GAS DYNAMICS LABORATORY (1247)

LOCATION PLAN

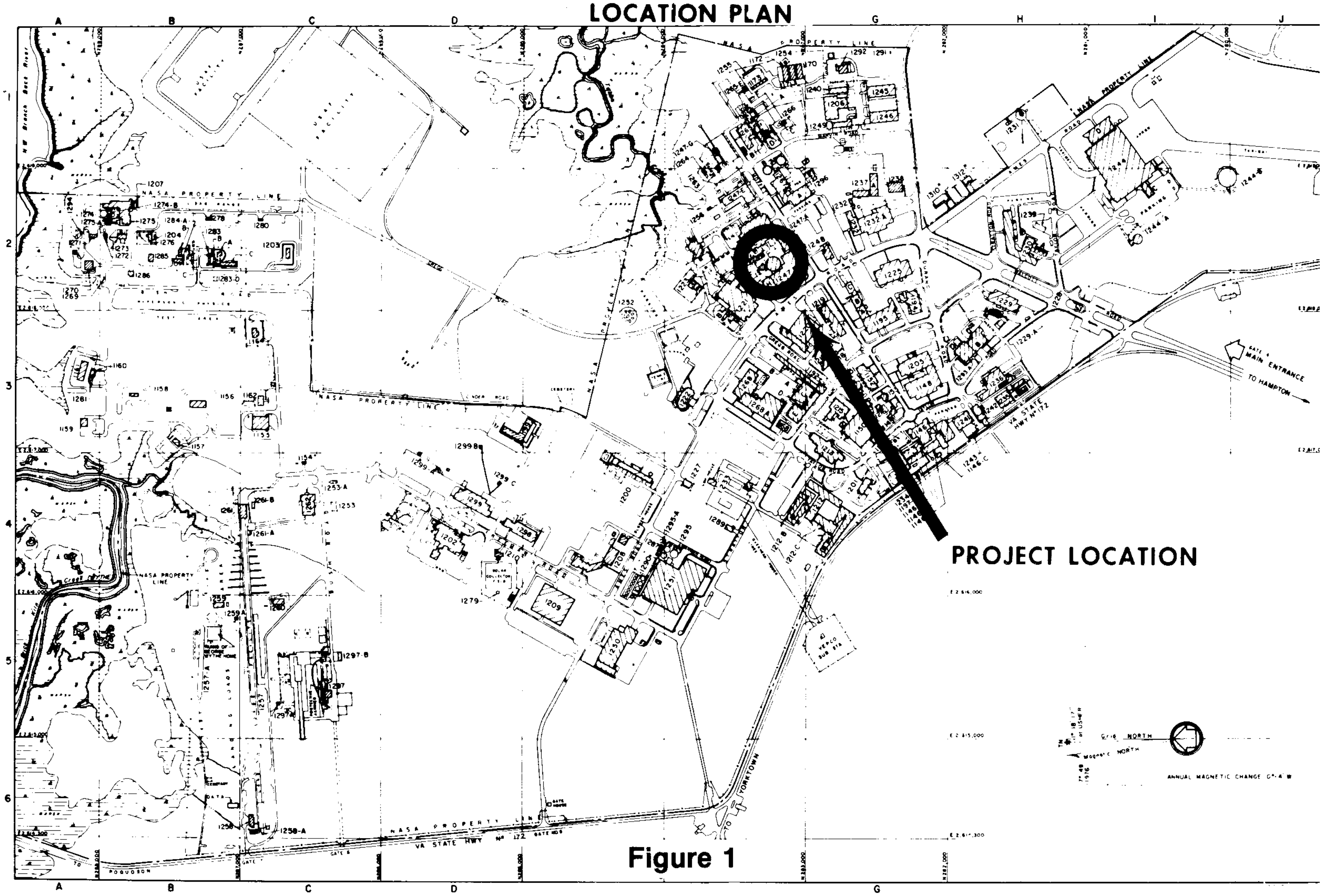


Figure 1

PROJECT TITLE: Rehabilitation and Modification of Gas Dynamics Laboratory (1247)

INSTALLATION: Langley Research Center

FY 1980 CoF ESTIMATE: $3,600,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology; Office of the Comptroller, Facilities Division

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	300,000	---	300,000
Capitalized investment	N/A	10,614,875	10,614,875
Total	300,000	10,614,875	10,914,875

SUMMARY PURPOSE AND SCOPE:

This project provides for the rehabilitation and modification of test cells, offices, and support equipment located within the Gas Dynamics Laboratory (GDL) (Figure 1) principally in Building 1247D, at the Langley Research Center (LaRC). The remaining areas of the GDL, Buildings 1247A, B and E, are planned to be done in a subsequent year. Building 1247D contains the more critical items that are in need of rehabilitation and/or modification. New tunnels and research equipment have been added since 1951 to reflect changes in research emphasis; however, none of the older equipment has been rehabilitated or subjected to a major overhaul. This project emphasizes the overhaul, upgrading and modernization necessary to assure future operations meeting safety, energy and performance requirements of this facility. Research in this facility supports many high priority NASA projects, such as laminar flow control, turbulent drag reduction, advanced supersonic transport, sonic boom alleviation, Space Shuttle, advanced space transportation systems (follow-on Shuttle), airbreathing launch vehicles, planetary entry probes, hypersonic aircraft (both civil and military), and hypersonic missiles.

PROJECT JUSTIFICATION:

The GDL is a 27-year old facility incorporating several types of wind tunnels and test apparatus. New tunnels and facility equipment have been added over the years reflecting changes in research emphasis; however, none of the older equipment has been rehabilitated or subjected to a major overhaul.

The GDL is critical to research over a wide speed range up to Space Shuttle reentry, and it is especially valuable in the Mach number range from approximately three to eight, where the next generation of advanced supersonic transports and hypersonic aircraft and missiles will operate. This laboratory of several small, flexible wind tunnels can test inexpensive, readily installed and easily modified models over a wide Mach number range. Each of the test cells has at least one special experimental feature, and thus each tunnel provides unique testing capabilities. Examples of such special features are high-speed model injection mechanisms, "quick-start" air supplies, test sections adapted for phase-change-paint heating rate techniques, low noise "quiet" flows, laser-doppler systems, Gamma radiation instrumentation, and varying Reynolds numbers (very high or low, or with ability to vary by a factor of over 100 in one tunnel).

The east wing of the GDL (Building 1247D) houses several major wind tunnels (Figure 2), a variety of space-oriented test cells, plus additional small experiments. Support equipment for these test cells includes a large, high-pressure air distribution system, two large vacuum systems, storsge tanks, cooling water systems, vacuum spheres, air heater's, etc.

While additions and changes to the test cells have been made over the years, the support equipment and the building structure are virtually identical with the original installation. Heavy use of this equipment has caused deterioration and increased maintenance costs.

This project completes all the necessary work for the critical items in Building 1247D (Figure 2). Because of the criticality of a potential failure of the deteriorating cooling tower (Building 1247C) and the possibility of pollution from oil being emitted by a precipitator (Building 1247B) that is beyond repair and needs replacing, these items have been included in this project also.

IMPACT OF DELAY:

Many of the components of this facility have been in existence since 1951 and have not had a major overhaul. If this facility is to continue in operation, rehabilitation and modification work of this nature to maintain the equipment must be performed now. If this project is delayed, possible failure of key components of this facility will impact operation of important research work being performed in this facility.

PROJECT DESCRIPTION:

The work to be performed on the GDL as part of this project includes the following:

1. Repair of Water Cooling Towers

Engineering inspection of the cooling towers, presently composed of five cells, indicates a need for repair by replacement. Since a large cooling load recently was permanently disconnected from this water system, it is now possible to accommodate future loads with only three cells. After provision of the three new cells, by this project, the remaining two cells will be dismantled. These cooling towers serve the entire GDL as well as the Hypersonic Propulsion Facility, Building 1221 and the central air compressor station.

2. Rehabilitation of Mechanical Equipment

Mechanical equipment includes a vast array of pumps, blowers, compressors, heat exchangers, valves, etc. The following paragraph describes the major components to be replaced.

The replacement of two electrostatic precipitators is necessary. Their present condition requires extensive repairs annually to insulators, wires, and sheet metal housing. One of the precipitators of the vacuum systems in Building 1247B has degenerated to such an extent as to permit unacceptable exhaust pollution. The two large vacuum systems, containing a total of eight pumps, are used almost daily. An overhaul is long overdue since no major overhaul (bearings, seals, cooling water passages) has been performed on either the pumps or their drive motors. A recent extension of the high-pressure air system has left one wind tunnel without proper isolation valving. The addition of a remotely operated isolation valve will improve safety and eliminate extensive manual operation. Two cooling tower water pumps were placed in service in 1951 and are run daily. Repairs are no longer cost effective. Replacement of the pumps with improved equipment is necessary to avoid delays that could impact operation of the facility. Three existing valves in the 3,000 psi (20,670,000 newtons per square meter) air system have been found to be defective. Replacement of these valves is necessary to allow for a more efficient and safer operation.

Lastly, in the Mach 8 tunnel a new variable density nozzle and a flow field survey probe are required. The existing variable density nozzle can not be used for the planned hypersonic research testing in this tunnel. The existing nozzle does not have the capability of providing the accuracy needed to achieve the increased requirement for hypersonic force measurements. The survey probe will provide an increased capability that does not presently exist. It will allow temperature, pressure and flow measurements to be made across the test section during each run.

3. Rehabilitation of Air Control and Distribution Svstem

A central control room in Building 1247D sets high-pressure air flow conditions and provides vacuum for several wind tunnels, plus scheduling, recording, and monitoring high-pressure air distribution to the entire west area of LaRC. The performance of these functions requires a large expenditure of manpower, most of which would be eliminated by automation.

Equipment operated from this control room includes two large electric air heaters, two vacuum systems, and many valves to provide pressure control, isolation, and flow routing. Air supply to Building 1247D is provided at 5,000 and 3,000 psi (34,473,800 and 20,670,000 newtons per square meter, respectively) some of which is reduced in pressure to 600 psi (4,134,000 newtons per square meter) and stored for various wind tunnel operations. Air is distributed to other LaRC facilities from this point of 600, 1,000, 1,800 and 5,000 psi (4,136,900; 6,894,000; 12,410,000; and 34,473,800 newtons per square meter, respectively).

Although valves and electrical breakers are remotely operated to a large extent, the distribution and conditioning (temperature, pressure, and flow) of air to the various test facilities is a manual process. The large and complex system contains electrical interlocking for safety purposes, but the human element is still present.

A microprocessor control system will replace the existing manual system, thus enabling each wind tunnel to be operated remotely and electronically at the desired flow parameters and routing. The results will be greater safety, elimination of manpower, and the reduction in energy brought about by the ability to more rapidly establish set points. In addition to the microprocessor installation, there will be wiring changes, relocation of valves, etc.

4. Rehabilitation of High Voltane Electrical EauiDment

Equipment in this category primarily includes breakers, controlling flow from large power supplies, and breakers and tap changers controlling power flow to various electric heaters. All of this switchgear has many service cycles. Linkage is becoming worn, and operation is sometimes erratic.

In addition to replacing approximately 12 large breakers, this item includes rehabilitation of several power distribution panels, an additional motor control center and the installation of high capacity cables to one air heater.

5. Rehabilitation of Building 1247D

Building 1247D contains a floor area of approximately 43,500 square feet (4,042 square meters) divided into 12 test cells and a large shop area. Also included are various control rooms, lavatory facilities, and a full basement. This building structure was erected in 1951.

A new central absorption type air-conditioning system is to be installed to take advantage of the steam available in the summer months from the new Refuse Fired Steam Generating Facility. This new system will consolidate 15 independent air-conditioning systems into one central system and replace air-conditioning equipment that is 30 years old.

In addition to the air-conditioning, the building requires repairs to the roof and masonry walls. New windows will be installed. Plumbing fixtures will be replaced where necessary, and the fire alarm system will be upgraded.

6. Modification of Data Acauisition and Processing Capability

Present capabilities for acquiring and processing experimental wind tunnel data are limited to low frequency, low volume data samples. Wind tunnel runs are often prolonged in order to provide sufficient data sampling time. This results in increased power consumption and degraded facility utilization. In recent years, new and more sophisticated instrumentation has been routinely used to obtain experimental data; and this new instrumentation (e.g., laser velocimeter, Raman scattering, hotwires, and fluctuation gauges) generally requires extremely rapid data sampling rates and retention in huge data banks. Processing procedures for these vast volumes of data change from test-to-test and present a formidable problem in coordinating with data reduction personnel.

Installing microprocessing equipment with attendant, terminals will provide the necessary speed and volume capability and will allow on-site, on-line data reduction capability. This equipment is necessary to meet present needs and will result in substantial savings of facility operation costs while providing higher quality data reduction capabilities.

PROJECT COST ESTIMATE:

The project cost estimate is based on a completed Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acauisition.........................	---	---	---	---
Construction..	---	---	---	---
EauiDment..	---	---	---	3,600,000
Repair of cooling towers..............................	LS	---	---	285,000
Rehabilitation of mechanical equipment..................	LS	---	---	885,000
Rehabilitation of air control & distribution system....	LS	---	---	1,075,000
Rehabilitation of high voltage electrical equipment....	LS	---	---	405,000
Rehabilitation of building 1247D......................	SF	43,500	14.48	630,000
Modification of data acquisition system................	LS	---	---	320,000
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 collateral equipment is involved.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Rehabilitation and modification of Gas Dynamics Laboratory Building 1247, is planned for FY 1981, at a cost of approximately $3,200,000. This project will include the necessary work to be performed in the remaining wings of the Laboratory.

LANGLEY RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

REHABILITATION AND MODIFICATION OF GAS DYNAMICS LABORATORY (1247)

SITE PLAN

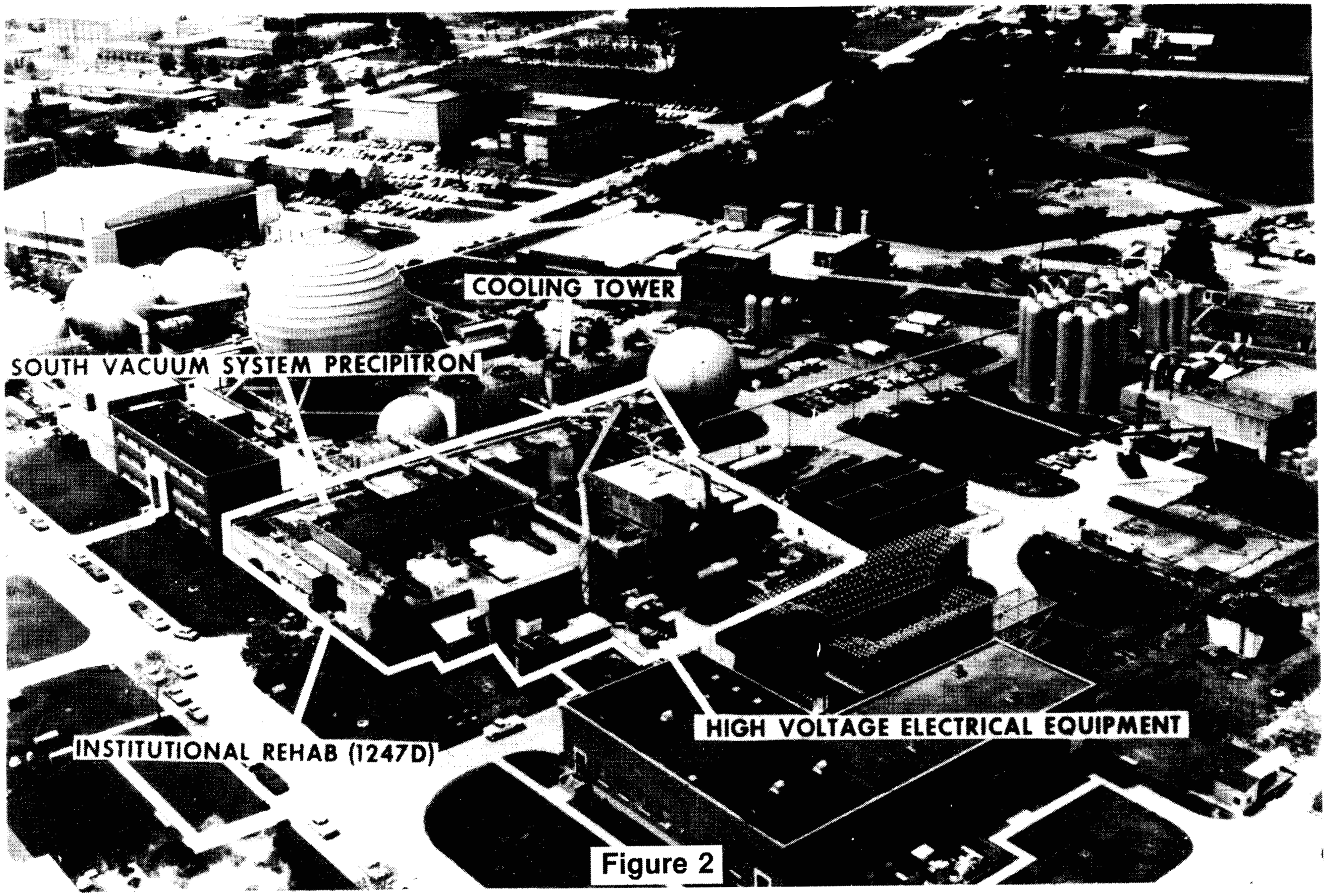
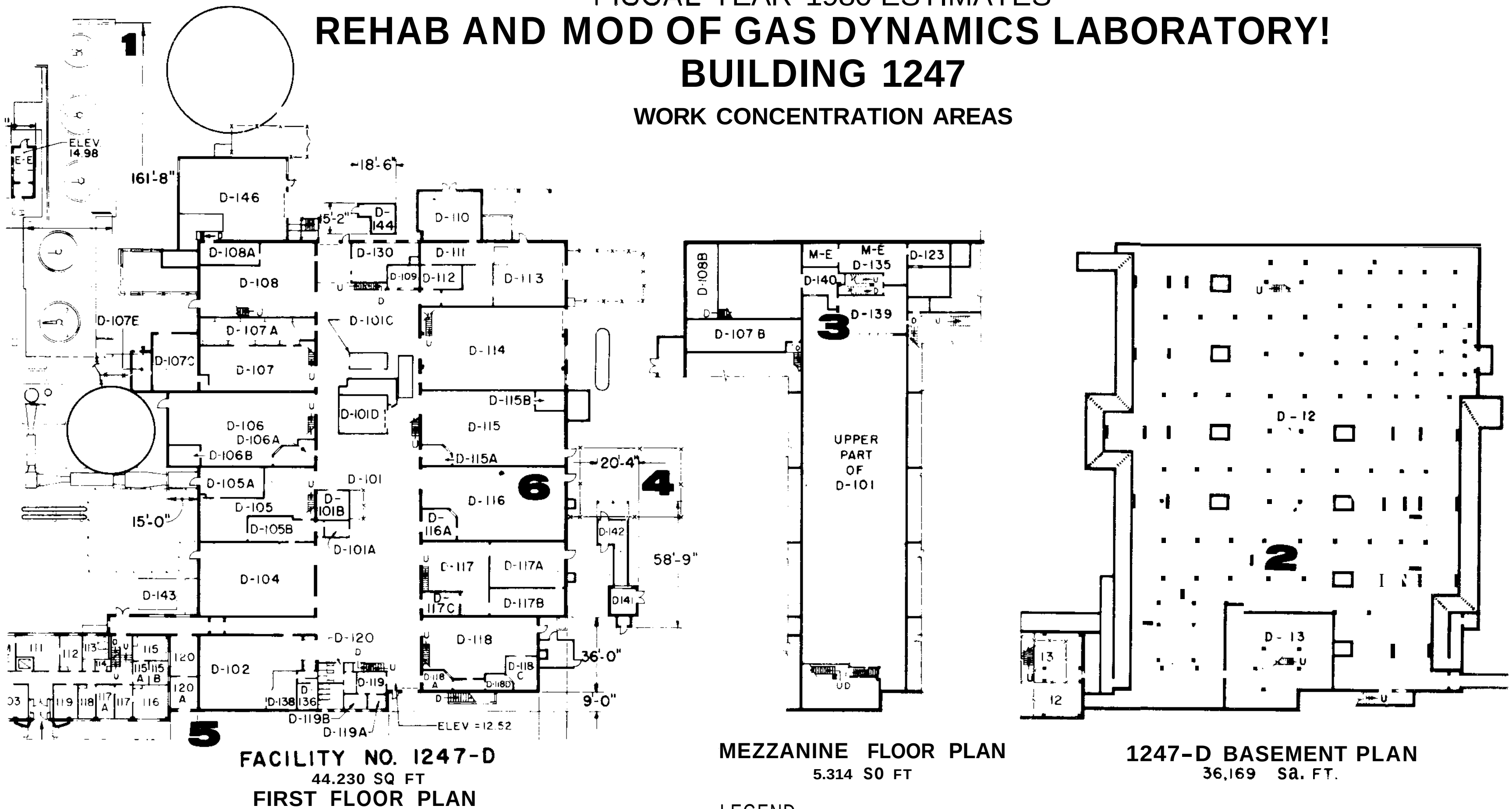


Figure 2

LANGLEY RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES
REHAB AND MOD OF GAS DYNAMICS LABORATORY!
BUILDING 1247
WORK CONCENTRATION AREAS



LEGEND

1. REPAIR OF COOLING TOWERS
2. REHAB OF MECHANICAL EQUIP.
3. REHAB OF AIR CONTROL & DISTRIBUTION SYSTEMS
4. REHAB OF HIGH VOLTAGE ELECTRICAL EQUIPMENT
5. REHAB OF BLDG. 1247D
6. MOD OF DATA ACQUISITION SYSTEM

Figure 3

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

LEWIS RESEARCH CENTER

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Modifications to Central Air System, Various Buildings......................	5,720,000	CF 6-1

LEWIS RESEARCH CENTER

FISCAL YEAR **1980** ESTIMATES

MODIFICATIONS TO CENTRAL AIR SYSTEM, VARIOUS BUILDINGS

LOCATION PLAN

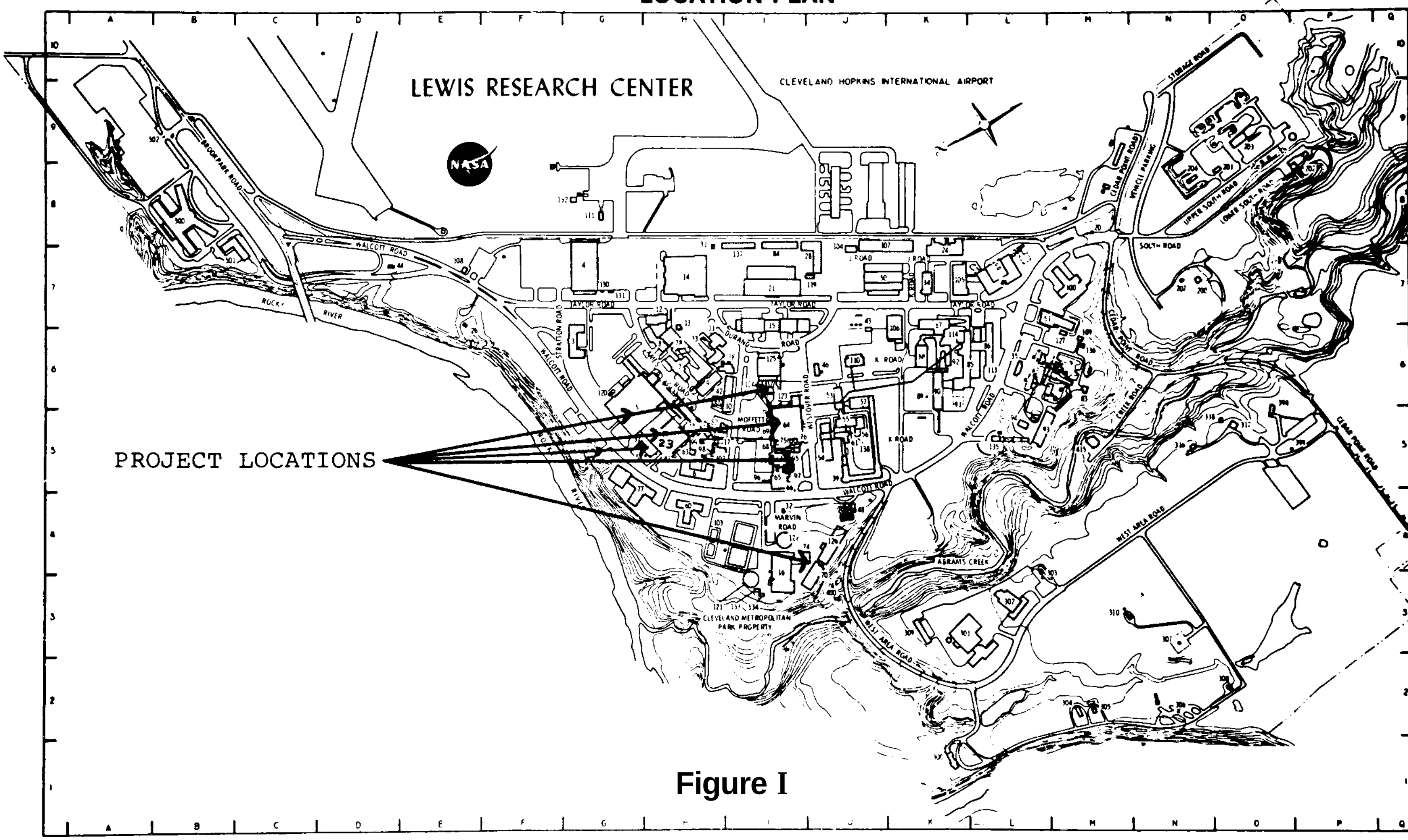


Figure I

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modifications to Central Air System, Various Buildinas

INSTALLATION: Lewis Research Center

FY 1980 CoF ESTIMATE: $5,720,000

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	711,000	450,000	1,258,000
Capitalized investment	N/A	41,084.000	41,084,000
Total	711,000	41,534,000	42,342,000

SUMMARY PURPOSE AND SCOPE:

Modifications to the Lewis Research Center (LeRC) Central Air System's 20 to 30-year old antiquated control and dats acquisition systems are necessary to effectively meet the present and future aeronautical research program requirements. This air system, which is basic and critically essential to research activities at LeRC, contains a diversity of compressors, exhausters, drive motors, chillers, heaters, and other auxiliary equipment located primarily in the Propulsion Systems Laboratory Equipment Building (PSLEB), the Engine Research Building (ERB) complex, and related buildings and outdoor areas. Air at various pressures, temperatures, humidity levels, and flow rates, as well as exhaust capability at various vacuum levels and flow rates (for simulating altitude flight conditions) is provided to many research users through a complex piping distribution network

(Figures 4 and 5). The existing equipment controls are obsolete and have poor set-point tolerance and speed of response characteristics. These controls and the data acquisition systems for monitoring the Central Air System (CAS) operation are primarily manual and are located near noisy operating equipment throughout the various buildings and outdoor areas. This inefficient arrangement requires a large staff of equipment operators. Because of minimal equipment monitoring instrumentation, detection of abnormal operation is by surveillance of the actual operating equipment. Equipment operators, therefore, must be sufficiently experienced and familiar with the operating equipment to detect the onset of impending equipment failures.

This project provides for: (1) centralization and upgrading of the control and data acquisition systems for the equipment located in the PSLEB, Building 64, related Buildings 74, 95 and 124, and outdoor areas as well as construction of a new PSLEB control room addition (Figures 1, 2 and 3), and (2) installation of an ERB diagnostic "core" data acquisition system for determining the performance characteristics of the Roots-Connersville compressors and nxhausters and other equipment in the ERR complex (Buildings 5, 23, and 37). As a result of this work: (1) operations will be not only more effective in meeting research needs, but will also require fewer and less experienced operators, (2) understanding of the operating equipment's performance characteristics and the overall CAS's capabilities will be improved which will result in significant energy savings, and (3) safety will be enhanced.

PROJECT JUSTIFICATION:

LeRC's 20 to 30-year old CAS, with its obsolete local controls and manual data monitoring techniques, provides compressed air and exhaust capabilities to numerous test cells and wind tunnels throughout, the Center, serving over 100 different aeronautical, energy conservation and engine exhaust emission reduction research users. Usually, three-shift operations are such that an average of 23 research users are served each working day. Present and future research programs require closer control of system temperatures, pressures, and flow rates and faster transient response than the existing antiquated controls can provide. In addition, the available manpower is insufficient in quantity and experience to effectively meet research run schedules. This project provides for upgraded centralized remote control and monitoring of the equipment in and around the Propulsion Systems Laboratory (PSL) and also for centralized diagnostic monitoring of selected ERB equipment. The modifications will substantially improve the operational effectiveness and efficiency of the CAS while facilitating energy conservation, enabling full operations with a smaller and less experienced staff of equipment operators, and enhancing safety.

LeRC is a recognized leader in support of the Nation's aeronautical research programs. Many of LeRC programs require the use of the CAS for testing of propulsion systems (e.g., complete engines) and components (e.g., combustors, turbines, compressors, diffusers, and seals). Generally, aeronautical research programs fall into the following two categories: (1) Cooperative NASA/Air Force - Full Scale Engine Research (FSER) and (2) NASA research programs for extending the state-of-the-art in both full scale engines and individual engine components. (Cooperative programs with the Air Force and Navy are being considered for this second category of research). The cooperative FSER programs use the large test cells. Current programs for pressure and temperature inlet air distortion, fan and compressor blade flutter, and improved engine performance controls use F100, J85-21, and TF30 test engines. NASA full scale engine research programs also use the large test cells and include research on plug nozzles, high frequency inlet distortion and afterburner rumble (low frequency instability). The High Pressure Turbine and Combustor Facility and numerous small test cells are delegated to engine component research for refinement of present engines and development of advanced engines including those with pressure ratios up to 40:1. The CAS provides conditioned air (dried and either heated or cooled) at 45, 150 or 450 psig (31, 103 or 310 newtons per square centimeter) to these test cells at various required research test conditions. This air is also exhausted from these test cells by the CAS at vacuum levels corresponding to the flight altitudes being simulated.

The present control and data acquisition systems consist of locally located manual controls and monitoring instruments widely distributed throughout 40,000 square feet (3,700 square meters) of the PSLEB, 175,000 square feet (16,300 square meters) of the ERB, related buildings and outdoor areas in noisy environments near the controlled equipment. Data logging is done manually. Present and future research requirements for air services supplied by the CAS, both during steady state and transient operation, are not attainable with the present antiquated controls. Research users have experienced long waiting periods for temperature set-point attainment and stabilization due to the present sluggish manual temperature controls. In addition, valuable research run time has been wasted due to pressure level perturbations resulting from pressure control instabilities. Monitoring instrumentation is minimal and equipment operators are relied on to detect indications of developing problems such as increased vibration levels, unusual noises and abnormal equipment operating temperatures by observation of the actual equipment. These ineffective and inefficient operations require a large number of experienced personnel familiar with the operating and general performance characteristics of the various pieces of equipment as well as the multitude of the CAS air routing possibilities. However, the staff of such operators is steadily diminishing and training of new operators is a long process requiring several years because of the complexity and size of the CAS. An additional 20 to 30 years of useful CAS equipment life is expected; however, the age of the equipment, the anticipated loss of experienced equipment operators, and the impact of major equipment failures on research activities make it increasingly important that continuous monitoring of critical equipment operating conditions be provided.

Accurate operating performance charts for much of the equipment are not available. When obtained for all equipment, these charts will provide a thorough understanding of the total CAS capability. Data obtained using the data acquisition systems provided by this project and the PSLEB "core" data acquisition system provided by an FY 1978 project will enable more effective and energy efficient operations.

This project will result in an estimated annual energy savings of 14,000,000 kilowatt hours.

IMPACT OF DELAY:

These needed improvements are long overdue. Increased research requirements; decreased levels of experienced manpower; canceled research runs; lost run time; aging equipment; impact of major equipment failures; unreliable, inadequate, and obsolete controls; nonexistent, but necessary, monitoring and diagnostic instruments; limited energy budgets; manual data logging; and a need for more appropriate scheduling of equipment maintenance combine to form the pressing need for this work. These modifications must be accomplished to avoid these increasing operational limitations which impact the Center's overall research capability. The completion of the installation phase of this project is scheduled for early 1982 with the completion of the checkout phase by early 1983.

PROJECT DESCRIPTION:

This project includes the construction of a 4,500 gross square feet (418 gross square meters) control room addition to the PSLEB; the completion of the CAS control and data acquisition systems modifications in PSLEB, related buildings and outdoor areas started with a diagnostic "core" date acquisition system in FY 1978; and the installation of a diagnostic "core" data acquisition system for the Roots-Connersville compressors and exhausters and other equipment located in the ERB complex.

The new control room (Figure 2) will provide space for centralized remote control and monitoring of the CAS equipment located in PSLEB, related buildings and outdoor areas. Space is also provided for the future relocation of the central air dispatch (CAD) and electrical dispatch (ED) functions, as well as the utility control system (UCS) master control station.

This modification includes new equipment controllers with improved safety interlocks , a 3,000 channel, 12 remote multiplexer, data acquisition system and various new transducers to control and monitor air system parameters and equipment operating conditions including temperatures, pressures, flow rates vibration levels, valve positions, and other necessary subsystem data (Figure 3). In addition to highly responsive remote equipment controls, the operators in the control room will also be provided with: (1) immediate ,alarms for advance warning of potential problems, (2) hard copy printout capability for all channels (3) video (cathode ray tube) readout of selected flow system parameters and alarm channels, (4) fast, accurate, and continuously updated information on equipment operating conditions, and (5) long term trend information for more appropriate maintenance scheduling. A dedicated minicomputer and necessary peripheral equipment are included for implementation of data acquisition and display as well as for supervisory control. Also included are miscellaneous pieces of equipment including valves and actuators for implementation of the controlmodifications.

The diagnostic "core" data acquisition system for the ERB Roots-Connersville compressors and exhausters and other equipment includes multiplexers, a dedicated mini-computer, transducers, and the necessary peripheral equipment. This "core" package provides for the monitoring of approximately 500 measurements and will operate independently with the present ERB equipment controls and data acquisition systems. This system will provide valuable operating performance charts for the equipment monitored.

This project will be implemented concurrent with the on-going CAS support of research operations. Proper scheduling of the installation work will result in minimal disruption of research activities.

This project includes work in the following facilities:

Bldg. No.	Name	Gross Area Sq. Ft.	Gross Area Sq. Meters	Year Built	Capitalized Investment
	Propulsion Systems Laboratory (PSL) Complex				
64	PSL Equipment Building	87,590	8,058	1952	21,000,000
74	PSL Cooling Tower Water Pump Building	4,702	433	1952	247,000
95	PSL Desiccant 'Air Dryer	1,024	94	1957	383,000
124	PSL Heater Building	5,680	523	1969	215.000
	TOTAL	98,996	9,108		21,845,000
	Engine Research Building (ERB) Complex				
5	ERB (Central Section)	233,917	21,520	1942	14,100,000
23	ERB (West Wing)	104,246	9,684	1944	3,475,000
37	ERB (Northwest Wing)	35,010	1.221	1946	1,664,000
	TOTAL	373,173	34,425		19,239,000

The replacement value of these facilities in terms of 1983 dollars will probably be about $300,000,000.

PROJECT COST ESTIMATE:

The basis of this cost estimate is a Preliminary Engineering Report dated June 1978, and related studies.

	Unit of Measure	Quantity	Unit Cost	Cost
Land Acquisition	---	---	---	---
Construction	---	---	---	640,000
Demolition	LS	---	---	65,000
Architectural/structural modifications	SF	4,500	66.67	300,000
Mechanical modifications	LS	---	---	160,000
Electrical modifications	LS	---	---	115,000
Equipment	---	---	---	5,080,000
Controllers installation and integration	LS	---	---	1,220,000
Multiplexer system installation	LS	---	---	375,000
Transducers installation	LS	---	---	340,000
Data acquisition, display, minicomputer installation and integration	LS	---	---	2,470,000
Miscellaneous equipment installation	LS	---	---	175,000
ERB "Core" data acquisition system and integration	LS	---	---	500,000
Fallout Shelter (not feasible)	---	---	---	---
Total				5,720,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Plan View--New PSLEB Control Room
Figure 3 - Typical Configuration for Modification
Figure 4 - Schematic Drawing--Central Air System
Figure 5 - Aerial View of Piping Network

OTHER EQUIPMENT SUMMARY:

None.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Future CoF funding of $7,000,000 will be required to: (1) complete the CAS control and data acquisition systems in the ERB, (2) relocate present central air dispatch (CAD) and electrical dispatch (ED) functions and the utility control system (UCS) master control station to the new PSLEB control room provided by this project, and (3) provide a new 450 psig air compressor and render the single aging 450 psig air compressor a standby. This follow-on work will complete the necessary modifications to the CAS.

LEWIS RESEARCH CENTER

FISCAL **YEAR 1980** ESTIMATES

MODIFICATIONS TO CENTRAL AIR SYSTEM, VARIOUS BUILDINGS

PLAN VIEW — NEW PSLEB CONTROL ROOM

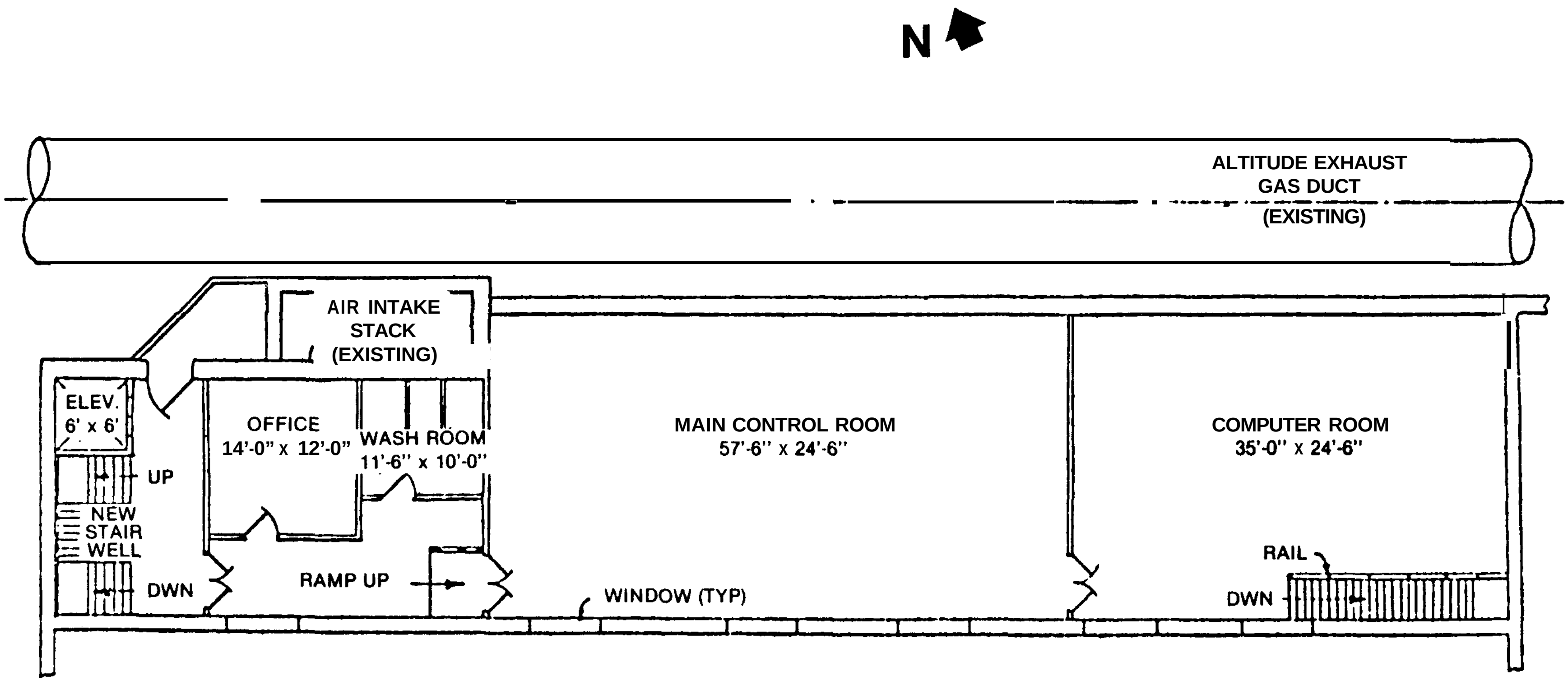


Figure 2

LEWIS RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS TO CENTRAL AIR SYSTEM, VARIOUS BUILDINGS

TYPICAL CONFIGURATION FOR MODIFICATION

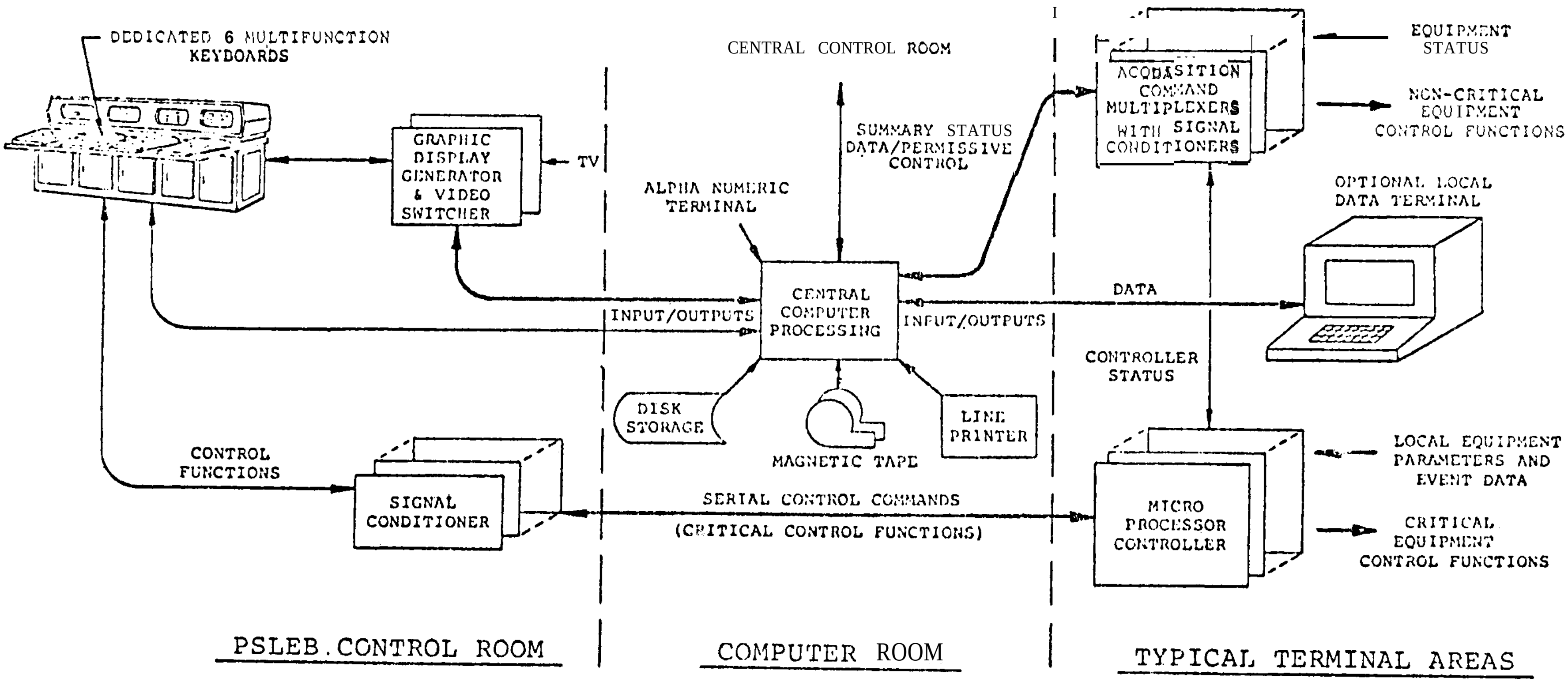


Figure 3

LEWIS RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS TO CENTRAL AIR SYSTEM, VARIOUS BUILDINGS

SCHEMATIC DRAWING - CENTRAL AIR SYSTEM

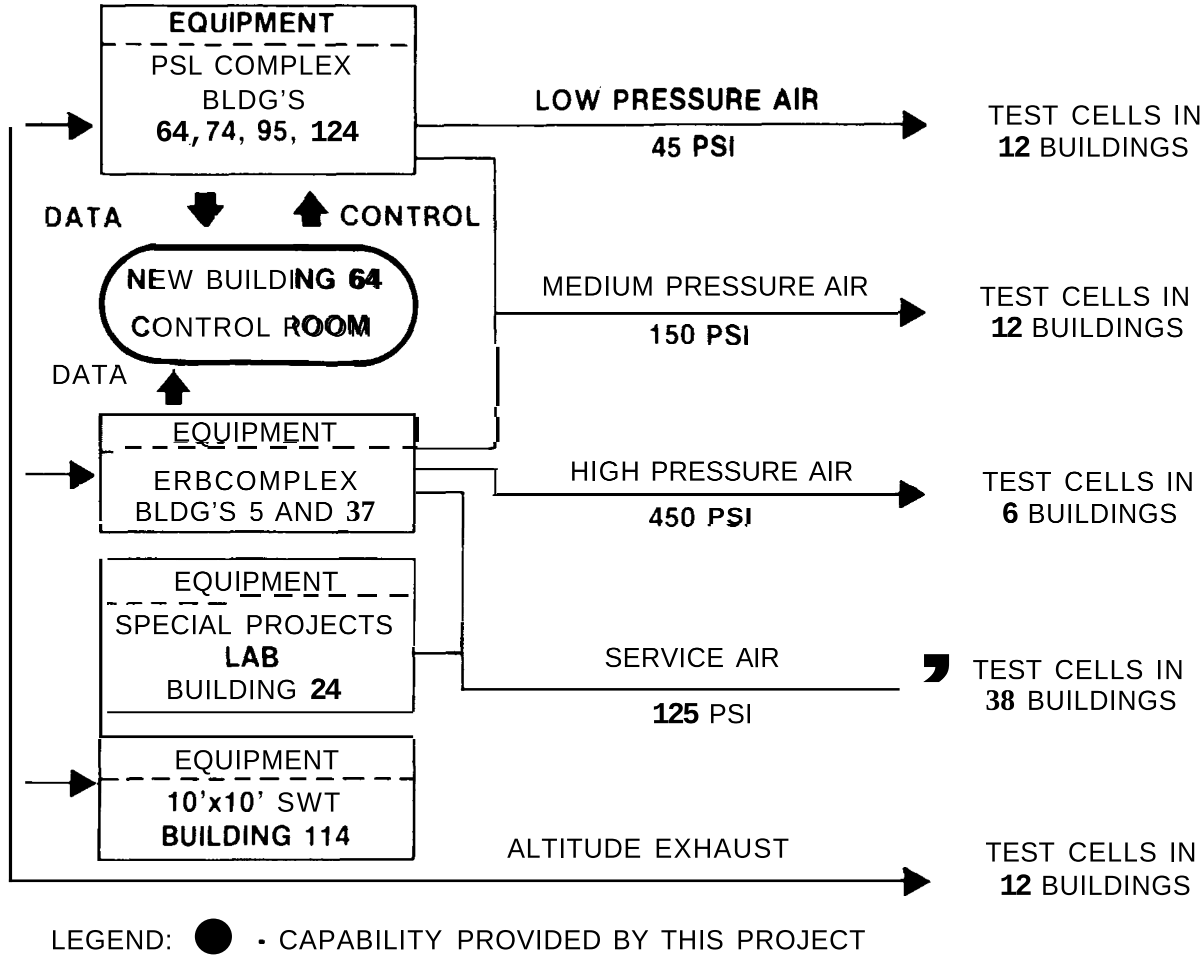


Figure 4

LEWIS RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS TO CENTRAL AIR SYSTEM, VARIOUS BUILDINGS

AERIAL VIEW OF PIPING NETWORK

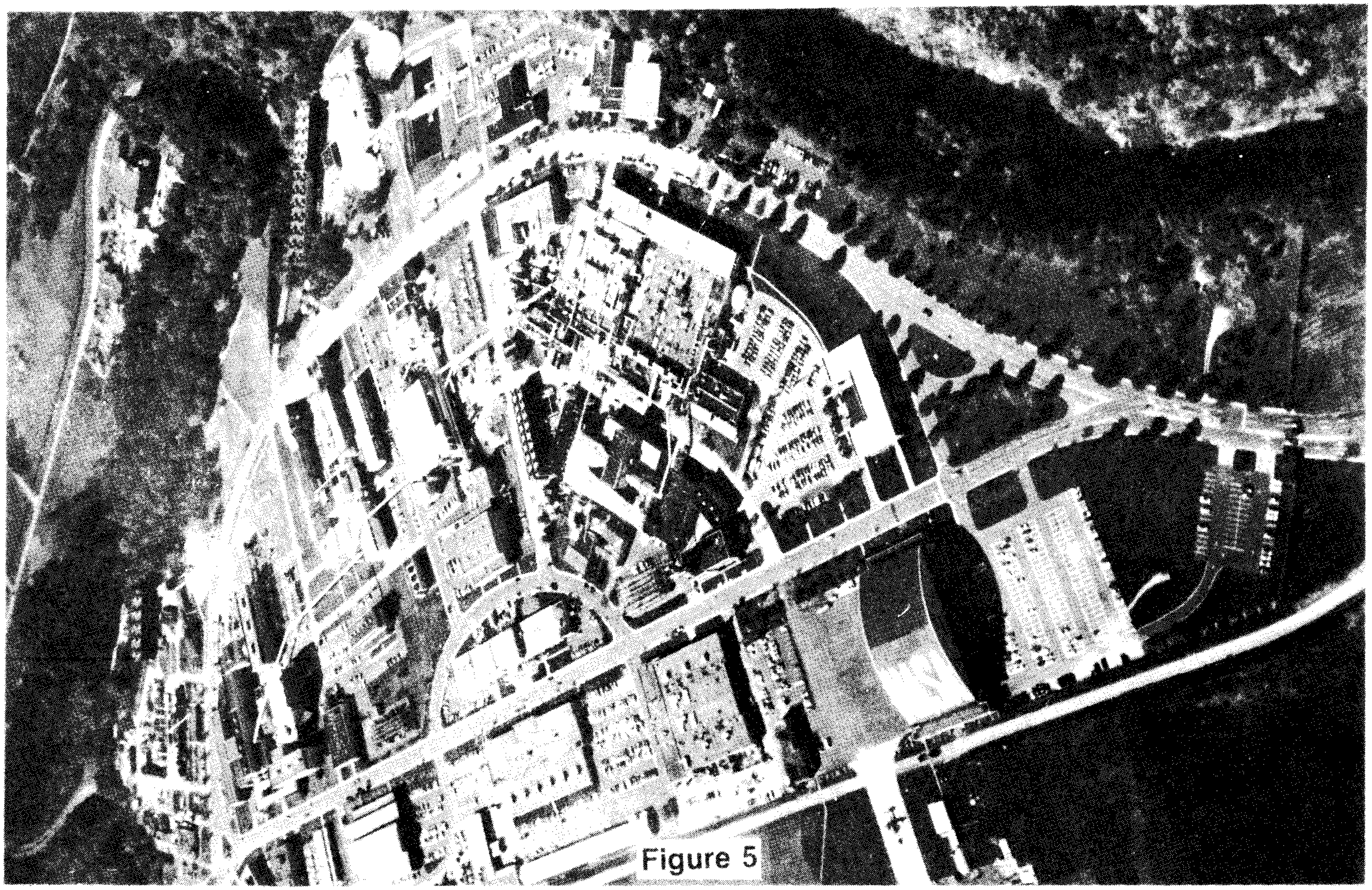


Figure 5

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

GEORGE C. MARSHALL SPACE FLIGHT CENTER

Office of the Comptroller:	Amount	Page No.
Modifications to Various Buildings	2,640,000	CF 7-1
Rehabilitation of Roofs, Various Buildings	900,000	CF 7-10
Total	3,540,000	

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO VARIOUS BUILDINGS

LOCATION PLAN

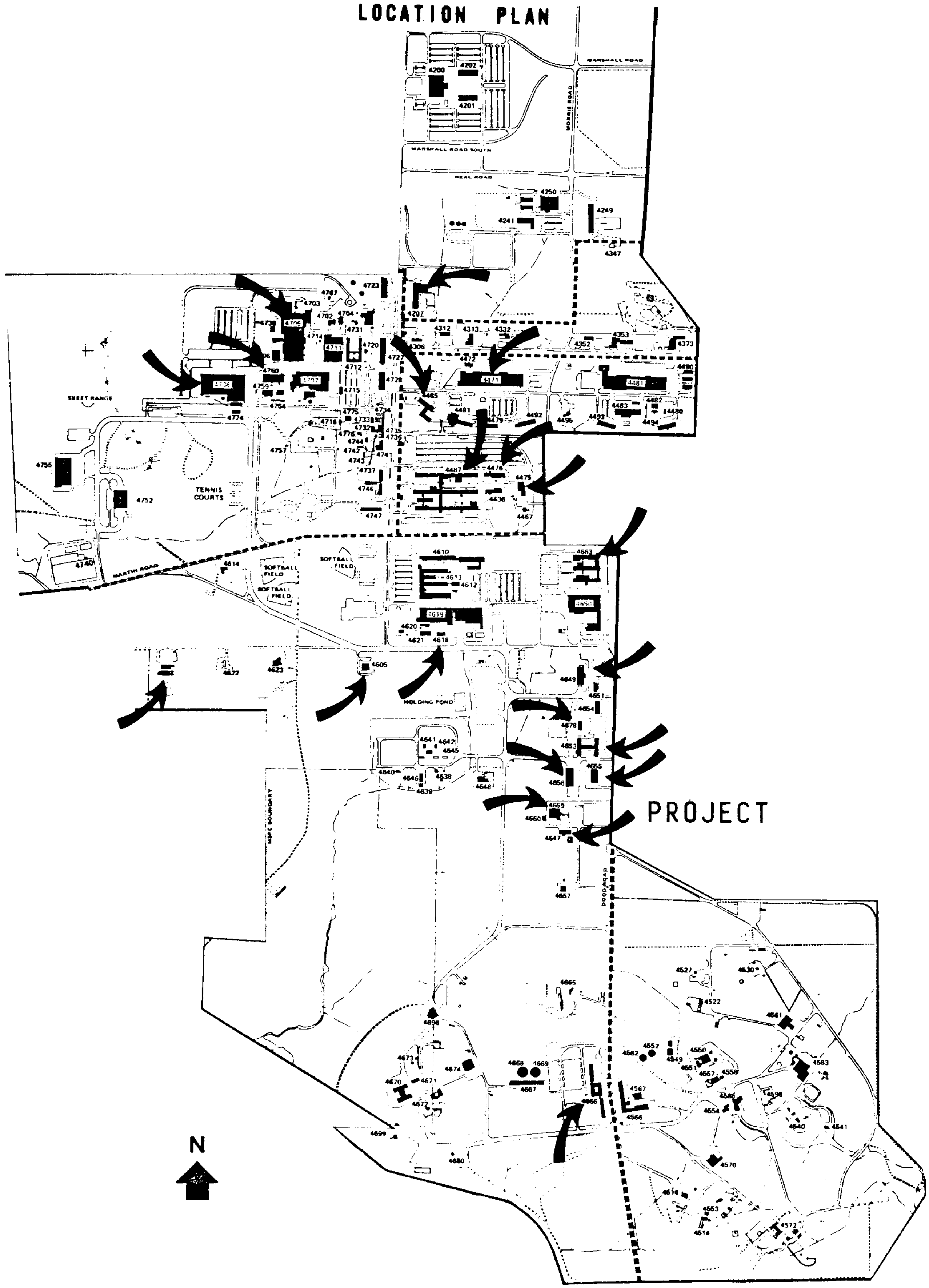


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modifications to Various Buildings

INSTALLATION: George C. Marshall Space Flight Center

FY 1980 CoF ESTIMATE: $2,640,000

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

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	131,000	---	131,000
Capitalized investment	N/A	39,408,258	39,408,258
Total	131,000	39,408,258	39,539,258

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to the heating, ventilating, and air-conditioning (HVAC) systems in ten buildings and installation of modular boilers in eleven buildings at Marshall Space Flight Center. Modifications to the HVAC systems are required to correct the deteriorated condition of existing systems, reduce maintenance costs, reduce energy consumption, and better accommodate Center operations in support of new and ongoing missions. The work includes modifications to fan drives, air distribution systems, control systems and lighting systems; repair of air-handling units; and installation of computer room process-cooling units, a heat pump to recover computer-generated heat, chilled water interconnections between buildings, and additional building insulation. Modular boilers will be installed in eleven buildings, to serve thirteen buildings and replace the existing service supplied by the Redstone Arsenal Steam System (RASS). Eight of these buildings will go off the RASS permanently and five will go off the system in summer months only. Ten other buildings will have only hot water heaters installed and will similarly go off the steam distribution systems for the summer months. All of the RASS and most of the MSFC systems can be shutdown for approximately 6 months each year. This change is necessary due to the heavy heat losses experienced in these old long run steam lines.

PROJECT JUSTIFICATION:

MSFC is directing efforts in a planned reduction of energy consumption and this project is a necessary step in this reduction. It provides for the complete modification of systems to reduce energy consumption and maintenance costs. Utility rates have increased approximately 125 percent in the last 3 years, and trends indicate similar increases in the near future. Maintenance forces continue to decline and related material costs continue to inflate. Delay in accomplishing the work included in this project will not allow the Center to substantially reduce energy consumption; it hampers support to important Center programs and other research and development activities. These buildings are and will continue to be utilized in providing direct support to many NASA programs, such as Space Shuttle, Spacelab, Space Telescope, Space Processing, Large Space Structures, Solar Heating and Cooling, and Space Research and Technology. Accordingly, these modifications are required not only to conserve energy but also to provide the working environment necessary to support these programs.

The age of these facilities range from 14 to 35 years, with the average age of 23 years. Many changes and minor additions have been required and they, coupled with age, have contributed to overloading and unbalancing of the utility and mechanical systems. As a result, the building systems require extensive maintenance and also use excessive amounts of energy. The HVAC systems have required extensive piecemeal modifications. They should be properly rehabilitated and the systems modernized and rebalanced for greater reliability and energy conservation.

YSFC "inherited" the existing steam distribution system from the Redstone Arsenal when the Center became activated in 1960. Though the arsenal still generates the steam and operates the system, the steam is metered as it crosses the boundary and NASA is billed accordingly. Through a series of studies and site investigations, it has been determined that the steam line losses are abnormally high, especially due to long line runs, thus MSFC is being subjected to excessive steam energy costs. The buildings in which the modular boilers and water heaters are to be installed to replace the steam lines, are widely dispersed. The boiler and water heater installations are considered to be more economical than repairing or replacing the steam lines. Six of the buildings will be taken completely off the steam system, resulting in the deactivation of 24,000 linear feet (7,315 meters) of steam supply and return lines. The other five buildings will be taken off the system during the summer months only. In this latter case, the boilers will be sized and used for summer reheat, potable hot water, and process steam requirements only, but not for winter heating. In addition to these five buildings, ten additional buildings will have only electric heaters installed and will also be taken off the steam distribution system during the summer months. These facilities are required to support ongoing and planned programs at the Center. Activities performed at these facilities include: non-destructive evaluation of materials, hydraulic component and system testing, low temperature and cryogenic testing, high-pressure gas systems, control actuator development, gaseous nitrogen generation, and treatment of industrial waste. These activities support all currently assigned programs and will be similarly used to support future programs assigned to the Center. This project will permit the periodic and/or complete deactivation of steam lines for which heat losses have been excessive.

The total project will result in an estimated saving in energy costs of over $750,000/year during the first year of operation with a simple payback of approximately 3.5 years for the total investment.

IMPACT OF DELAY:

As previously described, this project has a very attractive energy savings and good payback savings. Failure to implement the project at this time will not allow these savings to be made and will prolong a high energy consumption/high utility cost situation.

PROJECT DESCRIPTION:

This project provides for modifications to HVAC systems in various buildings at MSFC. Work in Building 4705 (Fabrication and Machine Shop) will include the modifications to heating system controls to permit shutting off steam circulation in accordance with area demands, rehabilitating the HVAC system to permit maximum outside air intake capability, converting controls to demand system, reducing air velocity in the system and reducing the lighting system to current illumination guidelines.

Buildings 4475 (Hazardous Operations Laboratory) and 4476 (Environmental Test Facility) will have the chilled water systems modified by extending the chilled water distribution piping from Building 4487 to replace 2 chillers (90- and 100-tons) in these two buildings, thereby eliminating the need for replacement of the two units. The Building 4487 system can easily handle the extra load from capacity provided for earlier programs.

Modifications to Buildings 4207 (Communications Facility), 4485, 4666 (Office Buildings), and 4708 (Engineering and Development Laboratory) will include the installation of time clock systems for the start/stop of HVAC systems, conversion to a Variable Air Volume (VAV) System, revision of controls from set point to demand, and elimination of redundant overhead systems and bypasses.

The five air-handling units on the west end of Building 4471 (Storage and Office Building) will be removed from above the ceiling, and one new unit will be installed at floor level. The system will be converted to an economizer cycle, utilizing outside air for cooling when appropriate, thereby permitting shutdown of the Central Water Chiller during the winter months.

The project also provides for modifications to Building 4487 (Laboratory and Office Buiding) computer room HVAC systems. The work will include segregation of computer rooms from adjacent offices and conference rooms to permit better use of demand capability, and modifications to make computer waste heat available for heating the building.

Modifications to the HVAC systems in Building 4663 (Computer Facility) will include replacing 40 obsolete, deteriorated air-handling units with 11 new chilled water type and 21 chilled water, process-cooling units designed for use in computer room application by making maximum use of computer-generated heat.

Modular boilers will be installed in Buildings 4605 (Non-destruction Evaluation Lab), 4618 (Hydraulic Test Facility), 4628 (Cryogenic Testing Facility), 4647 (Compressor Building), 4649 (Multi-purpose High Bay Facility), 4656 (Hydraulic Equipment Development Facility), 4659 (High Pressure GN_2 Facility), and 4678 (Office and Storage Building) to meet year-round steam/heating requirements. All valving necessary to permit cutting off the existing steam supply to the buildings will also be included, as will the necessary electrical and water connections to the new boilers. Both electrical and oil-fired boilers will be analyzed during the design phase to determine the most economical system in terms of initial and life-cycle costs, as well as fossil fuel consumption.

This project also provides for the installation of modular boilers in Buildings 4487 (Laboratory and Office Building), 4663 (Computer Facility), 4760 (Surface Treatment Facility), 4705 (Fabrication and Machine Shop) and 4706 (Neutral Buoyancy Simulator) to fulfill the building requirements for summer reheat, potable hot water, and process steam. The work includes connections to existing supply and condensate return lines where required for all five buildings. Both electric and oil-fired boilers are to be considered during the design phase in terms of initial and life-cycle costs, and fossil fuel consumption.

For further conservation of heat energy, electric hot water heaters will be installed in ten buildings where only reheat and/or potable hot water are required and the buildings will be removed from the distribution systems during the summer months. Installation of these modular boilers and hot water heaters will permit complete shutdown of the RASS and some 60-75 percent of the MSFC systems.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition..	---	---	---	---
Construction..	---	---	---	2,640,000
HVAC modifications	---	---	---	2,035,000
Building 4705, Fabrication and Machine Shop	LS	---	---	(310,000)
Building 4475, Hazardous Operations Facility	LS	---	---	(50,000)
Building 4476, Environmental Test Facility	LS	---	---	(30,000)
Building 4207, Communications Facility	LS	---	---	(25,000)
Building 4485, Office Building	LS	---	---	(15,000)
Building 4666, Office Building	LS	---	---	(95,000)
Building 4708, Engineering & Development Laboratory.	LS	---	---	(190,000)
Building 4471, Storage and Office Building	LS	---	---	(90,000)
Building 4487, Laboratory and Office Building	LS	---	---	(220,000)
Building 4663, Computer Facility	LS	---	---	(1,010,000)
Installation of modular boilers and water heaters	---	---	---	605,000
Eauipment	---	---	---	---
Fallout Shelter (not feasible)	---	---	---	---
Total			...	2,640,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Economizer Cycle
Figure 3 - Typical Timer Control of HVAC Units

OTHER EQUIPMENT SUMMARY:

There is no other equipment required to be used with this facility project.

FUTURE CoF ESTIMATED FUNDING TO COMPLETE THIS PROJECT:

No future CoF funding is anticipated for this project.

MODIFICATIONS TO VARIOUS BUILDINGS, ECONOMIZER CYCLE

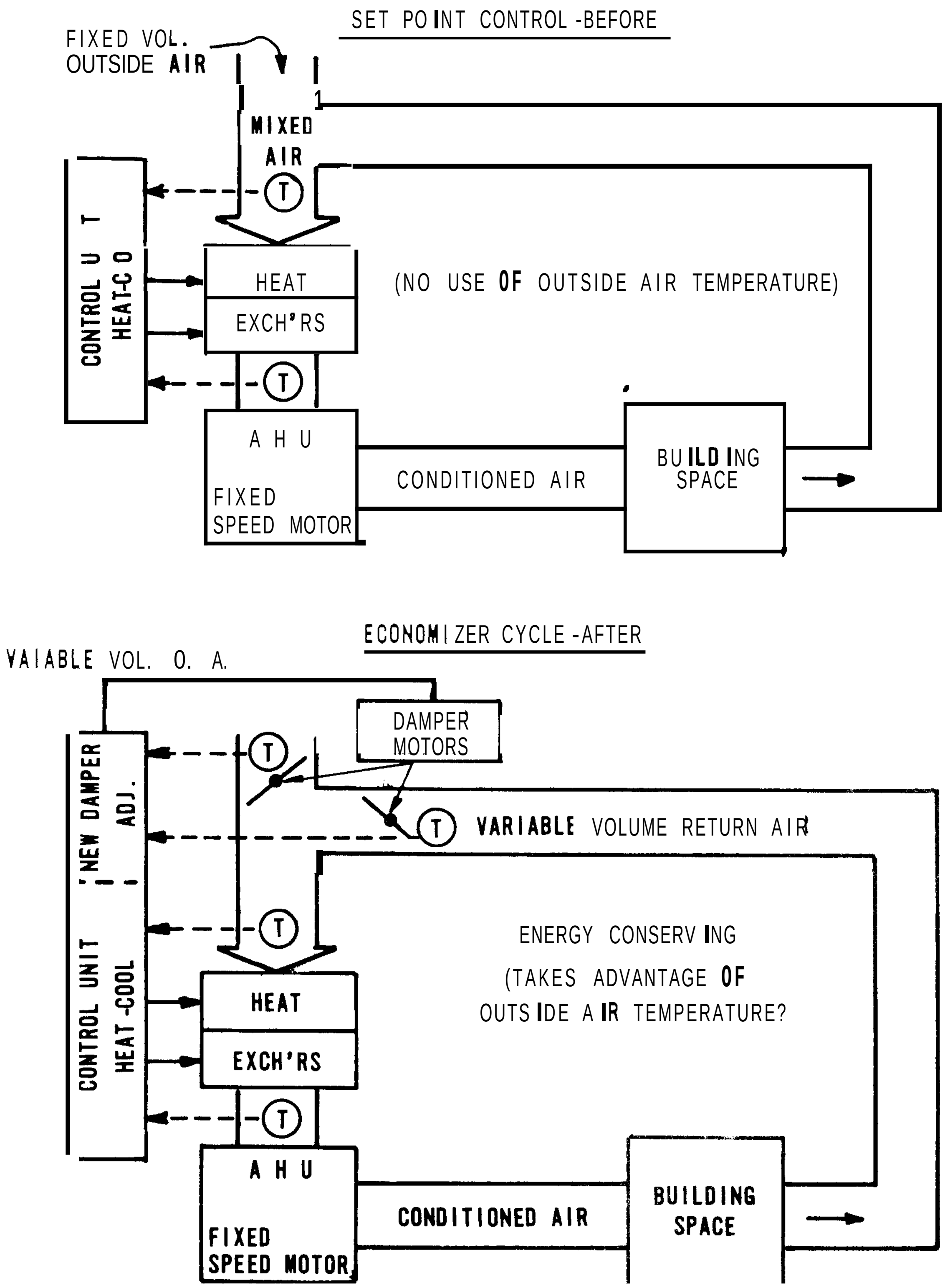


FIGURE 2

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS TO VARIOUS BUILDINGS

TYPICAL TIMER CONTROL OF HVAC UNITS

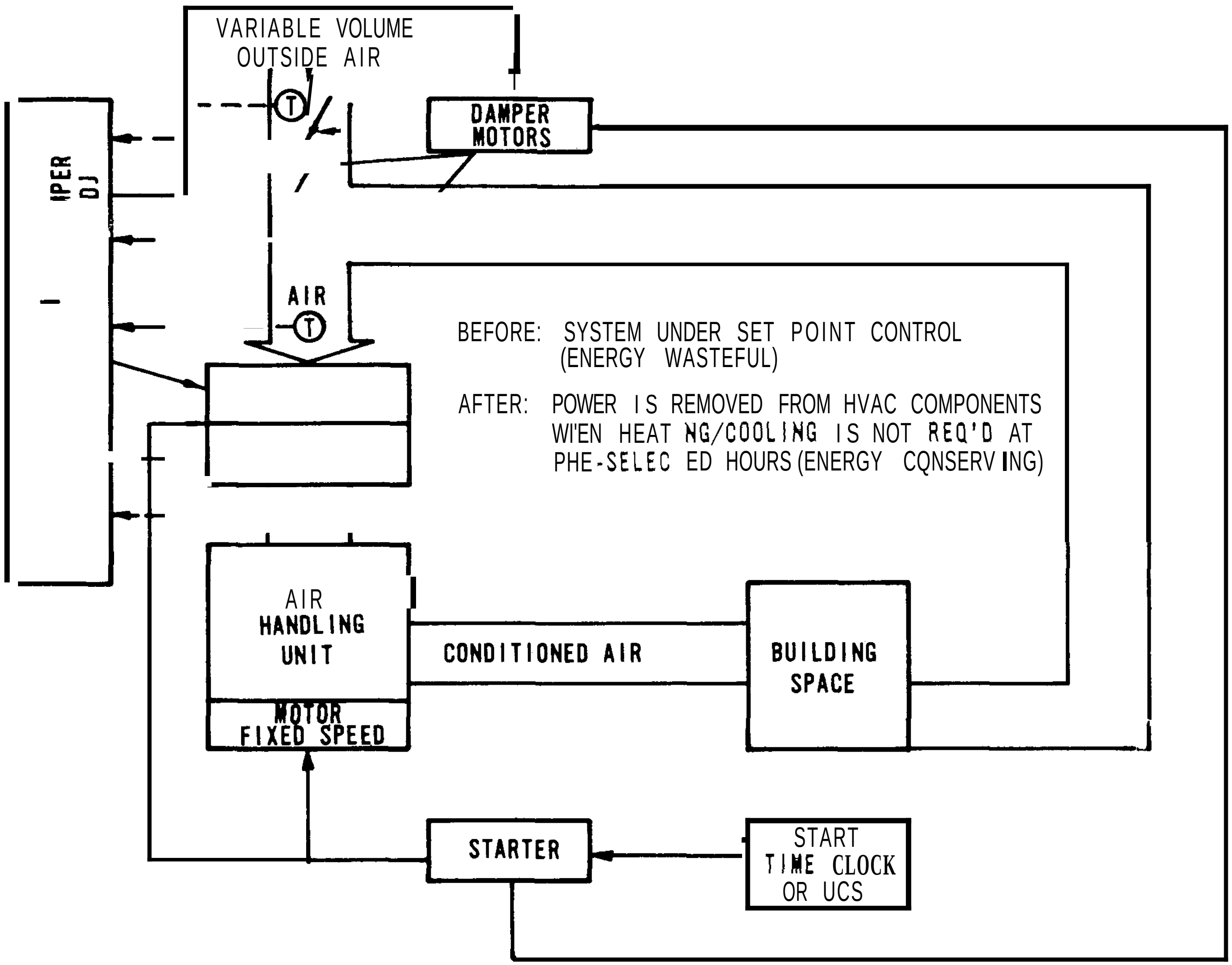


FIGURE 3

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS OF ROOFS, VARIOUS BUILDINGS

LOCATION PLAN

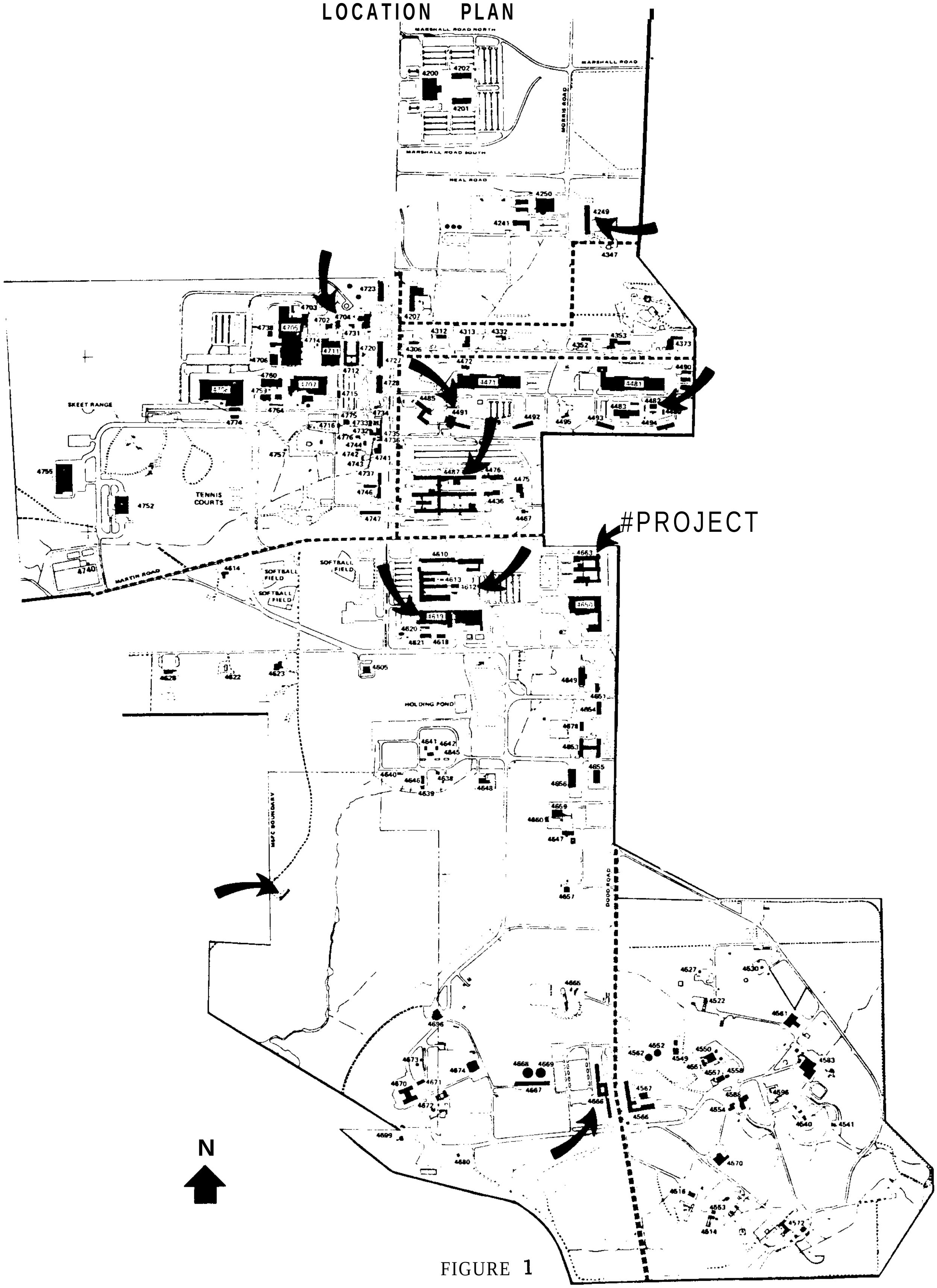


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Rehabilitation of Roofs, Various Buildinas

INSTALLATION: George C. Marshall Space Fliaht Center

FY 1980 CoF ESTIMATE: $900,000

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

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Desian	Construction	Total
Specific CoF funding..	44,000	---	44,000
Capitalized investment....	N/A	29,377,506	29,377,506
Total.....	44,000	29,377,506	29,421,506

SUMMARY PURPOSE AND SCOPE:

This project provides for the rehabilitation of the roofs of ten major buildings at Marshall Space Flight Center (Figure 1), by the replacement and/or repair of approximately 1700 squares of roofing (a square is 100 square feet). The proposed work includes selected roof portions of Buildings 4249, 4482, 4487, 4491, 4612, 4619, 4663, 4666, 4697, and 4704. Work is required to rectify blistering, soft spots, drying-out, and alligatoring of roof surfaces. This calls for the replacement of roofing, insulation and damaged flashing. This rehabilitation will correct the deteriorated condition of the building roofs, reduce maintenance costs, and eliminate the possibility of damage to ceilings, floor, light fixtures, and equipment.

PROJECT JUSTIFICATION:

The rehabilitation of roofs is essential to protect and preserve facility capability and to remove the threat of unscheduled interruption to the Center's research operations. By 1980, the roof age of these facilities will range from 15 to 37 years, with the average being 22 years. Normal roof lifetime in this geographic area is 15 years or about and, consequently, these roofs have served a normally expected life span. Higher priority mission-related needs coupled with limited resources have resulted in the need to progressively defer major roof maintenance work for the last three years and this has added to the ultimate urgency of doing this work now. The roofs in this project have been continuously patched many times in the past 15 years and in many areas the patches have been repatched. As a result, the maintenance cost is increasing each year. This project will provide for the refurbishment of the roofs to protect the building structural integrity and prevent possible damage which could cost several times the cost of the roof repairs. Many areas on the roofs are soft and spongy, indicating a breakdown of the insulation. Once roof insulation is saturated with water, it must be replaced. Imminent danger of roof failure is clearly demonstrated by blisters, soft spots, air pockets, and cracked and dried out areas. Roofs in this condition must be repaired or replaced as soon as possible to preclude damage to building structures, ceilings, light fixtures, and sensitive electronic equipment. Counter flashing, roof vents, gutters and downspouts are rusted or in bad condition and need replacement on some of the buildings listed. The buildings included in this project represent some 797,000 square feet (74,000 square meters) of office, laboratory, and shop space, or approximately 22 percent of MSFC's inventory of active usable space.

IMPACT OF DELAY:

Delay of repairing the roofs requested in this project will subject the buildings to damage from water leakage. Damage that could occur would vary from building damage, to serious damage to valuable R&D equipment. Delay will also make it necessary to continue less effective and economical efforts to patch on a wider basis.

PROJECT DESCRIPTION:

This project addresses the rehabilitation of approximately 1700 squares of roof area. The buildings selected have been determined to be those in greatest need of repair. Approximately 1200 squares of roofing on 7 buildings will be repaired by replacing gravel guard foam glass insulation, counter flashing, cants, nailers, and 5-ply built-up roofing. Approximately 450 squares of 5-ply built-up roofing only will be installed on 2 buildings. Building 4704 has a 50-square corrugated metal roof, which will be repaired by spraying two coats of black emulsion sealer and one finish application of aluminum coating. All roofs will have a smooth silver-gray finish to reflect solar heat as an energy conservation measure. Roof drains, gutters, and downspouts will be realigned and replaced as required.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition.............	---	---	---	---
Construction..........................	---	---	---	900,000
Replace roofing, cants and nailers....................	SQ	1,650	409.82	676,200
Replace insulation..............	SQ	1,200	50.92	61,100
Roof coating..	SQ	50	114.00	5,700
Replace sheet metal and drains.........	LS	---	---	157,000
EauiDment.	---	---	---	---
Fallout Shelter (not feasible)...........................	---	---	---	---
Total.......................				900,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan

OTHER EQUIPMENT SUMMARY:

No other equipment is required.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is anticipated that an average of about $700,000 per year over the following four years will be required to "catch up" so that a normal maintenance program can be effective until the next cycle of major rehabilitation is needed.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

WALLOPS FLIGHT CENTER

	Amount	Page No.
Office of the Comptroller:		
Construction of Facilities Operations Shop Building	1,100,000	CF 8-1

WALLOPS FLIGHT CENTER

FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF FACILITIES OPERATIONS SHOP BUILDING

LOCATION/SITE PLAN

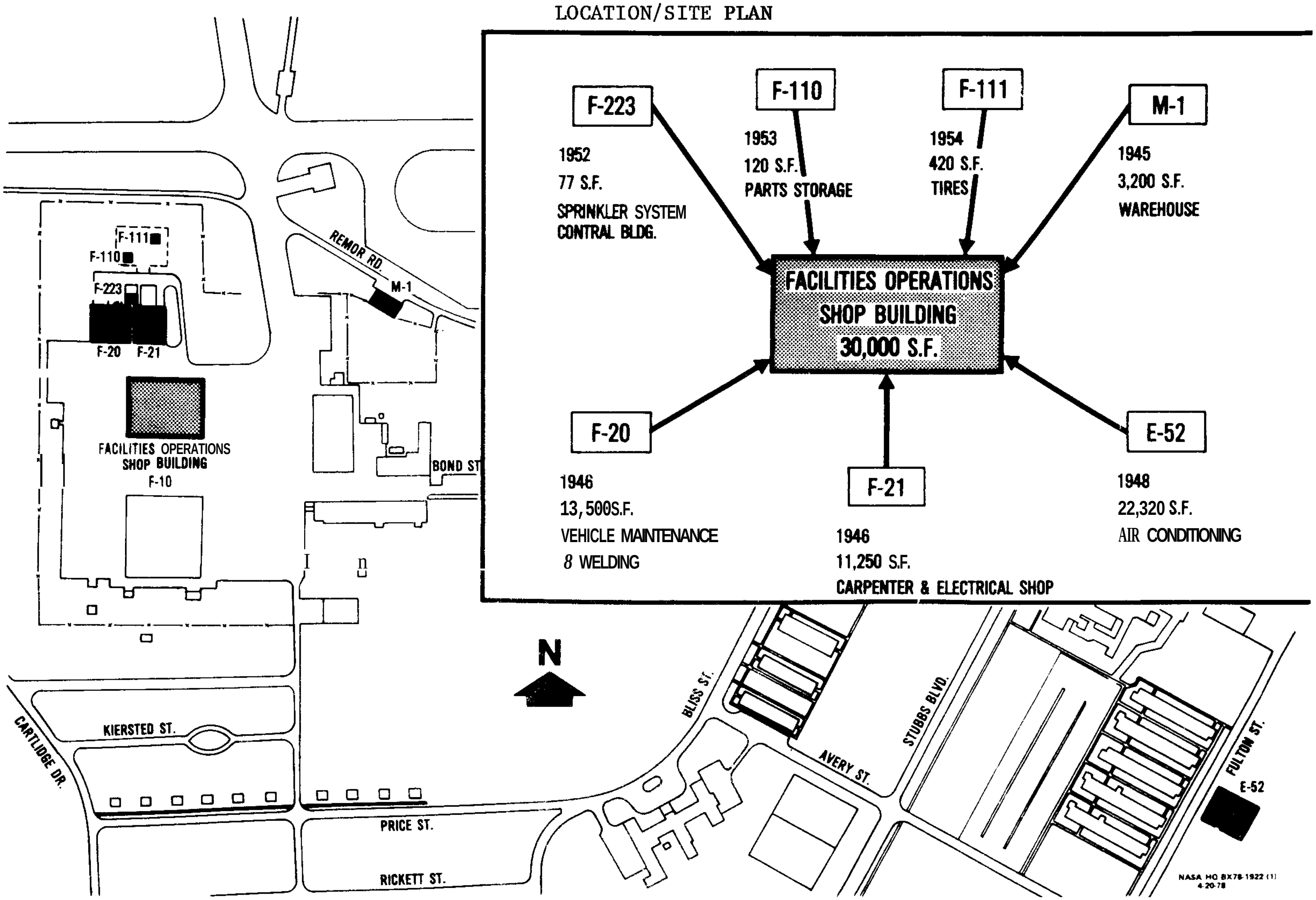


Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Construction of Facilities Operations Shop Building

INSTALLATION: Wallops Flinht Center

FY 1980 CoF ESTIMATE: $1,100,000

LOCATION OF PROJECT: Wallops Flight Center, Wallops Island, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller, Facilities Division

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Desian	Construction	Total
Specific CoF funding	95,000	---	95,000
Capitalized investment...	N/A	---	---
Total	95,000	---	95,000

SUMMARY PURPOSE AND SCOPE:

This project provides for the consolidation of the maintenance shop functions at the Wallops Flight Center (WFC) into a new shop building of 30,000 square feet (2,787 square meters) (Figure 1). These functions are presently located in seven substandard 30-year old buildings. The new shop building will be centrally located, of pre-engineered steel construction, with energy efficient mechanical and electrical systems. This new facility is required at this time to improve the working conditions and operations of these vital maintenance functions.

PROJECT JUSTIFICATION:

This project will consolidate the Center's maintenance functions from seven old, substandard buildings into a new centrally located shop building. The seven buildings are scattered over a distance of 3,000 feet (914 meters), are beyond economical rehabilitation and will be demolished. This consolidation is the result of a utilization study of the existing facilities which examined several options and was directed towards more economical operations. The consolidation of the Facilities Operations Branch will result in a reduction of energy consumption, permit better utilization of available equipment and personnel, and provide an improved level of maintenance support. The new shop facility will provide space for 85 people in the vehicle maintenance, electrical, carpentry, utility, and air conditioning shops, and for the branch office (Figure 2).

This project is needed at this time to permit the demolition of buildings which are beyond their useful lives, improve working conditions and operations, save energy, and provide better mainteiiance support with the available manpower.

IMPACT OF DELAY:

The delay in providing for these vital research support facilities will involve the continuation of very unsatisfactory conditions and the probable expenditure of resources on old facilities with limited results.

PROJECT DESCRIPTION:

This project provides for the construction of a 30,000-square foot (2,787 square meter) pre-engineered steel building with insulated wall and roof panels. The building will be located near the Technical Service Shops and Office, Building F- 0, on an existing concrete apron. Electrical, steam, water, and sanitary services will be extended to the building. Shop space will be provided for: vehicle maintenance of 11,000 square feet (1,022 square meters), electrical of 4,000 square feet (372 square meters), carpentry of 4,000 square feet (372 square meters), utility of 4,000 square feet (372 square meters), air conditioning of 4,200 square feet (380 square meters), and others. Operable vehicle access doors, parts and tool storage space will be provided for each shop space. Suitable electric power, lighting, installed shop equipment, heating and ventilation will be provided. In addition, locker room facilities and air conditioned mezzanine-level office space of 1,500 square feet (139 square meters) will be included. Appropriate safety and fire protection systems will be installed in the building.

This work also includes the demolition and site restoration of Buildings E-52, F-20, F-21, F-110, F-Ill, F-223, and M-1.

PROJECT COST ESTIMATE:

The basis of this cost estimate is a Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit Cost	cost
Land Acauisition	---	---	---	---
Construction	---	---	---	920,000
Utilities (outside 5' line)	LS	---	---	50,000
Architectural	SF	30,000	19.67	590,000
Plumbing	SF	30,000	1.67	50,000
HVAC	SF	30,000	3.67	110,000
Electrical	SF	30,000	4.00	120,000
EauiDment	LS	---	---	70,000
Demolition and Site Restoration	SF	50,000	2.20	110,000
Fallout Shelter (not feasible)	---	---	---	---
Total				1.100.000

LIST OF RELATED GRAPHICS:

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

OTHER EQUIPMENT SUMMARY:

There is no other equipment required to be used with this facility project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THE PROJECT:

No further funding is anticipated for this project at this time.

WALLOPS FLIGHT CENTER
FISCAL YEAR 1980 ESTIMATES
CONSTRUCTION OF FACILITIES OPERATIONS SHOP BUILDING

FLOOR PLAN

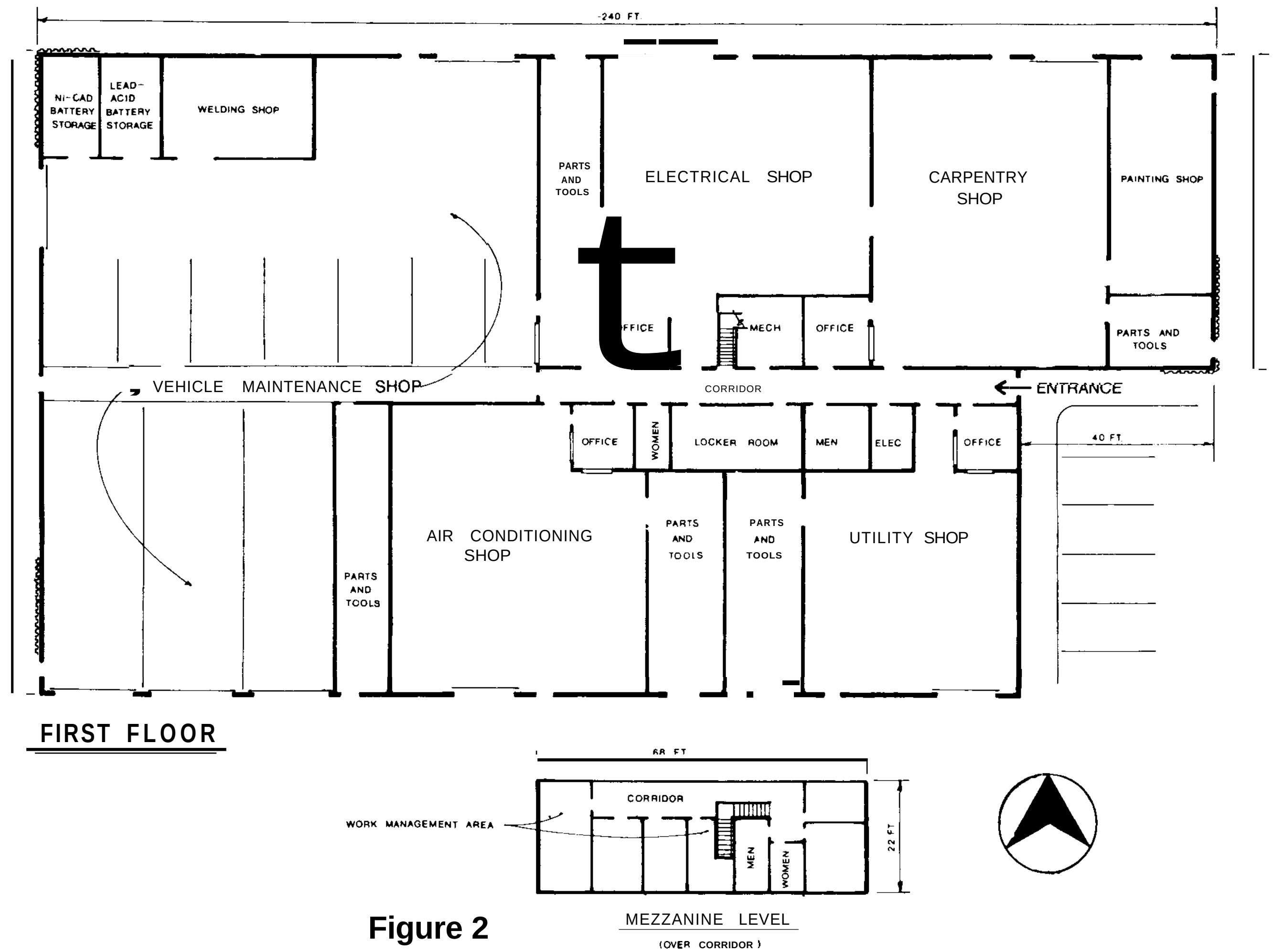


Figure 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

LARGE AERONAUTICAL FACILITIES

	Amount	Page No.
Office of Aeronautics and Space Technology:		
Construction of national transonic facility (LaRC)	12,000,000	CF 9-1
Modification of 40- by 80-foot subsonic wind tunnel (ARC)	33,900,000	CF 9-21
Total	45,900,000	

LANGLEY RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY
LOCATION PLAN

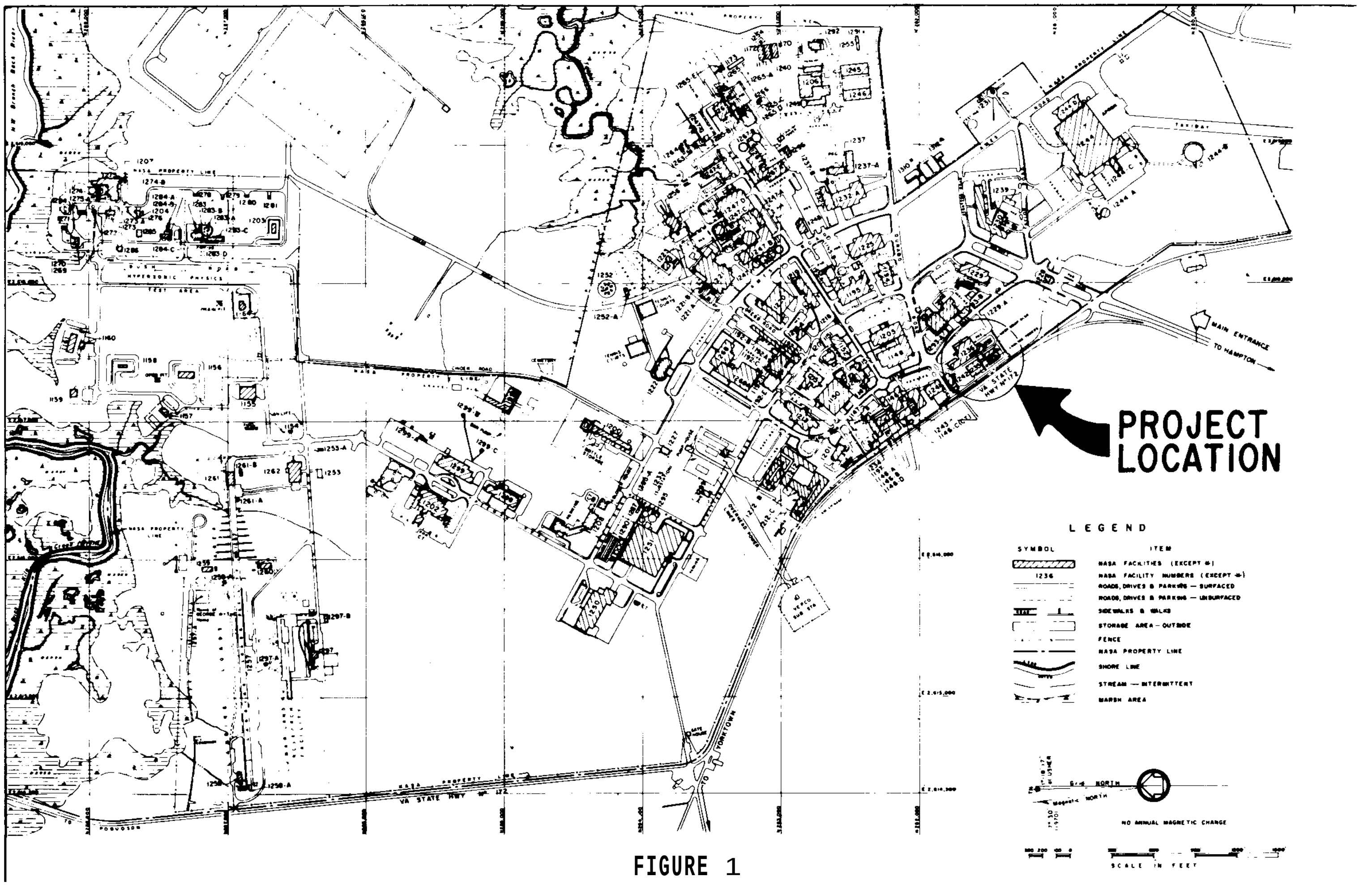


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Construction of National Transonic Facilitv

INSTALLATION: Lannlev Research Center

FY 1980 CoF ESTIMATE: $12,000,000

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding..	7,850,000	73,000,000	80,850,000
Capitalized investment..	N/A	4,942,000	4,942,000
Total..	7,850,000	77,942,000	85,792,000

SUMMARY PURPOSE AND SCOPE:

Construction of the National Transonic Facility (NTF) at Langley Research Center (Figure 1), began with FY 1977 funding, was continued with FY 1978 and FY 1979 funding, and will be completed with this requested funding. This facility, a transonic wind tunnel which will serve the research needs of NASA and the development testing needs of DOD and the aerospace industry, will provide a totally new and vital capability to test a broad spectrum of aeronautical vehicles, including civil, commercial, military, as well as space vehicles, at full-scale Reynolds numbers. It will employ a cryogenic test medium for achieving high Reynolds numbers without excessive model loads or power requirements, This will involve injection and subsequent evaporation of liquid nitrogen to develop the extremely low temperature test medium in an otherwise conventional fan-driven closed circuit wind tunnel. With temperature, pressure and speed independently controlled, the facility will permit clear separation of aeroelastic, Mach number and Reynolds number effects on the aerodynamic performance of test configurations. The capability to separate these effects has heretofore been unattainable in ground facilities. Thus, when completed, the new tunnel will provide an entirely new realm of research capability geared not only to Reynolds numbers, but also to the ability to investigate other significant aerodynamic parameters independently of one another.

Funding requested for FY 1980 will be used to complete both the fabrication of the tunnel structural components and their installation. It will also provide for continuation of work on the tunnel drive system and it will support the beginning of construction on all of the remaining NTF work packages.

The relationship of the FY 1977, FY 1978, FY 1979, and FY 1980 funding requirements is summarized in Figure 11.

Analysis of project schedules and project management capabilities indicate that scheduling resources in several consecutive years, as is done for this project, will not adversely affect the operational schedule for this large facility. At present, the NTF is expected to be operational in the latter half of 1982. Most of the preliminary engineering, special studies and design have been completed, and actual construction was initiated in late 1976.

PROJECT JUSTIFICATION:

World leadership in aircraft design and the superiority of U.S. military flight vehicles are heavily dependent upon ongoing research and new technology. In recent years, an urgent need has developed for several new ground facilities for aerodynamic testing at transonic speeds and at flight Reynolds numbers. This need is supported by the Department of Defense, the U.S. aerospace community, and by the North Atlantic Treaty Organization Advisory Group for Aerospace Research and Development (AGARD). In spite of spectacular advances in aerodynamics during the last 20 years, a number of leading aircraft developments have encountered difficulty because of misleading or inadequate wind tunnel testing data in the transonic regime. Experimental data obtained from existing low Reynolds number transonic wind tunnels often are inadequate to predict flight vehicle performsnce. This is because a vehicle traveling at transonic speed experiences supersonic air flow velocities over portions of its surface area, thereby leading to unsteady flow conditions where Reynolds number sensitive shock/boundary layer interaction effects occur. While the transonic flight environment is common to a broad spectrum of flight vehicles— such as civil, commercial, military, and space--this "Reynolds number sensitive" aerodynamic environment generally is difficult to study analytically and thus, accurate experimental data at or near flight Reynolds numbers are required for an adequate solution.

A wind tunnel permitting accurate experimental measurement at transonic speeds approaching flight Reynolds numbers is therefore necessary for the continuing development of new technology. This will allow increases in the efficiency, performance, size and range of civil and military aircraft. Thus, the urgency of the new testing capability suggests that this facility be completed at the earliest possible time.

When operational, the NTF will provide the test capability to meet the high Reynolds number, transonic speed regime technology development requirements of NASA, DOD and industry. Current planning indicates that NASA programs will use approximately 40 percent of the available test time, DOD 40 percent also, and industry 20 percent. To meet these program needs, the tunnel will be operated on a two-shift basis. Approximately 75 percent of the NTF operation will be conducted using the cryogenic test medium, consuming on the order of 90-120 thousand tons of liquid nitrogen per year.

The capability to simulate full-scale Reynolds numbers on a model in a wind tunnel at Mach numbers near 1.0 requires a workable test section size of 8.2 x 8.2-feet (2.5 x 2.5 meters) with a maximum operating pressure of about 130 psi (896,000 newtons per square meter). It also requires run times long enough to permit accurate data measurements in all areas of aerodynamic research. The quality of the test flow should be of the highest practical level. There are no known wind tunnels in the United States or Europe that will satisfy these requirements. The need for an aeronautical test facility with these capabilities was confirmed in FY 1977, FY 1978 and again in FY 1979, in which years $25 million, $23.5 million, and $24 million, respectively, were made available for construction of the NTF. The FY 1980 request is for resources to complete work already begun on this facility.

IMPACT OF DELAY:

The need for significantly improved ground test capability of aerodynamic configurations in the high Reynolds number, transonic flight regime has been validated and fully supported by prior years resources availability. With this request, the fourth for this multiyear funded project, construction can proceed to completion as scheduled in an orderly and business-like fashion. Delay would not only impact scheduled completion but also it would greatly impact total ultimate cost of this facility. A number of contracts, started with prior years resources, will be completed with these requested funds. Delay would require the lengthening of the schedules for these particular contracts at an increased cost to the government. Also, such delay would affect other contracts which interface with the directly impacted work packages.

PROJECT DESCRIPTION:

FY 1980 resources will provide the fourth sequential funding element for the construction of a fan-driven, closed circuit wind tunnel as shown in Figure 4. It will be 200 feet (61 meters) long, 48 feet (14.6 meters) wide, will vary in diameter from 40 feet (12.2 meters) to 11 feet (3.4 meters), and will have an operating pressure range from 14.7 psi (101,400 newtons per square meter) to a maximum of 130 psi (896,000 newtons per square meter) and an operating temperature range from 155°F to -300°F (341.5°K to 88.7°K). Cryogenic temperatures will be obtained by evaporating liquid nitrogen that has been injected into the tunnel circuit. The cryogenic approach is now the most effective energy conserving technique for achieving high Reynolds numbers without excessive model loads. The tunnel pressure shell will be fabricated from stainless steel and will be insulated internally to contain the cold gas. A fixed-pitch single-stage fan will drive the tunnel air flow through an 8.2 x 8.2-Foot (2.5 x 2.5 meters) slotted test section to produce Mach numbers ranging from 0.2 to 1.2. The Mach number range is obtained through the use of variable speed motors and variable inlet guide vanes.

A three-dimensional model support system (Figures 5 and 6), having an angle of attack range of 30 degrees, will be installed in the test region. Viewing ports in the walls of the slotted test section will be provided for remote television viewing of the model under test.

The NTF is being constructed on the site of the recently demolished 4x4-Foot (1.2 x 1.2 meters) Supersonic Wind Tunnel (4-Foot SWT) (Figure 2) and will incorporate the electric motor drive system of that tunnel. These two motors, which will provide approximately half the total operating power required, have a combined rating of 47,000 HP (35,062 KW) for continuous duty. They are capable of 70,000 HP (52,220 KW) for run times up to 10 minutes. A two-speed gear system (Figure 7) will be provided to match the fan with motors at both ambient and the full-range of cryogenic temperatures. A speed control system will be provided to achieve a constant torque from the motor over a wide range of revolutions per minute to improve the power characteristics of the motors for this new application. A new 60,000 HP synchronous drive motor (44,760 KW) (10 minute rating) will be installed to provide the additional power required to achieve the greater pressure needed to obtain higher Reynolds numbers. The facility will use the existing cooling tower, pumps, auxiliary equipment and buildings. A new two-story shop addition (Figure 3) of approximately 33,500 square feet (3,112 square meters) will accommodate the larger transonic test section. The shop will include space for a control and data acquisition room, and for an improved model preparation area. Adequate controls, process monitors, and data acquisition systems are included in this project.

A liquid nitrogen storage and supply system will accommodate nitrogen flows to the tunnel at rates up to about 1,000 pounds per second (454 kg per second). This is required to remove the heat generated by the fan during constant cryogenic temperature operation. Additionally, a pressure control and venting system is provided to maintain constant pressure during data gathering. The vent will feed into an exhaust stack acoustically designed to satisfy environmental standards.

Both the design and construction of this project are being managed on a "work package" basis. Each of the "work packages" contains all elements of work to be accomplished through separate procurement, scheduling, and cost control. This approach is particularly effective for an extremely complex facility such as this because it results in better project management, improved competition, and better functional and cost-effective designs.

FY 1977 funding provided for the demolition and removal of nonreusable portions of a 4x4-Foot (1.2 x 1.2 meters) Supersonic Wind Tunnel (located on the NTF site). It also provided for the driving of piles and construction of virtually all foundations required for the new tunnel, as well as the first increment of the tunnel pressure shell fabrication and erection. Additionally, initial funding provided for the first increment of the new drive system and fan components.

FY 1978 funding provided for completion of the foundations, continuation of the tunnel pressure shell fabrication and erection, purchase of the tunnel insulation and liner, and construction of the liquid nitrogen storage system. It also provided for the start of work on the tunnel structure components fabrication and the special piping system. The second funding element permitted continuation of work on the tunnel drive system and fabrication of the model support system. Fsbrication of the drive shaft and disk has been completed and these major components have been shipped to the drive system fabricator.

FY 1979 funding provided for the completion of the tunnel pressure shell fabrication and erection (Figures 3, 9 and 10) and initiation of the tunnel structure internal components fabrication (Figure 8). The tunnel pressure shell will form the general aerodynamic shape of the tunnel circuit and is being built of rolled and welded stainless steel plate and forgings designed to withstand the extreme temperature and pressure fluctuations that will occur during actual tunnel operations. Foundations for the tunnel pressure shell have been completed and considerable progress has been made in fabrication of the pressure shell. The tunnel structure internal components, to be fabricated of aluminum, will define the actual flow boundaries in the test section and fan region. FY 1979 resources are also being used to start installation of these complex and difficult-to-install internal components.

Equipment provided with FY 1979 resources included the cooling coil, the process controls, the data acquisition and research instrumentation system and the electrical systems. The cooling coil (Figure 4), an aerodynamically shaped heat exchanger, will be installed upstream of the test section. It will serve during noncryogenic operations to remove heat generated by the fan from the flowing test medium. Also included in this work package are provisions to suitably expand the capacity of the supporting cooling tower.

Fabrication and installation of the process control system began with FY 1979 resources. This programmed, computerized system will be used to operate the tunnel in an efficient and energy conservative mode. The system will provide integrated control of fan speed, liquid nitrogen injection rates, model angle-of-attack, tunnel pressure, and the geometry of the test section.

Additionally, work was started on the fabrication and installation of the data acquisition/research instrumentation system. This system will remotely sense and record tunnel operating conditions and corresponding research data from the model under test.

Finally, FY 1979 resources were used to start fabrication and installation of electrical systems that will bring power to the facility and route it to the proper locations in the tunnel and building.

Other previously started work includes the special piping system, the drive system, and the fan components. The special piping system includes the lube oil system, the cooling water system, the high pressure compressed air system, the vacuum system, and the nitrogen admission and venting systems. The drive system includes the new synchronous 60,000 HP (44,760 KW) drive motor (Figure 7), the drive shaft, associated gear boxes, clutches, couplings and bearings, and the rewinding of an existing 4-Foot SWT motor. Fan components to be provided are the fiberglass fan blades and the attachment assemblies that connect the blades to the shaft-mounted fan disk assembly.

FY 1980 funding will be used to complete fabrication and installation of the tunnel structure internal components and the tunnel drive system. Also to be completed with FY 1980 resources are the sitework and building. This work package includes a two-story building addition (Figure 3) to house controls, data acquisition and instrumentation systems, and the test model preparation area. Included is the vent stack (Figure 2) through which the high pressure exhaust nitrogen will flow and which will attenuate associated noise to environmentally acceptable levels.

The 1982 milestone operational date is heavily contingent on this FY 1980 element of funding. Engineering estimates at the present time indicate that the total cost of this facility will be about $85 million. This includes consideration of the results of contract solicitations to date which amount to approximately 60 percent of the total project.

Some potential design and fabrication problems still exist. Prime among the potential problem areas is completion of the fabrication and installation of the tunnel structure internal components. As can be seen in Figure 8, these components are very large, consist of many compound curved surfaces, and must be put in place as the tunnel pressure shell is being erected. Other difficult problem areas are:

- Controls optimization - math modeling of the various systems (fan speed, liquid nitrogen injection rate, tunnel pressure, etc.) to develop the most efficient controls for rapid change of the test environment.

- Seals - development of seals, to be placed between movable components, that will render repeated good performance over the expected wide range of temperature and pressure.

There is growing confidence that these problems are manageable and can be solved within the target cost, but recognition of these "unknowns" at this time is prudent.

A final environmental impact statement (EIS) for this project has been prepared and fully circulated. As indicated in the EIS, proper design, construction, and controlled operation of the completed facility will mitigate possible environmental effects, such as noise, venting of large volumes of nitrogen gas, and the possible formation of ground fog caused by venting cold nitrogen gas.

Although several studies pertaining to these areas of concern are not yet complete, findings to date indicate that acoustic treatment of the tunnel drive system and the vent stack will reduce noise to acceptable levels. Similar efforts, including pilot vent stack operation, indicate that the nitrogen can be satisfactorily vented without adverse effects. However, there may be occasions when prevailing atmospheric conditions will require the mode of tunnel operation to be somewhat modified to insure avoidance of a ground fog "problem" which might otherwise be caused by the venting of cold nitrogen gas. Work is continuing to develop the most effective combination of equipment an3 operational parameters to deal satisfactorily with these problems; however, it is not now felt that any of these will become impediments or offer any significant operational constraints.

PROJECT COST ESTIMATE:

The basis of this cost estimate is advanced final planning.

	Unit of Measure	Quantity	Unit cost	Total
Land Acquisition..	---	---	---	---
Construction..	---	---	---	10,400,000
Sitework and building construction (Increment II)......	LS	---	---	400,000
Tunnel structure components fabrication (Increment III)	LS	---	---	4,800,000
Tunnel structure components installation..............	LS	---	---	5,200,000
Equipment...	---	---	---	1,600,000
Tunnel drive system fabrication and installation (Increment IV)......................................	LS	---	---	1,300,000
Test section side access system fabrication and installation.....	LS	---	---	200,000
Model handling equipment fabrication.............	LS	---	---	100,000
Fallout Shelter (not feasible)...........................	---	---	---	---
Total........				12,000,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Perspective (Plan) View
Figure 3 - Second Floor Plan and Tunnel Layout
Figure 4 - Aerodynamic Lines
Figure 5 - Test Section Elevation
Figure 6 - Model Support System

Figure 7 - Fan Drive System
Figure 8 - Tunnel Structure Components
Figure 9 - Site Construction
Figure 10 - Fabricated Shell Section
Figure 11 - Funding Plan

OTHER EQUIPMENT SUMMARY:

Existing collateral equipment consisting mainly of the drive motors and a portion of the building for the 4x4-Foot Supersonic Wind Tunnel (4-Foot SWT) will be used in this facility. The estimated replacement value of this equipment is about $14 million. Although no other noncollateral equipment is required to either complete this facility or operate it for its intended purpose, it is anticipated that model calibration equipment, test support equipment, and model instrumentation technology for cryogenic testing will be required to fully exploit the capabilities of the completed facility. These non-CoF costs are programmed over several years, starting in FY 1980 and extending into the early operational years of the NTF. It is also anticipated some additional research equipment needs will be satisfied from existing inventories at LaRC.

FUTURE CoF ESTIMATED FUNDING TO COMPLETE THIS PROJECT:

At the present time, additional future CoF funding is not scheduled.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY

PLAN VIEW

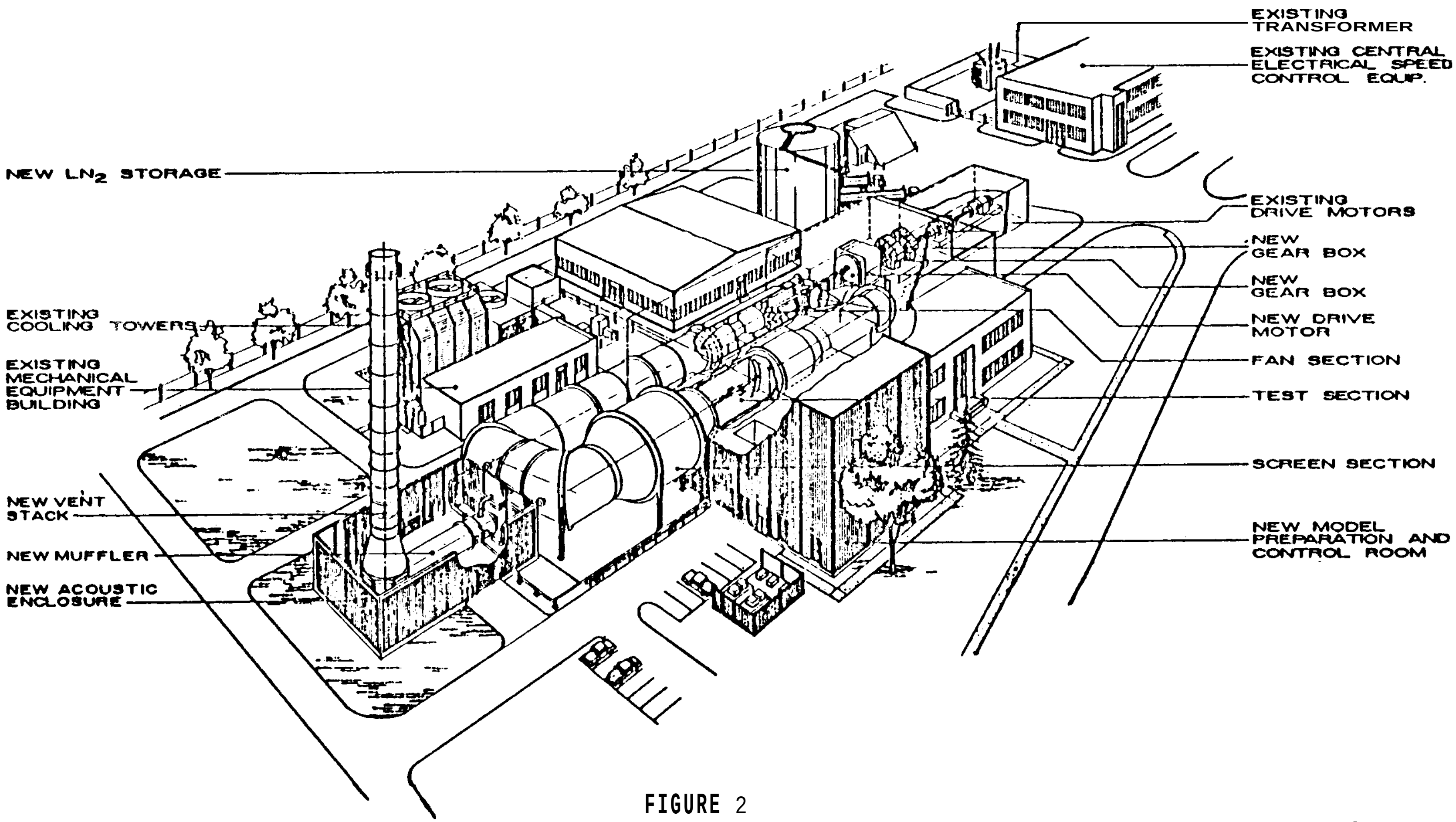


FIGURE 2

LANGLEY RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY SECOND FLOOR PLAN AND TUNNEL LAYOUT

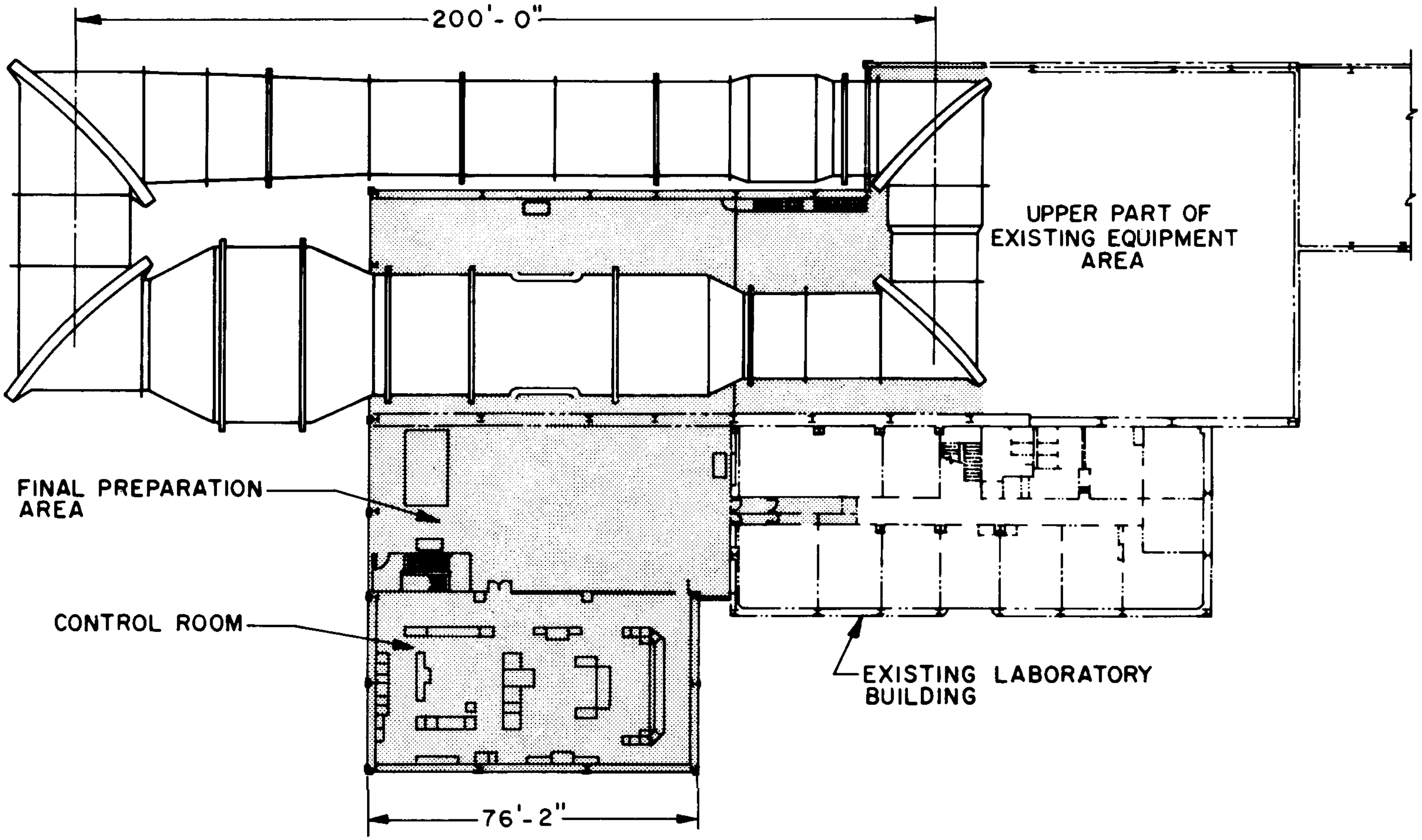


FIGURE 3

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY
AERODYNAMIC LINES

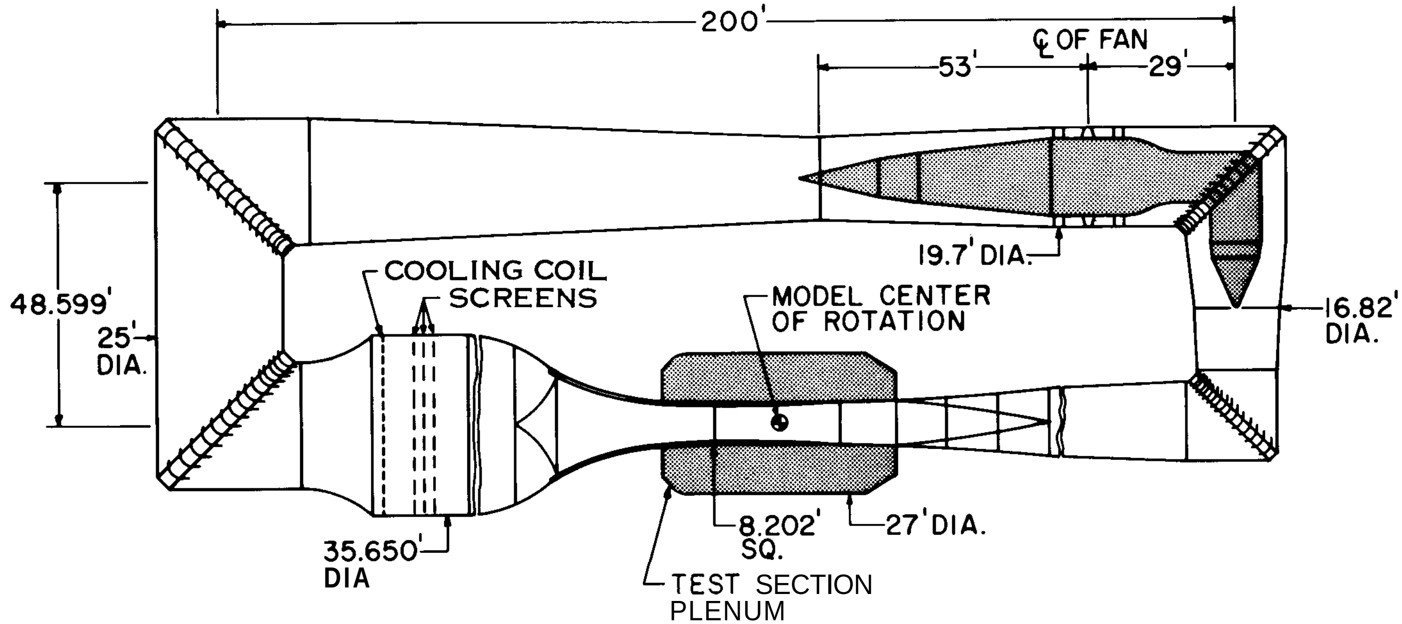


FIGURE 4

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY
TEST SECTION ELEVATION

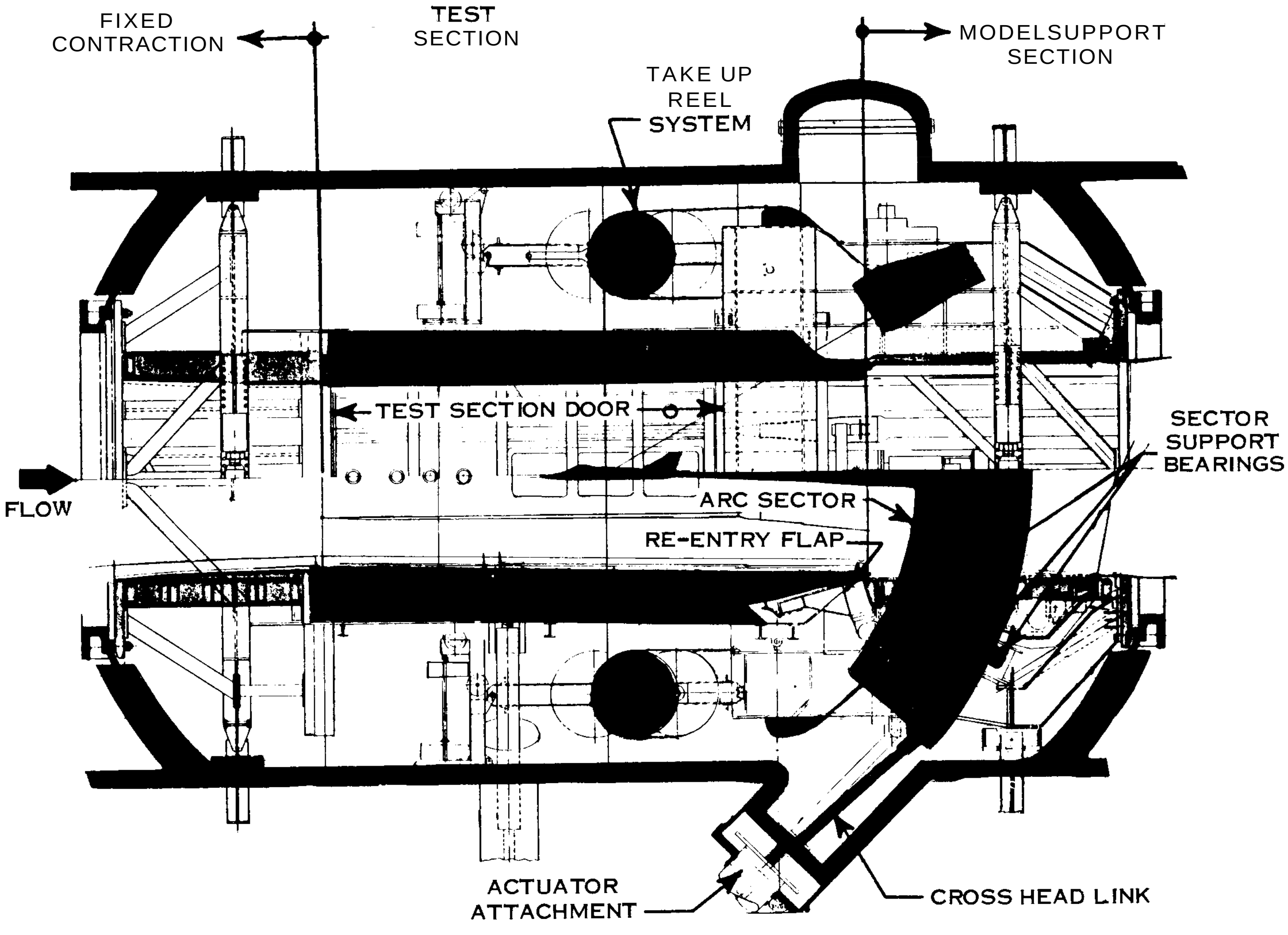


FIGURE 5

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY MODEL SUPPORT SYSTEM

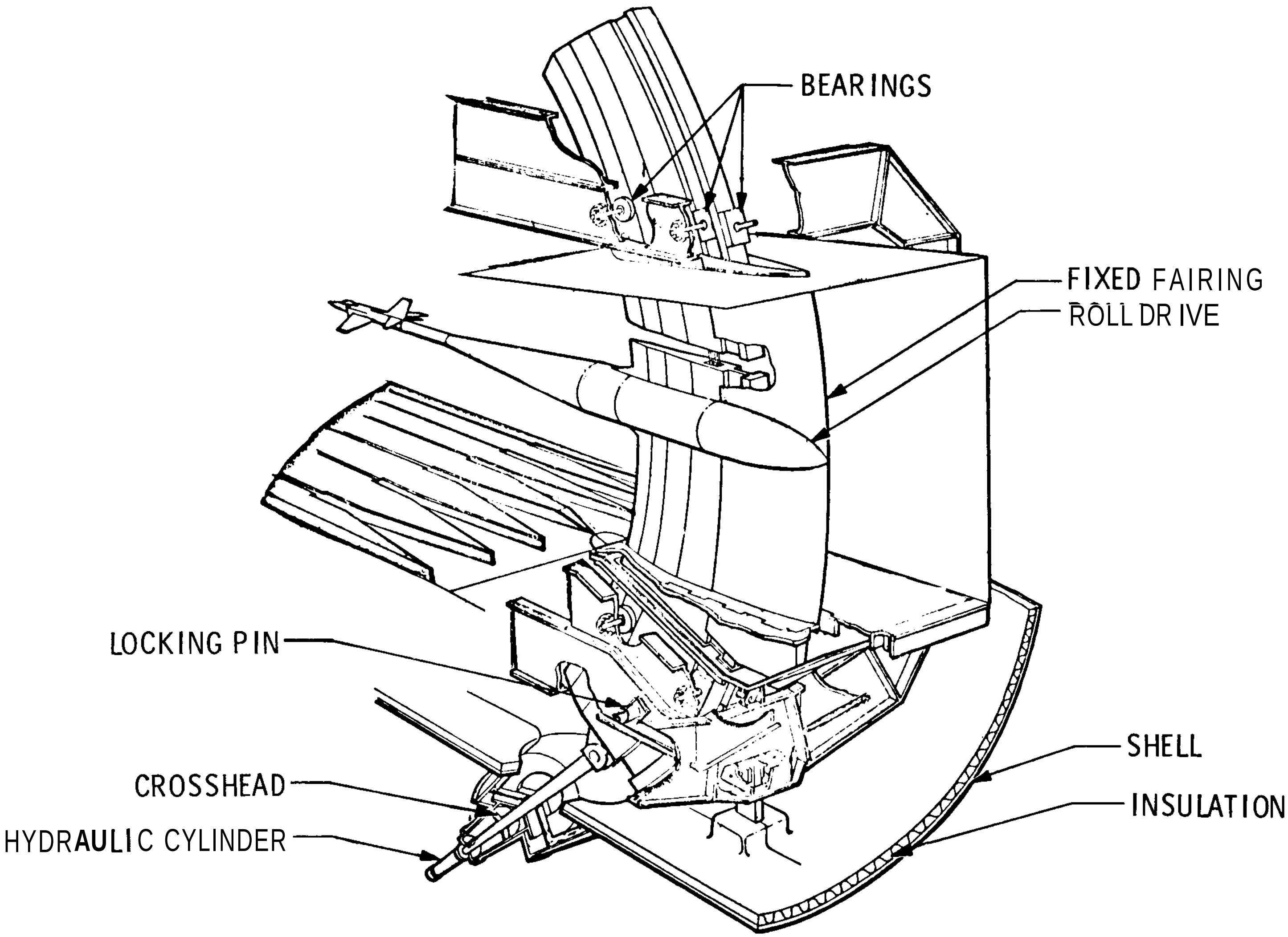


FIGURE 6

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY
FAN DRIVE SYSTEM

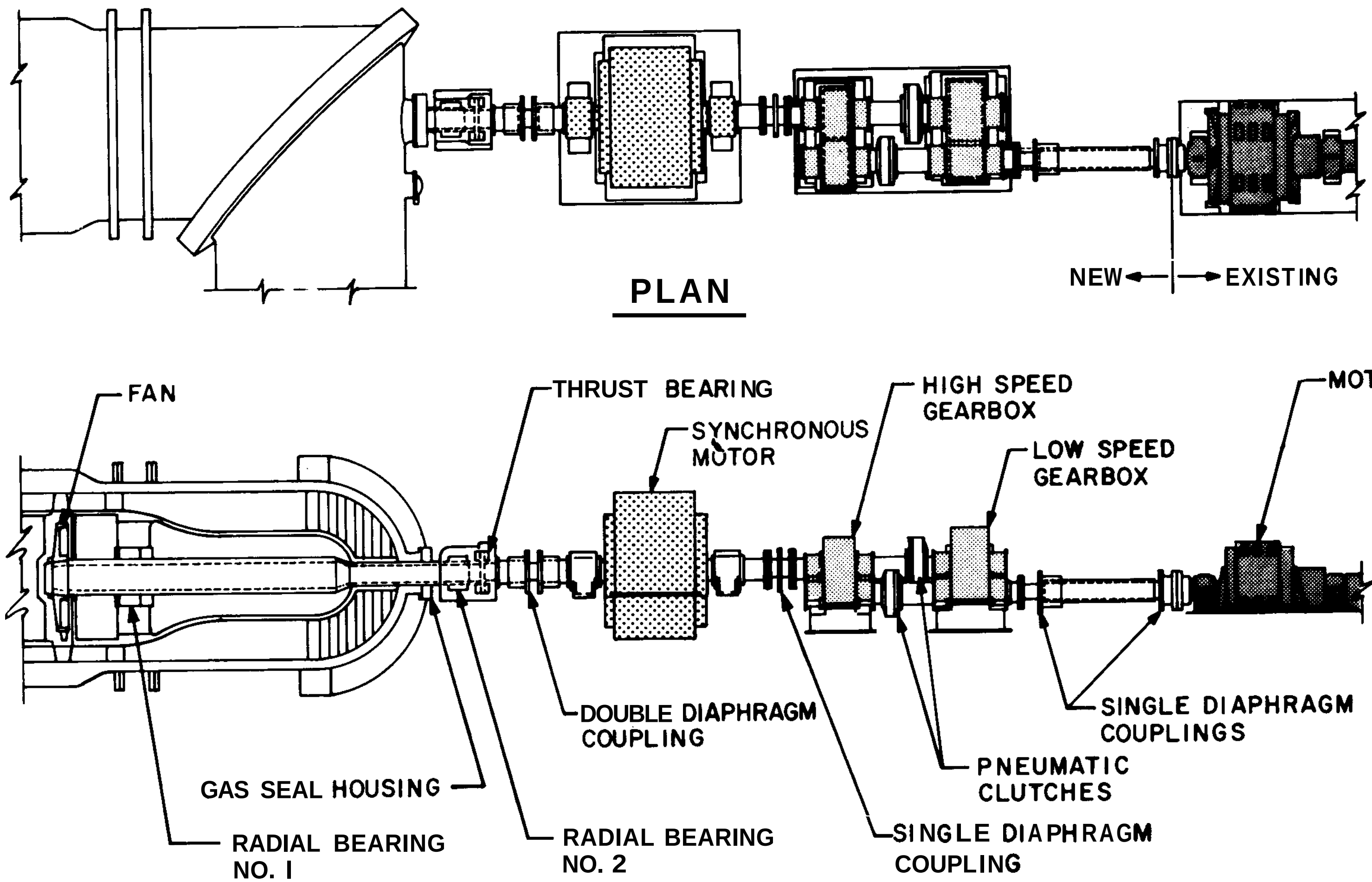


FIGURE 7

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY
TUNNEL STRUCTURE COMPONENTS

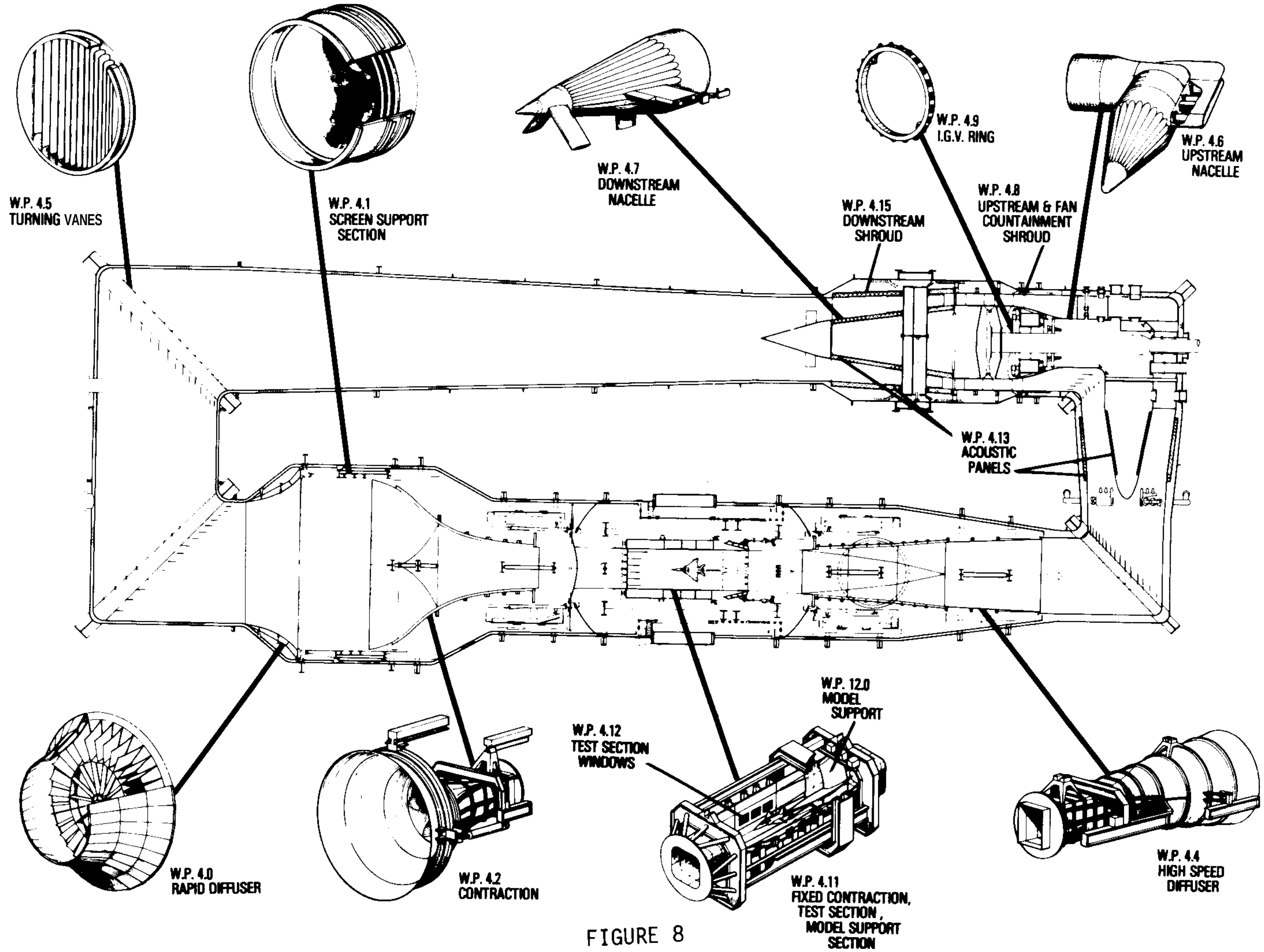


FIGURE 8

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY
SITE CONSTRUCTION

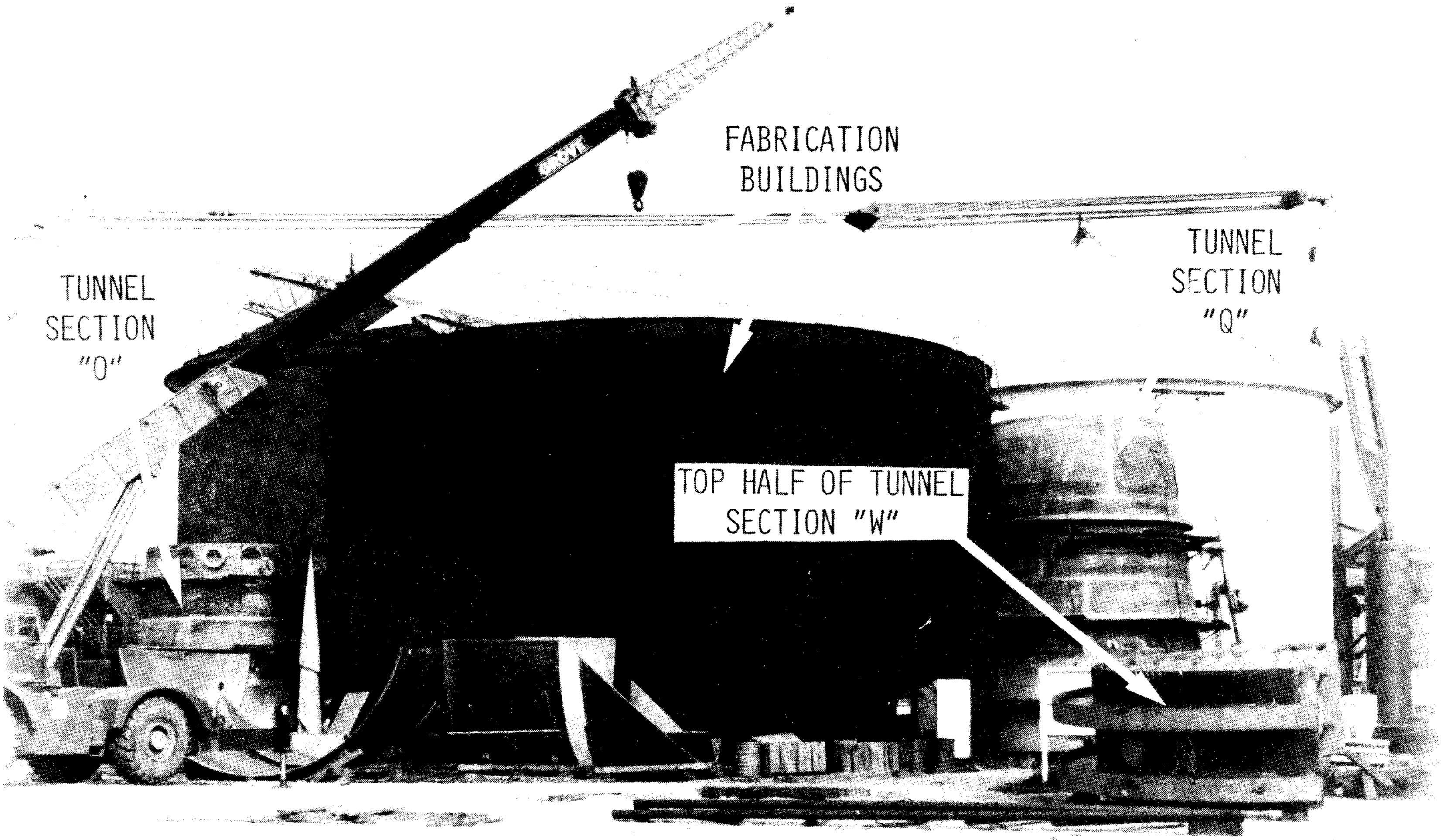


FIGURE 9

LANGLEY RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF NATIONAL TRANSONIC FACILITY
TUNNEL STRUCTURE SECTION '6'

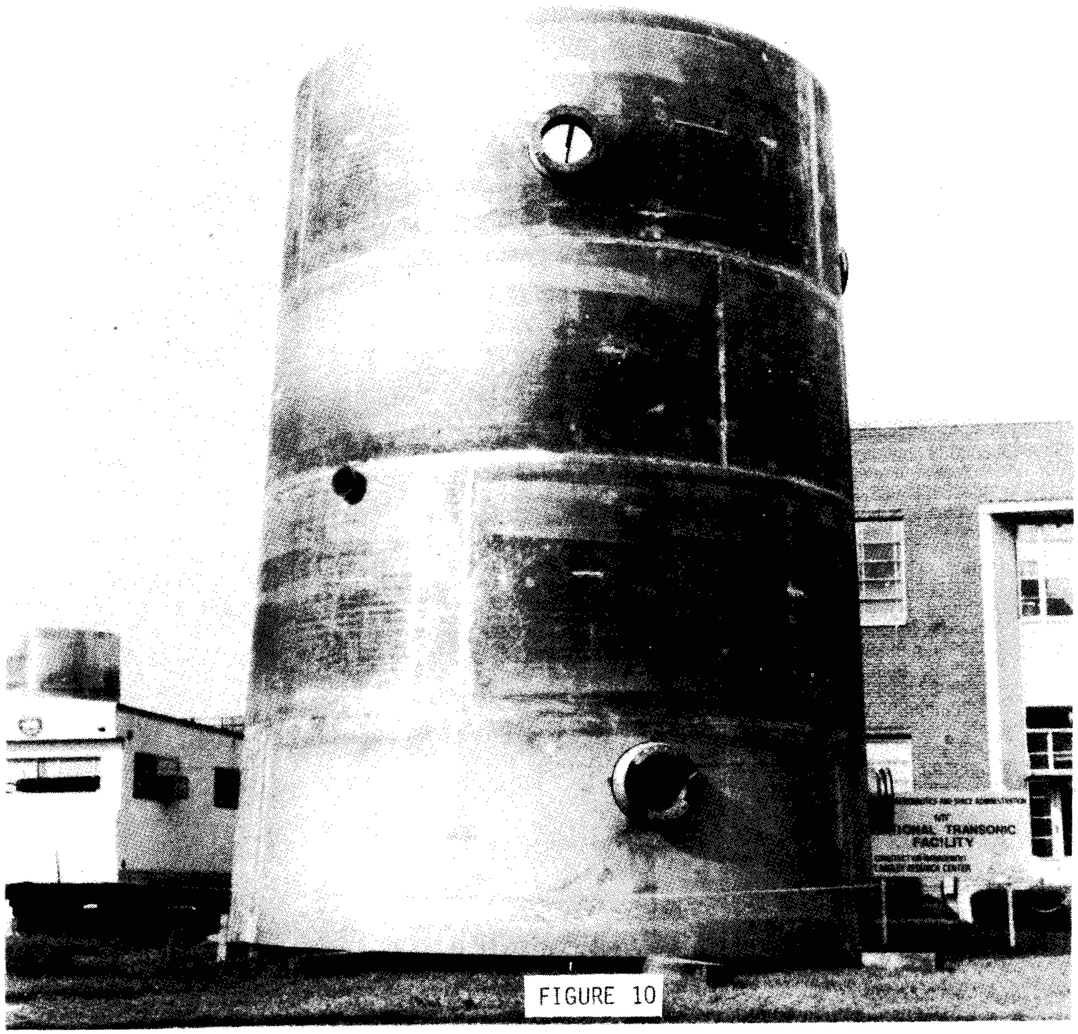


FIGURE 10

LANGLEY RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES
CONSTRUCTION OF NATIONAL TRANSONIC FACILITY
FUNDING PLAN
(Millions of Dollars)

	Fiscal Year			
	1977&1978	1979	1980	Total
Construction..	37.8	9.4	10.4	57.6
Demolition. piles. and foundations..............................	1.2	---	---	1.2
Site work and building..	---	3.9	.4	4.3
Tunnel pressure shell..	22.3	2.6	---	24.9
Tunnel structure components fabrication........................	11.4	.8	4.8	17.0
Tunnel structure components installation.......................	---	.9	5.2	6.1
Insulation and liner...	2.2	1.2	---	3.4
Nitrogen storage...	.7	---	---	.7
Equipment...	10.7	15.1	1.6	27.4
Special piping system..	3.4	.7	---	4.1
Cooling coil...	---	1.5	---	1.5
Tunnel drive system..	5.2	4.4	1.3	10.9
Fan components...	.6	.9	---	1.5
Model support system...	1.5	---	---	1.5
Process control system...	---	3.8	---	3.8
Data acquisition and research instrumentation..................	---	2.8	---	2.8
Test section side access system................................	---	---	.2	.2
Model handling equipment.......................................	---	---	.1	.1
Electrical systems...	---	1.0	---	1.0
Total				
By year..	48.5	24.5	12.0	85.0
Cumulative...	48.5	73.0	85.0	---

FIGURE 11

AMES RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATION OF 40-by 80-FOOT SUBSONIC WIND TUNNEL
LOCATION PLAN

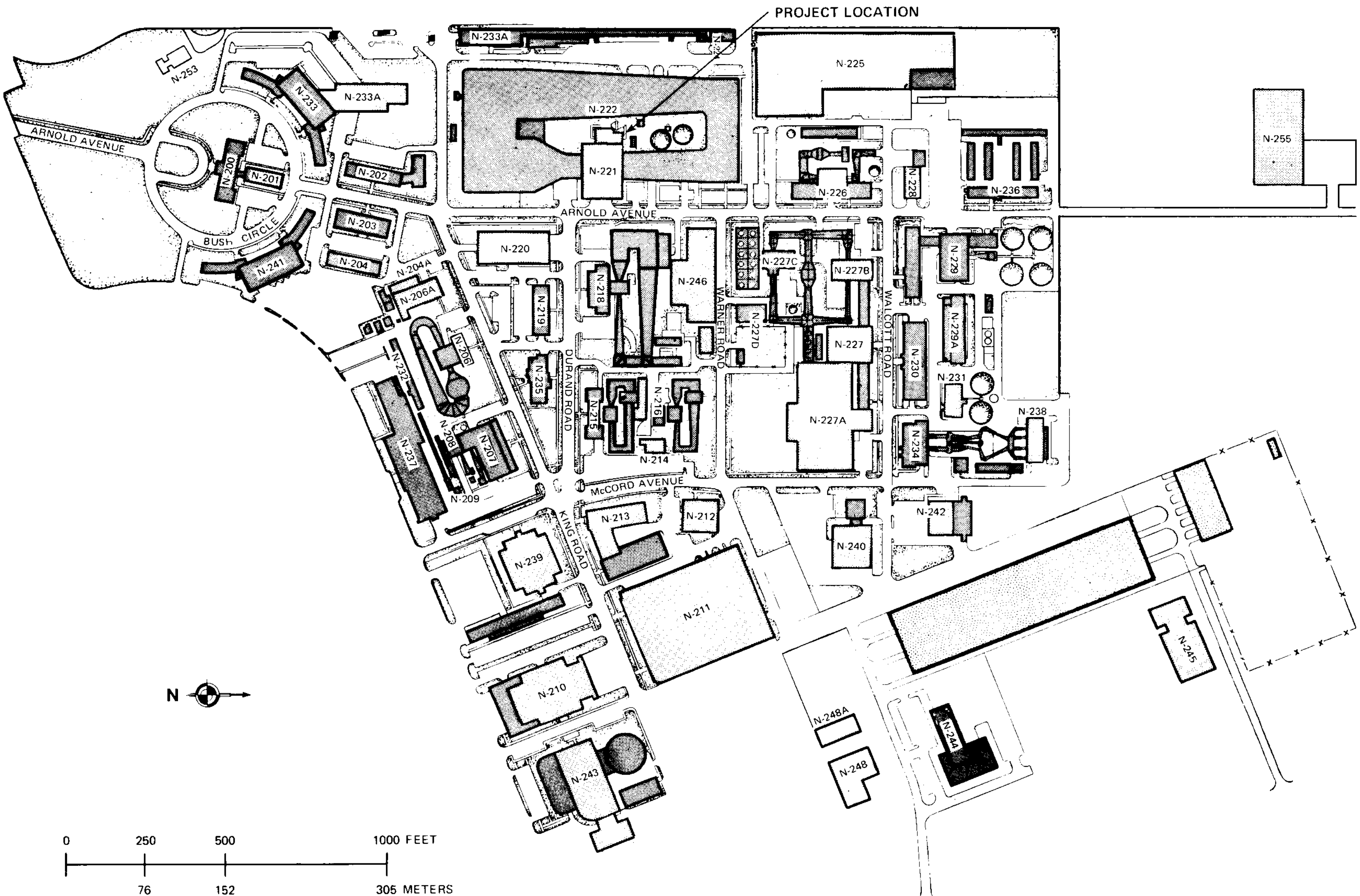


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modification of 40- X 80-Foot Subsonic Wind Tunnel

INSTALLATION: Ames Research Center

FY 1980 CoF ESTIMATE: $33,900,000

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

COGNIZANT HEADQUARTERS OFFICE: Office of Aeronautics and Space Technology

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	4,670,000	51,100,000	55,770,000
Capitalized investment	N/A	17,333,000	17,333,000
Total	4,670,000	68,433,000	73,103,000

SUMMARY PURPOSE AND SCOPE:

These resources will provide for continuing the modification of the 40- X 80-Foot (12.2 X 24.4 meters) Subsonic Wind Tunnel at Ames Research Center (ARC). The modified facility will permit the testing of rotorcraft at speeds up to 300 knots (154 meters per second). Additionally, a new 80- X 120-Foot (24.4 X 36.6 meters) test section, which is part of this total modification project, will allow for the testing of full-scale vertical and short takeoff and landing (V/STOL) aircraft including large rotorcraft in the speed range of 5 to 100 knots (2.6 to 51 meters per second). The location of the 40- X 80-Foot Subsonic Wind Tunnel is shown in Figure 1. The major items of work involved in this total project are shown in Figure 2. This project is being implemented with multiyear resources of which the FY 1980 estimate is the fourth funding element. Additional funding is not presently planned for the attainment of an initial operational capability under this project as now defined, since the present cost estimate is $85 million.

PROJECT JUSTIFICATION:

Modifications to the 40- x 80-Foot Subsonic Wind Tunnel will provide a National facility with a capability for research as well as development tests of full-scale rotorcraft and other V/STOL aircraft. Both civil and military rotorcraft have advanced significantly in speed capability over the last decade and can no longer be adequately evaluated in any existing test facility. Furthermore, V/STOL technology exemplified by the Advanced Harrier AV-8B has advanced to the extent that full-scale testing of flight configurations is now required. This manner of testing is essential to optimal solution of the complex problems of propulsion system/airframe structure/control interactions.

The usefulness of wind tunnel testing prior to flight testing has been demonstrated in a wide variety of test programs conducted in this facility in the past three to five years. These include V/STOL aircraft such as the OV-10A, XV-5, H-126, and AV-8B; STOL aircraft such as the F-14, F-15, F-111B, and A-37; rotorcraft such as the XV-15, AH-56A, and ABC flight rotor; propulsion systems such as the Q-Fan and 5-79; recovery devices such as the B-77 drogue chute and full-scale parawings; and the space shuttle orbiter. In spite of these successful testing programs,. the growing limitations of current test facilities were recognized as early as 1967 by the Aeronautics and Astronautics Coordinating Board (AACB). It was AACB-initiated studies that ultimately suggested a modification to the 40- x 80-Foot Subsonic Wind Tunnel.

Initial studies addressed the feasibility of constructing a new full-scale wind tunnel which would accomplish defined testing requirements. The projected cost of $300 million (1973 dollars) was considered excessive and alternative solutions were then pursued. Subsequent studies showed that essentially the same capability could be achieved by retrofitting the 40- x 80 drive support structure with a new generation drive system and by the addition of a new test leg. Since this modified tunnel would satisfy most testing needs at considerable monetary savings, it was presented to and subsequently approved by the AACB in 1973.

The higher wind speed provided by the modified 40- x 90-foot test section is necessary to properly evaluate high-speed rotor systems presently under development for both civil and military mission roles. Aerodynamic response of rotorcraft systems, for instance, can be best understood by wind tunnel studies. These studies lead to economical and structurally acceptable designs while reducing noise levels and improving flight performance. The Advancing Blade Concept (ABC) helicopter and the XV-15 typify the kinds of advanced rotorcraft which require the increased speed capability of the modified tunnel.

The large 80- x 120-foot subsonic test section is needed to eliminate the tunnel wall interference problems and the large wake "downwash angles" which are Reynolds number sensitive and difficult to reproduce accurately at less than full-scale. Certain mechanical and structural aspects of high lift systems, such as air leaks and deflection under load, can significantly affect test results of aerodynamic performance. The main problem for V/STOL aircraft is usually the propulsion system and its interface with the aircraft. Certain components of the propulsion system (rotor or fan blades, inlets, vectoring devices, etc.) operate in the range of Reynolds numbers where significant variations in aerodynamics occur. Additionally, there are important aeroelastic, mechanical, and structural aspects of these propulsion systems that require extensive experimental studies using full-scale or flight hardware. The major technical risks of V/STOL aircraft employing low disk-loading rotor systems are associated with dynamic loads, dynamic stability, and control of the rotor system. These characteristics are highly dependent on the unsteady aerodynamic force inputs to the rotor and on the dynamic characteristics of the rotor and its control system, including backlash, breakout forces, and nonlinear effects. Again, the Tilt Rotor Research Aircraft (XV-15) now being developed is typical of a low disk-loading V/STOL aircraft which requires full-scale wind tunnel testing. V/STOL aircraft which employ high disk-loading, direct-lift propulsion systems develop problems in hovering and in the transition to wing-supported flight. The lift propulsion system in the transition flight regime is generally required to operate in a highly distorted, unsteady and turbulent flow field. Resulting high vibratory loads on fan blades may produce catastrophic failures in flight due to fan or engine stalling. It is therefore essential that the characteristics of the propulsion system, as installed in the aircraft, be determined in ground-based facilities prior to committing the hardware to flight. This is particularly true for high powered V/STOL aircraft and is also relevant for high-performance CTOL fighter-attack aircraft.

It is anticipated that approximately 70 percent of the available wind tunnel time will be devoted to such research work as rotor aerodynamic/dynamic interactions, aircraft aerodynamic/propulsion interactions, engine/airframe integration, V/STOL propulsion control system, snd noise/gust alleviation. Developmental problems of rotorcraft and other V/STOL aircraft, as well as CTOL fighter-attack aircraft, will consume the remaining wind tunnel time. These developmental problems include configuration definition, system integration and evaluation, and performance improvement. NASA, in general, will sponsor the research activities, and DOD and industry will be the prime developmental testing users.

Additional program responsibilities recently assigned to Ames Research Center have altered the schedule requirements for the modified 40- x 80-Foot Subsonic Wind Tunnel. A minimum of two shifts per day and a 5-day week is now projected to meet these programmatic demands in 1982, recognizing that some testing backlog may develop. The available test time projected for this facility will be shared by NASA (70 percent), DOD (25 percent), and industry working on DOD programs (5 percent).

In summary, successful research and developmental testing of civil and military advanced rotorcraft and other V/STOL aircraft now being scheduled require that the 40- x 80-Foot Subsonic Wind Tunnel be repowered to increase the maximum wind speed and be modified to incorporate the new test leg by early 1982. Funding must therefore be continued for those contracts whose procurement was initiated with prior year resources and for completing the new leg construction to be initiated with FY 1979 resources. The tunnel will not be available for research for a period of 10 to 12 months starting in early to mid-1980, when construction and calibration activities will be accomplished. The primary impact of this downtime will be on NASA's long-range test programs, which may be delayed with minimum program disruption. There are no known programs from other agencies which must be accomplished during this period.

IMPACT OF DELAY:

Examination of the factors affecting both the military and the civil requirements indicates that there will be an urgent need for advanced rotorcraft and other V/STOL aircraft in the 1985 to 1990 time period. In order to provide the critical technology for these aircraft, the expanded test capability provided by this modified facility must be available well before this time frame. The current construction schedule calls for facility completion in 1982 which is the latest date acceptable if an adequate technology base is to be available by 1990. Delays in providing added funds to previously awarded multiyear funded contracts could well also result in contractor claims for termination costs or schedule extensions. Those contracts not yet swarded can also be expected to rise in cost if delayed because of the high escalation rates currently being experienced.

PROJECT DESCRIPTION:

Repowering will increase the maximum test speed of the 40- x 80-foot test section from 200 to 300 knots. This increased capability will be achieved through an increase in drive system power. The six existing 6,000 HP (4,500 KW) induction motors will be replaced with six new 22,500 HP (16,800 KW) synchronous motors (Figure 4), and the existing 6-bladed, fixed-pitch fans will be removed and new 15-blade, variable-pitch fans (Figures 3 and 5) will be installed. The total drive system will be increased to 135,000 HP (101,000 KW) from 36,000 HP (27,000 KW). The wind tunnel will be repowered within the present drive-section structure. Frequency control for varying fan rotational speed will be provided by the existing motor generator set which requires some modification. This combination of variable-pitch fans and frequency control will provide a precisely controlled speed range of 5 to 300 knots (2.6 to 154 meters per second) within the 40- x 80-foot test section.

Figure 2 shows the 80- x 120-foot test leg which will be added just upstream of the drive motor section. This new leg will include the new test section transition and flow-directing equipment, the entrance cone, and sound muffling treatment. Air will be inducted at the entrance cone; flow through the 80- x 120-foot section, the drive motor section, and portions of the existing wind tunnel circuit; and finally exhaust to the atmosphere through the new air exit louvers. As shown in Figure 3, sir flow diversion vanes and louvers, together with adjustable turning vanes, will be installed to permit operation in either the 40- x 80- or in the 80- x 120-foot mode.

The entire project is being funded over a period of several fiscal years. Funds in the amount of $51.1 million have been provided in prior year appropriations for the facility modification. The program plan for FY 1977 through 1980 funds is summarized in Figure 5. The FY 1977 increment provided for the initiation of procurement for the main drive motors and controls, the fan and stator blades, the fan hub and variable pitch mechanism, and the relocation of the Ames' electrical power substation. The second increment of funding for the long-lead items was included in the FY 1978 estimates. FY 1978 resources also provided for the initial sitework, structural modifications, and the new balance and model support system for the 80- x 120-foot test section. Both the FY 1978 and FY 1979 budget requests included funds for continuing the funding of contracts awarded with prior year resources. The FY 1979 request also included funds required to initiate the construction of the "new leg." Funds have been included in the FY 1980 budget request to complete the "new leg" construction to include painting and finishing, and fabrication and installation of the fire protection system, the model handling system, the test section doors, and the floor panels.

Several significant risks remain which may impact the final configuration of the modified facility. The present wind tunnel requires some structural modifications to support increased air loads; to allow for operation of the new leg circuit; and to support the new larger drive system. Recent bids received on the associated structural steel modification contracts have exceeded the government estimate. After evaluating these bids, it was determined that a redesign effort to reduce costs was necessary. This redesign has caused a slip to early 1982 in the estimated operational dates for the modified facility. Additional risks associated with installation of the drive system and fabrication of the flow straighteners clearly show that this project faces major technical and managerial challenges. Increased staffing together with intensive scheduling and cost control techniques will continuo to assist in isolating and resolving these critical "problems." On-going efforts to identify and eliminate work elements not essential to the Initial Operating Capability (IOC) will also assist in controlling project costs.

The Ames Research Center's Environmental Impact Statement has been amended to cover the Modification of the 40- x 80-Foot Subsonic Wind Tunnel. The final statement was submitted to the Council on Environmental Quality (CEQ) and made available to the public on July 5, 1977. Comments received subsequent to publication revealed noise to be the only item of significance. Experimental tests have been performed which demonstrate that the noise generated by the modified facility will be less than of the current configuration. It is probable that noise levels presently predicted are conservative and that the actual levels will be even lower than now estimated. Consequently, this earlier concern should not constitute a problem.

PROJECT COST ESTIMATE:

This cost estimate is based on varying degrees of final planning, design and contract awards.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition	---	---	---	---
Construction	---	---	---	23,100,000
Site work and utilities (Increment IV)	LS	---	---	490,000
Structural modifications (Increment III)	LS	---	---	13,100,000
Structural erection (Increment IV)	LS	---	---	3,000,000
Acoustical treatment (Increment III)	LS	---	---	5,000,000
Painting and finishing	LS	---	---	900,003
Fire protection	LS	---	---	300,000
Miscellaneous mechanical	LS	---	---	400,000
Equipment	---	---	---	10,800,000
Main drive assembly and installation (Increment III)	LS	---	---	3,200,000
Main drive system fabrication (Increment IV)	LS	---	---	1,500,000
Fan and stator blades fabrication (Increment IV)	LS	---	---	500,000
Electric installation (Increment II)	LS	---	---	2,500,000
Model auxiliary systems	LS	---	---	'-100,000
Test section doors and floor panel fabrication	LS	---	---	1,100,000
Model support and turntable fabrication (Increment 11).	LS	---	---	1,100,000
Data acquisition & operation control system fabrication (Increment III)	LS	---	---	500,000
Fallout Shelter (not feasible)	---	---	---	---
Total				33,900,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Site Plan
Figure 3 - Vanes, Louvers, and Fan Drive System
Figure 4 - New Fan Drive Unit
Figure 5 - Program Plan

OTHER EQUIPMENT SUMMARY:

Existing collateral equipment consisting mainly of the model support syst m, the balance, the motor generator sets, the rheostat, and other equipment of the present 40- x 80-Foot Subsonic Wind Tunnel will be used with this modification project. The total replacement value of the present 40- x 80-Foot Subsonic Wind Tunnel is approximately $70 million. Existing noncollateral equipment valued at about $1.5 million, which consists primarily of computers, will also be used in the new facility. No major additional noncollateral equipment is involved.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Current cost reviews for this facility nodification work, with capabilities 2s currently configured, support an $85 million estimate. Thus, additional future CoF funding is not scheduled.

AMES RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATION OF 40-by 80-FOOT SUBSONIC WIND TUNNEL

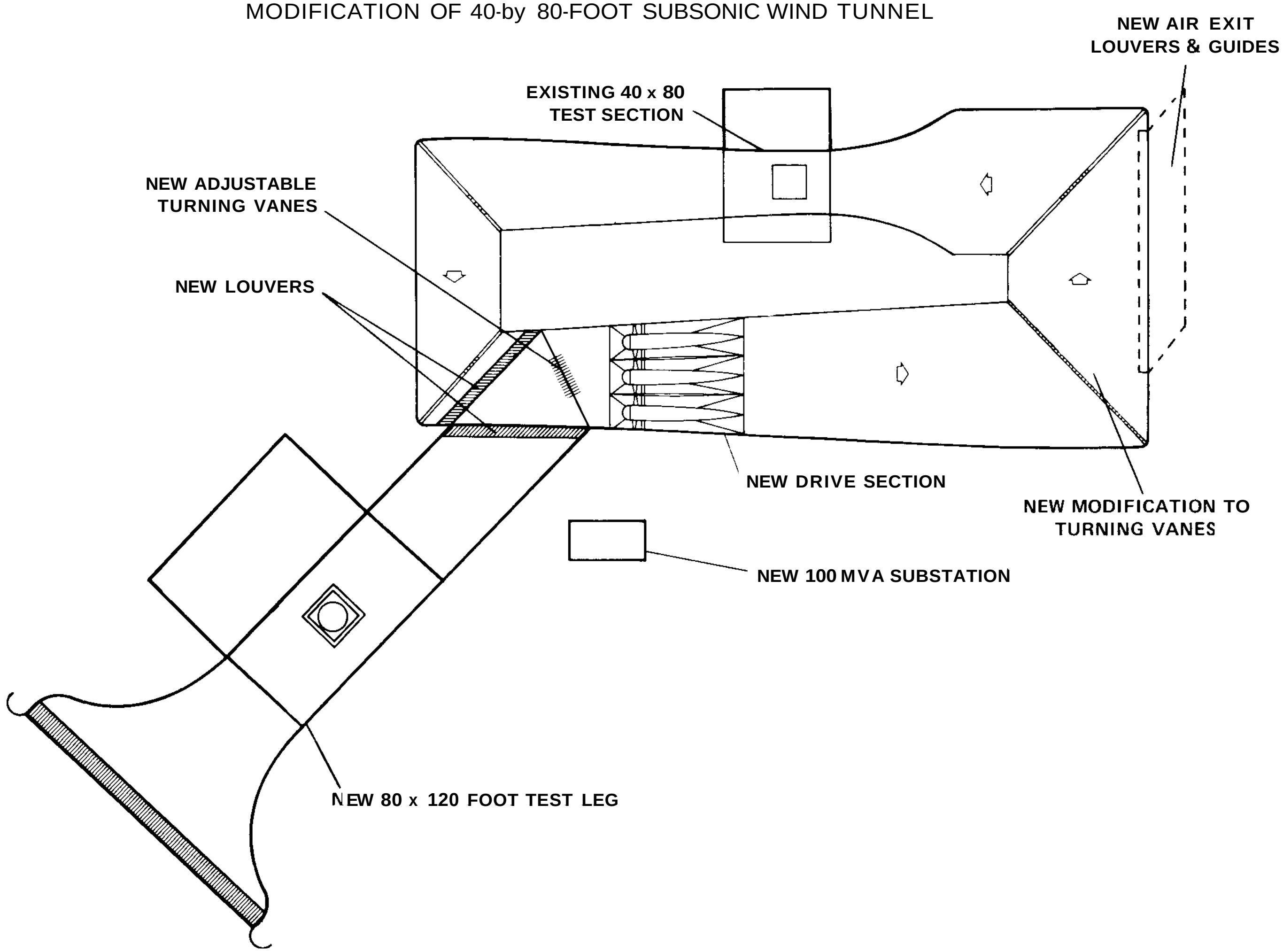


FIGURE 2

AMES RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATION OF 40-by 80-FOOT SUBSONIC WIND TUNNEL

VANES, LOUVERS, AND FAN DRIVE SYSTEM

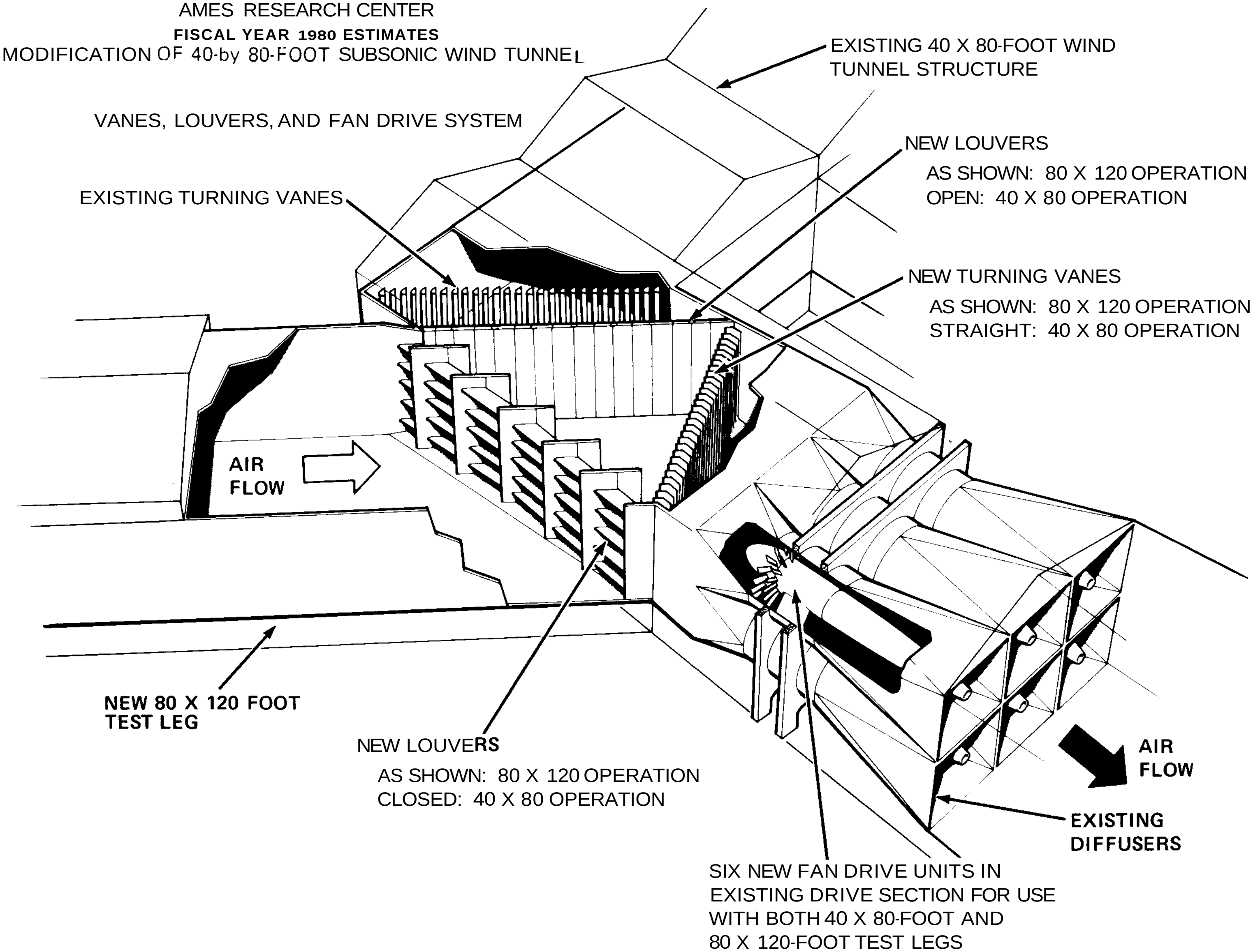
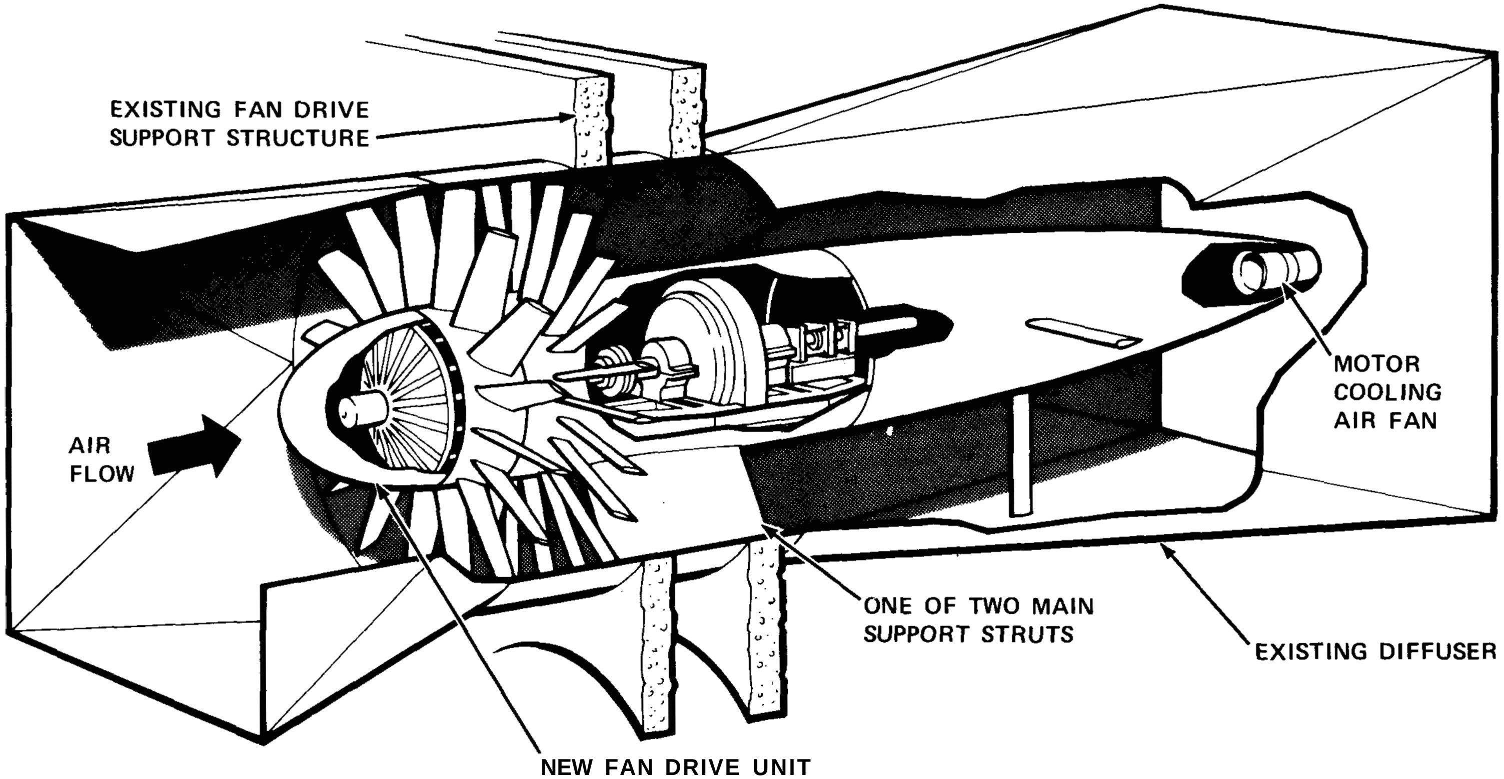


FIGURE 3

NEW FAN **DRIVE** UNIT



22,500 HORSEPOWER ELECTRIC MOTOR
40-FOOT DIAMETER 15-BLADE VARIABLE-PITCH FAN, AND 23-BLADE STATOR
CENTER BODY – 17.5-FOOT MAX DIAMETER BY 138.5 FEET LONG
DRIVE UNIT WEIGHT: 400,000 LBS.

FIGURE 4

AMES RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATION OF 40- BY 80-FOOT SUBSONIC WIND TUNNEL
FUNDING PLAN
(Millions of Dollars)

	Fiscal Year 1977	1978	1979	1980	Total
Construction	.1	4.2	13.6	23.1	41.0
Site work and utilities	---	.2	.1	.4	.7
Piles and concrete	---	.3	1.6	---	1.9
Structural modifications	---	1.5	3.4	13.1	18.0
Structural erection	.1	1.2	6.6	3.0	10.9
Painting and finishing	---	---	.1	.9	1.0
Fire protection	---	---	---	.3	.3
Acoustic treatment	---	1.0	1.8	5.0	7.8
Miscellaneous mechanical	---	---	---	.4	.4
Equipment	5.9	9.3	18.0	10.8	44.0
Main drive assembly and installation	---	---	1.5	3.2	4.7
Main drive system	1.6	1.3	3.3	1.5	7.7
Main drive power supply	.8	.5	1.1	---	2.4
Fan and stator blades	1.2	1.6	2.3	.5	5.6
Fan hub and variable pitch mechanism	1.7	.4	1.2	---	3.3
Nacelle, fairings, and spinner	---	1.7	2.5	---	4.2
Electric installation	---	---	1.4	2.5	3.9
Substation relocation	.6	.8	2.1	---	3.5
Model handling system	---	---	1.4	---	1.4
Model auxiliary systems	---	---	.1	.4	.5
Test section doors and floor panels	---	---	---	1.1	1.1
Model support and turntable	---	1.8	---	1.1	2.9
Model balance system	---	1.2	1.1	---	2.3
Data acquisition and operation control systems	---	---	---	.5	.5
Total	6.0	13.5	31.6	33.9	85.0

FIGURE 5

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

SPACE SHUTTLE FACILITIES

	Amount	Page No.
Office of Space Transportation Systems:		
Summary		CF 10-1
Launch and Landing Facilities:	18,950,000	
Modifications to launch complex 39 (KSC)	17,700,000	CF 10-4
Modifications to crawler transporter maintenance facility (KSC)	1,250,000	CF 10-16
Manufacturing and Final Assembly Facilities:	10,000,000	
Modification of manufacturing and final assembly facilities for external tanks (MAF)	10,000,000	CF 10-24
Minor Facilities:	2,500,000	
Minor shuttle-unique projects, at various locations	2,500,000	CF 10-40
Total	31,450,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE:	Space Shuttle Facilities
INSTALLATION:	Various Locations
FY 1980 CoF ESTIMATE:	$31,450,000

LOCATION OF PROJECT: Locations are identified in the following documentation.

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	14,934,500	178,781,500	193,716,000
Capitalized investment	N/A	615,865,220	635,865,220
Total	14,934,500	814,646,720	829,581,220

The above data summarizes only the projects included in this submittal. Before FY 1980, $31.3 million was made available for Shuttle planning and design in addition to $343.7 million for Shuttle facilities construction.

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to rehabilitate, modify, and add to existing Government-owned facilities, and to construct those limited new facilities to meet unique requirements of the Space Shuttle Program. As in prior years, this Shuttle facility package includes all major facility requirements unique to the Space Shuttle Program. In FY 1980, the proposed Shuttle facilities are related to the launch and landing requirements at

John F. Kennedy Space Center (KSC) and the external tank manufacturing and final assembly at Michoud Assembly Facility (MAF). The projects included in this request are as envisioned at the time of the FY 1979 budget with minor adjustments in scope necessary to accommodate program developments. Also included are minor rehabilitation and modification projects which are required to support the Space Shuttle and are therefore considered unique Space Shuttle projects.

PROJECT JUSTIFICATION:

Prior years CoF projects for the Space Shuttle Program authorized modification and construction of facilities for technical development, Space Shuttle main engine tests, ground tests, manufacturing, and launch and landing. All of the facilities to support the first Manned Orbital Flight and the Development, Design, Test and Evaluation portion of the program will be completed in 1978 with activation intensifying on the launch facilities at KSC. The FY 1980 request is intended to continue to provide launch capability for the Space Shuttle vehicle at KSC. The primary element in this request is a continuation of Pad "B" modifications. Pad "B" is planned to be operational by late 1983 at which time it will he needed to support the planned launch rate as well as provide needed operational reliability and flexibility. Also at KSC is a project for Modifications to the Crawler Transporter Maintenance Facility. The major discrete project at MAF provides for the continuation of manufacturing and final assembly of the external tank.

The facilities included in this request have been carefully reviewed to insure they are not brought into the program prematurely but as required to support planned operational capabilities.

PROJECT COST ESTIMATE:

Launch and Landing Facilities	18.950. 000
Modifications to Launch Complex 39. Kennedy Space Center	17.700. 000
Modifications to Crawler Transporter Maintenance Facility. Kennedy Space Center	1.250. 000
Manufacturing and Final Assembly Facilities	10.000.000
Modification of Manufacturing and Final Assembly Facilities for External Tanks. Michoud Assembly Facility	10.000. 000
Minor Facilities	2.500. 000
Minor Shuttle - Unique Projects. Various Locations	2.500. 000
Total	31.450.000

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES

MODIFICATIONS TO LAUNCH COMPLEX 39

LOCATION PLAN

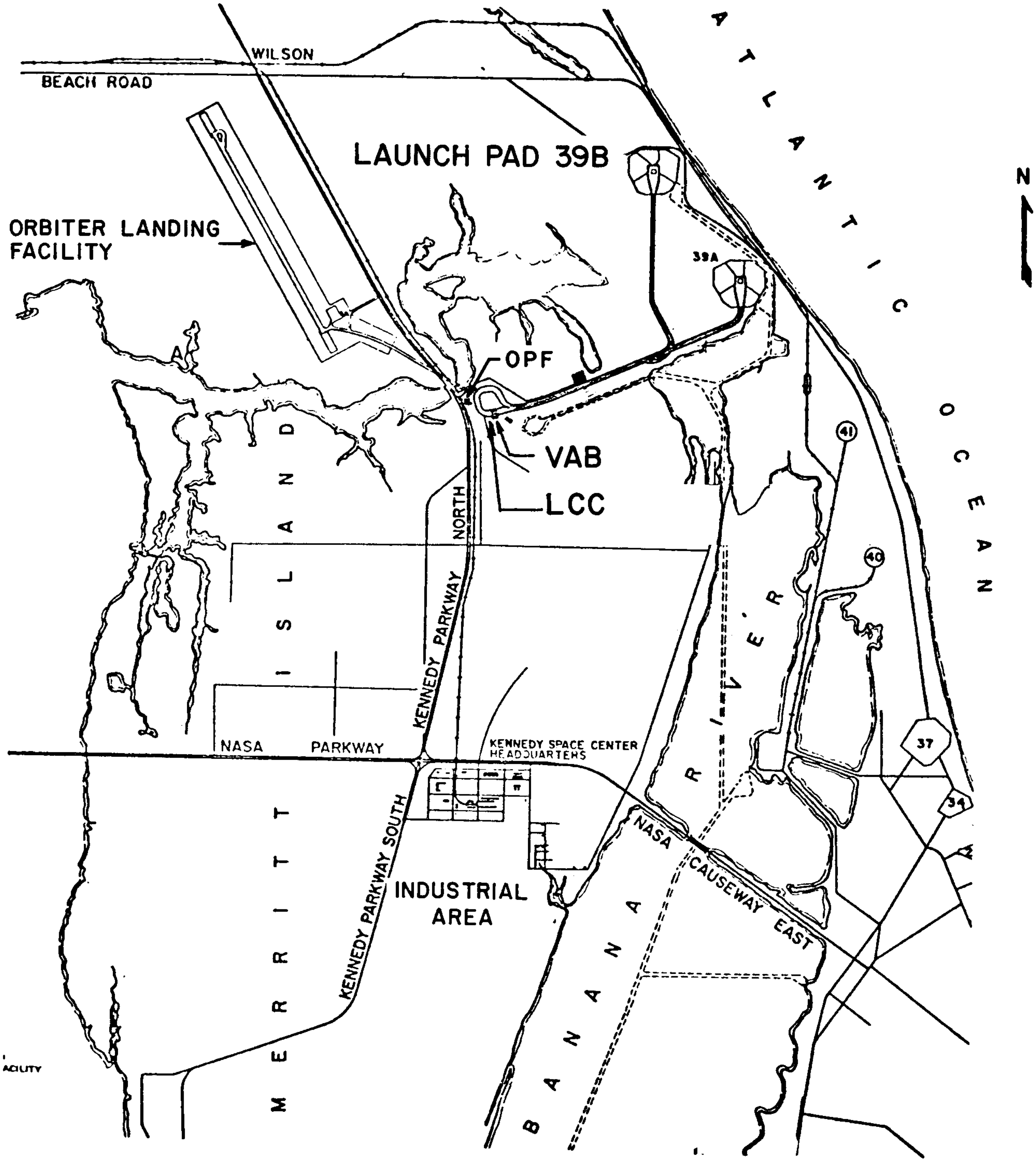


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modifications to Launch Complex 39

INSTALLATION: John F. Kennedy Space Center

FY 1980 CoF ESTIMATE: $17,700,000

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	9,810,000	123,530,000	133,340,000
Capitalized investment	N/A	501,538,000	501,538,000
Total	9,810,000	625,068,000	634,878,000

SUMMARY PURPOSE AND SCOPE:

This project continues modifications to Launch Complex 39 (LC-39), begun with FY 1975 resources and continued with FY 1976, FY 1977, FY 1978, and FY 1979 resources to support Space Shuttle operations. The FY 1975, FY 1976, and a portion of the FY 1977 resources provided for modifying two high bays in the Vehicle Assembly Building (VAB), the Launch Control Center, one mobile launch platform, and Launch Pad "A." These initial LC-39 facilities were those essential for the launch of the First Manned Orbital Flight. The balance of the 1977 project coupled with 1978 resources provided for modifying the second mobile launch platform, the two remaining high bays in the VAB, and initial modifications to Launch Pad "B." The FY 1979 project continued modifications to Launch Pad "B", and provided freon recovery and hypergol support facilities and rehabilitation of roads in the LC-39 area. This year's work provides for completing modifications to Launch Pad "B," specifically for the construction of the Rotating Service Structure and launch systems and other construction, modification and rehabilitation work in the LC-39 area.

PROJECT JUSTIFICATION:

The Space Transportation System (STS) operational phase will begin after the first six Space Shuttle development flights in CY 1979 and CY 1980. Launch rates will increase gradually to a maximum of 40 flights per year in the mid-1980's. During this operational phase, the risk of having only one launch pad in the early years is conditionally acceptable. By late 1983, launch rates and the attendant risks associated with a single launch pad make a second launch pad essential. Prior year resources provided for the beginning of modifications to Launch Pad "B." This year's project will complete the work on Pad "B" to allow it to be operational by late 1983.

Vital operations on the launch pad must take place before final countdown and launch of the Space Shuttle. These activities include performing final checkout of vehicle systems, loading propellants in the external tank, and loading hypergolic propellants in the auxiliary propulsion system pods and the reaction control systen. Power reactants and cooling and life support fluids must also be loaded; payloads may be inserted, prepared, or changed; and the crew must be boarded. During the early years of the Space Transportation System operational phase, the functions described above will be performed on a single launch pad (Pad "A"). Should there be any large variations in on-pad operations due to checkout problems, adverse weather, or the unknowns associated with Department of Defense payloads or planetary missions, schedules could be drastically affected. Such delays are conditionally acceptable in the early years of the STS operational phase. As the launch rate increases however, these delays become less and less acceptable as they adversely impact schedules. In addition, should any damage to the launch pad occur during launch, subsequent launches will have to be delayed while repairs are being made. By early 1983 when flight rates are expected to increase considerably, a significant operational risk develops until Pad "B" is completed. As a consequence, it is felt that Pad "B" must be operational by late 1983 so that the Space Transportation System is not adversely affected. December 1983 is thus the latest acceptable operational ready date for Launch Pad "B" and is a critical milestone.

Recent predictions of the solid rocket motor exhaust gas pressures on the blast deck of the Mobile Launch Platform (MLP) indicate that in some cases the load will be greater than that for which the deck is currently configured. This necessitates a strengthening of structural members, and a stiffening of the blast deck. MLP-1 will be modified for this purpose with prior year resources while MLP-2 will be modified with this FY 1980.

project. Other facilities generally associated with the total LC-39 complex must also be provided or further modified with FY 1980 resources. These include construction of work support and staging facilities, Pad "B" support area, modifications to the Propellant Laboratory and Mobile Equipment Maintenance Shop and rehabilitation of the Vendor Tanker Staging Area.

The Launch Control Center (LCC) roof is in poor condition and in need of repair. Its top surface is blistered, and water collects due to inadequate slope and insufficient drainage. The vapor barrier has been ruptured in several locations, causing leaking. Normal repair efforts have not been successful in halting the degeneration of this roof. Important Shuttle launch control operations are conducted in this building. As this roof continues to leak in spite of repair efforts, the risk of damage to expensive equipment and interference with critical operations grows. It is essential to rehabilitate this roof as planned so as not to interfere with later critical Shuttle operations.

Integrated resource requirements for all of Launch Complex 39 are shown in Figure 5. While it was originally planned that the $27.1 million of the FY 1978 resources provided would be available for application to the Rotating Service Structure, later needs associated with both Mobile Launch Platforms, the Vehicle Assembly Building, and Launch Pad "A" have required the allocation of these resources to those facilities. It is now estimated that $21.4 million of FY 1978 and $12.8 million of FY 1979 resources will be available for Pad "B" work. As a consequence, $8.0 million will be required in FY 1980 for the Rotating Service Structure and $7.1 million will be required for the launch systems. In addition, $2.6 million will be required for the other work in the LC-39 area, as outlined above, and the deck "beef-up" of MLP-2.

IMPACT OF DELAY:

If this project is not funded in FY 1980, it will be impossible to complete Launch Pad "B" by its need date of December 1983. In light of launch rates projected for that period and the fact that two orbiters could be tied up if the single launch pad were damaged, this is not a prudent risk. Similarly, it is felt that the other work in the LC-39 area, if deferred, could drastically impact Shuttle operations and this is not an acceptable risk.

PROJECT DESCRIPTION:

This project provides for continuing modifications to Launch Pad "B" begun with FY 1978 resources. Prior year resources provided for site work, piling and foundations, construction of a fixed service tower, a flame deflector, and an acoustic reduction system. Existing structural, mechanical, and electrical systems were also modified. The FY 1979 project, coupled with this FY 1980 project, provides a Rotating Service Structure (RSS) mounted on rails on the surface of the launch pad which is attached to the Fixed Service Structure (FSS)

(Figure 2). The Rotating Service Structure (Figure 3) consists primarily of a rotating bridge, the Payload Changeout Room (PCR), a system of external and internal access platforms, and a powerful drive system for moving the RSS away from the orbiter when it is ready for launch. The rotating bridge is constructed of large tubular steel members welded into the configuration shown in Figure 3. On top of the rotating bridge and attached to it is the Payload Changeout Room, approximately 52 feet wide by 50 feet deep by 76 feet high (15.8 meters by 15.2 meters by 23.3 meters). The PCR provides a clean environment where payloads can be removed or inserted into the orbiter's payload bay; thus, an extensive environmental control system is an essential part of the PCR. Within the PCR, an elaborate system of fixed platforms capable of extending and retracting is provided for checkout and servicing of payloads. A service elevator connects the platforms so that various pieces of support equipment can be moved between the levels of the PCR. Additionally, hoisting systems are provided for handling payloads within the PCR and for their transfer into the orbiter payload bay.

Another room, approximately 32 feet wide by 27 feet deep by 30 feet high (9.8 meters by 8.2 meters by 9.1 meters), located above the PCR, will provide access to the Shuttle forward reaction control system, while platforms beneath the PCR will provide access to the Shuttle aft propulsion system. Additional access to the orbiter, solid rocket boosters, and the external tank for last minute inspection and possible repairs is provided by platforms, swinging arms, an3 other devices. The entire Rotating Service Structure moves by its own power from the position where it is mated with the orbiter (Figure 2) to its retracted position (Figure 3). This movement is accomplished by means of large traction motor drive systems attached to the legs of the Rotating Service Structure and moving on a fixed rail system. Operations on payloads or the build-up of payloads will normally take place while the RSS is moved away from the flight vehicle, whereas final insertion of the payload into the orbiter and fueling of the flight vehicle will occur while the RSS is in its forward position mated to the Shuttle vehicle.

This work also provides for extensive modifications of the launch systems, including the environmental control, pneumatic, fuel, and high-pressure gas systems on Pad "B". In addition, MLP-2 will be modified by structurally beefing up main members and the blast deck to withstand the increased predicted blast pressures.

The existing flat roof of the LCC, which is badly blistered and leaking, will be stripped down to the vapor barrier, new roof drains will be installed, expansion joints will be provided, and all roof penetrations will be reflashed. A new layered roof of asphaltic felt covered with lightweight concrete will then be installed. This process, although more expensive than usual, is essential if the roof is to be adequately sloped to solve the existing drainage problem. A top covering of fiberglass felts with roof vents and a final seal coat will be applied. The general layout of the LCC roof can be seen in Figure 4. Work support and staging facilities for the overall LC-39 area and a Pad "B" support facility will be constructed using pre-engineered metal buildings. The existing Propellant Laboratory and Mobile Equipment Maintenance Shop will be expanded by adding a 900 square foot (83.7 square meters) storage area. An additional maintenance bay will also be constructed inside the Mobile Equipment Maintenance Shop.

PROJECT COST ESTIMATE:

The bases of this cost estimate are the final design for the Pad "B" portion and Preliminary Engineering Reports for other LC-39 work.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition....	---	---	---	---
Construction.........................	_--	---	---	17,700,000
Construct rotating service structure.	LS	---	---	8,000,000
Modify launch systems..................................	LS	---	---	7,100,000
Environment control system	LS	---	---	(1,270,000)
Pneumatic systems......................................	LS	---	---	(1,040,000)
Propellent and high pressure gas systems.	LS	---	---	(950,000)
Fuel systems...	LS	---	---	(2,220,000)
Electrical/communication systems....................	LS	---	---	(1,620,000)
Modify Mobile Launch Platform-2........................	LS	---	---	1,100,000
Construct work support and staging facilities..........	LS	---	---	900,000
Roof rehabilitation - LCC........	LS	---	---	600,000
EauiDment...............................	---	---	---	---
Fallout Shelter (not feasible)...........................	---	---	---	---
Total...				17.700.000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Perspective - Launch Pad "B"
Figure 3 - Rotating Service Structure
Figure 4 - Roof Layout - LCC
Figure 5 - Resource Requirements, LC-39

OTHER EQUIPMENT SUMMARY:

It is anticipated that approximately $30 million of R&D resources will be required to provide noncollateral equipment for initial operation of facilities included in the project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

At the present time, no major future requirements for LC-39 have been firmly identified. However, should Mobile Launch Platform #3 be later validated, its cost would be added at approximately $18 million. In the same manner, if further major programmatic modifications to LC-39 facilities are so required, their cost of execution must also be additive.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR **1980** ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX *39*

PERSPECTIVE
LAUNCH PAD "B"

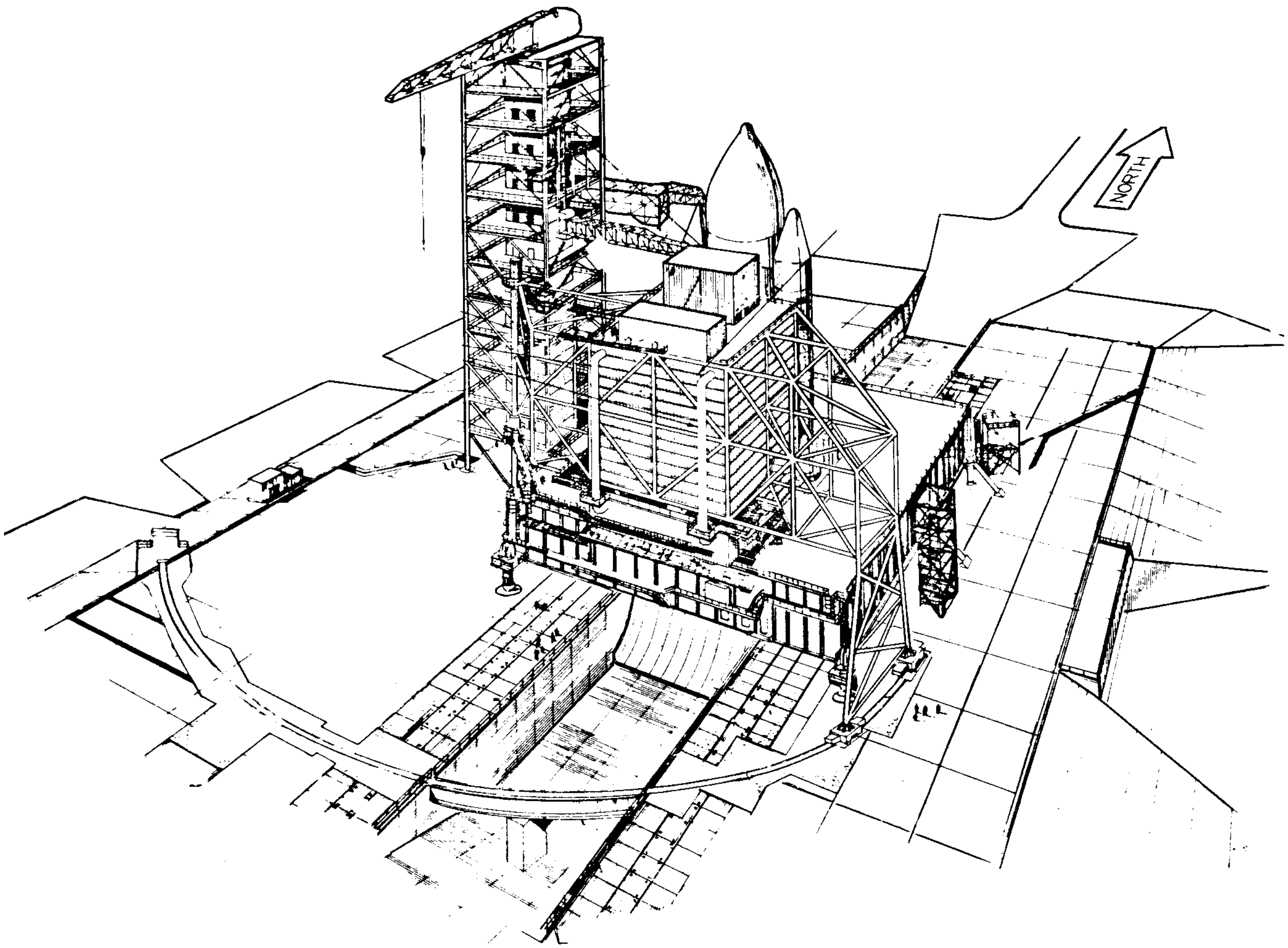


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR *1980* ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX *39*

ROTATING SERVICE STRUCTURE
(Shown in Retracted Position at Launch Pad A)

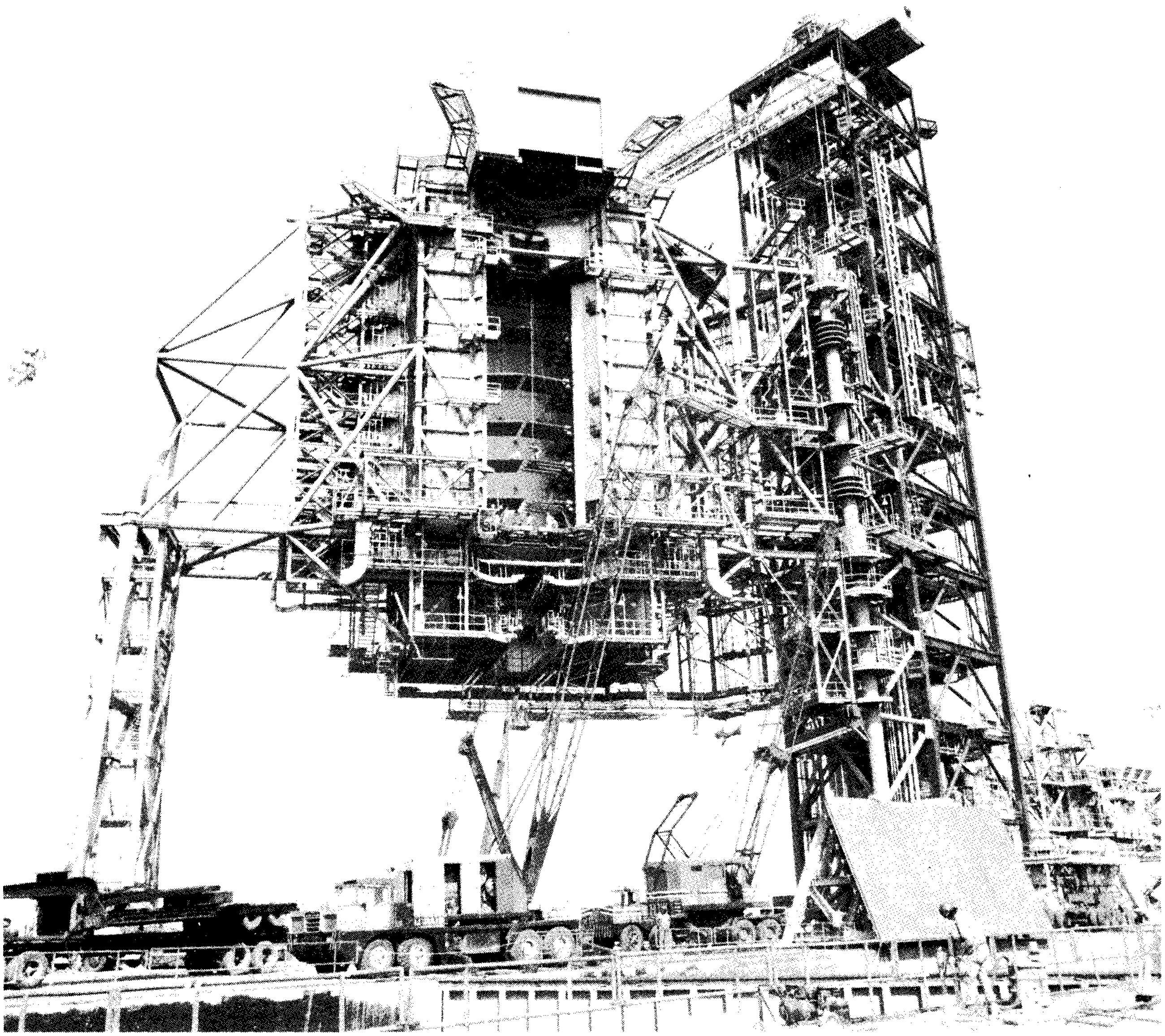
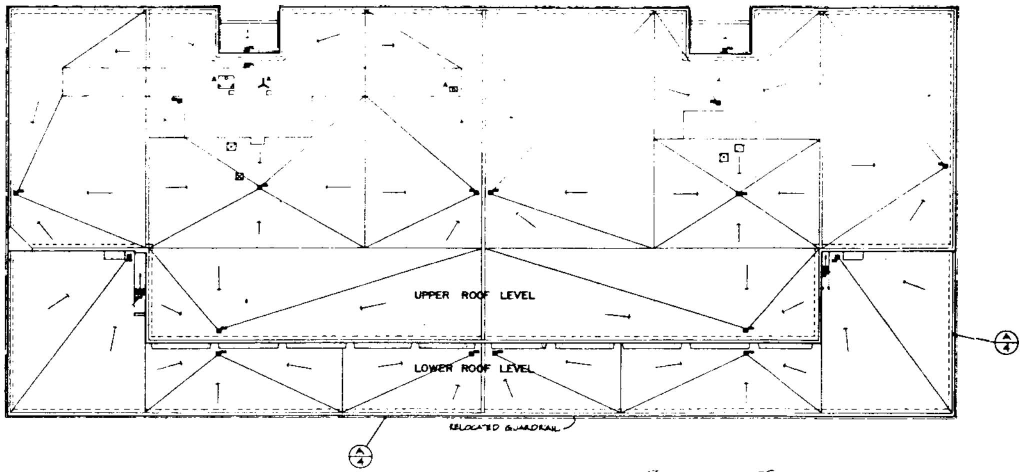


FIGURE 3

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX 39

ROOF LAYOUT-LCC



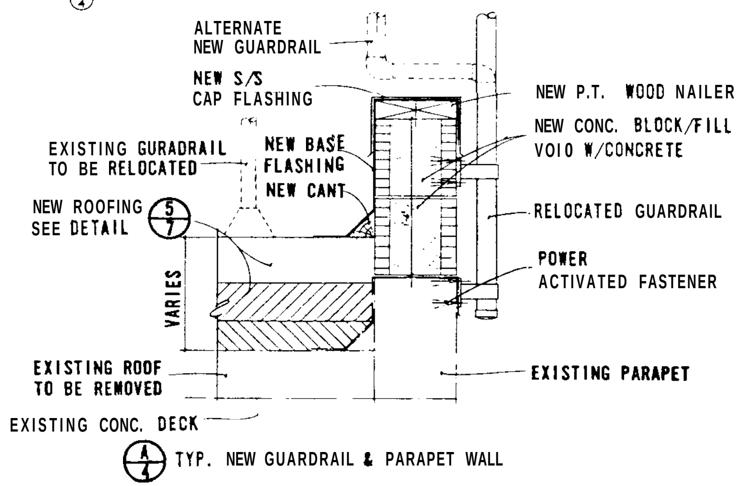


FIGURE 4

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX 39

RESOURCE REQUIREMENTS
(Millions of Dollars)

	Fiscal Year							
	1977 & Prior	1978		1979		1980	Future	
Item	PP	BR	PP	BR	PP	BR	BR	CCE
Launch Pad A........................	36.0	---	4.4	---	---	---	---	40.4
Launch Pad B........................	---	27.1	21.4	12.8	12.8	15.1	---	49.3
MLP-1................................	13.8	---	.5	---	---	---	---	14.3
MLP-2................................	9.5	4.9	4.8	---	---	1.1	---	15.4
MLP-3................................	---	---	---	---	---	---	---	17.6*
Vehicle Assembly Building (VAB).....	7.9	8.7	9.6	---	---	---	---	17.5
Launch Control Center (LCC).........	2.1	---	---	---	---	.6	---	2.7
Other...............................	---	---	---	.8	.8	.9	---	1.7
Total...	69.3	40.7	40.7	13.6	13.6	17.7	---	141.3

Note: PP = Program Plan
BR = Budget Request
CCE= Current Cost Estimate

* Not included in total; not a presently validated requirement.

FIGURE 5

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO CRAWLER TRANSPORTER MAINTENANCE FACILITY

LOCATION PLAN

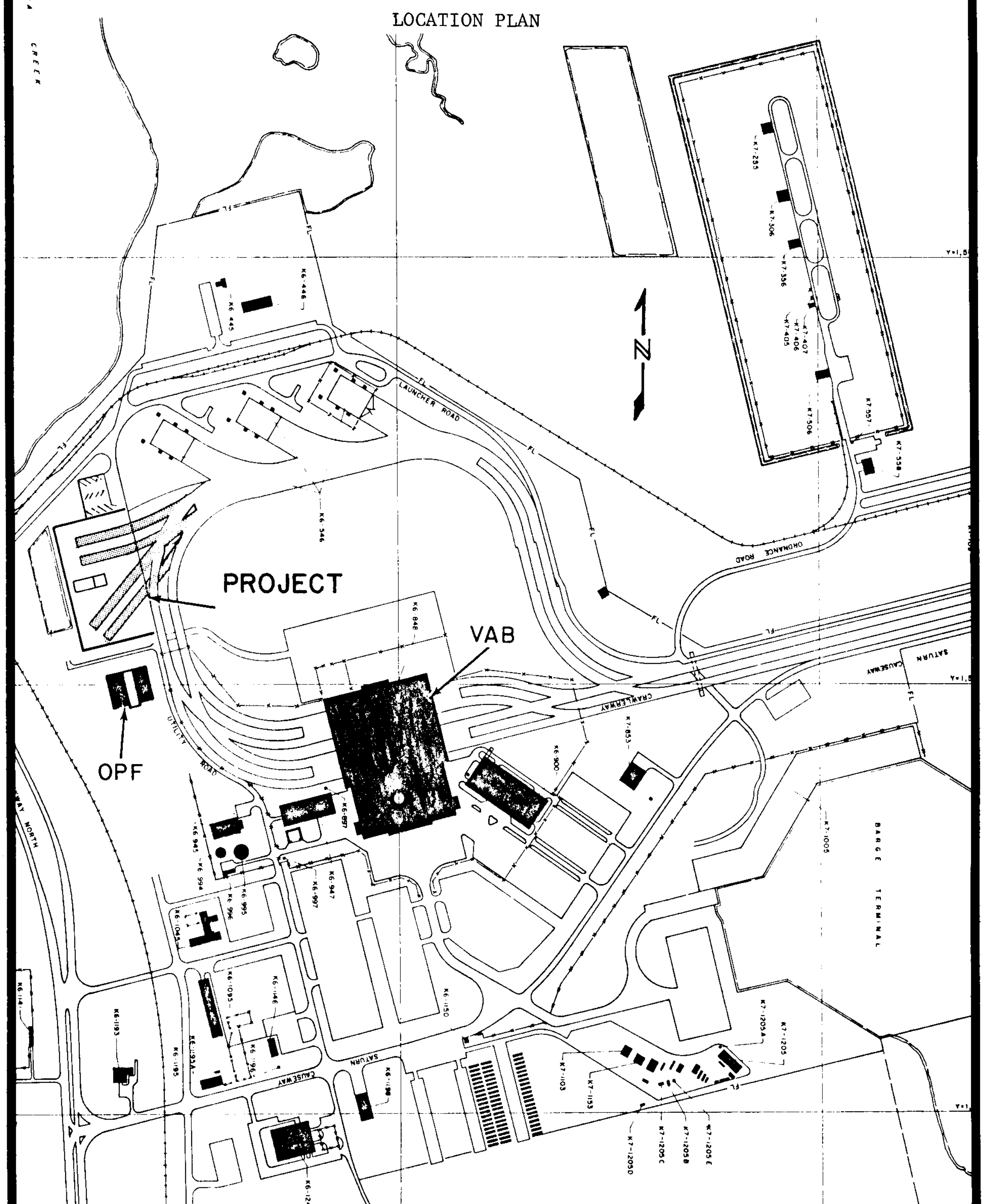


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE:	Modifications to Crawler Transporter Maintenance Facility
INSTALLATION:	John F. Kennedy Space Center
FY 1980 CoF ESTIMATE:	$1,250,000

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	92,500	---	92,500
Capitalized investment	N/A	46.220	46.220
Total	92,500	46.220	138,720

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to modify the present Crawler Transporter Maintenance Facility to provide sufficient maintenance and administrative areas to support the high level of maintenance for the two crawler transporters required to support the Space Transportation System launch schedule. The scope of work (as shown in Figure 2) will include grading the north area to improve drainage in wet weather, moving the Crawler Transporter (CT) parking positions, and relocating crawlerway extensions to be tangential to the centerline of the curved portion of the main crawlerway. Other tasks include relocating and modifying the steel support building (K6-793), moving the northerly gate directly east, and building reinforced concrete servicing pits. Finally, utilities will be modified and extended and a parking lot with a new entrance will be constructed.

The two CT's used in the Apollo Program will be utilized to transport the Space Shuttle vehicles from the assembly site in the Vehicle Assembly Building (VAB) to the launch pad. The projected Shuttle launch schedule will increase the use and therefore the maintenance of the CT's to an extent far greater than that necessary for the peak years of the Apollo program. With increased maintenance now necessary on a routine basis, the existing facilities are not adequate to support the projected level of activity. This project provides necessary facilities to allow a viable CT maintenance operation. Additionally, this facility will allow optimization of operation and maintenance procedures, thus reducing maintenance costs and improving quality control.

PROJECT JUSTIFICATION:

As the flight rate for the Shuttle grows, the number of round trips -- each one 6.8 miles (10.9 kilometers) -- the CT's will increase significantly. The CT's are unique and complicated transport vehicles; to perform their crucial function they must be maintained at the highest level of readiness. This difficult task can be achieved only by an intensive maintenance program. Such a program is possible only if adequate support facilities are also available. The most difficult of the CT maintenance tasks is replacement of the treads or the tread rollers that carry the load from the main frame of the truck. Presently, to replace either of these components, the only method available is to excavate a trench under the area involved, drop the damaged tread or tread roller, move it within the trench, and pick it up with a mobile crane. Because the increased flight schedule will cause more repairs, specifically developed maintenance pits are necessary in order to do this work in an efficient and timely fashion.

Hydraulic maintenance must be performed under clean, reasonably dust-free conditions; it is best supported by an overhead crane with a hook height of 25 feet (7.6 meters) for assembling or disassembling the long hydraulic units. Previously, these operations were performed on a short-term basis in available facilities, but all these facilities will be fully utilized for the Shuttle and payload programs and are not available.

Furthermore, an electrical test area is required for repair, checkout, and calibration of electrical components, and a quality control area is needed to check out tolerances and the condition of worn or repaired equipment. Additional space is also needed for engineering support as the need for it grows with increased CT activities and maintenance.

This project will provide a consolidated maintenance facility for the two CT's that will be essential in the Shuttle operational era. In late 1981 the Shuttle program will be moving into the operational phase with higher flight rates and an associated increase in required maintenance. It is currently planned that this facility be operational by late 1981. As construction and checkout of the facility are estimated to take 18 to 20 months, an early 1980 start is required.

IMPACT OF DELAY:

Delaying this project will seriously reduce the capability to perform the essential maintenance required to keep the crawler transporters operational for the launch rates projected. The risk associated with deferral is considered imprudent under these circumstances; accordingly, this project should not be delayed.

PROJECT DESCRIPTION:

The project will move existing Building K6-793 approximately one-tenth of a mile (0.2 kilometers) from its present location, to that shown in Figure 2. The building will then be modified and an addition added to provide maintenance space, a shop with an overhead crane, and additional administrative space. Reinforced concrete servicing pits will be constructed. Additionally, the area will be graded to improve drainage in wet weather, the CT parking positions will be moved, the crawlerway extensions will be relocated to be tangential to the centerline of the curved portion of the main crawlerway, utilities will be modified and extended as required, and a parking area will be provided.

Building K6-793 is a single-story, concrete and steel, industrial building. After the building is. modified and the addition is added (as shown in Figure 3), it will be 187 feet (57.0 meters) long, 40 feet (12.2 meters) wide and 35 feet (10.7 meters) high. The gross area will be 7,880 square feet (733 square meters). Only one piece of transfer equipment is to be installed: a crane with a 25-foot (7.6 meters) hook height. All related equipment is included in the project cost.

PROJECT COST ESTIMATE:

The basis of this cost estimate is a Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit cost	Cost
Land Acauisition..	---	---	---	---
Construction..	---	---	---	1,250,000
Crawler maintenance building..................................	LS	---	---	944,000
Structural..	LS	---	---	(555,000)
Mechanical..	LS	---	---	(182,000)
Electrical..	LS	---	---	(137,000)
Utilities..	LS	---	---	(70,000)
Service pits..	EA	2	84,000	168,000
Crawlerway..	SY	14,000	8.29	116,000
Paving..	SY	1,500	14.67	22,000
Equipment..	---	---	---	---
Fallout Shelter (not feasible)..................................	---	---	---	---
Total..				1,250,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Proposed Maintenance Facility
Figure 3 - Modified Maintenance Building

OTHER EQUIPMENT SUMMARY:

No other equipment has been identified for use with this facility project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Additional funding for basic plant equipment is not anticipated. However, future modification work may be necessary to satisfy unique program requirements as they evolve.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO CRAWLER TRANSPORTER MAINTENANCE FACILITY

PROPOSED MAINTENANCE FACILITY

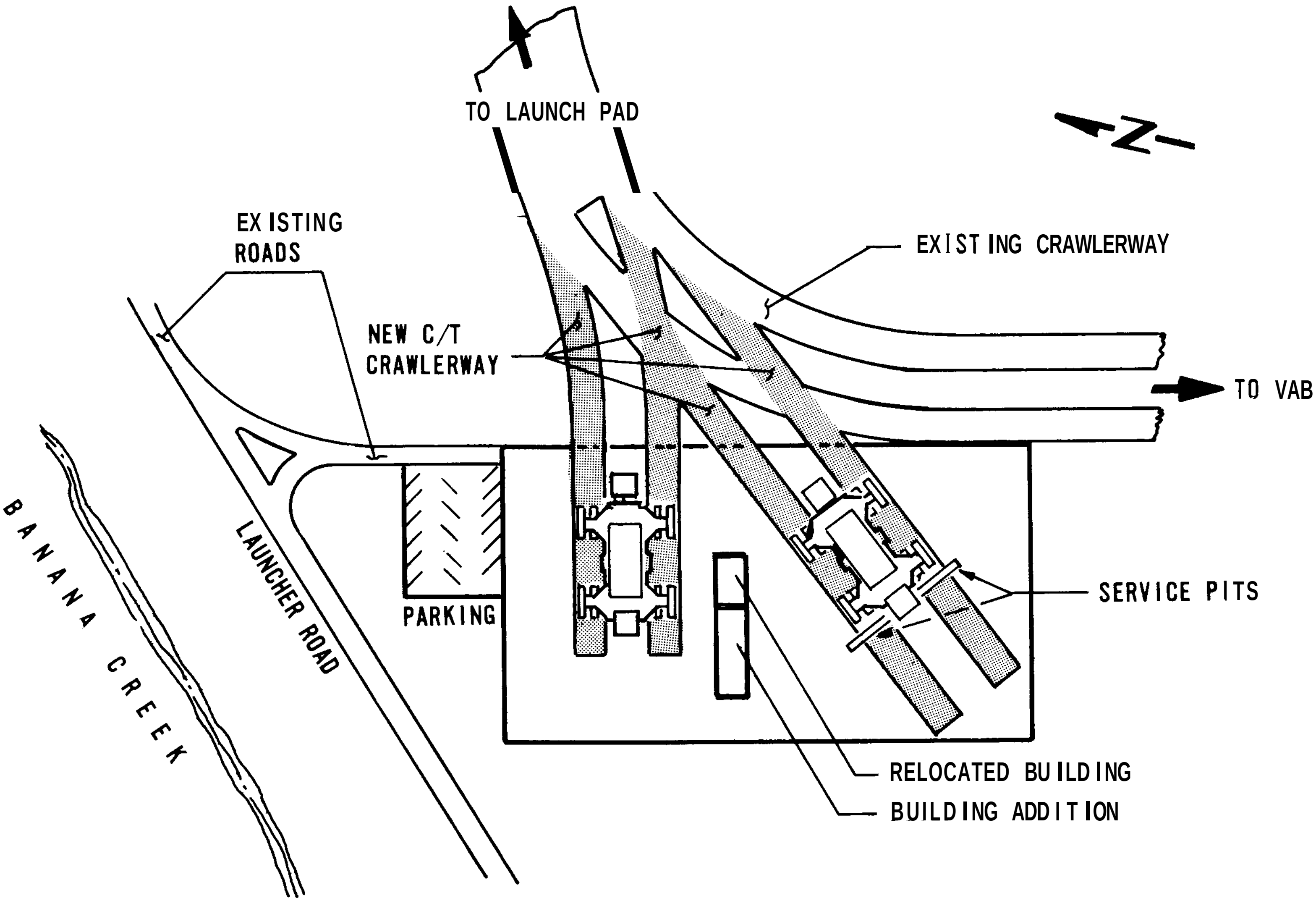


FIGURE 2

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
MODIFICATIONS TO CRAWLER TRANSPORTER MAINTENANCE FACILITY

MODIFIED MAINTENANCE BUILDING

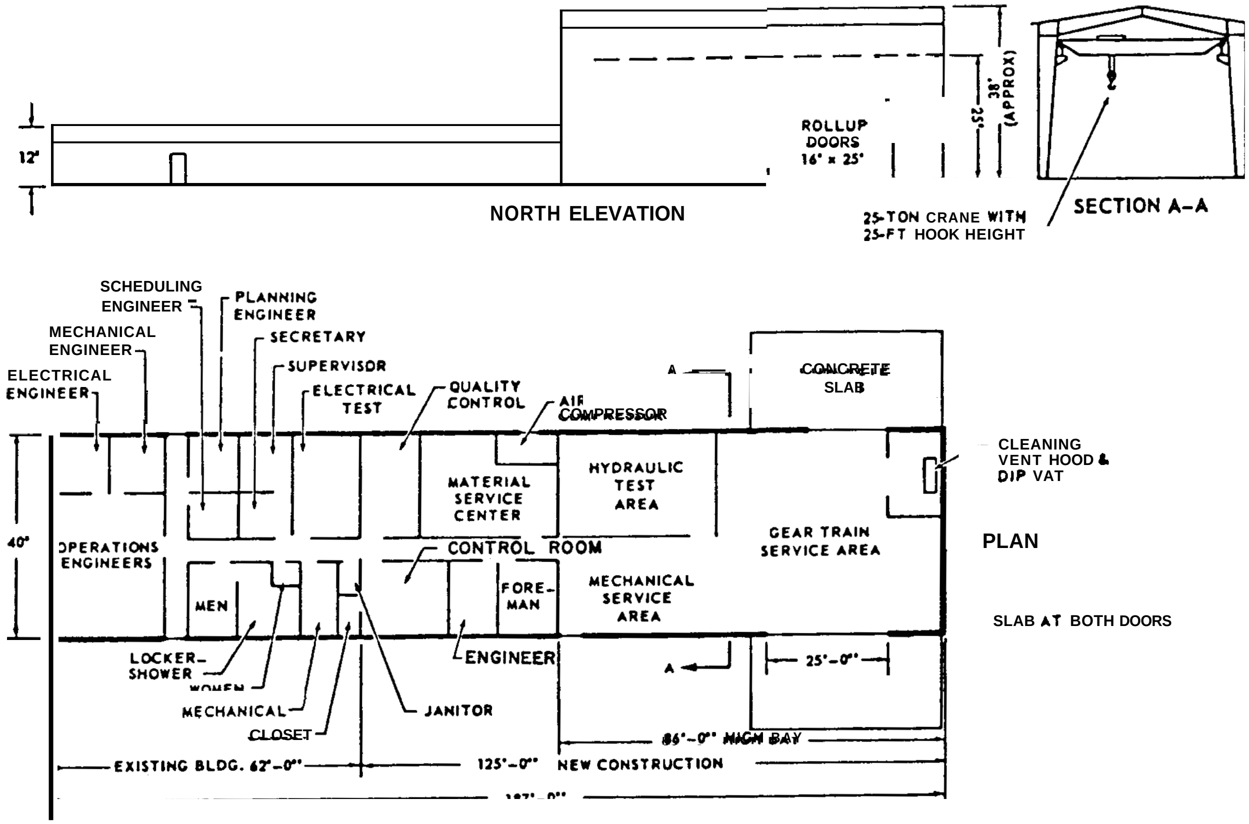


FIGURE 3

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1980 ESTIMATES
MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES
FOR EXTERNAL TANKS

LOCATION PLAN

1. MOD - VAB CELL 'B' CONVERSION
2. NEW - LH_2 HORIZONTAL CLEAN AND PRIME
3. NEW - TPS WASTE DISPOSAL FACILITY
4. REHAB-REPLACE ROOF BUILDING 103, PHASE I
5. REHAB-BUILDING 207 AND INTERCONNECTING SYSTEMS

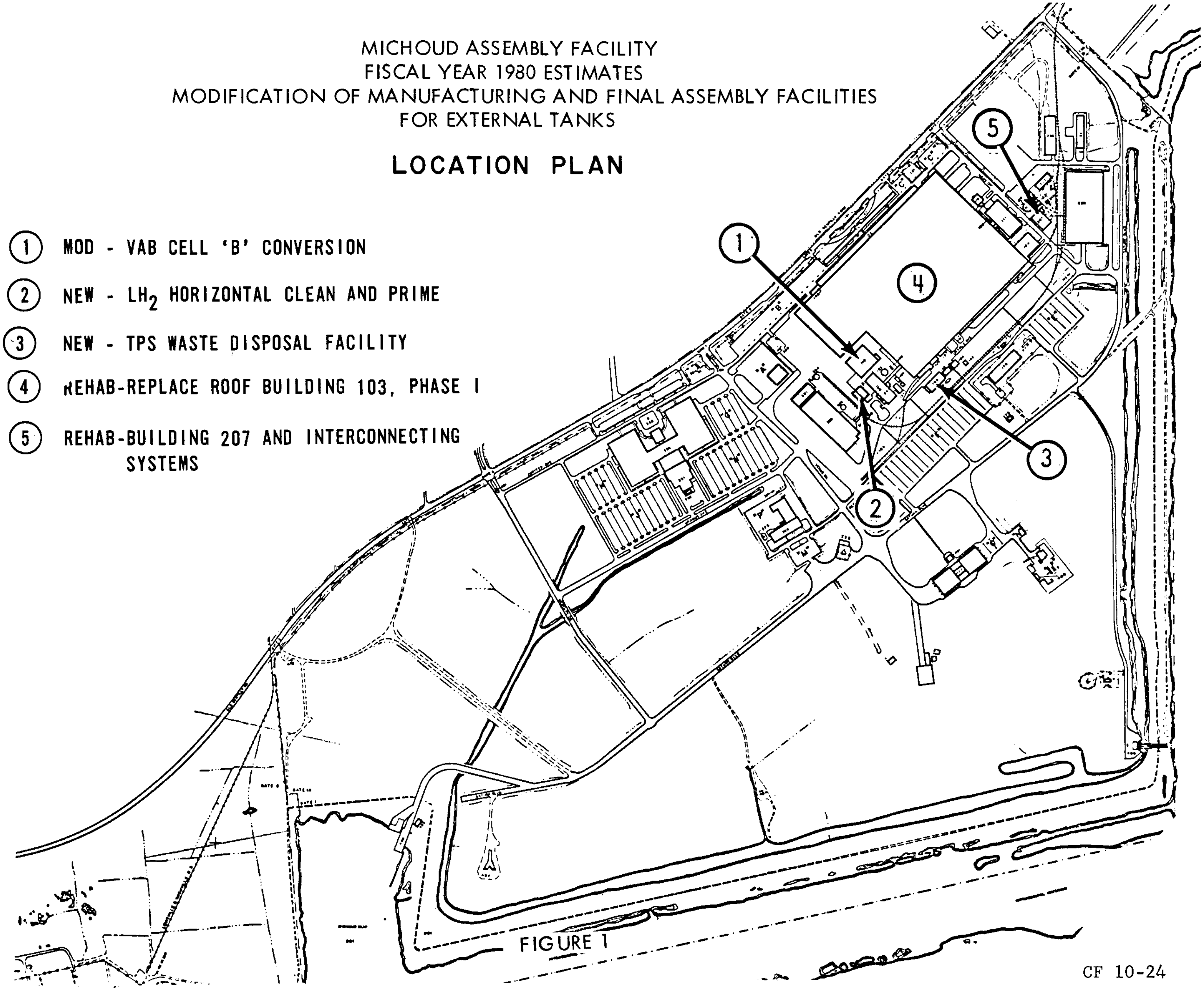


FIGURE 1

PROJECT TITLE:	Modification of Manufacturing and Final Assemblv Facilities for External Tanks
INSTALLATION:	Michoud Assembly Facility
FY 1980 CoF ESTIMATE:	$10.00 0.000

LOCATION OF PROJECT: New Orleans, Orleans Parish, Louisiana

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	4,430,000	49,041,500	53,471,500
Capitalized investment	N/A	132,716,000	132.716.000
Total	4.430.000	181,757,500	186,187,500

SUMMARY PURPOSE AND SCOPE:

This project continues work begun with FY 1973 and other prior years resources, including FY 1979. This work involves the modification of manufacturing and final assembly facilities at the Michoud Assembly Facility (MAF) for the Space Shuttle external tank (ET) production. The external tank is an essential component of the space shuttle system in that it supplies propellants to the orbiter's main engines. Each ET consists of three major components: a liquid oxygen (LO_2) tank, an intertank and a liquid hydrogen (LH_2) tank. The prior year resources provided certain modification3 to the Main Manufacturing Building, Building 103, the Vertical Assembly Building (VAB), Building 110 and the Final Acceptance and Checkout Building, Building 420; and construction of Phase I, High Bay Addition, Building 114; a facility to apply ablator to the LH_2 Building 131, and a proof test facility for the LH_2 tank, Building 451. The overall facility work at Michoud is required to provide the facilities necessary to fabricate and assemble the three major components of the ET, test and clean them, apply a thermal protection system (TPS) to their surfaces, and assemble the major components into a complete ET. The tank is then equipped with plumbing and electrical systems, checked and approved, and shipped to the launch site where it will be mated with the orbiter and solid rocket boosters.

The FY 1979 project provided certain additional production facilities needed to support ET manufacturing and final assembly at a revised rate of 20-24 per year. Work to bring the utility plant and distribution system to a reliable level on a phased basis was also initiated.

This FY 1980 project provides for additional production previously planned and needed to be started now to provide the facilities to support ET production. It includes completing the LH_2 tank cleaning and priming cell in the building provided by the FY 1979 program and converting Cell "B" to its final production configuration. These projects have been done in stages to meet the requirements of production as it expands without overbuilding in the early years. Work has been phased so that construction will be completed in critical production areas before the production schedule becomes critical. This schedule should minimize interference between construction work and ET production.

One "new start" is also included in FY 1980. It will provide a complete facility to dispose of TPS wastes and handle other waste as well. Two added items are related to the integrity, reliability, and energy efficiency of the total plant and its basic support system. Repair of one half of the roof of Main Manufacturing Building, Building 103 (over the major ET production area), is included as a priority item. Additional modification and repair of the utility system to insure reliability is also essential.

PROJECT JUSTIFICATION:

The facility work included in the FY 1980 estimate for MAF involves the following projects:

a. Conversion of Cell "B" to its final production configuration at this time fits with other elements of the planned construction program. As cells in the High Bay Addition, Building 114, and the Horizontal LH_2 Ablator Spray Facility, Building 131, come on line, this cell can be converted from its initial production setup to a TPS foam spray cell for the LH_2 tank that is required to meet the production schedule as its companion, Cell "C", becomes overloaded.

b. Construction of the second phase of the Horizontal LH_2 Ablator Spray Facility includes outfitting the cleaning and priming bay within the facility. This phase of the work was originally planned as a cleaning cell only, but a problem of cross contamination caused by performing priming of the LH_2 tank in the Horizontal Ablator Cell lead to the need for priming capability also.

c. Construction of TPS Waste Disposal Facility is scheduled to come on-line at a point in the production schedule when TPS wastes will be of such a volume that the current landfill method of disposal will no longer be acceptable. The new system will handle both the solids and liquids from the TPS as well as other wastes generated in the plant. The operating costs of the disposal system will be partially offset by savings in hauling the wastes outside the facility and use will be made of the heat generated to aid in plant power requirements.

d. Repair one-half of the roof of the Manufacturing Building 103. A recent storm has shown that the replacement of this roof cannot be delayed. During this storm, severe leaking of the roof occurred which was detrimental to production and would have had increased significance had production activities been at a higher rate. A recent survey of the roof showed excessive moisture exists throughout the roof system which requires replacement. In addition, moisture is penetrating the built-up roof at various locations in the complex drainage system over this large roof area. There is concern that, as the roofing work is performed, debris will fall into the production area and related damage can be minimized by completing work as soon as possible. The new roof will have an improved insulation value and will reduce energy consumption.

e. Rehabilitate the Boiler Plant, Building 207, and the supporting utility system. The first major effort to improve efficiency and reliability of the utility system came with the inclusion of the replacement of the chillers in the FY 1979 budget. This follow-on work is the next planned step in an overall effort to provide a utility system that will support ET production through the late 1980's. It includes rehabilitating the main steam condensate distribution system, modifing parts of the electrical distribution systems, providing backup fuel storage and ability to operate on Number 5 and 6 fuel oils, and rehabilitations within the central boiler plant.

VAB Cell "B", Buildinn 110

Cell "C" is currently being utilized for manual ablator bonding on the LH_2 tank as well as forward dome and barrel spray foam operations. After'the planned offload of ablator operations to the horizontal spray facility, Cell "C" will be devoted to spray foam operations and will attain a production rate of 20 LH_2 tanks/year in the early years. As the learning process improves, it will eventually accommodate 30 tanks/year. During the time frame when Cell "C" has not reached a rate of 30 LH_2 tanks/year, Cell "B", is required to support production of LH_2 tanks at a rate greater than 20 per year. In the early years, Cell "B" and "C" will have a combined spray foam capability of 40 LH_2 tanks/year which could ultimately increase to 60 LH_2 tanks/year with experience.

Due to the interference generated by having construction subcontractors in the VAB facility while production is going on, it is advantageous to perform the cell conversion while the ET production rate is still low.

LH_2 Horizontal Clean and Prime Position, Building 111. Phase II

Presently, Cell "E" in the VAB is the cleaning cell for both the interior and exterior of the various major ET components. As activities and the production rate in the VAB increase, the cleaning capability and logistic activities associated with this function become saturated. As forecast in the FY 1979 project, a second cleaning position is required for the exterior of the LH_2 tank which will significantly reduce the load on Cell "E". Addition of this facility will result in less use of deoxidizer in Cell "E", thereby prolonging the cell's effective life and reducing maintenance problems. It will also reduce the risk of a "program shutdown", which would result if Cell "E" fails because it is a one-of-a-kind facility. The addition of a primer capability to this cleaning cell effectively eliminates the possibility of silicone cross-contamination which can occur if primer and ablator operations are combined in the ablator cell.

TPS Waste Disposal System. Building 105

TPS waste (solids and liquids) will continue to increase through the life of the ET project. The excessive volume and amount of waste material dictates specialized disposal which MAF is not now equipped to handle. As a minimum, the production phases will generate over 60,000 cubic feet of TPS waste annually. Long term storage of waste is costly, impractical and does not reduce the requirement for disposal. This facility will also handle other waste generated at the plant. The volume of waste generated as production increases, will no longer make the current landfill method of disposal cost effective or acceptable.

Rehabilitate Roof, Building 103, Phase I

Building 103 was constructed in 1943 and completely reroofed in 1963. Major roof rehabilitations were performed during 1965, 1969, and 1972. Since the initial rehabilitation, the roof has been patched and repaired but there are still continuous leaks and soft spots where insulation is saturated and blistered due to trapped moisture. Manufacturing operations are often disrupted due to leaking water. To correct these problems and to preserve the roof structure this roof should be replaced. Replacement of the roof will also improve the energy profile of the plant with the replacement of the insulation system. This project is Phase I of two phases and would encompass half of the approximately 1,800,000 square feet (167,200 square meters) of Building 103, and would be primarily devoted to the solution of the roof problem over the manufacturing areas.

Rehabilitation of Buildinn 207 and Interconnectina Utilitv Svstem

Building 207 is the main boiler house and it, along with the utility system of the Michoud Assembly Facility, was constructed in 1943. Numerous repairs hsve been made over the past three years on a spot basis.

The following items are included:

a. Rehabilitation and Replacement of Steam Condensate Svstem and HVAC Distribution Svstem, Buildinn 103

The steam condensate system is 25 years old and is a part of the environmental control system for the main manufacturing building supporting External Tank production. Presently, the system has developed numerous leaks that are beginning to seriously affect production. Also included in the project is work to seal up the 42 roof fan houses and provide better control for improved energy efficiency.

b. Modifv Electrical Distribution Svstem

Modification to selected, existing transformer substations will provide increased load capacity snd ability to switch load between substations to prevent production shutdown in the event of the failure of one the these transformers. Changes in the feeder system to the substation will increase the reliability of the system.

c. Rehabilitate Motor Control Center (MCC), Building 207

The motor control center provides electrical service to the boiler plant condenser water pumps #1 through #6. These pumps are necessary for continuous operation of the MAF Boiler Plant which supplies environmental control for External Tank production areas. The motor control center components are obsolete and replacement parts are unavailable. In addition, the unit requires excessive maintenance (i.e., 265 man-hours in 1977).

d. Modifv MAF Boiler Plant for Number 5 and Number 6 Fuel Oil Capability

The prime source of fuel for the MAF Boiler Plant is natural gas which MAF has been advised may be severely curtailed. The backup source of fuel for MAF is Number 2 oil which is also in short supply. This proposed boiler plant modification will permit use of Number 5 or 6 heavy grade oils in the event natural gas or Number 2 fuel oil cannot be obtained. A curtailment of usable fuels would necessitate shutting down the boiler plant. This act would result in loss of the plant HVAC system and an unacceptable degradation of the controlled environment required for space hardware fabrication, assembly, and storage activities.

e. Construct 500.000-Gallon Fuel Oil Tank and Dock Facilitv

Existing reserve capabilities of fuel oil at MAF will allow for approximately 3 weeks continuous operation of the MAF boilers. These boilers provide environmental control (heating, backup cooling, and humidity) to the main External Tank manufacturing building. Installation of a second 500,000-gallon storage tank will provide added reserve capability, and an offloading dock facility will allow the tanks to be supplied by barge. As with the previous items, failure to have usable fuel available would stop operations at MAF. This system will accommodate Number 5 and 6 fuel oil.

f. Modifv Platforms and Other Safetv Modifications

This item modifies the main boiler plant to conform to OSHA standards for access platforms, stairs, machinery guards and pipe identification.

g. Rehabilitate Buildinn 207. Structure and Roof

As with the utility systems it houses, the building shell itself needs to be rehabilitated. Doors are deteriorated, hinges are corroded, many windows are defective, and mechanical controls on the windows are defective and inoperable, and some drain systems require rerouting. The basic roof is over 35 years old and in poor condition. In addition to storm damage, it has been penetrated during early equipment installation. This project is phased to be completed with the major work on the utility system.

IMPACT OF DELAY:

The LH_2 Horizontal Clean and Prime Position and VAB Cell "B" conversion are required to support production rate capability. Failure to provide them at this time will affect the ability to manufacture ET's to support flight rates in the 1982-1983 time frame. The TPS Waste Disposal System, if not provided, creates the problem of disposing of TPS and other waste by more costly hauling off-site and landfill techniques. Failure to replace the roof of Building 103 and to rehabilitate Building 207 and the interconnecting utility system would, because of water damage or loss of vital utilities, seriously impact production.

PROJECT DESCRIPTION:

This project continues work authorized in prior years. It includes constructing modifications to Buildings 103, 110 and 207; adding a cleaning and priming position to the LH_2 Horizontal Ablator Spray Facility; modifying Building 105 to house a TPS Waste Disposal Facility; rehabilitation of Building 207 and its connected utility system; and rehabilitation of one-half of the roof of Building 103.

Modifv VAB Cell "B", Building 110

Cell "B" of the VAB will be converted from an LO_2 tank and intertank TPS position to an LH_2 tank position for applying foam on the forward dome and barrel. This conversion requires changing air-conditioning and heating ducting, changing interface utility connections, modifying tool installation interfaces, and providing additional doorways and access platforms.

Construct LH_2 Horizontal Clean and Prime Position, Building 131, Phase II

This project is a continuation of the FY 1979 project for a Horizontal Ablator Spray, Phase I (as shown in Figures 2 and 3). It provides the capability of accepting the LH_2 tank in a horizontal position for exterior cleaning, deoxidation, and application of primer. The entire cleaning process will be semi-automatic; it will be controlled through pushbutton operations in the control room. The primer application will be carried out by a numerically controlled spray system. Specifically provided is the outfitting of the cell, which includes special wall and floor finishes, miscellaneous foundations for pumps, etc., and concrete and structural steel for pipe racks. Mechanical and electrical equipment for cleaning and priming is also installed.

Modifv for TPS Waste Disposal Facilitv. Buildinn 105

MAF Building 105 will be modified and equipped with a disposal unit capable of the incineration of liquid and solid TPS waste, industrial waste, and garbage. A layout of this facility is shown in Figure 4. It includes the installation of a pipeline from Building 103 to 105 for disposal of MEK/HEPTANE-contaminated water. Gas or fuel oil burn incineration will be possible. Incinerator heat will be used when possible to generate steam for space heating and processes.

Rehabilitate Roof, Building 103 Phase I

This project provides for the removal of existing roofing (shown in Figure 5) and the installation of an asphalt, built-up, 4-ply roof with insulation, flashing, expansion joint covers, pitch pockets etc., over the concrete tile deck. Also included is the elimination of all unnecessary roof openings and the rehabilitation or replacement of vents and hatches. This project is Phase I of two phases; it will encompass approximately one-half of the 1,800,000 square feet (167,200 square meters) of Building 103's roof area.

Rehabilitate Buildina 207 and Interconnecting Utility Svstems

This project consists of rehabilitation and modification of the main boiler plant at Michoud Assembly Facility, Building 207. Work involves installing new doors, caulking and re-glazing windows, reworking window control mechanisms, modifying drain systems, replacing defective structural members, and removing and replacing broken concrete blocks and bricks of the exterior walls. The interconnected utility systems consist of the following:

a. Rehabilitate Steam Condensate Svstem and HVAC Distribution Svstem of Building 103. The work consists of replacing in part 6,000 feet (1,829 square meters) of insulated pipe and repairing insulation on the remaining pipe. The majority of this pipe is located above the 40-foot (12 meters) level in the Main Manufacturing Building 103. This project also provides for replacing miscellaneous valves, pipe hangars, fittings, and traps, and rehabilitating steam condensate stations. Also included are sealing and other efforts to improve the efficiency of the plant's roof fan houses.

b. Modifv Electrical Distribution Svstem. This project increases the capability and provides load shifting ability at eight transformer substations and load transfer only at two substations. The addition of two feeder lines and the rehabilitation and modification of two feeder lines will service five substations and one master station to enhance reliability of the electrical system.

c. Rehabilitate Motor Control Center. Building 207. This project provides for replacing the existing motor control center for Substation #13 at the MAF Boiler Plant which provides service to six boiler plant condenser water pumps.

d. Modification of MAF Boilers for #5 and #6 Fuel Oil Capability. These modifications involve changing burners, internal fuel oil piping, day tank storage systems, and boiler control system; adding air pollution control equipment; and providing steam supply lines, condensate return lines, and steam trace lines on the piping system connecting the fuel oil storage tank farm area required to handle Number 5 and 6 fuel oil.

e. Construct 500.000-Gallon Fuel Oil Tank and Dock Facilitv. These modifications involve installing a second 500,000-gallon storage tank with heater and steam coils, electric lights and connecting piping. Also included is the construction of a dock on the Michoud canal for unloading two barges and a transfer line from the dock to the storage tanks, with necessary steam and electrical power lines.

f. Modifv Platforms and Other Safetv Modifications, Building 207. This project provides for properly identifying all piping; installing OSHA standard access platforms for valves and fitting; installing new stairs and ladders; and installing safety guards, rails, and shields.

g. <u>Rehabilitate Buildinn 207. Structure and Roof</u>. This project consists of rehabilitating the main boiler plant at MAF. Work involves installing new doors, caulking and reglazing windows, reworking window control mechanisms, changing the drain system, replacing defective structural members and removing and replacing broken concrete blocks and bricks of the exterior wall. The existing roof (17,000 square feet (1,580 square meters)) will be removed and replaced with an aggregate surfaced asphalt built–up, 4–ply roof with insulation over the existing deck. Also included will be the rehabilitation or replacement of vents and hatches.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition..	---	---	---	---
Construction...	---	---	---	10,000,000
Modifications to the vertical assembly building..........	---	---	---	800,000
Cell "B" conversion....................................	LS	---	---	(800,000)
Construction of LH_2 tank clean and prime facility........	---	---	---	2,700,000
Foundations..	LS	---	---	(140,000)
Process heating and air-conditioning..................	LS	---	---	(450,000)
Fire protection systems...............................	LS	---	---	(110,000)
Mechanical systems....................................	LS	---	---	(1,790,000)
Utility systems.......................................	LS	---	---	(210,000~
Site work..	LS	---	---	---
Construction of TPS waste disposal facility..............	LS	---	---	900,000
Rehabilitation and modification of building 207 and rehabilitation of interconnecting utility system.......	---	---	---	2,500,000
Replace roof building 103................................	SF	goo,000	3.44	3,100,000
Equipment..	---	---	---	---
Fallout Shelter (not feasible)...........................	---	---	---	---
Total..				10,000,000

LIST OF RELATED GRAPHICS:

OTHER EQUIPMENT SUMMARY:

Special tooling (e.g., spray tooling, assembly tooling, unique work platforms, and special dollies) will be needed to meet initial operations. They will be funded from R&D sources. Existing additional Apollo tooling, with modifications as required, will be used to the maximum extent possible.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Some $14 to 17 million of CoF resources may be required in the future to provide storage for a minimum of eight completed External Tanks, two additional TPS cells for the LO_2 and Intertank in Building 114, more storage capacity for demineralized water, an additional Tank Ablator Spray Cell, a chemical tank foam recovery system, a second Final Acceptance and Checkout Station, and the second and final phase of replacing the roof of Building 103. Additional modification work may also be necessary to satisfy future programmatic requirements as they may evolve.

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR *1980* ESTIMATES
MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES
FOR EXTERNAL TANKS

LH2 HORIZONTAL CLEAN AND PRIME FACILITY,
BUILDING 131

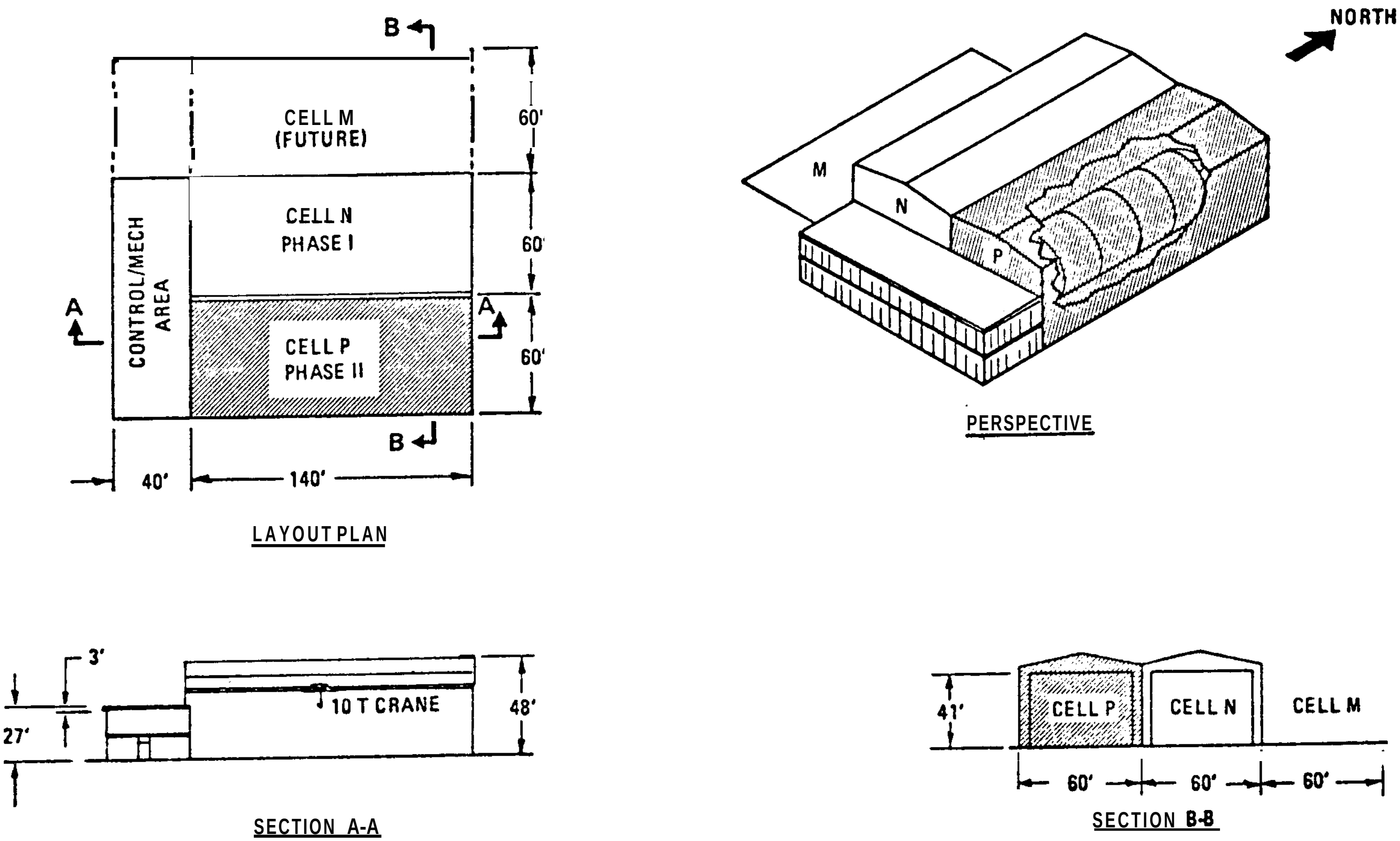


FIGURE 2

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1980 ESTIMATES
MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES
FOR EXTERNAL TANKS

MODIFICATIONS AND ADDITIONS

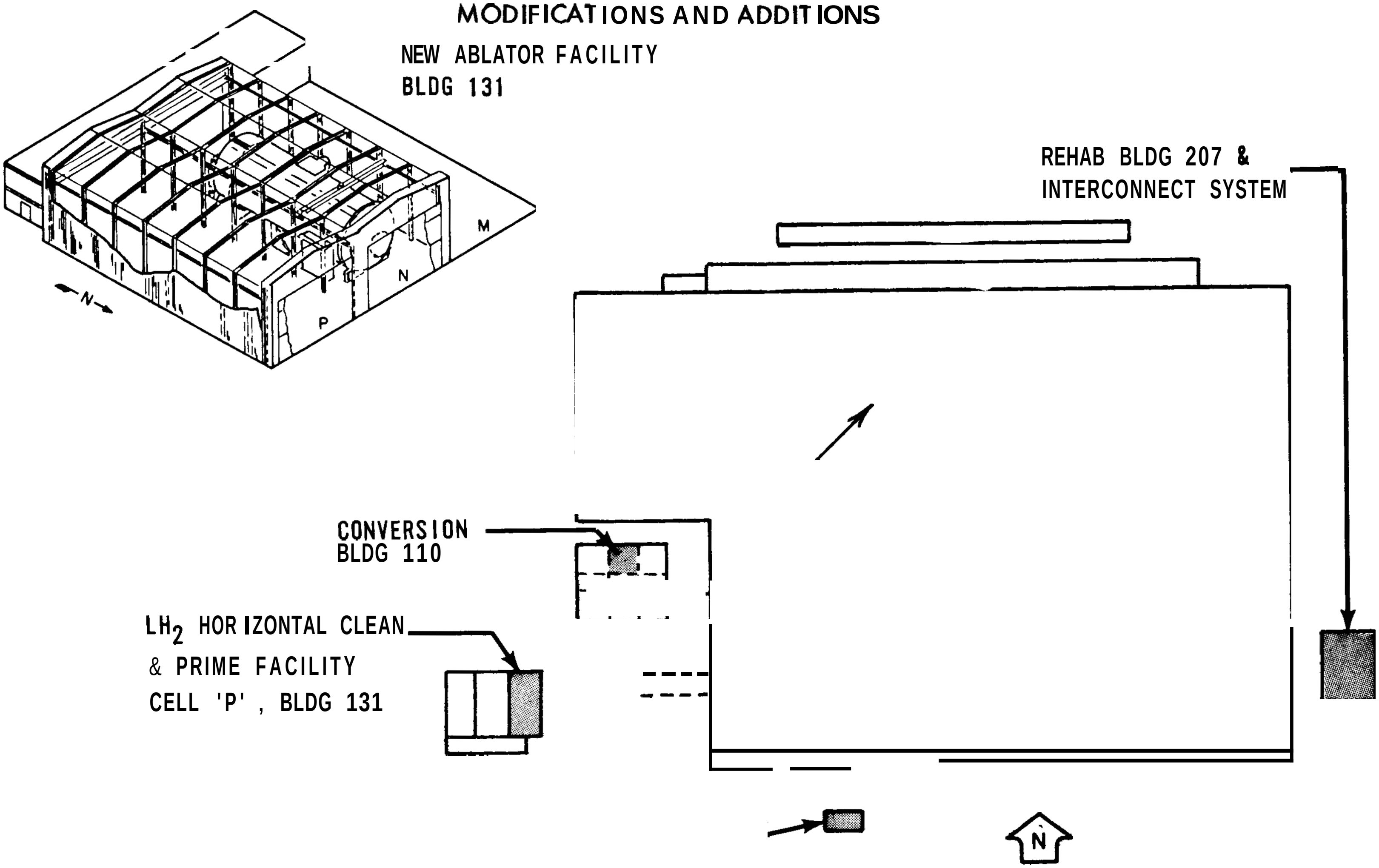
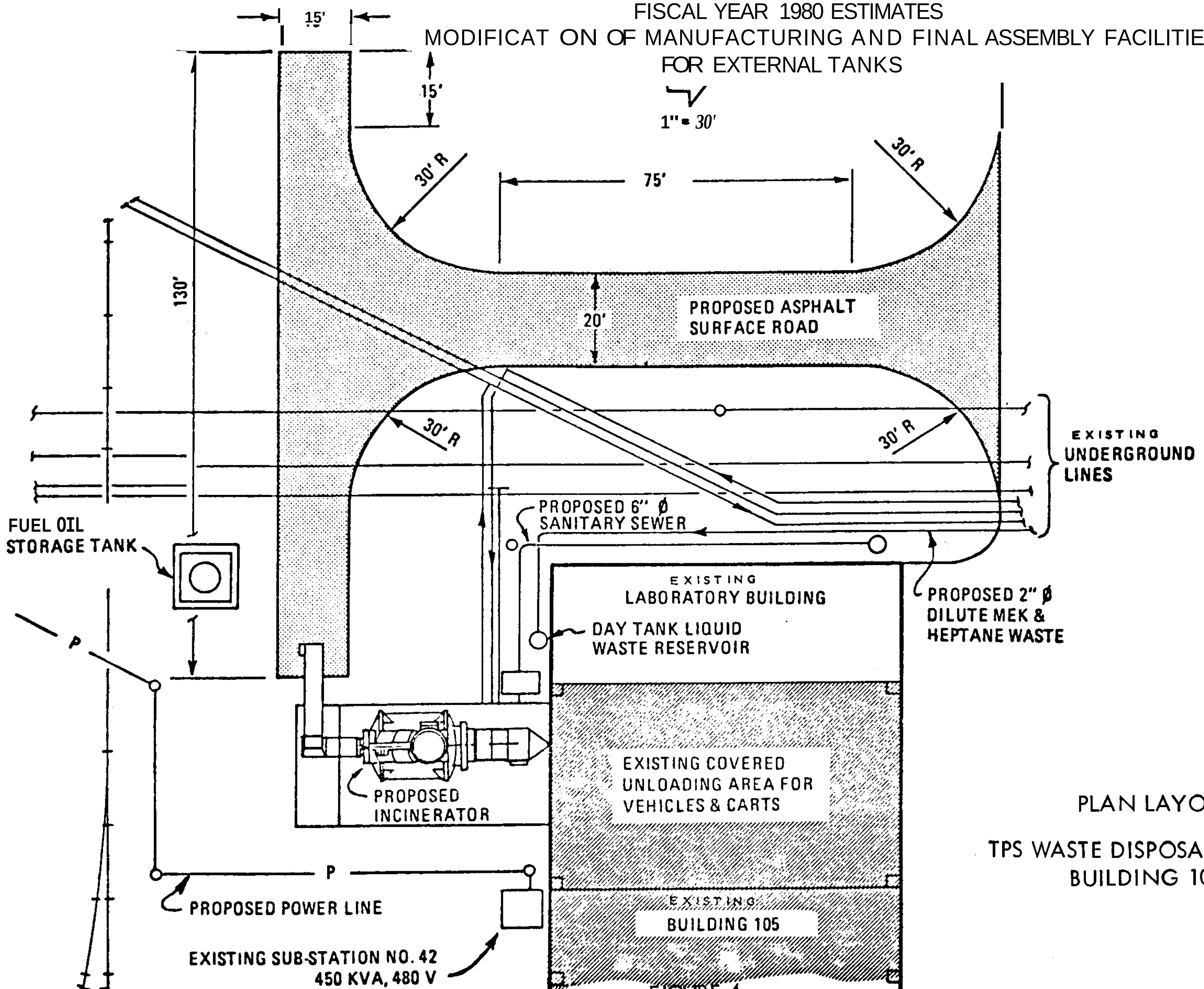


FIGURE 3

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1980 ESTIMATES
MODIFICAT ON OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES
FOR EXTERNAL TANKS



PLAN LAYOUT,

TPS WASTE DISPOSAL FACILITY,
BUILDING 105

FIGURE 4

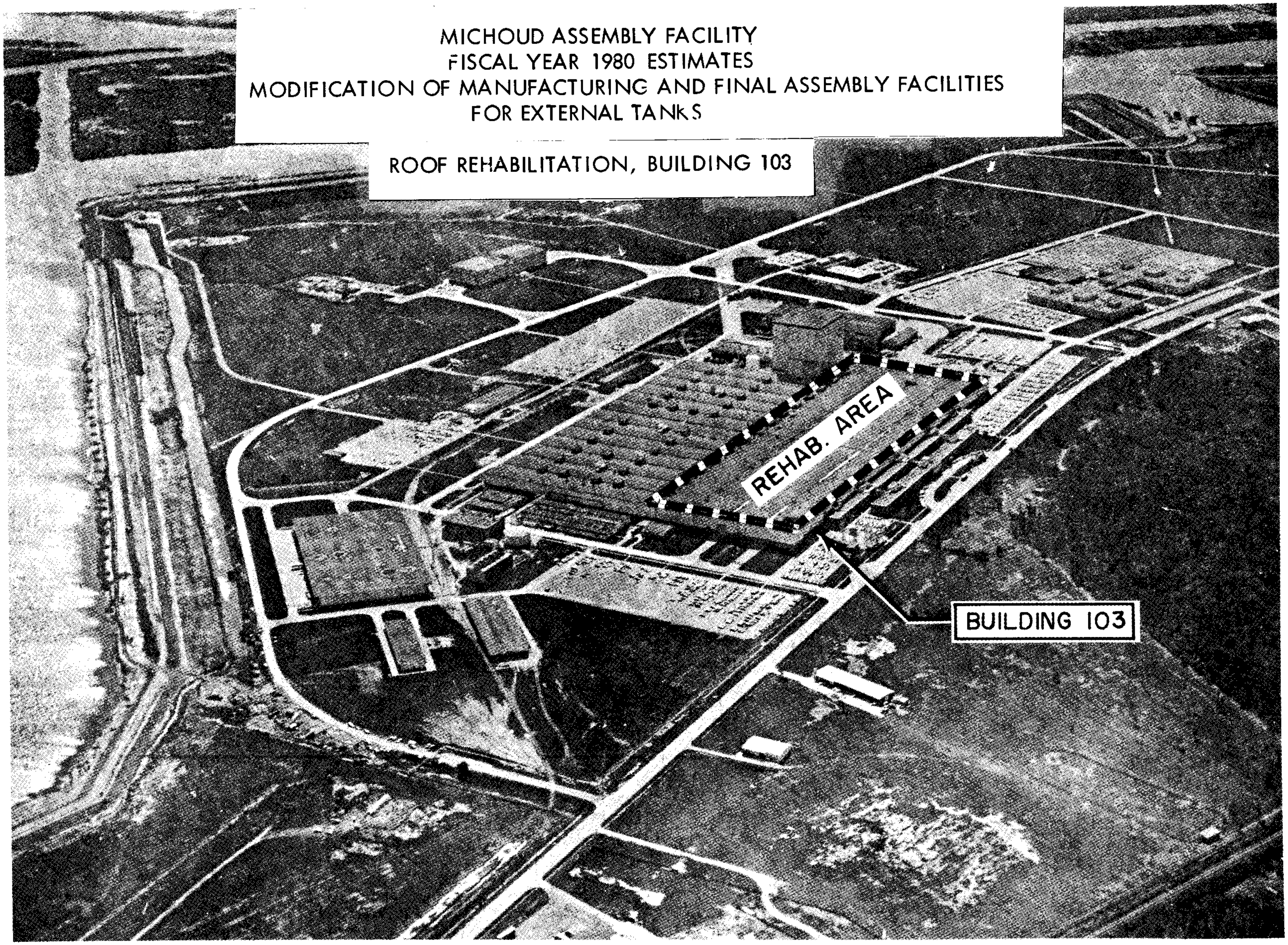

MICHOUD ASSEMBLY FACILITY
FISCAL YEAR 1980 ESTIMATES
MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES
FOR EXTERNAL TANKS
ROOF REHABILITATION, BUILDING 103
REHAB. AREA
BUILDING 103

FIGURE 5

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Minor Shuttle-Uniaue Projects

INSTALLATION: Various Locations

FY 1980 CoF ESTIMATE: $2,500,000

LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	602,000	*6,210,000	6,812,000
Capitalized investment..	N/A	**1,565,000	1,565,000
Total..	602,000	7,775,000	8,177,000

*CoF Minor Shuttle-Unique Projects
**R&D/R&PM Minor Shuttle-Unique Projects

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide for minor rehabilitation and modification of facilities necessary to support the Space Shuttle Program at NASA field installations. Included in this project are facility rehabilitation and modification projects estimated to cost less than $500,000 and minor construction projects estimated to cost less than $250,000. These projects are unique requirements of the Space Shuttle Program to achieve initial operational capability or to meet program milestones.

PROJECT JUSTIFICATION:

Space Shuttle development, assembly, and test requirements are being carried out to a large extent in existing Government facilities at the various NASA installations and industrial plants. The major modifications and new construction required at these locations are presented as discrete line items within an integrated Space Shuttle facilities project. In many instances, Shuttle support can be accommodated in existing facilities, or when only limited rehabilitation or modification is required to achieve the desired capability.

This project includes only Shuttle-unique facility rehabilitation and modification projects estimated to cost less than $500,000 and minor construction projects estimated to cost less than $250,000. Each work item is necessary to support a specific Shuttle requirement, insure continued reliability, provide a safer environment, and/or improve the efficiency and economy of individual facilities supporting the Space Shuttle Program.

For clarity, full disclosure purposes, and better fiscal and technical control, all unique Space Shuttle facility requirements, both discrete individual line items and the smaller facility projects, are included in the total Space Shuttle CoF budget. The work covered in this project is of such a nature and magnitude that it is included under a single rehabilitation and modification Shuttle project for various locations. The cost of this project and all similar follow-on projects will be charged against the total Space Shuttle facilities commitment.

PROJECT DESCRIPTION:

This project provides for necessary unique rehabilitation and modification to existing facilities and minor construction in support of the Space Shuttle Program. The justification, description, and cost estimate for each element are listed below:

A. Johnson Space Center (JSC) 225,000

1. Modifications of Mission Control Center, Building 30 225,000

This project is required to further reconfigure the Mission Operations Wing (MOW) and lobby wing of Building 30, Mission Control Center, for the Space Shuttle operational phase. It provides for modifications within approximately 6,950 square feet (646 square meters) on the second and third floors of the MOW, and 3,800 square feet (353 square meters) on the second floor of the lobby wing. The work includes reconfiguration of interior partitions, replacement of suspended ceiling, and replacement of damaged raised flooring. Also included are modifications to lighting, electrical power distribution, air-conditioning and fire detection and supression systems. The MOW of Building 30 was originally designed for single mission capability. As the flight rate increases in the Shuttle operational phase, the second and third floors of the MOW must be configured to accommodate simultaneous support of multiple Shuttle flights and payloads. The modifications on the second floor of the lobby wing are required to meet additional configuration changes to support Shuttle operations.

B. Drvden Flight Research Center (DFRC) 490.000

1. Rehabilitation of Microwave Scanning Beam Landing System Cabling 490,000

Permanent installation of the Microwave Scanning Beam Landing System (MSBLS) at Edwards Air Force Base is required by October 1980 in order to support the Secondary Landing Site concept for contingency Space Shuttle landings. After the early Space Shuttle developmental test flights are completed, the existing MSBLS equipment will be relocated from runway 17/35 at the lakebed to runway 04/22 for permanent installation. The existing inter-site control and monitoring cabling has been subjected to vehicular traffic and the normal debilitating effects of a desert-like environment. This cabling was not planned to be permanent, and is not direct burial cable. Resources from this project will be used to procure and install some 30,000 linear feet of audio wide-band cabling for control and monitoring of the MSBLS.

C. Marshall Space Flight Center (MSFC) 1,440,000

1. Modify Major Component Clean Facility, MAF 490,000

The major component clean facility at Michoud Assembly Facility (MAF) is an existing Apollo facility that has been converted for the use of cleaning major External Tank components prior to assembly operation. The facility and its supporting utilities and equipment is over fifteen years old and is in need of modification and repair. The present floor lining must be removed and the subfloor resealed with a special chemical repellant sealant and a curbing system installed to retain chemical spills. The associated utilities and equipment will be refurbished to lessen the potential for breakdown. A more powerful and corrosive cleaning solution than originally planned is now used in this facility. These modifications will provide adequate protection against corrosion essential to continued operation of this one-of-a-kind facility.

2. Modify "Missile Grade" Air, Building 420, MAF 360,000

At the present time, gaseous nitrogen (GN_2) is used to purge the Intertanks and Liquid Hydrogen (LH_2) tanks prior to shipment from MAF. This purge operation takes place in Building 420. By providing the capability to purge these tanks with "missile grade" air (clean/filtered compressed air), the use of the present nitrogen system and its associated safety hazards can be eliminated. In addition, this project will produce an estimated savings of $1,500 (1977 prices) per External Tank (ET) by eliminating the need for GN_2. The project includes activating two large existing air compressors in Building 111. Piping will be installed from Building 111 to Building 420 to connect the compressors to the purge system. The existing GN_2 system will be tied-in as a backup.

3. Modify Cell "E" for Cleaning Environment, MAF 290,000

Due to the debonding problem of the Thermal Protection System primer on tanks produced early in the cycle, it became necessary to go to a more vigorous cleaning solution. Aerowash "A" has been replaced with a deoxidizer. This change created a requirement to protect the cell equipment exposed to this deoxidizer. This includes protecting or replacing lighting fixtures, exhaust ducts and fans, instrumentation panels and tubing, and adding new exhaust scrubbers for environmental protection. An additional portion of the distribution and storage system used for the cleaning solution must be replaced or protected.

4. Install Monorails and Bridge Cranes, MAF 300,000

These overhead cranes are required to support production operations in the Assembly of hardware on the External Tank, horizontal final assembly positions 3 and 4. This additional capability is necessary to support production of ET's beyond a rate of 24 per year. Providing for the construction during this fiscal year ensures timely completion of construction activity in Building 103 prior to achieving a high production rate, thereby reducing the possibility of additional contractor cost to compensate for work interruption and eliminating interferences with ongoing critical production operations. It includes two 2-ton and two 3-ton cranes and the associated bridge and trolley system. The 2-ton cranes are mounted at the bottom chord of the roof structure with 200 feet of rail. The 3-ton cranes are mounted in the roof truss system with approximately 50 feet of rail. This project will handle the ET into, during processing, and out of horizontal positions 3 and 4.

D. Kennedy Space Center (KSC) 345,000

1. Modifications to Lighting in Vehicle Assembly Building (VAB) 210,000

This project provides for modifications to the 1286 mercury vapor lamps in the high and low bay areas of the Vehicle Assembly Building (VAB). 570 lamps will be permanently disconnected and removed, and 510 fixtures in the transfer aisle of both the low and high bay areas will be respaced to provide 37 foot candles of illumination at the center line of the transfer aisle. In the four high bays, all mercury vapor lamps below the 192 foot level will be removed and replaced with the sodium vapor lamps. They will be spaced to provide

10 foot candles on the Mobile Launcher platform in high bays 1 and 3, and 37 foot candles at the center line of the floors in high bays 2 and 4 to support SRB operations. The lamps will be capable of selective switching to provide 5 foot candles when vehicle operations are not in progress. The mercury vapor lighting system in the VAB exceeds the area coverage and the light levels required to support the Space Transportation Systems operations for the future, and is less energy efficient than present day fixtures. By redesigning and implementing the lighting system, this project will produce energy savings of 46.815 x 10^9 BTU's per year, resulting in a 1.21 year payback period.

2. Rehabilitation and Modification of Demineralized Water Facility 135,000

This project provides for the replacement of the existing manually operated, 1.5 million gallons per year, demineralized water production units with new semi-automatic, 3.0 million gallons per year units at Launch Complex 39 and replacement of the inter-connecting pipe system. An annual requirement of almost 3.0 million gallons will be required to support peak Space Shuttle activities, principally in the field clean and pre-clean rooms (1,900,000 gallons), SRB Disassembly Facility (800,000 gallons) and the chemical analysis laboratory (100,000 gallons). Also included will be the installation of a IO-foot by 20-foot canopy/roof over the units to protect them from the elements. Maintenance of the existing system is costly, and spare parts are not available. Replacement of the existing piping system is necessary at an early date, and this costly work should be integrated to fit with the larger and demineralized water production units. The new semi-automatic system will result in a reduction of the cost of demineralized water production from $.0179 per gallon to $0.0100 per gallon, thereby paying for the unit in six years.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

SPACE SHUTTLE PAYLOAD FACILITIES

	Amount	Page No.
Office of Space Science:		
Rehabilitation and modification for payload ground support operations (KSC)............	2,610,000	CF 11-1
Modification of and addition to materials science laboratory (ARC).	1,640,000	CF 11-13
Total	4,250,000	

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
REHABILITATION AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS
LOCATION PLAN

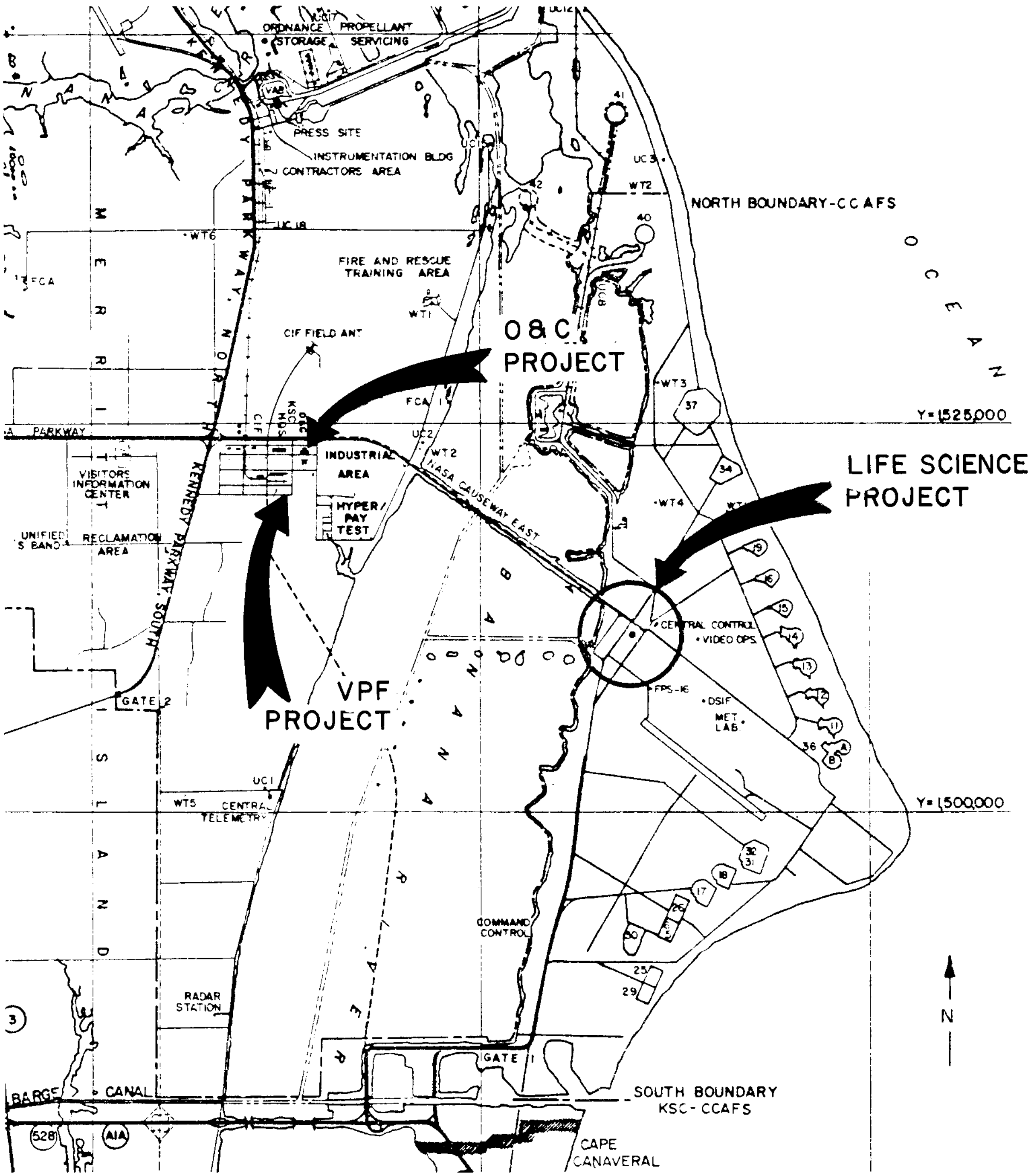


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Rehabilitation and Modification for Payload Ground Support Operations

INSTALLATION: John F. Kennedy Space Center

FY 1980 CoF ESTIMATE: $2,610,000

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	1,113,568	9,980,000	11,093,568
Capitalized investment	N/A	48,357,348	48,357,348
Total	1,113,568	58,337,348	59,450,916

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide for rehabilitation and modification of facilities necessary to support Space Shuttle payload ground operations at the NASA launch site, Kennedy Space Center. Included in this project are major discrete projects and facility rehabilitation and modification projects estimated to cost less than $500,000. These projects are requirements in support of the Space Shuttle payload program. This project continues modifications to the Operations and Checkout (O&C) Building, and the Vertical Processing

Facility begun with FY 1977 and FY 1978 resources. In addition, it provides for modifications to the Missile Assembly Building (Hangar L) located at Cape Canaveral Air Force Station (CCAFS), Florida, to accommodate Integrated Life Sciences Operations.

PROJECT JUSTIFICATION:

Space Shuttle Payload Ground Support Operations will be carried on at NASA's launch site, KSC. Many different facilities will be involved in payload support operations, requiring both major (discrete) and minor construction, and facility rehabilitation and modification. For the purposes of clarity, full disclosure, and better technical and fiscal control, it was thought best to now include all payload ground support projects at KSC in one category.

The Space Transportation System (STS) operational phase of the Space Shuttle program will commence after the first six development flights in CY 1979 and CY 1980. At this time the primary purpose of the STS will be in the support of payload operations. FY 1977 resources provided for modifications to the O&C Building for the horizontal processing of Spacelab payloads and other classes of payloads while FY 1978 resources provided for the vertical processing of the Inertial Upper Stage (IUS), the Spinning Solid Upper Stage (SSUS), and other payloads in the former Spacecraft Assembly and Encapsulation Facility (SAEF-1), now called the Vertical Processing Facility (VPF).

This project provides for additional modifications to the O&C Building to support Spacelab Payload Level IV integration. Level IV integration is that work needed to place experiments in racks, and buildup and integrate racks and pallets for further integration into the Spacelab. This is a new requirement for KSC that did not exist at the time the FY 1977 project was requested. An intensive NASA study has recently concluded that substantial savings, primarily in transportation costs, can be achieved if Level IV "hands on" Spacelab payload integration is done at the launch site (KSC) rather than at field Centers or other government or industry locations where the experiments are developed. Prior to Shuttle missions, payloads will be shipped to KSC and received, processed and checked out in off-line locations other than the O&C Building. These payloads will then be brought to the O&C Building for integration and checkout in the Spacelab hardware. Specifically, the work included in this project will modify the area in the O&C Building dedicated to this Level IV activity. Previous modifications to the O&C Building provided the capability for functions associated with final assembly and checkout of the Spacelab and disassembly following completion of a Shuttle mission.

Also included in this project are resources to continue modifications to the Vertical Processing Facility (VPF) to support vertical payload integration. When this specific project was submitted in FY 1978, the crane capacity of the existing facility (SAEF-1) was thought to be adequate for all known payloads. Since then however, the weight of the IUS vehicle has increased considerably and future planning now includes missions that require twin stage IUS's. The individual IUS's will be integrated into a twin stage configuration in the workstands in the VPF, and once in this mode, must be lifted together in a strongback for certain NASA missions. The existing crane in the VPF has only 25 tons of capacity and must be upgraded to 35 tons to lift twin or twin + spinner stage IUS vehicles. The first requirement for this increased crane capacity is for the Galileo mission presently scheduled for early CY 1982. In order to support this mission, fabrication and installation must be accomplished prior to October 1981, thus an FY 1980 project is essential.

Resources will also be provided for a Life Sciences Support Facility. This facility will be used to house animal/biological specimens for preflight conditioning and selection, and to provide a research lab capability for Principal Investigators to conduct preflight specimen preparation, and synchronous ground control experiments during flight. In addition, it will be used to perform post-flight analyses of flight and control specimens and to allow preparation of experiments for payload integration. At the present time no permanent facility capability exists to support extensive Life Science missions. In previous programs, Life Science requirements were of such a reduced magnitude that they could be satisfied by temporary facilities such as trailers. In the Space Shuttle era, Life Science payloads are planned as routine with both dedicated Life Science missions, or Life Science experiments flying alongside other Spacelab experiments. Each dedicated payload mission will involve 20-45 experiments and 20 principal investigators. Housing for up to thirty primates and 500 rodents per specific mission will be required. This facility will also provide holding areas for plants, fish and amphibians, and cells and tissues.

It is highly desirable to locate this facility close to the launch site as it is not scientifically feasible to perform the required operations at any great distance from the launch site. Preflight conditioning requires specimens to be as stabilized and quiescent as possible before lift-off. Hangar "L" at CCAFS (adjacent to KSC) was selected for this facility because it is available for use and close to the launch pad. Studies have indicated that the required modifications to this facility will be most cost effective when compared to those required for other candidate facilities. The Life Sciences Support Facility is required in FY 1980 in order to allow sufficient construction and activation time to meet a required facility Operational Readiness Date (ORD) of July 1981. This requirement is based upon the need for specimen delivery to Kennedy Space Center at least one month prior to the first dedicated Life Sciences mission, currently scheduled for late fall 1981.

IMPACT OF DELAY:

The Level IV integration of payloads into the Spacelab hardware can be accomplished at other NASA Centers than KSC, but at a definite higher cost penalty. To operate in this mode is very expensive, due to the need to ship Spacelab flight hardware to and from the launch site and the duplication of equipment and facilities. In order to accomplish modifications to the O&C Building prior to major Spacelab operations, and thus minimize the impact of construction on these critical operations, these modifications are required in FY 1980. Payload operations in the VPF will be adversely affected if these respective modifications are not made. Without the crane modification requested for the Vertical Processing Facility, the twin and twin + spinner stage **IUS** vehicles will have to be handled by complicated and risky workarounds which could impact schedule and jeopardize the important Galileo mission. Life Science requirements in previous programs were not as extensive as those planned for the Space Shuttle era and were handled in temporary facilities. If this project is not provided, the extensive Life Science program planned for the Shuttle era will have to operate in temporary, inadequate facilities, resulting in the degradation of the extent and quality of the Life Sciences experiments and incur additional operating cost.

PROJECT DESCRIPTION:

Prior work (FY 1977) in the O&C Building provided for modifying the high and low bay areas by removing Apollo era equipment, and constructing and installing assembly and checkout workstands. Mechanical and electrical systems were modified and extended to new interfaces with the Spacelab workstands, and control rooms were refurbished. The O&C Building will be modified for Level IV "hands on" payload integration by providing power, grounding, fluids, gases, raised flooring and fire protection. Minor architectural modifications will be performed to provide increased laboratory and control room capabilities (Figure 2).

Modifications in the Vertical Processing Facility continue work begun with FY 1978 resources to accommodate vertical payload processing. The FY 1978 resources provided for two assembly, test, and checkout stands with vertical payload handling devices. Each workstand has a series of fixed and moveable platforms that allow access to critical areas of the many different vertical payloads to be processed through the VPF. The entrance door to the the VPF has been modified, and electrical, pneumatic, mechanical and support services have been provided to the workstands. This FY 1980 request provides a 35-ton bridge crane to replace the existing 25-ton unit in order to lift the heavy twin and twin + spinner stage **IUS** vehicles now planned for processing. Studies show that the existing crane rails are of sufficient size to support the 35-ton crane. The present 25-ton crane will be removed, and the larger crane will be installed and checked out between missions in CY 1981.

The third element of this project provides for the modification of the Missile Assembly Building No. 01732 (Hangar "L") at CCAFS to provide a Life Sciences Support Facility. This facility will be used for Life Sciences payload operations, including specimen receipt, holding, conditioning, and experimentation, and payload integration preparation. It will also provide Principal Investigator support with offices, labs, and equipment. This project will provide resources for modifying the interior of Hangar "L" (as shown in Figures 3, 4 and 5) by rearranging walls, partitions, and ceilings. Those areas to be modified as animal holding rooms will be provided with non-porous washable surfaces. Other existing areas will be modified into laboratories, experiment areas, offices, and a conference room. The mechanical systems that support these areas must also be modified to support the new arrangement of functions. The heating, ventilating and air-conditioning systems are to be rehabilitated and modified to provide closely controlled environments in the various specialized areas. The interior water distribution and compressed air systems must also be modified. An emergency power system consisting of a 480-volt generator and switch gear will be installed. The electrical distribution system is to be modified to also serve the new functional areas of the buildings. Upgraded lighting is required in critical locations and will be provided by the use of energy-efficient fluorescent fixtures. Local switches and timers will also be provided to optimize energy use. Facility equipment such as laboratory benches, environmental chambers, an incinerator, cage washer, and autoclaves will be provided and installed as part of this project.

PROJECT COST ESTIMATE:

The bases of this cost estimate are Preliminary Engineering Reports.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition.	---	---	---	---
Construction	---	---	---	2,610,000
Modify O&C building	---	---	---	390,000
Architectural/structural	LS	---	---	(130,000)
Mechanical systems	LS	---	---	(260,000)
Modify vertical processing facility	---	---	---	510,000
35-Ton Bridge Crane (VPF)	LS	EA	---	(610,000)
Modify Hangar "L".	LS	---	---	1,610,000
Architectural/structural	LS	---	---	(473,000)
Mechanical systems	LS	---	---	(312,000)
Electrical systems	LS	---	---	(435,000)
Life science support equipment	LS	---	---	(390,000)
Fallout Shelter (not feasible)	---	---	---	---
Total				2,610,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Pictorial of O&C
Figure 3 - Ground Floor Plan, Life Science Support Facility (LSSF)
Figure 4 - Second Floor Plan (LSSF)
Figure 5 - Elevation and Cross Section (LSSF)

OTHER EQUIPMENT SUMMARY:

Centain non-collateral equipment. to be funded from R&D resources, and estimated to cost $3-4 million, will be required to support initial operations.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Additional funding for basic plant and equipment is not snticipated. However, future modification work may be necessary to satisfy unique future programmatic needs.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR *1980* ESTIMATES
REHABILITATION AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS

PICTORIAL VIEW - O&C BUILDING

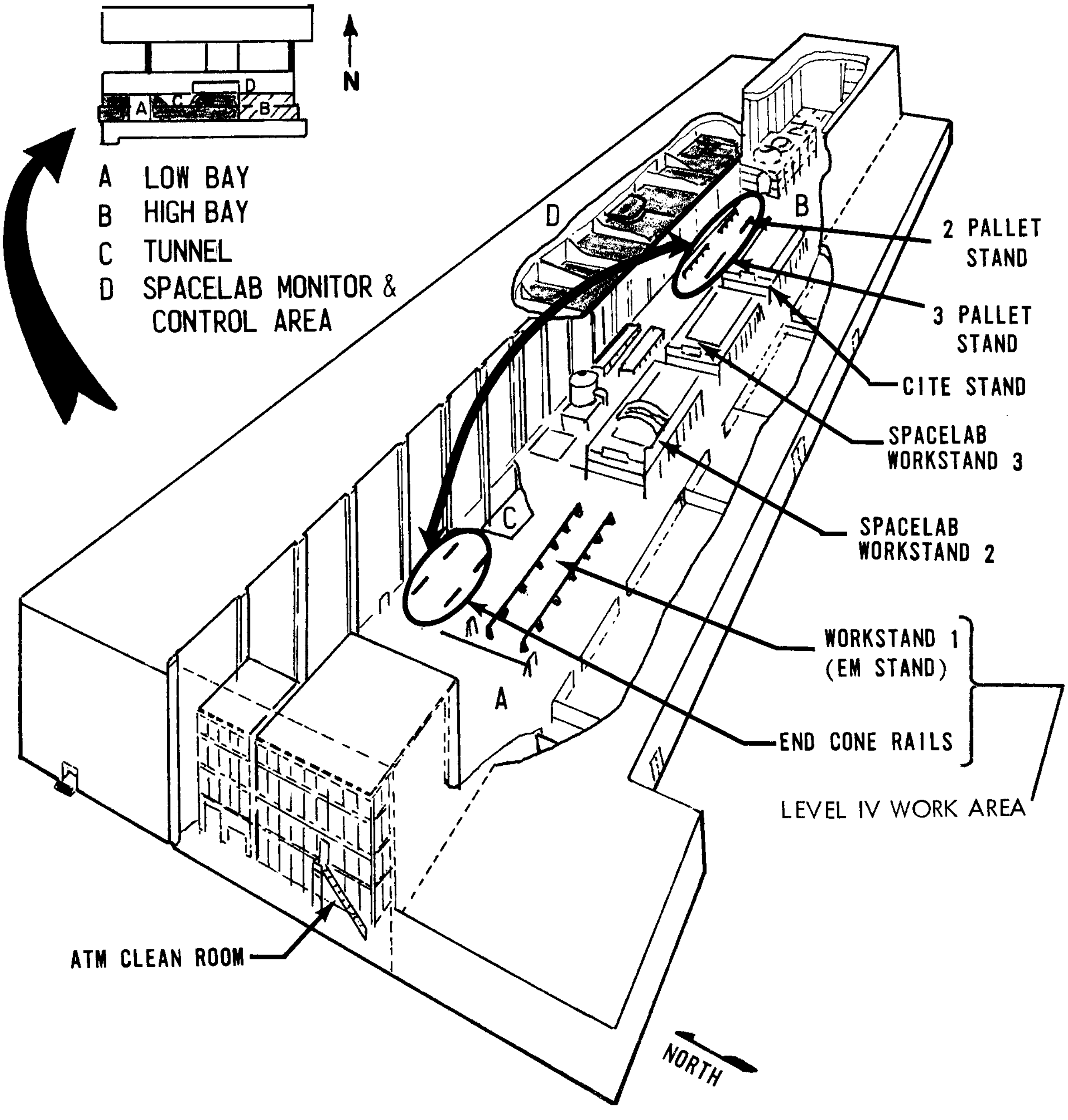


FIGURE 2

JOHN F. KENNEDY SPACE CEMER
FISCAL YEAR 1980 ESTIMATES
REHABIL TAT ON AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS

GROUND FLOOR PLAN

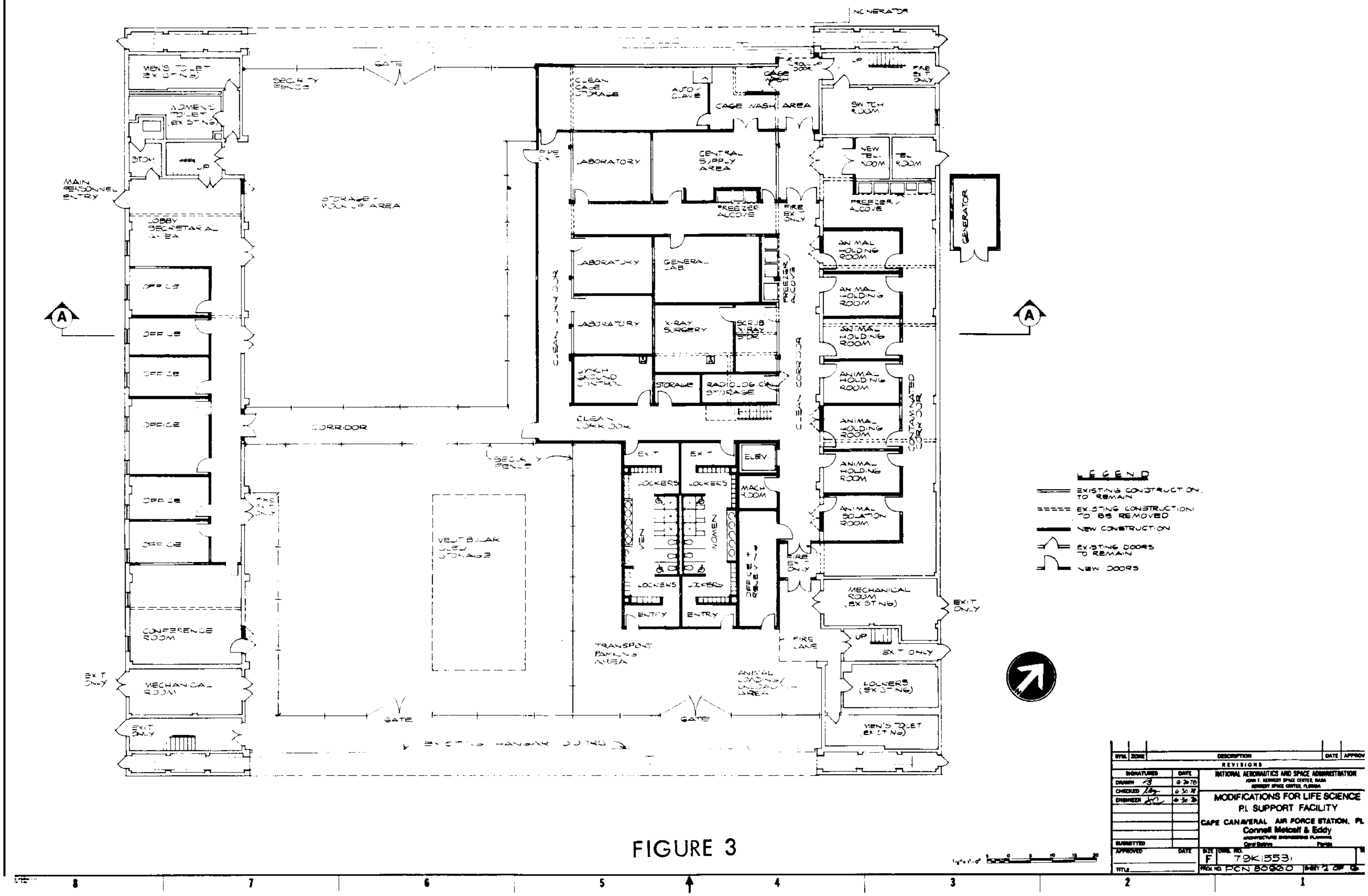


FIGURE 3

JOHN F. KENNEDY SPACE CENTER

FISCAL YEAR 1980 ESTIMATES

REHABILITATION AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS

SECOND FLOOR PLAN

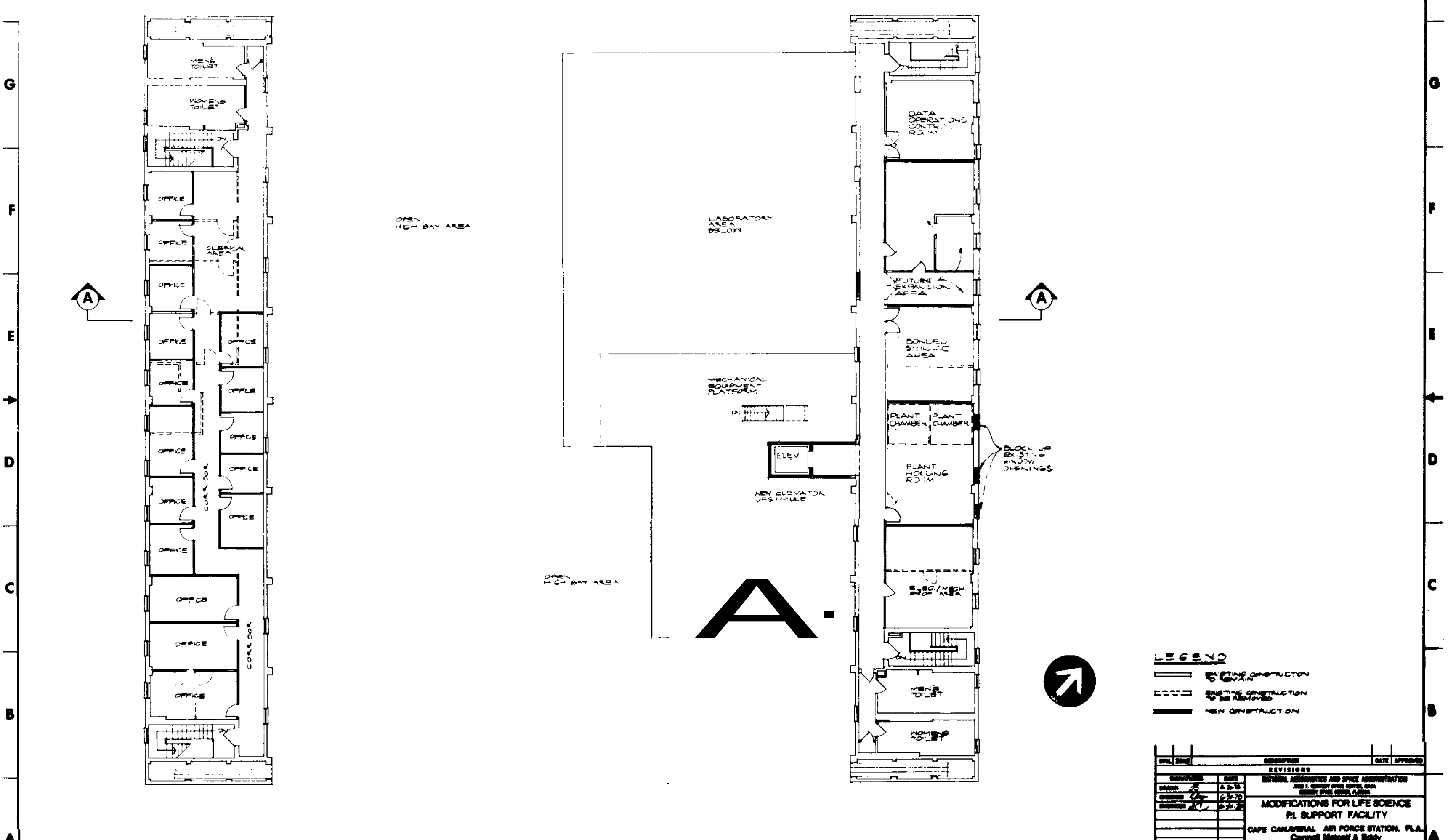


FIGURE 4

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
REHABILITATION AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS

ELEVATION AND CROSS SECTION

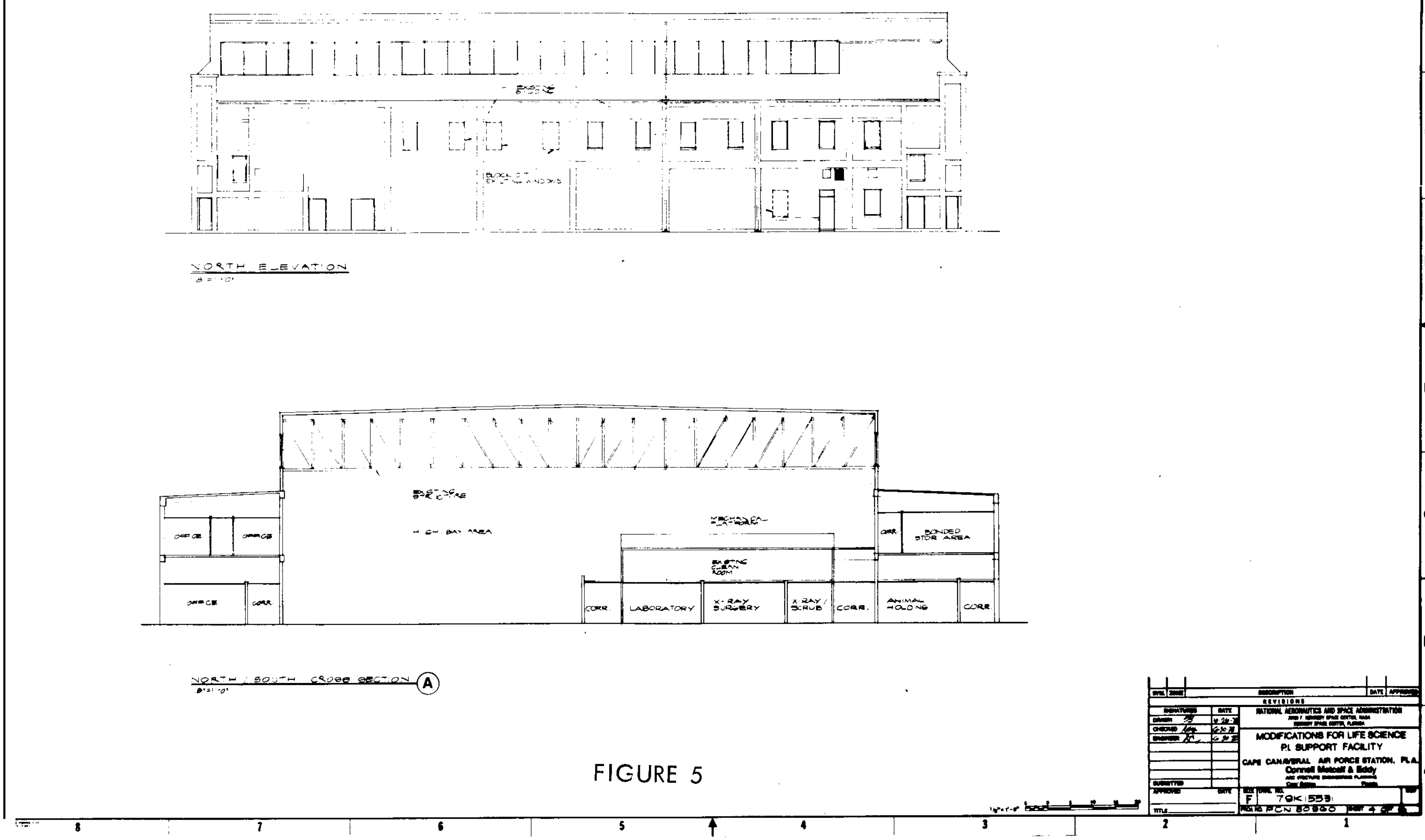


FIGURE 5

AMES RESEARCH CENTER

FISCAL **YEAR** 1980 ESTIMATES

MODIFICATION OF AND ADDITION TO MATERIALS SCIENCES LABORATORY (N-240)

LOCATION PLAN

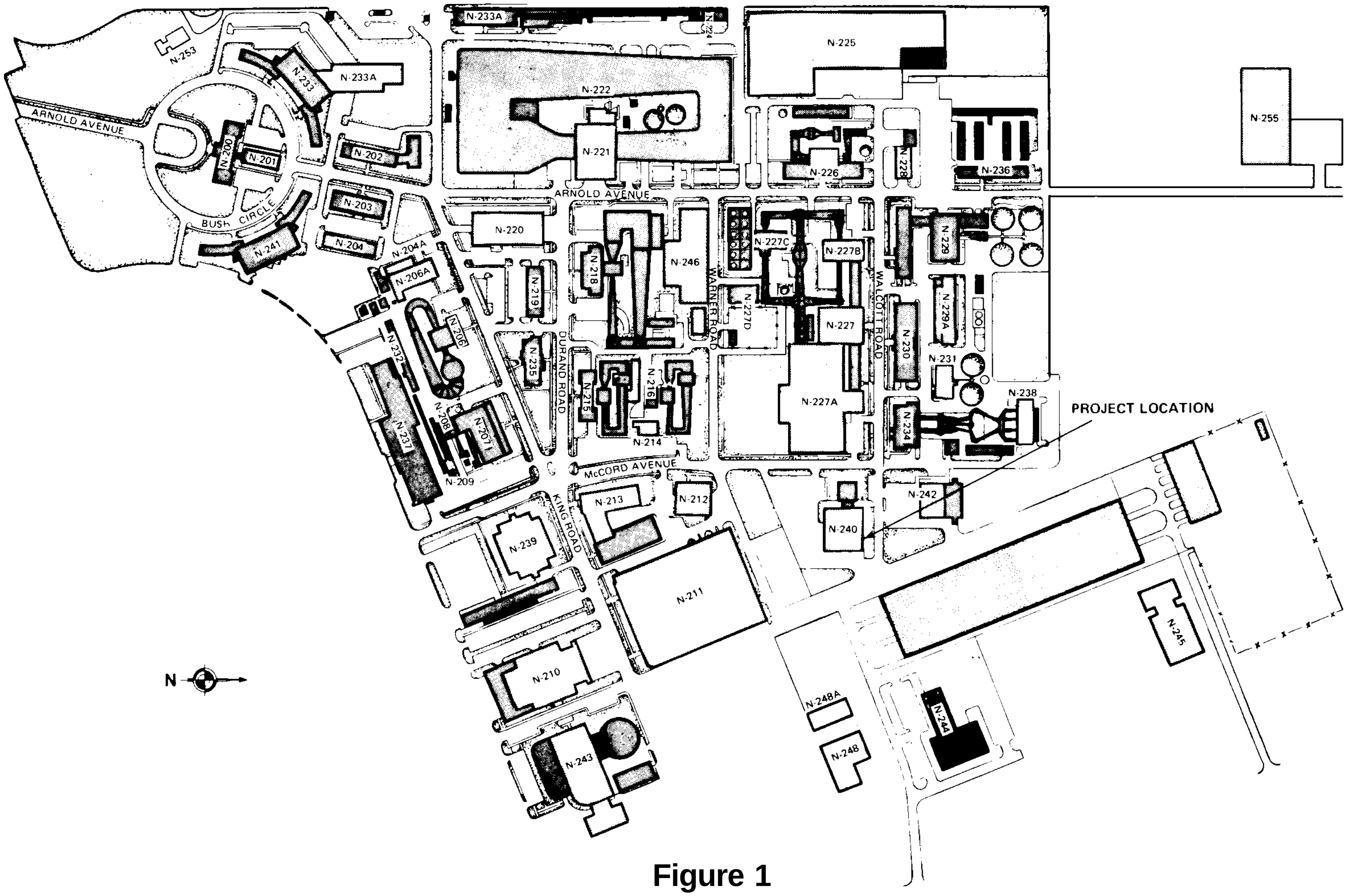


Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modification of and Addition to Materials Sciences Laboratorv (N-240)

INSTALLATION: Ames Research Center

FY 1980 CoF ESTIMATE: $1,640,000

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

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	130,000	---	130,000
Capitalized investment	N/A	2,188,946	2,188,946
Total	130,000	2,188,946	2,318,946

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a 11,600 gross square foot (1,077 square meter) two-story addition to the east side of the Materials Sciences Laboratory, Building N-240, and modification of 16,000 gross square feet (1,486 square meters) of existing high bay and laboratory (Figure 1). The combined space will be used to support the Life Sciences Flight Experiments and Vestibular Function Research Programs. The facility will house research equipment and personnel in support of the development of animal, plant and tissue experiments for the Spacelab Life Sciences program. The building will contain laboratories equipped for research and flight experiment development. Specific programs to be supported are biological and plant physiology, biochemistry, microbiology, and radiobiology. Associated personnel and general laboratory space will be provided for spaceflight related Life Sciences activities.

PROJECT JUSTIFICATION:

NASA planning for the execution of Spacelab experimentation, envisions a multi-Center involvement in the development and integration of human, plant and animal experiments. Ames Research Center (ARC) has been assigned the lead role in the development of the plant and animal experiments for Spacelab. The first dedicated Life Sciences laboratory is scheduled to be launched in late 1981 and involves at least 15-30 biological investigations. The responsibility assigned to ARC for the Life Sciences Spacelab missions requires that a unique facility be developed at the Center to accommodate the activities required to fulfill its role over the coming years. These activities include:

- Receipt, inspection, checkout and utilization of ground support equipment (GSE) and flight equipment.
- Receipt and maintenance of biological specimeps and transportation to other life sciences centers.
- Development and checkout of spaceflight hardware and software.
- Definition of the data requirements for experiments and implementation of a data management plan.
- Preliminary training of principal investigators (P.I.'s), payload specialists and mission specialists in experimental operation procedures.
- Technical assistance to P.I.'s in preparing biological specimens for preflight, flight and post-flight tests and analyses.
- Packaging and shipping developed and checked out experiments to other NASA Centers for final stages of integration.
- Flight support for testing of experiment31 controls.
- Post-flight support for control experiments, data reduction and reporting.

The activities performed in this facility require a close interaction among ARC's management staff, engineers, support contractors, P.I.'s, and related groups at other NASA Centers. This will involve 45-48 people rotating through the facility. The new facility must provide accommodations for the personnel involved in the coordination and management of experiments as well as those directly involved in the experiments.

Participation in the first dedicated Life Sciences laboratory requires additional office space, and a physical area in which to carry out the development and management activities. Technical space is required in the facility for flight experiment build-up, test and check-out areas, as well as supporting laboratory, control room, live specimen processing, and office areas. General laboratory space is required for spaceflight related Life Sciences activities such as:

- Development and testing of biological life support hardware and new methods of feeding, watering, waste removal, and air revitalization.

- Development of advanced animal bioinstrumentation and telemetry systems.

- Determination of the tolerance of biological systems to the various environmental parameters of spaceflight (e.g., noise, vibration, confinement, etc.).

IMPACT OF DELAY:

This facility is required to meet the launch date of the first dedicated Life Sciences Spacelab mission, SL5, scheduled for 1981. Construction in FY 1980 is necessary for construction, equipment installation, personnel training and systems check-out before the facility is operational. An additional one year lead time, prior to launch, is also required for the preparation of the experiments for Spacelab. This project is directly tied to the first dedicated Life Sciences launch and delay would jeopardize the program. This facility, as configured, will support future Life Sciences programs on Spacelab at a maximum of one dedicated launch per year. Consequently, future missions are contingent upon this facility project.

PROJECT DESCRIPTION:

This project consists of a new two-story addition to the east side of Building N-240, and complete modification of functions in the east half of Building N-240 (Figure 2). The new addition will be 11,600 gross square feet (1,077 square meters) with a steel frame structure and precast concrete "tilt-up" exterior walls treated to match the existing building.

The first floor of the addition will house the live specimen area and will include a delivery dock, holding rooms, minor surgical area, and general utility space. Floors, walls and ceilings in these areas will be nonporous surfaces with a washable finish. The balance of the first floor will contain offices, laboratories related to the high bay area, locker rooms, and toilet facilities. A hydraulic elevator will be included to carry equipment supplies to the second floor. A new entrance will be provided to accommodate personnel and visitors associated with the facility. Three stairways, one of which will lead to the roof, will be provided to accommodate internal circulation and to comply with Life Safety Code requirements. The second floor will include office space, conference room, and toilet facilities.

The modification of 16,000 square feet (1,486 square meters) of high bay and laboratory area in Building N-240 will provide space for experiment development, integration, check, laboratory functions, storage, shipping, and receiving. The accelerator vault will be modified for an electronic laboratory, shop and bonded stores. A new corridor through the existing testing area west of the high bay will afford circulation among areas not related to this project. A portion of the mechanical room will be modified for a test control computer room with a raised floor system.

PROJECT COST ESTIMATE:

The cost estimate for this project is based on a completed Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition..	---	---	---	---
Construction......	---	---	---	1,640,000
Addition to Building N-240	---	---	---	1,240,000
Site preparation	LS	---	---	(190,000)
Architectural.	SF	11,600	25.45	(295,000)
Structural......	SF	11,600	32.75	(380,000)
Mechanical...	SF	11,600	25.85	(300,000)
Electrical	SF	11,600	6.45	(75,000)
Modification to Building N-240	---	---	---	400,000
Architectural	SF	16,000	8.10	(130,000)
Structural	SF	16,000	2.20	(35,000)
Mechanical..	SF	16,000	5.60	(90,000)
Electrical	SF	16,000	9.05	(145,000)
Fallout Shelter (not feasible)	---	---	---	---
Total..				1.640.000

LIST OF RELATED GRAPHICS:

Figure I - Location Plan
Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY:

Associated with this project is approximately $1.8 million of research and development equipment. This is needed to make this facility complete.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no presently known future requirements to complete this project.

AMES RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATION OF AND ADDITION TO MATERIAL SCIENCES LABORATORY (N-240)

SITE PLAN

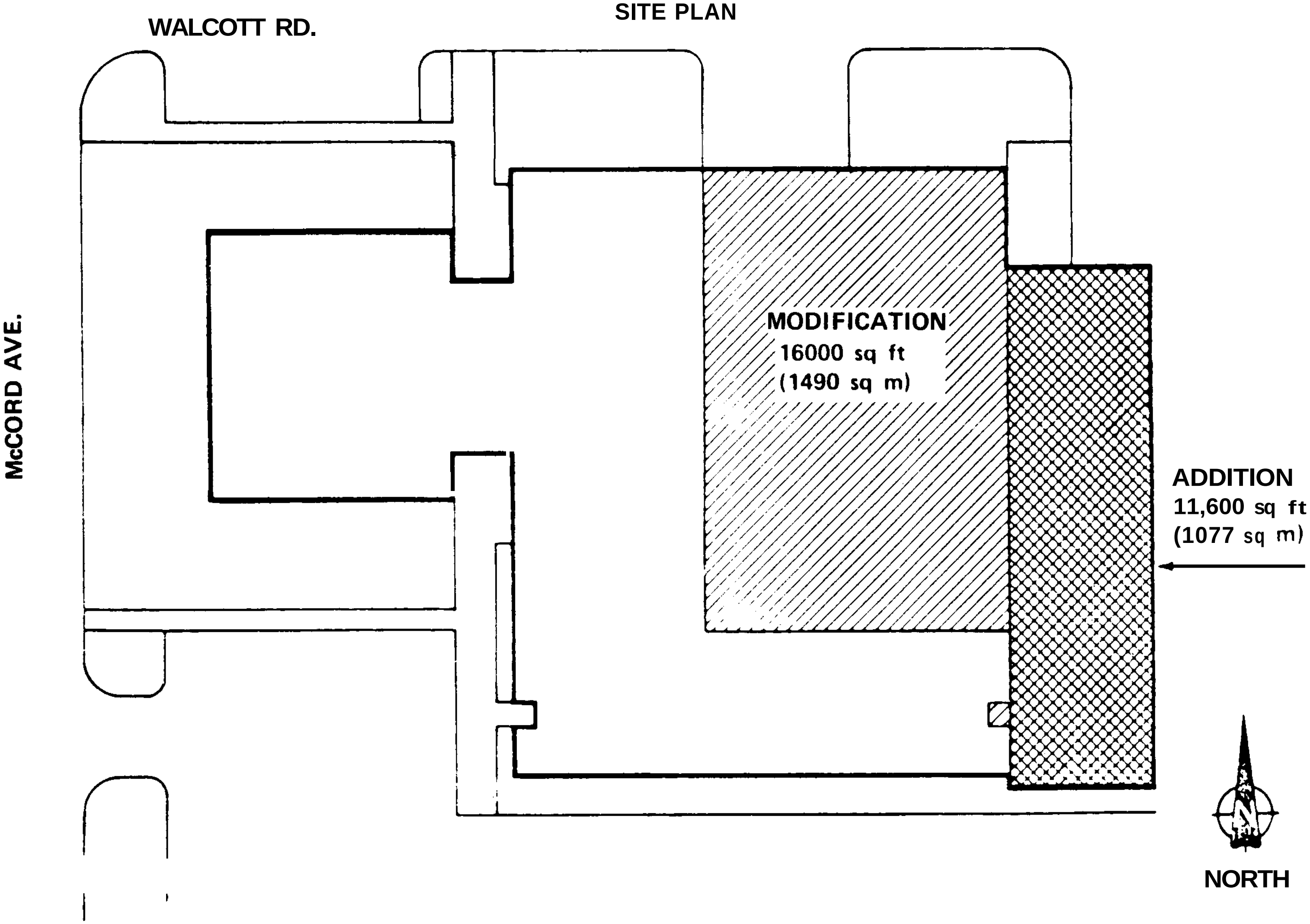


Figure 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

REPAIR

	Amount (In dollars)	Page No.
Summary of Project Amounts by Location:		
Ames Research Center	1.280.000	CF 12-4
Goddard Space Flight Center	595.000	CF 12-5
Jet Propulsion Laboratory	850.000	CF 12-6
Johnson Space Center	910.000	CF 12-8
Kennedy Space Center	185.000	CF 12-10
Langley Research Center	1.470.000	CF 12-10
Lewis Research Center	830.000	CF 12-11
Marshall Space Flight Center	1.305.000	CF 12-13
Michoud Assembly Facility	990.000	CF 12-15
National Space Technology Laboratories	1.035.000	CF 12-16
Wallops Flight Center	1.200.000	CF 12-17
Miscellaneous Projects less than $150.000 each	1.350.000	CF 12-19
Total	12.000.000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE:	Repair of Facilities not in Excess of $500,000 Per Project
INSTALLATION:	Various Locations
	FY 1980 CoF ESTIMATE: $12,000,000
FY 1978: None	FY 1979: None

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller

SUMMARY PURPOSE AND SCOPE:

This is a new project for inclusion in the Construction of Facilities (CoF) program.

This program is to provide for the larger, more basic and essential repairs to facilities at NASA field installations and Government-owned industrial plants engaged in NASA activities. Included in this project are those Priority repair facility needs for FY 1980 that can be foreseen at the time of the submission of these estimates, and that are estimated not to exceed $500,000 per project. The thrust of this program is to provide a means to restore appropriate facilities or components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. It includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown and consideration of associated obsolesence. The extent and nature of this work also includes major preventive measures which are normally accomplished on a cyclic schedule of greater than one year. Each of the individual items contained in this year's request for facility repair work is in itself a proper facility project. Each represents the consistent application of the approved and accepted definition of a facility project and, in this context, each includes all of the facility work that needs to be done in the budget time frame, or all of the facility work that can be done in that time frame, as limited by constraints other than availability of resources. Each individual item has been evaluated against applicable need dates, time lines and the ability to place the planned work under contract in the budget time frame.

The $12,000,000 request for FY 1980 is for those projects that are required in direct support of critical programmatic and institutional requirements.

PROJECT JUSTIFICATION:

In prior years it had been the objective to accommodate the larger repair projects within the Rehabilitation and Modification project line. This had been done by an administrative determination that required repair projects in excess of $100,000 to be managed as Rehabilitation and Modification projects. This had been working reasonably well until the past year or two when there appeared to be a surge of repair work. Examination of this indicated that this surge was directly related to the fact that a major portion of our building inventory is in the 15 + year old bracket and increases in repair requirements were to be normally expected. In fact, there are statistical bases to this evaluation that prove that 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 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. This condition is now being realized at locations such as Goddard Space Flight Center (GSFC) and Johnson Space Center (JSC). These more specific points, when coupled with the sheer age of other portions of the plant, such as at Langley Research Center (LaRC) and Lewis Research Center (LeRC), demand a more positive approach to the needs of repairs which are urgent and vital. Some 75 percent of our physical plant is in the 16- to 30-year old bracket.

As a consequence, a new budget line item is included in this year's CoF budget estimates. This program will achieve many objectives:

a. Provide the matter of repair an appropriate and badly needed better focus.

b. Permit central management and oversight, and thus better address priorities and changing conditions.

c. Allow R&PM facility services budget estimates to address timely recurrent annual costs and avoid periodic peaks for large cyclic preventive work.

This is all within the major thrust of preservation of the existing physical plant which, at its $6.0 billion initial cost, represents approximately $13.5 to 14.0 billion in 1979 dollars. It is recognized that, as such, repair is closely related to rehabilitation/modification. However, it is intended that the major distinction between these classes of work be 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 properly classed as "repair."

An analysis of each of the projects which follows indicates that this is the type of work which, in a prudent business-like way, must be addressed and progressively accomplished. Unless this is done, resultant risks are increased, and future costs of the specific work will be greater. More importantly, there will be increased "unscheduled breakdowns", impacting missions, and costly situations of "Emergency Patch and Repair" which will be required to make our facilities as useful as possible.

This project includes only facility repair work having an estimated cost not in excess of $500,000. The work covered in this project 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. Each repair project estimated to cost more than $500,000 is reflected as a separate major CoF line item project. Not included in this project are the other minor facility projects; Rehabilitation and Modification, and Minor Construction facilities projects required in FY 1980. Provisions for of these requirements are made under separate projects which are also included in these CoF estimates.

PROJECT DESCRIPTION:

Proposed repair items for FY 1980 are outlined under "PROJECT COST ESTIMATE"; they total $42,000,000. Deferral of this work would create high risks and consequences. These would impact program schedules and critical institutional facilities requirements in support of Agency mission goals and objectives.

Of the total projects listed, $10,650,000 represents discrete work packages at designated NASA installations. The remaining $1,350,000 relates to those smaller repair projects estimated to cost $150,000 or less, the nature and purpose of which are the same as for that work specifically delineated but which, because of their individual smaller sizes, are not listed by item. At this time, the items in this total package are considered to be of higher priority. They have been carefully selected from lists totalling about $25 million. This FY 1980 listing thus represents a modest increment in relation to the existing total backlog of this type of work for which provisions must be made over the next several years.

As indicated above, the projects in this request are considered to be of the highest present priority on the basis of relative urgency and expected return on the investment involved. It is recognized, however, that during the course of the year some rearrangement of priorities may be necessary. It is also realistic to assume that a change in some of the items to be accomplished within the allocated resources may be required. For the purpose of justifying this estimated facilities repair requirement, a tentative listing of projects is set forth under "PROJECT COST ESTIMATE." They will be accomplished on a priority basis. The total of $10,650,000 for separate projects relates to the following broad categories of facilities:

a.	Utility Distribution Systems	3,015,000
b.	Buildings and Structures	4,435,000
c.	Roads and Grounds	1,165,000
d.	Equipment	2,035,000

The additional lump sum estimate of $1,350,000 for smaller projects thus provides a total of $12,000,000 for this program.

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC) 1.280.000

1. Repair of Variable Frequency Power Systems 440,000

This project provides for the replacement of obsolete switchgear, circuit breakers, controls, central equipment of four motor generator sets, and the two associated 6.9 kv feeders which make up the ARC variable frequency power system. This equipment has been in continuous operation without a shutdown for major repairs since its installation in 1945. Most of the equipment is no longer manufactured and equipment which is manufactured has become more difficult to acquire. Numerous delays in the operation of the tunnel have occurred because of problems with deformed shafts, link pins and electrical contacts. This facility had four failures in a six-month time span (January-June 1978) impacting the operation of the major facilities that utilize this power. Failure to replace this equipment will result in more unscheduled shutdowns. This system supports work performed in the 2x2-Foot Wind Tunnel, Building N-227; 20g Centrifuge Building, Building N-221A; and the 40x80-Foot Wind Tunnel, Building N-221.

2. Repair of Electrical Drive Equipment 310,000

This project provides for the overhaul and rewinding of the motors and generators associated with the 7x10-Foot Wind Tunnel, Building N-216, drive system. This work includes the replacement of obsolete switchgear, circuit breakers, controls, and the overhaul of auxiliary support motors and generators located in the Thermal Protection Laboratory, Building N-234, and the Arc Jet Facility, Building N-238. Most of the equipment has been in operation for 30 years without major maintenance or overhaul. Many of the parts are not available for the switchgear and circuit breakers. As a result of the unavailability of the equipment, many parts are specially fabricated thus costing more than new parts. This equipment has become unreliable with a high risk of failure. In the event of failure, the operation of associated facilities (3.5-Foot Wind Tunnel and Air Jet Facility) also will be severely affected.

3. Repair of Building Exteriors, Various Buildings 165,000

This project provides for the repair of the siding to Buildings N-206, N-206A, N-207, N-211, N-229, N-230, N-231, N-234, N-235, and N-236. This involves waterproofing concrete surfaces of the buildings and sandblasting and painting of two metal buildings. In addition, the windows and screen replacements will be recaulked. These buildings are an average of 22 years old and in need of repair. During heavy rains, the concrete buildings leak causing water damage to the interior of the buildings. Rust and corrosion have seriously deteriorated the exterior surfaces of the metal buildings.

4. Repair of the Steam Vacuum System, Building N-234A 365,000

This project provides for the repair of the internal surfaces of the Steam Vacuum System. This work will include the cleaning, rebuilding and epoxy coating of the piping and replacement of the turning vanes and nozzle .assemblies. In addition the existing cooling water tank has a moveable wooden baffle which is damaged and does not effectively separate the cold and hot water. The wooden baffle will be replaced with new diffuser type piping. The repair of this system will reduce the steam losses due to leaks and increase the efficiency of the system. If this deterioration is allowed to continue, the facility could be damaged beyond economic repair.

B. Goddard Soace Flinht Center (GSFC) 595,000

1. Repair of Elevators, Buildings 14 and 23 200,000

This project provides for the repair of two hydraulic elevators, one in the Spacecraft Operations Facility, Building 14, and the second in the Data Interpretation Laboratory, Building 23. This repair work includes the cabs, related equipment, and all worn parts. The elevator in Building 14 was installed when the building was constructed in 1964, and the one in Building 23 during construction in 1965. These elevators have been in constant use since then for transporting both personnel and heavy equipment in support of spacecraft programs and data reduction. The downtime of these elevators is now excessive due to their age and the difficulty in obtaining parts for the outdated equipment. This equipment must be repaired at this time to increase the reliability to an acceptable level required by the programmatic computer and data reduction operations being conducted in these buildings. The delay in providing for this repair will result in the continuation of the present unsatisfactory conditions, increased downtime and maintenance cost, more expensive cost in the future, and inadequate support of operational spacecraft programs.

2. Repair of Roofs, Instrument Construction and Installation Laboratory, Building 5, Business Operations Building, Building 18, and Meteorological Systems Development Laboratory, Building 21 395,000

This project involves the repair of approximately 145,000 square feet (13,470 square meters) of roof surfaces of Buildings 5, 18, and 21 at GSFC. This work includes the removal of the deteriorated roofing material and insulation, and the installation of new material. This work also includes the repair of the flashing, exterior siding, masonry work, and the roof drainage where necessary. A moisture invasion and leak locating survey was conducted of 750,000 square feet (69,675 square meters) of built up roofing serving the GSFC facilities. This survey revealed chronic cracking of roofing felts, severe edge and drain flashing failure, and blisters on the roofing of these buildings. These roofs have further deteriorated since the survey and now require extensive repair work to restore them to acceptable conditions. Roof deterioration due to normal aging and necessary roof traffic has resulted in an increasing frequency of roof leaks. This condition has resulted in extensive maintenance costs and threatens scientific and building equipment and related programmatic test operations being conducted in these buildings. For these reasons, Buildings 5, 18, and 21 were selected as the most urgent need for roof repair. The remaining buildings surveyed have been repaired or are in a more favorable condition and major roofing repairs can be deferred.

C. Jet Propulsion Laboratory (JPL) 850,000

1. Repair to Exteriors of Various Buildings .... :.................... 400,000

This project provides for the repair, protection and exterior sealing of four buildings. The work involves the exterior painting of approximately 130,300 square feet (12,100 square meters) of surface. The areas include the Space Science Instrument Systems Laboratory, Building 168, at 36,600 square feet (3,400 square meters); the Engineering Office Building 169 at 33,700 square feet (3,100 square meters); the Physical Science Laboratory Building 183, at 40,500 square feet (3,800 square meters); and the Procurement Office

Building 190, at 19,500 square feet (1,800 square meters). Also included is the caulking of 55,700 linear feet (17,000 meters) of curtain wall joints in all four buildings and the epoxy pressure grouting of 4,400 linear feet (1,300 meters) of cracks in the concrete structure of Building 168 at 2,100 linear feet (600 meters), and Building 169 at 2,300 linear feet (700 meters). This work, which supplements the roof repairs done several years ago, will complete the sealing and waterproofing of the exterior surfaces of these four major structures at JPL. The exterior painting and sealing of the minor structure cracks of these buildings has not been done since the 1967-1969 period. The present paint is long overdue for recoating, repairing and applicable procedures to bring it up to a quality surface. In particular, attention must be paid to the curtain wall construction of these buildings which, over the years, tends to deteriorate and, with dried out caulking, induces cracks that permit the entrance of rain water at numerous locations. This, in turn, accelerated rusting and structural and wall/column deterioration. This work is basic to the long term preservation of these facilities.

2. Repair to Roofs on Various Buildings.. 220,000

This project provides for the repair, replacement and modification to the roofs of four buildings. Replacement of roofing is proposed for 12,400 square feet (1,200 square meters) of the 25-foot Space Simulator, Building 150; 4,100 square feet (400 square meters) for the west portion of the Engineering/Mechanics Building 157; and 3,400 square feet (300 square meters) of the penthouse area of the Telecommunications Building 238. Some 10,200 square feet (900 square meters) of the Materials Research Processing Laboratory, Building 158, will have a new roof installed along with demolition of abandoned cooling towers thereon, replacement of parapet caps and resloping of the roof for proper drainage and raising of the air handler equipment thereon. The roofs of these four buildings, in the areas specified, are in extremely poor condition. The recent winter rainstorms caused numerous leaks that penetrated the interior of the buildings to the extent that water had to be mopped up in Building 158. Also, leakage was evident in the other buildings. This specific work is essential now and of sufficient urgency that it must be included in this request at this time. It is felt that further deterioration of the roofs would provide an untenable situation for the tenants on the upper floors of these buildings and compound the deterioration of these facilities.

3. Repair of Roads, Table Mountain, California.... 230,000

This project provides for the repair of approximately 140,000 square feet (13,000 square meters) of badly damaged roads and the rerouting of approximately 7,000 square feet (650 square meters) of existing road at Table Mountain, California. The Table Mountain Facility is a government-owned site which is used to support JPL programs through astronomical observations/research, and for the development and testing of solar power devices for spacecraft applications. The roads within the main complex all require the removal of existing paving, removal of all wet base material and replacing it with suitable material, compaction of new base, and the installation of a new 3-inch (7.6-centimeters) asphaltic concrete surface with a seal coat. The road to the Users' Area will need a slurry coat on existing surface only. A portion of the existing boundary road will be rerouted through the complex. A recent inspection of the road conditions at Table Mountain disclosed that, in all cases, the roads showed excessive cracking and breaking due to unstable base material. These roads require this repair in order to place them in a more safe and satisfactory condition. The area of Table Mountain is subjected to extremes in climate from very hot to very cold and from very wet to very dry, and general maintenance would not be adequate to repair them to an acceptable condition.

D. Johnson Space Center (JSC) 910,000

1. Repair of Steam, Chilled Water, and Compressed Air Systems, Building 24 Complex 200,000

This project addresses a long-range requirement for the repair of various components of JSC's primary utilities generation and transmission systems located in the Central Heating and Cooling Plant, Building 24, and associated utility tunnels and cooling towers. The work includes repair of three central utility air compressors, heat exchangers, controls, a water pump, and cooling water piping in the compressed air generation system of Building 24. The work also includes replacement of approximately 10 expansion joints with loops, repair or replacement of 10 valves, and repair of pipe insulation in the steam and condensate lines located in the utility tunnel system. Work on the chilled water system includes repair or replacement of 10 chilled water and condenser water valves in the utility tunnel system, and replacement of insulation on one chiller evaporator and economizer located in Building 24. The project also includes repair of four 200-horsepower condenser water pumps located at the cooling tower. Though there have been no breakdowns or outward signs of trouble, this is the time when these components have reached their normal life expectancy based on experience and manufacturers' recommendations. This work is beyond the scope and capability of the annual maintenance program. The purpose of this project is to maintain the reliability, efficiency, and safety requirements of the installation's basic utility systems that are generated and distributed from the Central Heating and Cooling Plant. These systems are essential ingredients of the Center's energy conservation program and must be maintained in optimum operating condition.

2. Repair of Roofs, Various Buildings 250,000

This project addresses a long-range requirement to progressively repair the roofs of buildings at the Johnson Space Center. This project provides for roof work on Buildings 9, 351, 352, 353, 354 and 380. The work will consist of removing and replacing roofing material, resealing and caulking perimeter flashing and flashing at roof penetrations, and replacement of roof insulation board as required. Moisture relief vents will be provided where excessive moisture collects. A total of approximately 46,800 square feet (4,348 square meters) of built-up roofing and approximately 1,163 linear feet (354 meters) of neoprene flashing will be replaced on Buildings 9 (Technical Services Facility) and 380 (Hazardous Material Storage Facility). A total of approximately 19,300 square feet (1,793 square meters) of acid resistant elastomeric sheeting and approximately 1,263 linear feet (385 meters) of neoprene flashing will be replaced on Buildings 351, 352, 353 and 354, in the Thermochemical Test Area. Work on Building 380 includes the addition of alight-weight concrete fill on the roof slab and installation of a built-up roof. This project is essential to the continued operation of these JSC facilities. Over the past 12 years, the normal aging process together with various building modifications affecting the roofs and the presence of numerous roof penetrations have combined to significantly reduce the integrity of the roofs. Weathering, blistering, and flashing failures have resulted in numerous leaks and moisture penetrations. This project is needed to preclude damage to the building structures, as well as damage to interior ceiling panels, electrical panels, and sensitive equipment and electronics.

3. Repair of the Electrical Distribution System.. 230,000

This project addresses a long-range requirement to replace deteriorated feeder cables in the Center's electrical distribution system. The work includes replacing approximately 19,050 linear feet (5,806 meters) of existing 15-KV, 400 mcm, underground cable, extending from the substation to the utility tunnel, identified as feeders 1-8, 2-6, 2-7; the cable from the substation to Building 222 (feeder 3-1); and the cable from the substation to Buildings 32 and 36 identified as feeder 2-12. The existing cable in the Center's electrical distribution system has been in continuous service for the past 12 years, during which time a large amount of unscheduled maintenance has been required. Past faults have been repaired as they have occurred, but these repairs have not been of the magnitude to prevent future failures of a potentially extensive nature. The defective condition of the cable, at this stage, indicates that replacement is now required to assure the desired degree of reliability of power to the Center's facilities to avoid any major program impacts.

4. Repair of Roofs, NASA Industrial Plant, Downey, California............................ 230,000

This project provides for the repair of roofs of Buildings 001 and 290 at the NASA Industrial Plant, Downey, California. The work includes the repair/replacement of 29,000 square feet (26,941 square meters) of roofing, with associated flashings and drains on Buildings 001 and 290. These buildings house important functions that support the Shuttle manufacturing program. By 1980, the roof of Building 001 will be 18 years old, and the roof on Building 290 will be 17 years old. Both roofs are in a badly deteriorated condition. The roofs on both buildings have a history of numerous leaks and have required extensive maintenance over the years. Delay in reroofing beyond 1980 could cause damage to building structure, roof insulation, ceilings, walls, and floors, as well as costly test equipment and flight-type hardware.

E. Kennedv Space Center (KSC) 185.000

1. Repair Roofs, Flight Crew Support Building (M7-409) and Central Supply Building (M6-744) 185,000

This project will provide for the repair of 85,000 square feet (7,897 square meters) of 5-ply built-up roofing, with associated base flashing, gravel stop, gutters, and downspouts on the Flight Crew Support Building and the Central Supply Building. Also included is the repair and recoating of 74,000 square feet (6875 square meters) of metal roof on the Central Supply Facility. These roofs will be 16 years old by 1980 and will require more extensive repair later if the work is not accomplished in this time frame. The roof of the Flight Crew Support Building has deteriorated to a point where it is spongy and has some blisters. Leaks occur occasionally, but the portion of the roof to be replaced has deteriorated to a point where serious leakage during inclement weather will occur more frequently. The roof of the Central Supply Building has numerous leaks which occur during both mild and heavy rainy weather. The extent of leaks and deterioration of the roof assemblies makes this repair necessary, especially since many items stored in this facility are vulnerable to water damage. "Stop-gap" measures have been taken to control the leaks, but they are only temporary measures and usually are not very effective. The only solution is the replacement of the built-up roofs and a complete rework and coating of the metal roof as this project plans.

F. Langley Research Center (LaRC) 1,470,000

1. Repair of Potable Water Piping, West Area.... 440,000

This project provides for the replacement of three potable water supply lines in the following locations; (1) Utility Tunnel No. 2 between Buildings 1215 and.1244; (2) along Ames Road from Building 1232 to the 10-inch (25.4 centimeter) diameter line near the Gregg Road intersection; and (3) along Durand Road then across Marvin Road past Building 1206 down to Servil Road between Buildings 1169 and 1245. A total of approximately 5,800 linear feet (1,768 meters) of 6- and 8-inch (15.2 and 20.3 centimeter) diameter water lines and associated valving will be replaced. The existing cast iron pipe lines have been in service for up to 30 years and have had numerous breaks resulting in interruption of services,' as well as becoming a high maintenance item. As a consequence of the age of these pipes, there exists a significant amount-of corrosion and buildup in the lines resulting in poor water with inadequate pressure.

2. Repair of the Air and Steam Lines Serving the Vicinity of Building 1154................. 390,000

This project provides for the replacement of approximately 2,000 feet (610-meters) each of the 5,000 psi (34,000,000 newtons per square meter) airline, 100 psi (689,000 newtons per square meter) airline and the steam and condensate lines serving the vicinity of Building 1154. The lines will be installed in a shallow concrete trench having removable lids. They will be extended from Utility Trench No. 4. This work involves the replacement of valves, controls, flanges, and auxiliary equipment. The existing 5,000 psi airline was installed in 1960. Portions of the line pass through a marshy area having a saline environment resulting in corrosion of the line. As a result, there have been several failures requiring downtime that has impacted the utilization of the affected facilities. The 100 psi airline will replace a reducing station to minimize the use of the high pressure system for low pressure service. The insulated steam and condensate lines will be installed from Utility Tunnel No. 4 to the existing boiler located in Building 1154.

3. Repair of Heat Exchangers in Building 1247E 180,000

This project provides for the repair of two heat exchangers in the Compressor Facility, Building 1247E. The heat exchangers function with the compressors that provide high pressure air to most of the research facilities. These heat exchangers are 25 years old and have seriously deteriorated due to their age. Many repairs have been performed to plug the failing tubes. However, it is not cost effective to continua this operation because they can no longer provide adequate cooling.

4. Repair of the Instrument Research Facility, East Wing, Building 1230 460,000

This project provides for the repair of approximately 37,000 square feet (3,473 square meters) of laboratory and office space of the Instrument Research Facility, East Wing. The exterior repair will consist of replacing deteriorated wood window frames with insulating glass window/aluminum frame units, insulating exterior walls, and replacing exterior doors. Interior repairs to the mechanical systems to pravide the required environmental control will include the conversion of the existing two-pipe induction units to a four-pipe system, utilizing modified existing central equipment. This facility was constructed in 1950 and has been modified and adapted to serve various programs for almost 30 years. This project will correct serious deficiencies that require immediate attention.

G. Lewis Research Center (LeRC) 830,000

1. Repair of Icing Research Tunnel, Building 11 380,000

This project provides for the repair of the 34-year old Icing Research Tunnel, Building 11, necessary to reduce maintenance and to eliminate the potential development of safety problems resulting from corrosion of the tunnel structure. Included is the replacement of deteriorated corner turning vanes (including the associated steam heating system) and fan inlet screen; repair of the corroded tunnel structure; replacement of obsolete electrical switchgear and drive motor auxiliary equipment controls; and repair of the tunnel interior lighting system. The moist operating conditions of this tunnel have resulted in severe corrosion of the tunnel structure. Complete replacement of many structural components is necessary. The tunnel lighting, corner turning vanes, and fan inlet screen are similarly deteriorated. Although maintenance work has extended the useful life of this facility, major repairs are needed now to correct the present deficiencies. This tunnel, which is unique within NASA and is also the largest operating icing research tunnel in this country, supports on-going research under the Interagency and Industrial Assistance and Testing program. Typical of this research is the testing of more efficient wing heating systems; new anti-icing aircraft radio antennas, data probes, and engine components; and new pneumatic wing deicers. New areas of interest, which include icing research directed toward all-weather helicopter operation, low flying cruise missiles, and windmills for electric power generation, have increased the utilization of this facility. This repair work will restore the structural integrity and performance characteristics of this facility.

2. Repair of Roofs, Various Buildings 270,000

This project provides for the replacement of the roofs on Buildings 16, 66, 87, and 5 (Southwest Wing only), and a portion of the roof on Building 5 (Central Section) totaling 72,800 square feet (6,760 square meters). These roofs will be completely removed down to the support structures and new roofing systems will be installed. The new roofs will have thermal insulation as required to meet the current energy conservation standards and, where necessary, will be treated to withstand heavy traffic. Railings will be provided where necessary to meet Occupational Safety and Health Administration (OSHA) standards. Roof penetrations will be either eliminated or revised to meet current LeRC penetration standards. The roofs of these buildings, as included in this project, are from 23 to 36 years old. Separated flashing, roof surface blisters and punctures, and damage due to traffic have resulted in water saturated insulation. This condition increases heat losses while contributing to further roof degradation. Although routine repair and periodic maintenance of the roofs on these research facilities has been accomplished, these roofs have deteriorated to the point where complete replacement is necessary. In addition, this project provides for necessary localized repairs on over 500,000 square feet (46,450 square meters) of roofs that have been recently replaced. This work will also result in an estimated annual energy savings of 2.6 billion BTU per year or about $10,000 per year.

3. Repair of Exterior Surfaces, Various Buildings and Piping Systems 180,000

This project provides for the exterior surface repair of the 10-Foot x 10-Foot (3-Meter x 3-Meter) Supersonic Wind Tunnel (SWT) Loop, Building 85 (tunnel and building portions); the 10-Foot x 10-Foot SWT Secondary Compressor and Drive Building, Building 87; the 10-Foot X 10-Foot SWT Main Compressor and Drive Building, Building 90; the 10-Foot X 10-Foot SWT Exhauster Building, Building 114; and all major Central Air System combustion air and altitude exhaust piping. Included is the surface preparation and coating of corroded exterior metal surfaces. Surface repair of exterior iron, steel, and other metals at LeRC is required on approximately 7-year intervals to avoid serious corrosion of structures and piping and to preserve the aesthetic value of the Center. Many of the facilities at LeRC consist essentially of exterior metal surfaces. This is particularly true of the 10-Foot x 10-Foot SWT and the Central Air System piping. The massive tunnel sections and the network of large and small diameter air piping routed throughout the Center are plainly visible and, like all exterior surfaces at LeRC, are subjected to the extreme weather conditions and corrosive industrial atmosphere of the Cleveland, Ohio area. Some of the surfaces included in this project are already showing signs of deterioration such as thin finish coats; exposed or peeling undercoats; rusted joints, seams, and brackets; and rust-streaked surfaces. To preserve the Government's investment in facilities, LeRC has established a 7-year cycle for these necessary repairs. These facilities will reach the end of their 7-year interval in FY 1980.

H. Marshall Space Flight Center (MSFC) 1,305,000

1. Repair High Pressure Gas System 450,000

This project involves the repair and refurbishment of the 5,000 psi gaseous nitrogen and 3,500 psi "flight grade" air systems in twelve buildings throughout the Center. Included will be localized repair, refurbishment or replacement of the high pressure control systems, pumps, storage vessels, components, distribution piping, regulators, and valves. There is one high pressure gaseous nitrogen pumping station, two "flight grade" air pumping stations, 95,000 linear feet (28,956 meters) of primary distribution system and thirty high pressure reducing stations in these systems. This entire complex services the Marshall Center test stands, shops, laboratories and support facilities. The system will be recertified from other resources to permit full operational use upon completion of this project. These systems were installed in the 1950's and have deteriorated through age and heavy cyclic use. They are now at the end of their 20-year design life. Radiographic inspections of the systems have revealed deterioration in welds, and portions of the systems have been down rated and can only be operated at reduced pressures. Deterioration of these systems seriously affects the reliability required to support research and development associated with on-going and future programs. The nitrogen and air systems continually lose pressure through various leaks. Failures and serious defects in the systems are being found and corrected at an increasing rate by "breakdown" maintenance. This, coupled with the known age and validated "real life" condition, confirms the need for this planned repair work by not later than the FY 1980 time frame.

2. Repair High Pressure Water System Valves 200,000

This project provides for the repair of large valves in the high pressure water system servicing the MSFC test areas. Included are: seven 16-inch (40.6 centimeter) manual gate valves located in the fire protection system in the east test area; one manual and eight electrically operated 30-inch gate valves and nine 8-inch (20.3 centimeter) bypass valves located on the 30-inch (76.2 centimeter) main feeding the test facility in the east area; and three 20-inch (50.3 centimeter) gate valves located at Building 4572 (Propulsion and Structural Test Facility). Fire protection in the test area is hampered by deteriorating valves and lines, particularly in the east test area. Most of the test area high pressure water system was installed in the late 1950's without proper cathodic protection. As a result, the valves have deteriorated, are now leaking badly and must be repaired in the near future, as fire protection must be provided continuously to protect costly government equipment and facilities. Repair of the 30-inch valves is required to maintain cooling capability essential to fulfilling minimum test capability projected in the 1980 time frame.

3. Repair Air-conditioning Components 300,000

This project will repair major air-conditioning system cooling towers and chillers by replacement with substantially equivalent units. Four cooling towers, with a total capacity of 875 tons, are to be replaced. In addition, two water-cooled chillers with a total capacity of 425 tons are to be replaced. Also included will be miscellaneous piping, valves, and electrical work necessary to complete the work. This equipment ranges in age from 15 to 30 years but had an original design life of only 10 years. The equipment is in a very deteriorated condition and requires continual heavy maintenance to keep it operable. It is more economical to replace the components than to continue the "patchwork" repairs. All of the facilities supported by these components are in direct support of the Space Shuttle and Spacelab programs and various other research and development efforts essential to future programs. This repair work is essential in the FY 1980 time frame.

4. Exterior Repairs, Various Buildings 355,000

This project provides for the repairs to and painting of approximately 460,000 square feet (42,734 square meters) of exterior walls, doors, windows and other surfaces of Buildings 4476 (Environmental Test Facility), 4550 (Structural Test Facility), 4707 (Shop and Assembly Building), and 4760 (Surface Treatment Facility). Work includes surface preparation, minor repairs, caulking and application of 2 coats of paint. Protective painting guards against the cumulative damaging effects of wear, deterioration and weather, and preserves the facility's capability for prolonged operation.' The exterior surfaces are peeling, moisture is getting into the wood and other surfaces, and the caulking has deteriorated to a point where little protection is provided. There is some evidence of deteriorated wood where there has been direct exposure to the elements. Continued deferral will not be cost effective due to further deterioration and corrosion, and more extensive surface preparation will be required.

I. Michoud Assembly Facility (MAF).. 990,000

1. Repair of Cooling Towers... 360,000

This project includes the repair of three cooling towers, 11127, 11202 and 11352, that support Shuttle operations at MAF. Two of the towers were constructed in the 1963/1964 time frame and the third dates from 1952. Towers 11127 and 11202 directly support the production of the External Tank (ET). Cooling tower 11352 supports the cooling system of Building 350 that will house the engineering and management staff of both NASA and the prime contractor on the ET, as well as other Government tenants. Cooling tower 11202 is a single "point-of-failure" for the chilled water system that is required to maintain the production plant environment within the limits required. The last major repair of this tower was in 1964. Some 30 to 50 percent of the structural members must be replaced. Loss of baffles and wall members (approximately 20 percent) have caused a serious loss in the energy efficiency of the unit. Repair of the structure and replacement of the fan motors will return the efficiency of the unit to its original capability. Cooling'tower 11127 supports both the cooling and process systems in Buildings 110 and 130. These systems in turn directly support production cells and/or equipment for the manufacture of the ET. Constant exposure to the condenser water has caused deterioration to structural members, heaters, wall decking and basins. This repair work will improve the energy efficiency of the tower and the systems it supports as well as its reliability. Cooling tower #352, like the other two towers, requires replacement of rotted decking, head boards and structural members. Walkways and platforms required to service the unit must also be replaced. In this unit the motors and fan gear boxes will be repaired. The distribution headers and basins will be repaired. In all three cooling towers the fire protection system will be inspected and repaired. Control systems will be adjusted or replaced. This work is badly needed to insure reliability of the towers for the ET production and improvement of the energy efficiency and reliability of the systems.

2. Repair of Asphalt Roadways and Parking Areas................. 210,000

This project is part of an integrated repair program of the asphalt roadway and parking area designed to maintain these surfaces with a minimum expenditure of funds. The unstable soil conditions in the New Orleans area, with the large amount of rainfall and high temperature, contribute to a rapid deterioration of the roadways and parking areas. Previously deferred funding of this project has resulted in greater effort now to return these surfaces to an acceptable standard. Further delay in repairing these surfaces could mandate complete rebuilding. In this phase of the project approximately 60,000 square yards (50,160 square meters) of roadways and parking areas will be overlaid with asphalt concrete, with the associated prime and seal coats. Roads and parking areas included are Jupiter Avenue from Mercury Boulevard to and including Lots L, J, G and C; and Saturn Boulevard from Mars Drive, east 900 feet (274 meters).

3. Repair of Various Buildings 420,000

This project provides for the repairs to the exteriors of the Main Manufacturing Building 103, Vertical Assembly Building 110, and the Laboratory Building 111, which are the major manufacturing buildings at MAF for the production of the External Tank. Steel surfaces of metal and asbestos siding have suffered wind and weather damage. Repair of the damaged sections and application of protective coatings to the exterior building walls and doors is required to insure the integrity of the buildings and prevent further deterioration which would require extensive replacement of siding and doors. Damaged or loose asbestos and metal siding shall be replaced or secured. Approximately 20,000 square feet (1,858 square meters) of metal surface require sand blasting with other areas to be scraped and cleaned. Protective coating will be applied to 320,000 square feet (29,728 square meters) of surface.

J. National Space Technolonv Laboratories (NSTL) 1,035,000

1. Repair to Navigation Lock and Bascule Bridge 350,000

This project provides for the repair of the NSTL Navigation Lock and Bascule Bridge. The work includes dewatering the lock in order to repair needed component hardware such as upper and lower gate seals, bearings, sills, grease lines, and cathodic protection system, as well as providing protective coatings as needed. Also included is the repair of tainter valves, gates and underwater piping. The dewatering process will require the placement of structures in the canal upstream and downstream of the lock in order to barricade water flow. A recent inspection has been performed and recommendations for these repairs has been validated. This indicates that the dewatering, inspection and underwater repairs must be accomplished by 1980. The lock has not had this type of overall repair since completion of construction in 1965. Operational failure of bridge and/or lock could impair delivery of cryogenics by barge which directly support the Shuttle Test Program. This bascule bridge is the only access to NSTL from the South.

2. Repair of High Pressure Gas System Valves.............................. 485,000

This project will provide for the repair of high pressure gas system relief valves within the Shuttle Test Complex, cross country systems and base facilities. The work includes valve rework, repair, and certification. The scope of this effort meets 1980 requirements only, and will be a major continuous cyclic repair program to be accomplished on a year-to-year basis. During the reactivation of the high pressure gas system for Space Shuttle Main Engine, a large number of these valves and system components were replsced. However, because of the heavy test load involving 2 to 4 test firings per week, and because these components are continuously subjected to very high pressure, the repair cycle is most important. Based on experience since the start of engine development testing, it became clear that such cyclic repair on many system components would be required no later than each 4-5 years. Since the test program started in FY 1975, the initial phase of valve and component work will be necessary in FY 1980.

3. Repair of Diesel Engines.. 200,000

This project provides for the repair of fourteen diesel engines which drive high pressure water pumps and provide back-up power. There are 10 water pump engines rated at 4,460 horsepower each and 4 power generator engines rated at 2,120 horsepower each. These engines will have a detailed inspection, and the resulting repairs to include necessary replacement of parts and components will be accomplished in accordance with the manufacturers' recommendations and useage experience. These engines are necessary to support the Shuttle Engine Test Program. The ten diesel engines are used to pump high pressure industrial water to the test stand deflectors at a rate of 300,000 gallons per minute. The other four provide back-up power during test period in the event of commercial power failure. These engines have been subjected to heavy and continuous usage since their last major overhaul in 1974. Because of this heavy usage over the past four years, inspection and repair will be required during 1980. The test workload is such that engines must be serviced in sequence and thus will require a full year implementation cycle. The loss of any of the diesel engines would result in a compromise of the Shuttle Engine static firing program at NSTL.

K. Wallops Flinht Center (WFC)... 1.200.000

1. Repair of Airfield Facilities..... 440,000

This project provides for the most urgent repair of the airfield facilities. This work includes the repair of the deteriorated pavement and the overlay of four inches (10.2 centimeters) of bituminous concrete of approximately 12,800 square yards (10,702 square meters) of the south 800-feet (244 meters) of Runway 17/35. In addition: this work includes the repair of ramp areas around the Aircraft Control Tower, Building A-I, Fire Control Station, Building B-129, and the Fuel Tanks, E22 and E23, and the overlay with two-inches (5.1 centimeters) of bituminous concrete of approximately 29,000 square yards (24,247 square meters) of pavement. The related aircraft surface markings and improvements to the shoulder areas are included in this work. The repair of the airfield paving at the south end of Runway 17/35 and the ramp areas by Buildings A-1 and B-129 is necessary to maintain an acceptable surface quality that is conducive to aviation safety. Spalling is occurring in this area and the resulting loose debris is increasing the probability of damage to conventional and research aircraft. Surface markings are required to provide clear direction for aircraft ground control. The repair of these airfield facilities is necessary at this time to stop further pavement deterioration and more extensive and costly future repairs, and to provide adequate support for research aircraft operations.

2. Repair of Roads...... 285,000

This project provides for the repair of the principal roads on the Center and the island launch area. This repair work includes the overlay of two inches (5.1 centimeters) of bituminous concrete on approximately 40,000 square yards (33,444 square meters) of the main entrance to the Center, Stubbs Boulevard, Fulton, Wormhoudt, Bond and Bliss Streets. The drainage of the island road will be improved and a two-inch (5.1 centimeter) bituminous surface course will be applied to approximately 8,500 square yards (7,107 square meters) of pavement. In addition, this work will include the related repair of the curbs, sidewalks, and shoulder areas of these roads. These repairs are the result of a study of the existing conditions of the primary roads of the Center. Since 1959, maintenance of the primary heavy traffic roads of WFC has been by sealing and other short term measures. Major repairs are needed at this time to correct settlement, protect the subgrade, and provide adequate drainage. The Wallops Island road is the only access to the launch facilities and it has deteriorated to a condition that this repair work is necessary to provide a suitable surface for the transportation of research rocket motors. Some additional repair effort will be necessary in future years for the remaining roads and parking areas of the Center.

3. Repair of Various Roofs......... 175,000

This project involves the necessary repair of the roofs on Buildings N-162, V-45, V-50, V-55, W-65, X-15, X-35, and X-85 at WFC. These repairs include the installation of new roofing, insulation and related work on some 75,500 square feet (7,014 square meters) of roof surfaces on these buildings. This repair project is the result of a study of the roof conditions at the Center. This study indicates the roofs of these buildings have deteriorated to an extent that the repair work is beyond normal maintenance, and a major repair effort now is necessary. Deferral of this repair project will require more extensive and costly repair work at a later date, with the potential of water damage to the interior furnishings and equipment of the buildings caused by leaks.

4. Repair of Steam and Condensate Distribution System.. 300,000

This project provides for the repair of the steam and condensate distribution system at WFC. The work includes the repair of approximately 5,600 feet (1,707 meters) of steam and condensate piping, valves, expansion joints, and related equipment. The existing steam and condensate system serving the principal buildings of the Center was installed in 1958 and has deteriorated to the extent that continual repairs are required to maintain the steam service. The repair of the steam and condensate distribution system will provide better steam service and conserve energy and water resources by eliminating the waste due to leaks. This repair project is needed at this time to reduce maintenance, improve operating conditions, and reduce the consumption of energy at WFC.

MISCELLANEOUS PROJECTS LESS THAN $150,000 EACH	1,350,000
TOTAL	12,000,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that between $10 and $15 million per year will be required for the continuation of this facility repair program. It must be recognized that this is the initial year for a centrally managed repair program and that prior experience with Rehabilitation and Modification Programs indicates that early requirements tend to be conservative and may be underestimated.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

SPACE SHUTTLE PAYLOAD FACILITIES

	Amount	Page No.
Office of Space Science:		
Rehabilitation and modification for payload ground support operations (KSC).....................................	2,610,000	CF 11-1
Modification of and addition to materials sciences laboratory (ARC).	1,640,000	CF 11-13
Total	4,250,000	

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
REHABILITATION AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS
LOCATION PLAN

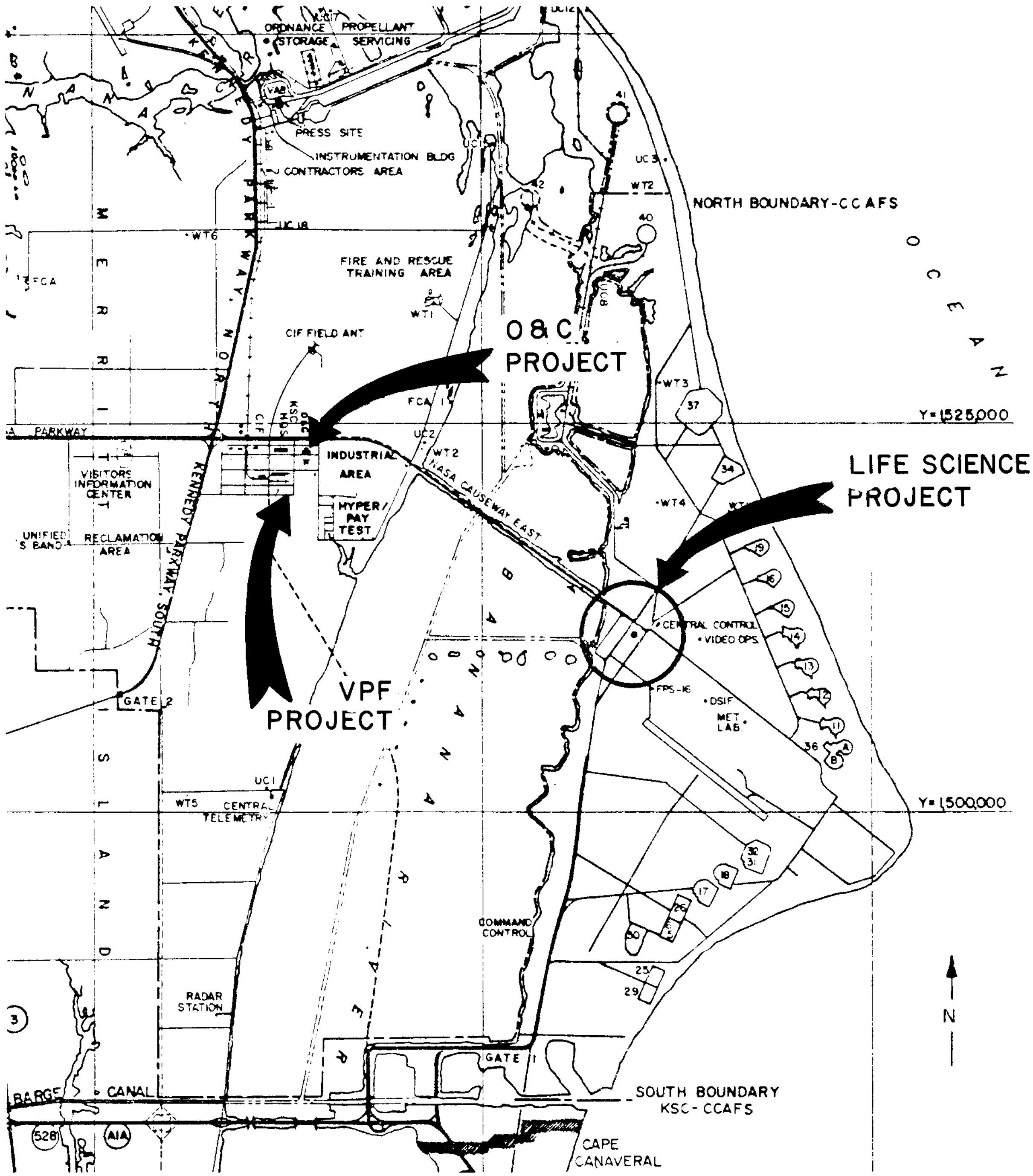


FIGURE 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Rehabilitation and Modification for Payload Ground Support Operations

INSTALLATION: John F. Kennedy Space Center

FY 1980 CoF ESTIMATE: $2,610,000

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT HEADQUARTERS OFFICE: Office of Space Transportation Systems

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	1,113,568	9,980,000	11,093,568
Capitalized investment	N/A	48,357,348	48,357,348
Total	1,113,568	58,337,348	59,450,916

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide for rehabilitation and modification of facilities necessary to support Space Shuttle payload ground operations at the NASA launch site, Kennedy Space Center. Included in this project are major discrete projects and facility rehabilitation and modification projects estimated to cost less than $500,000. These projects are requirements in support of the Space Shuttle payload program. This project continues modifications to the Operations and Checkout (O&C) Building, and the Vertical Processing

Facility begun with FY 1977 and FY 1978 resources. In addition, it provides for modifications to the Missile Assembly Building (Hangar L) located at Cape Canaveral Air Force Station (CCAFS), Florida, to accommodate Integrated Life Sciences Operations.

PROJECT JUSTIFICATION:

Space Shuttle Payload Ground Support Operations will be carried on at NASA's launch site, KSC. Many different facilities will be involved in payload support operations, requiring both major (discrete) and minor construction, and facility rehabilitation and modification. For the purposes of clarity, full disclosure, and better technical and fiscal control, it was thought best to now include all payload ground support projects at KSC in one category.

The Space Transportation System (STS) operational phase of the Space Shuttle program will commence after the first six development flights in CY 1979 and CY 1980. At this time the primary purpose of the STS will be in the support of payload operations. FY 1977 resources provided for modifications to the O&C Building for the horizontal processing of Spacelab payloads and other classes of payloads while FY 1978 resources provided for the vertical processing of the Inertial Upper Stage (IUS), the Spinning Solid Upper Stage (SSUS), and other payloads in the former Spacecraft Assembly and Encapsulation Facility (SAEF-1), now called the Vertical Processing Facility (VPF).

This project provides for additional modifications to the O&C Building to support Spacelab Payload Level IV integration. Level IV integration is that work needed to place experiments in racks, and buildup and integrate racks and pallets for further integration into the Spacelab. This is a new requirement for KSC that did not exist at the time the FY 1977 project was requested. An intensive NASA study has recently concluded that substantial savings, primarily in transportation costs, can be achieved if Level IV "hands on" Spacelab payload integration is done at the launch site (KSC) rather than at field Centers or other government or industry locations where the experiments are developed. Prior to Shuttle missions, payloads will be shipped to KSC and received, processed and checked out in off-line locations other than the O&C Building. These payloads will then be brought to the O&C Building for integration and checkout in the Spacelab hardware. Specifically, the work included in this project will modify the area in the O&C Building dedicated to this Level IV activity. Previous modifications to the O&C Building provided the capability for functions associated with final assembly and checkout of the Spacelab and disassembly following completion of a Shuttle mission.

Also included in this project are resources to continue modifications to the Vertical Processing Facility (VPF) to support vertical payload integration. When this specific project was submitted in FY 1978, the crane capacity of the existing facility (SAEF-1) was thought to be adequate for all known payloads. Since then however, the weight of the IUS vehicle has increased considerably and future planning now includes missions that require twin stage IUS's. The individual IUS's will be integrated into a twin stage configuration in the workstands in the VPF, and once in this mode, must be lifted together in a strongback for certain NASA missions. The existing crane in the VPF has only 25 tons of capacity and must be upgraded to 35 tons to lift twin or twin + spinner stage IUS vehicles. The first requirement for this increased crane capacity is for the Galileo mission presently scheduled for early CY 1982. In order to support this mission, fabrication and installation must be accomplished prior to October 1981, thus an FY 1980 project is essential.

Resources will also be provided for a Life Sciences Support Facility. This facility will be used to house animal/biological specimens for preflight conditioning and selection, and to provide a research lab capability for Principal Investigators to conduct preflight specimen preparation, and synchronous ground control experiments during flight. In addition, it will be used to perform post-flight analyses of flight and control specimens and to allow preparation of experiments for payload integration. At the present time no permanent facility capability exists to support extensive Life Science missions. In previous programs, Life Science requirements were of such a reduced magnitude that they could be satisfied by temporary facilities such as trailers. In the Space Shuttle era, Life Science payloads are planned as routine with both dedicated Life Science missions, or Life Science experiments flying alongside other Spacelab experiments. Each dedicated payload mission will involve 20-45 experiments and 20 principal investigators. Housing for up to thirty primates and 500 rodents per specific mission will be required. This facility will also provide holding areas for plants, fish and amphibians, and cells and tissues.

It is highly desirable to locate this facility close to the launch site as it is not scientifically feasible to perform the required operations at any great distance from the launch site. Preflight conditioning requires specimens to be as stabilized and quiescent as possible before lift-off. Hangar "L" at CCAFS (adjacent to KSC) was selected for this facility because it is available for use and close to the launch pad. Studies have indicated that the required modifications to this facility will be most cost effective when compared to those required for other candidate facilities. The Life Sciences Support Facility is required in FY 1980 in order to allow sufficient construction and activation time to meet a required facility Operational Readiness Date (ORD) of July 1981. This requirement is based upon the need for specimen delivery to Kennedy Space Center at least one month prior to the first dedicated Life Sciences mission, currently scheduled for late fall 1981.

IMPACT OF DELAY:

The Level IV integration of payloads into the Spacelab hardware can be accomplished at other NASA Centers than KSC, but at a definite higher cost penalty. To operate in this mode is very expensive, due to the need to ship Spacelab flight hardware to and from the launch site and the duplication of equipment and facilities. In order to accomplish modifications to the O&C Building prior to major Spacelab operations, and thus minimize the impact of construction on these critical operations, these modifications are required in FY 1980. Payload operations in the VPF will be adversely affected if these respective modifications are not made. Without the crane modification requested for the Vertical Processing Facility, the twin and twin + spinner stage IUS vehicles will have to be handled by complicated and risky workarounds which could impact schedule and jeopardize the important Galileo mission. Life Science requirements in previous programs were not as extensive as those planned for the Space Shuttle era and were handled in temporary facilities. If this project is not provided, the extensive Life Science program planned for the Shuttle era will have to operate in temporary, inadequate facilities, resulting in the degradation of the extent and quality of the Life Sciences experiments and incur additional operating cost.

PROJECT DESCRIPTION:

Prior work (FY 1977) in the O&C Building provided for modifying the high and low bay areas by removing Apollo era equipment, and constructing and installing assembly and checkout workstands. Mechanical and electrical systems were modified and extended to new interfaces with the Spacelab workstands, and control rooms were refurbished. The O&C Building will be modified for Level IV "hands on" payload integration by providing power, grounding, fluids, gases, raised flooring and fire protection. Minor architectural modifications will be performed to provide increased laboratory and control room capabilities (Figure 2).

Modifications in the Vertical Processing Facility continue work begun with FY 1978 resources to accommodate vertical payload processing. The FY 1978 resources provided for two assembly, test, and checkout stands with vertical payload handling devices. Each workstand has a series of fixed and moveable platforms that allow access to critical areas of the many different vertical payloads to be processed through the VPF. The entrance door to the the VPF has been modified, and electrical, pneumatic, mechanical and support services have been provided to the workstands. This FY 1980 request provides a 35-ton bridge crane to replace the existing 25-ton unit in order to lift the heavy twin and twin + spinner stage IUS vehicles now planned for processing. Studies show that the existing crane rails are of sufficient size to support the 35-ton crane. The present 25-ton crane will be removed, and the larger crane will be installed and checked out between missions in CY 1981.

The third element of this project provides for the modification of the Missile Assembly Building No. 01732 (Hangar "L") at CCAFS to provide a Life Sciences Support Facility. This facility will be used for Life Sciences payload operations, including specimen receipt, holding, conditioning, and experimentation, and payload integration preparation. It will also provide Principal Investigator support with offices, labs, and equipment. This project will provide resources for modifying the interior of Hangar "L" (as shown in Figures 3, 4 and 5) by rearranging walls, partitions, and ceilings. Those areas to be modified as animal holding rooms will be provided with non-porous washable surfaces. Other existing areas will be modified into laboratories, experiment areas, offices, and a conference room. The mechanical systems that support these areas must also be modified to support the new arrangement of functions. The heating, ventilating and air-conditioning systems are to be rehabilitated and modified to provide closely controlled environments in the various specialized areas. The interior water distribution and compressed air systems must also be modified. An emergency power system consisting of a 480-volt generator and switch gear will be installed. The electrical distribution system is to be modified to also serve the new functional areas of the buildings. Upgraded lighting is required in critical locations and will be provided by the use of energy-efficient fluorescent fixtures. Local switches and timers will also be provided to optimize energy use. Facility equipment such as laboratory benches, environmental chambers, an incinerator, cage washer, and autoclaves will be provided and installed as part of this project.

PROJECT COST ESTIMATE:

The bases of this cost estimate are Preliminary Engineering Reports.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition.	---	---	---	---
Construction	---	---	---	2,610,000
Modify O&C building	---	---	---	390,000
Architectural/structural	LS	---	---	(130,000)
Mechanical systems	LS	---	---	(260,000)
Modify vertical processing facility	---	---	---	510,000
35-Ton Bridge Crane (VPF)	LS	EA	---	(610,000)
Modify Hangar "L"..	LS	---	---	1,610,000
Architectural/structural...	LS	---	---	(473,000)
Mechanical systems	LS	---	---	(312,000)
Electrical systems	LS	---	---	(435,000)
Life science support equipment	LS	---	---	(390,000)
Fallout Shelter (not feasible)	---	---	---	---
Total				2,610,000

LIST OF RELATED GRAPHICS:

Figure 1 - Location Plan
Figure 2 - Pictorial of O&C
Figure 3 - Ground Floor Plan, Life Science Support Facility (LSSF)
Figure 4 - Second Floor Plan (LSSF)
Figure 5 - Elevation and Cross Section (LSSF)

OTHER EQUIPMENT SUMMARY:

Centain non-collateral equipment. to be funded from R&D resources, and estimated to cost $3–4 million, will be required to support initial operations.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Additional funding for basic plant and equipment is not snticipated. However, future modification work may be necessary to satisfy unique future programmatic needs.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR *1980* ESTIMATES
REHABILITATION AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS

PICTORIAL VIEW - O&C BUILDING

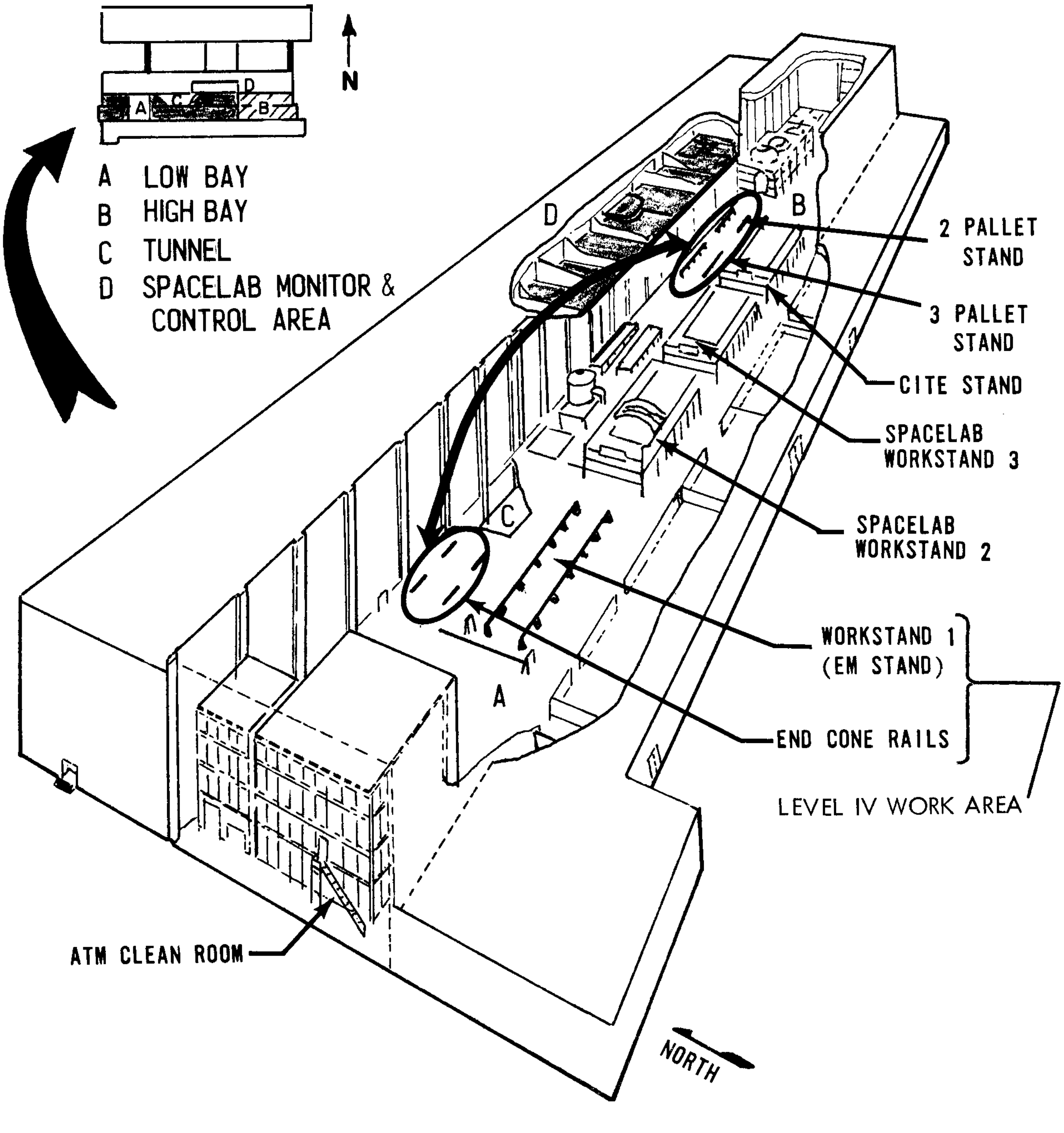


FIGURE 2

JOHN F. KENNEDY SPACE CEMER

FISCAL YEAR 1980 ESTIMATES

REHABIL TAT ON AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS

GROUND FLOOR PLAN

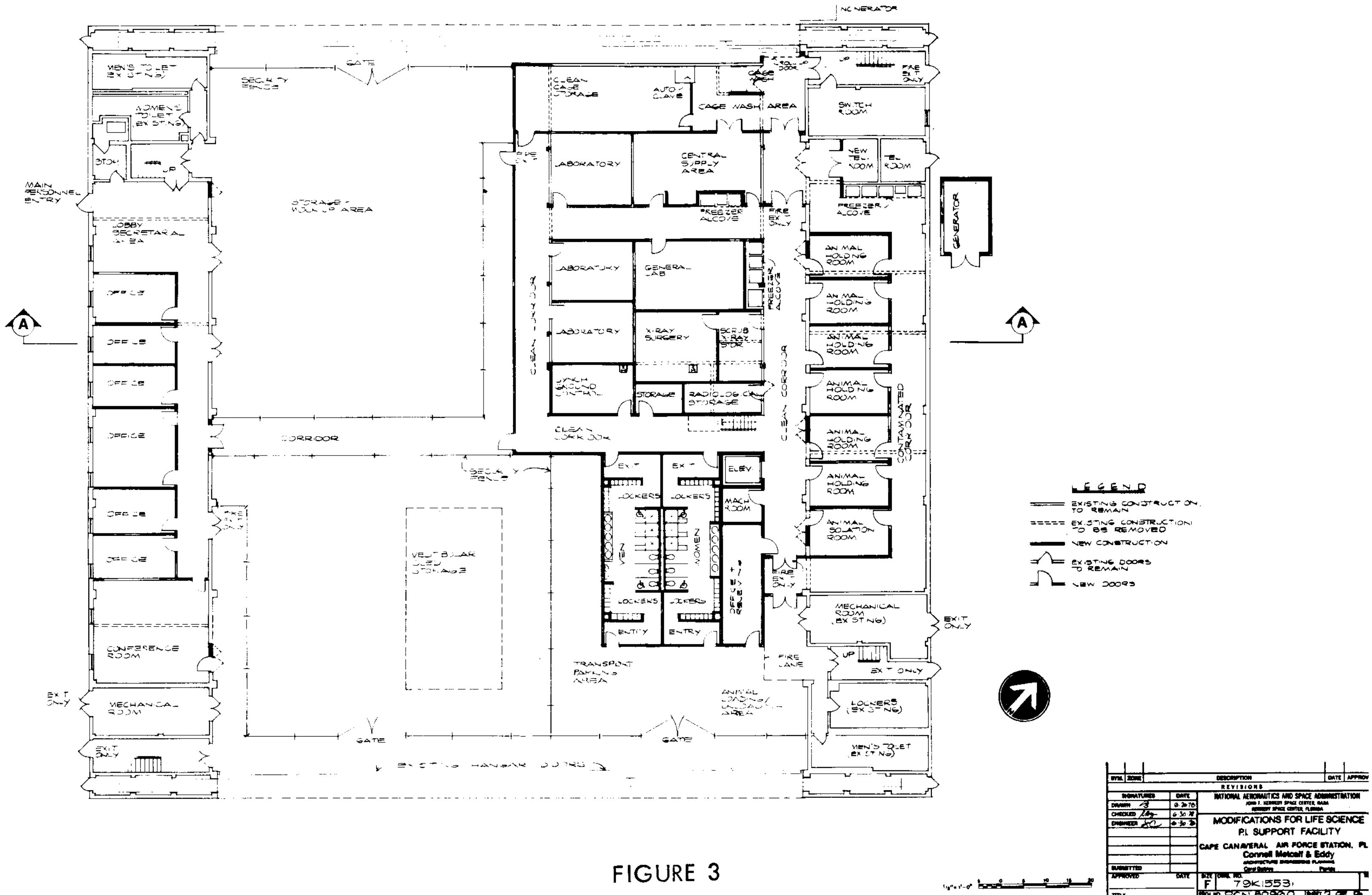


FIGURE 3

JOHN F. KENNEDY SPACE CENTER

FISCAL YEAR 1980 ESTIMATES

REHABILITATION AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS

SECOND FLOOR PLAN

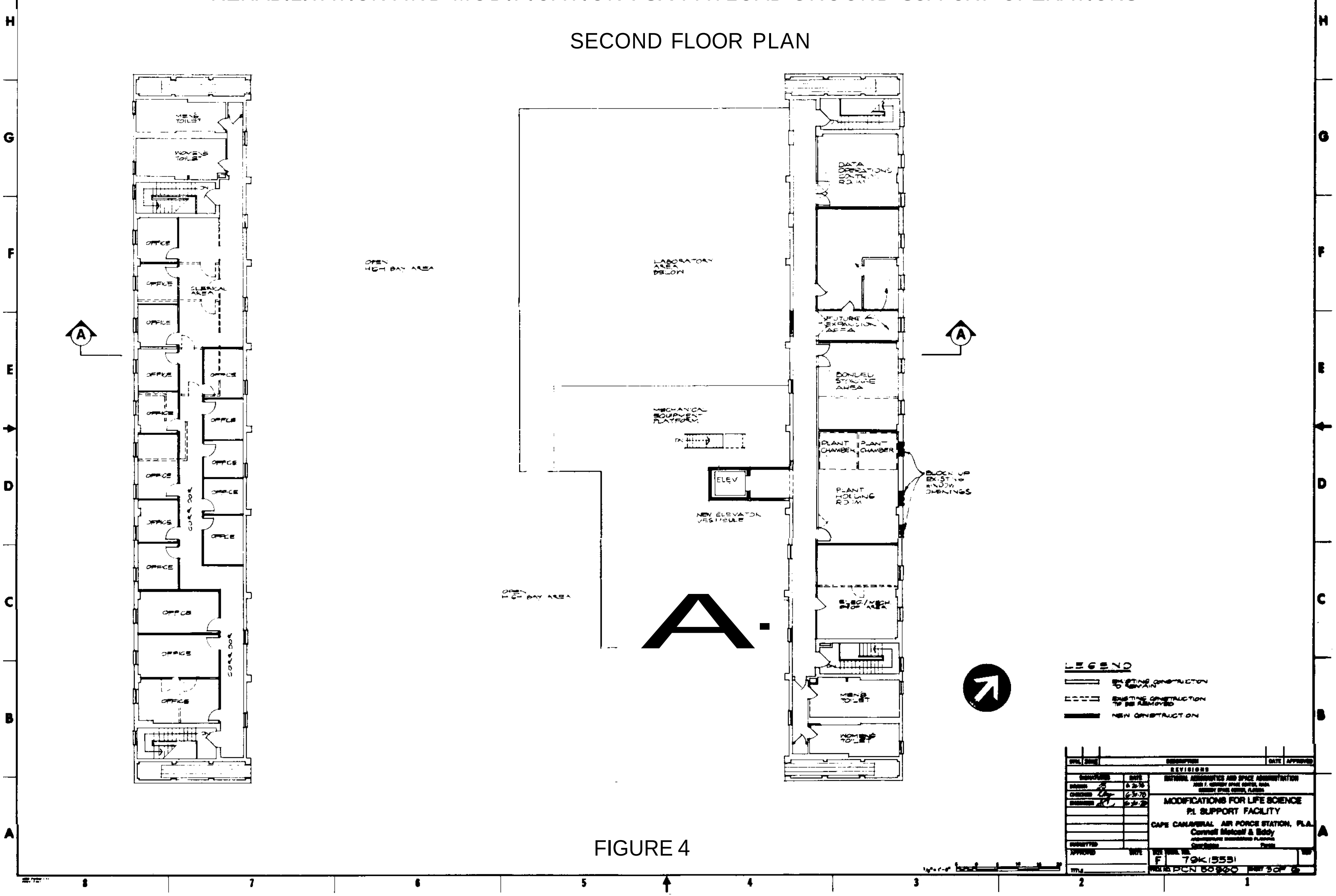


FIGURE 4

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1980 ESTIMATES
REHABILITATION AND MODIFICATION FOR PAYLOAD GROUND SUPPORT OPERATIONS

ELEVATION AND CROSS SECTION

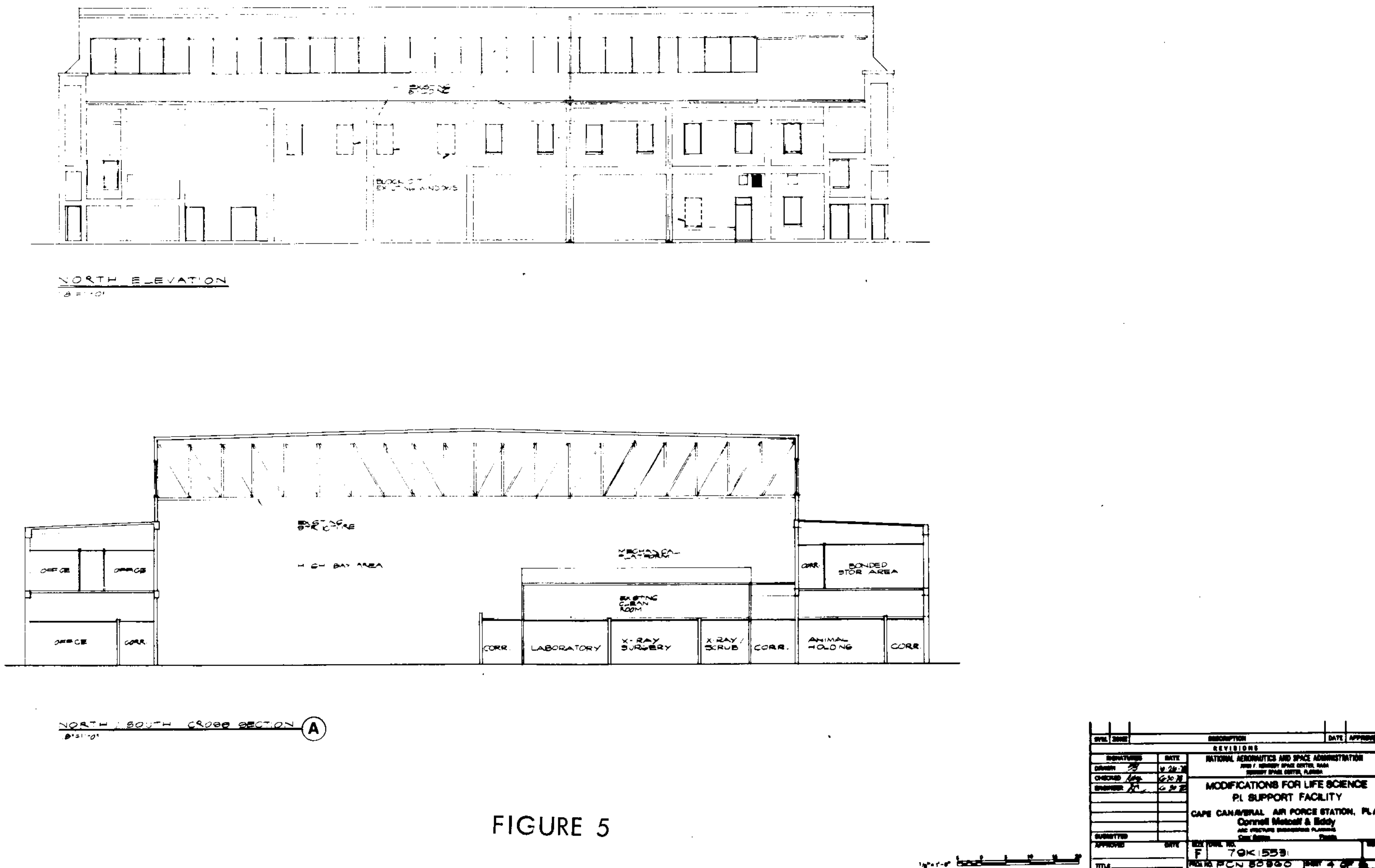


FIGURE 5

AMES RESEARCH CENTER

FISCAL **YEAR** 1980 ESTIMATES

MODIFICATION OF AND ADDITION TO MATERIALS SCIENCES LABORATORY (N-240)

LOCATION PLAN

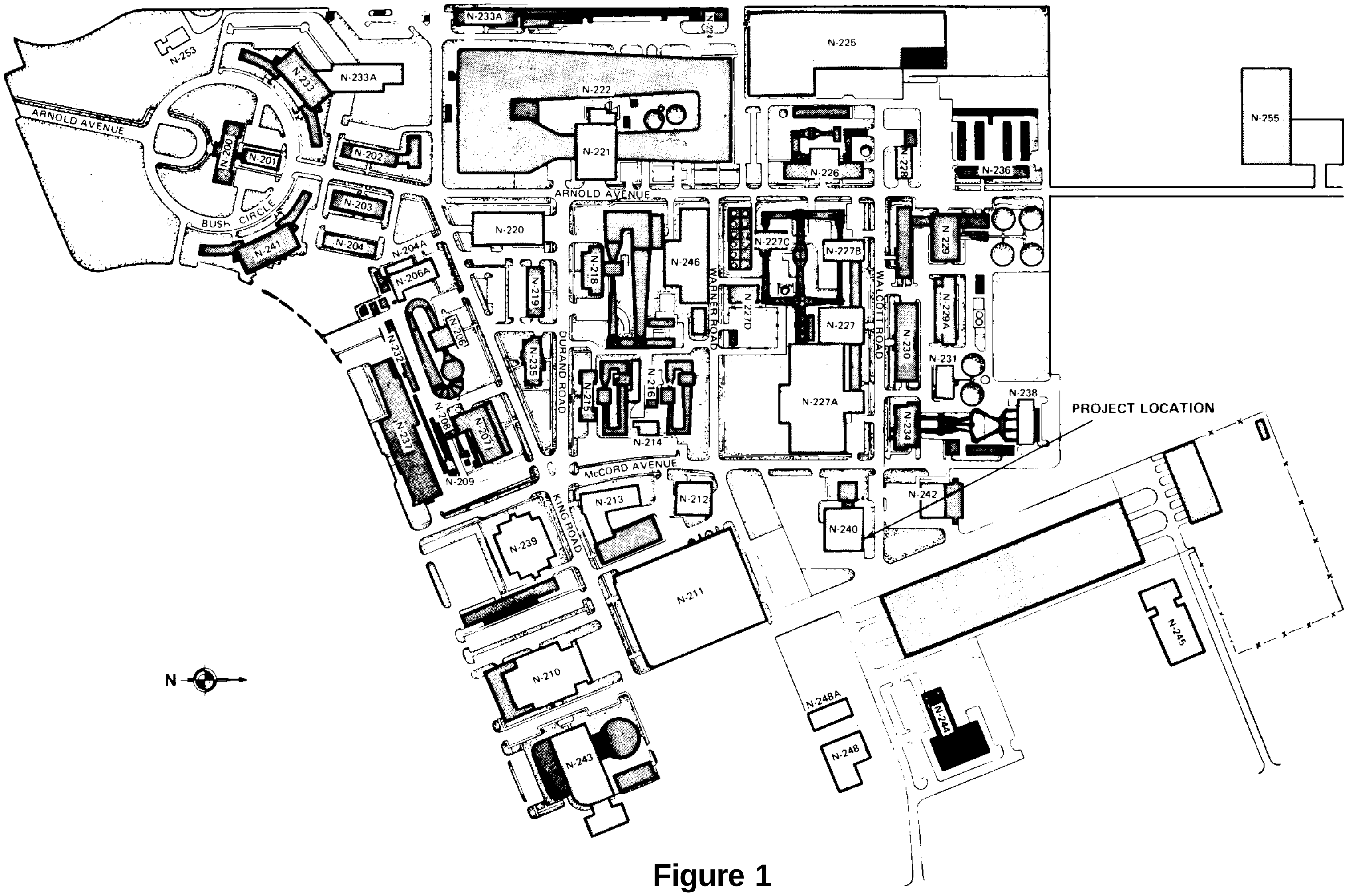


Figure 1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Modification of and Addition to Materials Sciences Laboratorv (N-240)

INSTALLATION: Ames Research Center

FY 1980 CoF ESTIMATE: $1.640.000

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

COGNIZANT HEADQUARTERS OFFICE: Office of Space Science

FY 1979 AND PRIOR YEARS FUNDING: The following prior years funding is related to this project:

	Planning and Design	Construction	Total
Specific CoF funding	130,000	---	130,000
Capitalized investment	N/A	2,188,946	2,188,946
Total	130.000	2,188,946	2,318,946

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a 11,600 gross square foot (1,077 square meter) two-story addition to the east side of the Materials Sciences Laboratory, Building N-240, and modification of 16,000 gross square feet (1,486 square meters) of existing high bay and laboratory (Figure 1). The combined space will be used to support the Life Sciences Flight Experiments and Vestibular Function Research Programs. The facility will house research equipment and personnel in support of the development of animal, plant and tissue experiments for the Spacelab Life Sciences program. The building will contain laboratories equipped for research and flight experiment development. Specific programs to be supported are biological and plant physiology, biochemistry, microbiology, and radiobiology. Associated personnel and general laboratory space will be provided for spaceflight related Life Sciences activities.

PROJECT JUSTIFICATION:

NASA planning for the execution of Spacelab experimentation, envisions a multi-Center involvement in the development and integration of human, plant and animal experiments. Ames Research Center (ARC) has been assigned the lead role in the development of the plant and animal experiments for Spacelab. The first dedicated Life Sciences laboratory is scheduled to be launched in late 1981 and involves at least 15-30 biological investigations. The responsibility assigned to ARC for the Life Sciences Spacelab missions requires that a unique facility be developed at the Center to accommodate the activities required to fulfill its role over the coming years. These activities include:

- Receipt, inspection, checkout and utilization of ground support equipment (GSE) and flight equipment.
- Receipt and maintenance of biological specimeps and transportation to other life sciences centers.
- Development and checkout of spaceflight hardware and software.
- Definition of the data requirements for experiments and implementation of a data management plan.
- Preliminary training of principal investigators (P.I.'s), payload specialists and mission specialists in experimental operation procedures.
- Technical assistance to P.I.'s in preparing biological specimens for preflight, flight and post-flight tests and analyses.
- Packaging and shipping developed and checked out experiments to other NASA Centers for final stages of integration.
- Flight support for testing of experiment31 controls.
- Post-flight support for control experiments, data reduction and reporting.

The activities performed in this facility require a close interaction among ARC's management staff, engineers, support contractors, P.I.'s, and related groups at other NASA Centers. This will involve 45-48 people rotating through the facility. The new facility must provide accommodations for the personnel involved in the coordination and management of experiments as well as those directly involved in the experiments.

Participation in the first dedicated Life Sciences laboratory requires additional office space, and a physical area in which to carry out the development and management activities. Technical space is required in the facility for flight experiment build-up, test and check-out areas, as well as supporting laboratory, control room, live specimen processing, and office areas. General laboratory space is required for spaceflight related Life Sciences activities such as:

- Development and testing of biological life support hardware and new methods of feeding, watering, waste removal, and air revitalization.

- Development of advanced animal bioinstrumentation and telemetry systems.

- Determination of the tolerance of biological systems to the various environmental parameters of spaceflight (e.g., noise, vibration, confinement, etc.).

IMPACT OF DELAY:

This facility is required to meet the launch date of the first dedicated Life Sciences Spacelab mission, SL5, scheduled for 1981. Construction in FY 1980 is necessary for construction, equipment installation, personnel training and systems check-out before the facility is operational. An additional one year lead time, prior to launch, is also required for the preparation of the experiments for Spacelab. This project is directly tied to the first dedicated Life Sciences launch and delay would jeopardize the program. This facility, as configured, will support future Life Sciences programs on Spacelab at a maximum of one dedicated launch per year. Consequently, future missions are contingent upon this facility project.

PROJECT DESCRIPTION:

This project consists of a new two-story addition to the east side of Building N-240, and complete modification of functions in the east half of Building N-240 (Figure 2). The new addition will be 11,600 gross square feet (1,077 square meters) with a steel frame structure and precast concrete "tilt-up" exterior walls treated to match the existing building.

The first floor of the addition will house the live specimen area and will include a delivery dock, holding rooms, minor surgical area, and general utility space. Floors, walls and ceilings in these areas will be nonporous surfaces with a washable finish. The balance of the first floor will contain offices, laboratories related to the high bay area, locker rooms, and toilet facilities. A hydraulic elevator will be included to carry equipment supplies to the second floor. A new entrance will be provided to accommodate personnel and visitors associated with the facility. Three stairways, one of which will lead to the roof, will be provided to accommodate internal circulation and to comply with Life Safety Code requirements. The second floor will include office space, conference room, and toilet facilities.

The modification of 16,000 square feet (1,486 square meters) of high bay and laboratory area in Building N-240 will provide space for experiment development, integration, check, laboratory functions, storage, shipping, and receiving. The accelerator vault will be modified for an electronic laboratory, shop and bonded stores. A new corridor through the existing testing area west of the high bay will afford circulation among areas not related to this project. A portion of the mechanical room will be modified for a test control computer room with a raised floor system.

PROJECT COST ESTIMATE:

The cost estimate for this project is based on a completed Preliminary Engineering Report.

	Unit of Measure	Quantity	Unit cost	cost
Land Acauisition..	---	---	---	---
Construction......	---	---	---	1,640,000
Addition to Building N-240	---	---	---	1,240,000
Site preparation	LS	---	---	(190,000)
Architectural.	SF	11,600	25.45	(295,000)
Structural......	SF	11,600	32.75	(380,000)
Mechanical...	SF	11,600	25.85	(300,000)
Electrical	SF	11,600	6.45	(75,000)
Modification to Building N-240	---	---	---	400,000
Architectural	SF	16,000	8.10	(130,000)
Structural	SF	16,000	2.20	(35,000)
Mechanical..	SF	16,000	5.60	(90,000)
Electrical	SF	16,000	9.05	(145,000)
Fallout Shelter (not feasible)	---	---	---	---
Total..				1.640.000

LIST OF RELATED GRAPHICS:

Figure I - Location Plan
Figure 2 - Site Plan

OTHER EQUIPMENT SUMMARY:

Associated with this project is approximately $1.8 million of research and development equipment. This is needed to make this facility complete.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no presently known future requirements to complete this project.

AMES RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

MODIFICATION OF AND ADDITION TO MATERIAL SCIENCES LABORATORY (N-240)

SITE PLAN

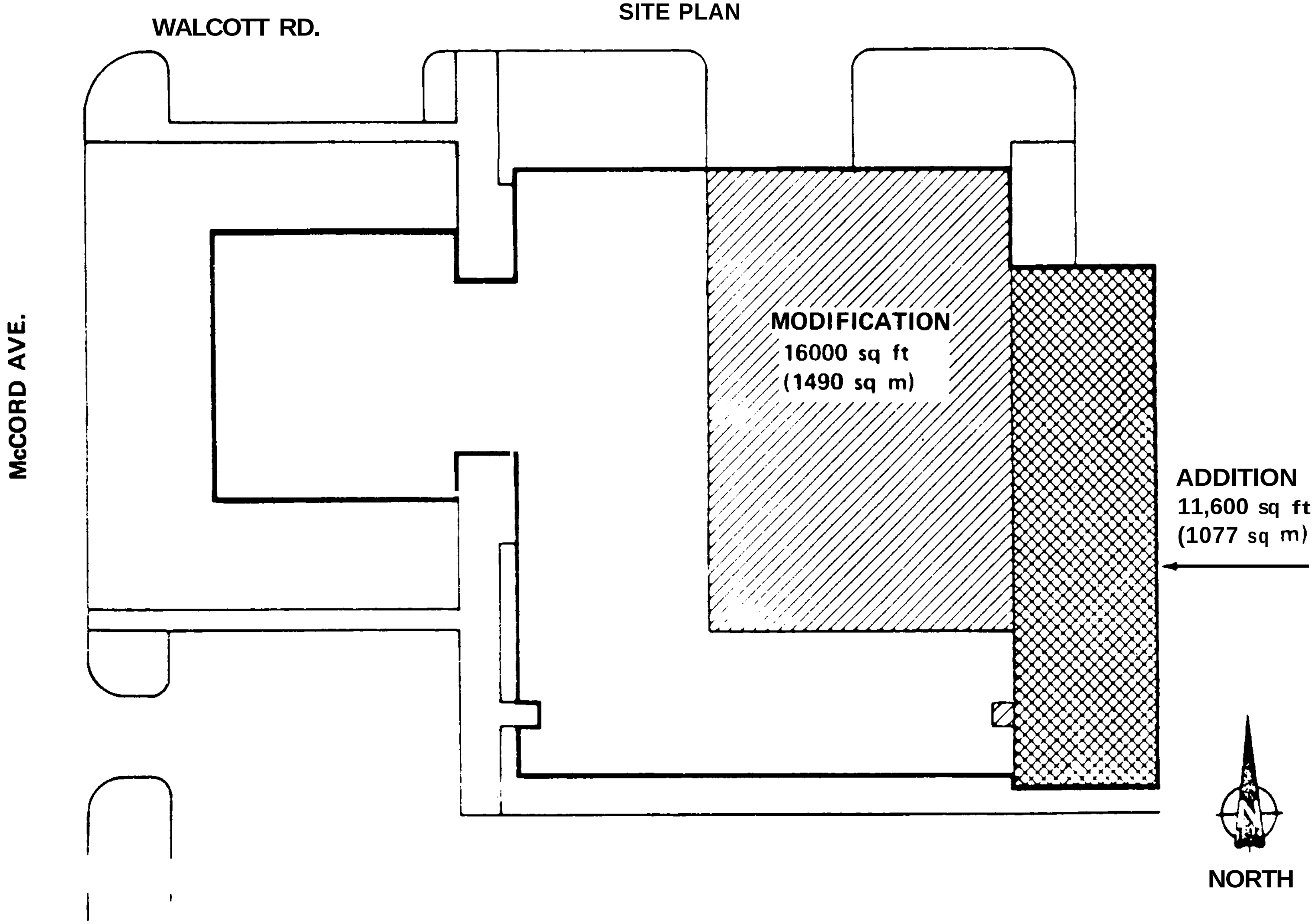


Figure 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

REPAIR

Summary of Project Amounts by Location:	Amount (In dollars)	Page No.
Ames Research Center	1.280.000	CF 12-4
Goddard Space Flight Center	595.000	CF 12-5
Jet Propulsion Laboratory	850.000	CF 12-6
Johnson Space Center	910.000	CF 12-8
Kennedy Space Center	185.000	CF 12-10
Langley Research Center	1.470.000	CF 12-10
Lewis Research Center	830.000	CF 12-11
Marshall Space Flight Center	1.305.000	CF 12-13
Michoud Assembly Facility	990.000	CF 12-15
National Space Technology Laboratories	1.035.000	CF 12-16
Wallops Flight Center	1.200.000	CF 12-17
Miscellaneous Projects less than $150.000 each	1.350.000	CF 12-19
Total	12.000.000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE:	Repair of Facilities not in Excess of $500,000 Per Project
INSTALLATION:	Various Locations
	FY 1980 CoF ESTIMATE: $12,000,000
FY 1978: None	FY 1979: None

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller

SUMMARY PURPOSE AND SCOPE:

This is a new project for inclusion in the Construction of Facilities (CoF) program.

This program is to provide for the larger, more basic and essential repairs to facilities at NASA field installations and Government-owned industrial plants engaged in NASA activities. Included in this project are those Priority repair facility needs for FY 1980 that can be foreseen at the time of the submission of these estimates, and that are estimated not to exceed $500,000 per project. The thrust of this program is to provide a means to restore appropriate facilities or components thereof, including collateral equipment, to a condition substantially equivalent to their originally intended and designed capability. It includes the substantially equivalent replacement of utility systems and collateral equipment necessitated by incipient or actual breakdown and consideration of associated obsolesence. The extent and nature of this work also includes major preventive measures which are normally accomplished on a cyclic schedule of greater than one year. Each of the individual items contained in this year's request for facility repair work is in itself a proper facility project. Each represents the consistent application of the approved and accepted definition of a facility project and, in this context, each includes all of the facility work that needs to be done in the budget time frame, or all of the facility work that can be done in that time frame, as limited by constraints other than availability of resources. Each individual item has been evaluated against applicable need dates, time lines and the ability to place the planned work under contract in the budget time frame.

The $12,000,000 request for FY 1980 is for those projects that are required in direct support of critical programmatic and institutional requirements.

PROJECT JUSTIFICATION:

In prior years it had been the objective to accommodate the larger repair projects within the Rehabilitation and Modification project line. This had been done by an administrative determination that required repair projects in excess of $100,000 to be managed as Rehabilitation and Modification projects. This had been working reasonably well until the past year or two when there appeared to be a surge of repair work. Examination of this indicated that this surge was directly related to the fact that a major portion of our building inventory is in the 15 + year old bracket and increases in repair requirements were to be normally expected. In fact, there are statistical bases to this evaluation that prove that 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 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. This condition is now being realized at locations such as Goddard Space Flight Center (GSFC) and Johnson Space Center (JSC). These more specific points, when coupled with the sheer age of other portions of the plant, such as at Langley Research Center (LaRC) and Lewis Research Center (LeRC), demand a more positive approach to the needs of repairs which are urgent and vital. Some 75 percent of our physical plant is in the 16- to 30-year old bracket.

As a consequence, a new budget line item is included in this year's CoF budget estimates. This program will achieve many objectives:

a. Provide the matter of repair an appropriate and badly needed better focus.

b. Permit central management and oversight, and thus better address priorities and changing conditions.

c. Allow R&PM facility services budget estimates to address timely recurrent annual costs and avoid periodic peaks for large cyclic preventive work.

This is all within the major thrust of preservation of the existing physical plant which, at its $6.0 billion initial cost, represents approximately $13.5 to 14.0 billion in 1979 dollars. It is recognized that, as such, repair is closely related to rehabilitation/modification. However, it is intended that the major distinction between these classes of work be 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 properly classed as "repair."

An analysis of each of the projects which follows indicates that this is the type of work which, in a prudent business-like way, must be addressed and progressively accomplished. Unless this is done, resultant risks are increased, and future costs of the specific work will be greater. More importantly, there will be increased "unscheduled breakdowns", impacting missions, and costly situations of "Emergency Patch and Repair" which will be required to make our facilities as useful as possible.

This project includes only facility repair work having an estimated cost not in excess of $500,000. The work covered in this project 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. Each repair project estimated to cost more than $500,000 is reflected as a separate major CoF line item project. Not included in this project are the other minor facility projects; Rehabilitation and Modification, and Minor Construction facilities projects required in FY 1980. Provisions for of these requirements are made under separate projects which are also included in these CoF estimates.

PROJECT DESCRIPTION:

Proposed repair items for FY 1980 are outlined under "PROJECT COST ESTIMATE"; they total $42,000,000. Deferral of this work would create high risks and consequences. These would impact program schedules and critical institutional facilities requirements in support of Agency mission goals and objectives.

Of the total projects listed, $10,650,000 represents discrete work packages at designated NASA installations. The remaining $1,350,000 relates to those smaller repair projects estimated to cost $150,000 or less, the nature and purpose of which are the same as for that work specifically delineated but which, because of their individual smaller sizes, are not listed by item. At this time, the items in this total package are considered to be of higher priority. They have been carefully selected from lists totalling about $25 million. This FY 1980 listing thus represents a modest increment in relation to the existing total backlog of this type of work for which provisions must be made over the next several years.

As indicated above, the projects in this request are considered to be of the highest present priority on the basis of relative urgency and expected return on the investment involved. It is recognized, however, that during the course of the year some rearrangement of priorities may be necessary. It is also realistic to assume that a change in some of the items to be accomplished within the allocated resources may be required. For the purpose of justifying this estimated facilities repair requirement, a tentative listing of projects is set forth under "PROJECT COST ESTIMATE." They will be accomplished on a priority basis. The total of $10,650,000 for separate projects relates to the following broad categories of facilities:

a.	Utility Distribution Systems	3,015,000
b.	Buildings and Structures	4,435,000
c.	Roads and Grounds	1,165,000
d.	Equipment	2,035,000

The additional lump sum estimate of $1,350,000 for smaller projects thus provides a total of $12,000,000 for this program.

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC) 1.280.000

1. Repair of Variable Frequency Power Systems 440,000

This project provides for the replacement of obsolete switchgear, circuit breakers, controls, central equipment of four motor generator sets, and the two associated 6.9 kv feeders which make up the ARC variable frequency power system. This equipment has been in continuous operation without a shutdown for major repairs since its installation in 1945. Most of the equipment is no longer manufactured and equipment which is manufactured has become more difficult to acquire. Numerous delays in the operation of the tunnel have occurred because of problems with deformed shafts, link pins and electrical contacts. This facility had four failures in a six-month time span (January-June 1978) impacting the operation of the major facilities that utilize this power. Failure to replace this equipment will result in more unscheduled shutdowns. This system supports work performed in the 2x2-Foot Wind Tunnel, Building N-227; 20g Centrifuge Building, Building N-221A; and the 40x80-Foot Wind Tunnel, Building N-221.

2. Repair of Electrical Drive Equipment 310,000

This project provides for the overhaul and rewinding of the motors and generators associated with the 7x10-Foot Wind Tunnel, Building N-216, drive system. This work includes the replacement of obsolete switchgear, circuit breakers, controls, and the overhaul of auxiliary support motors and generators located in the Thermal Protection Laboratory, Building N-234, and the Arc Jet Facility, Building N-238. Most of the equipment has been in operation for 30 years without major maintenance or overhaul. Many of the parts are not available for the switchgear and circuit breakers. As a result of the unavailability of the equipment, many parts are specially fabricated thus costing more than new parts. This equipment has become unreliable with a high risk of failure. In the event of failure, the operation of associated facilities (3.5-Foot Wind Tunnel and Air Jet Facility) also will be severely affected.

3. Repair of Building Exteriors, Various Buildings 165,000

This project provides for the repair of the siding to Buildings N-206, N-206A, N-207, N-211, N-229, N-230, N-231, N-234, N-235, and N-236. This involves waterproofing concrete surfaces of the buildings and sandblasting and painting of two metal buildings. In addition, the windows and screen replacements will be recaulked. These buildings are an average of 22 years old and in need of repair. During heavy rains, the concrete buildings leak causing water damage to the interior of the buildings. Rust and corrosion have seriously deteriorated the exterior surfaces of the metal buildings.

4. Repair of the Steam Vacuum System, Building N-234A 365,000

This project provides for the repair of the internal surfaces of the Steam Vacuum System. This work will include the cleaning, rebuilding and epoxy coating of the piping and replacement of the turning vanes and nozzle .assemblies. In addition the existing cooling water tank has a moveable wooden baffle which is damaged and does not effectively separate the cold and hot water. The wooden baffle will be replaced with new diffuser type piping. The repair of this system will reduce the steam losses due to leaks and increase the efficiency of the system. If this deterioration is allowed to continue, the facility could be damaged beyond economic repair.

B. Goddard Space Flinht Center (GSFC) 595,000

1. Repair of Elevators, Buildings 14 and 23 200,000

This project provides for the repair of two hydraulic elevators, one in the Spacecraft Operations Facility, Building 14, and the second in the Data Interpretation Laboratory, Building 23. This repair work includes the cabs, related equipment, and all worn parts. The elevator in Building 14 was installed when the building was constructed in 1964, and the one in Building 23 during construction in 1965. These elevators have been in constant use since then for transporting both personnel and heavy equipment in support of spacecraft programs and data reduction. The downtime of these elevators is now excessive due to their age and the difficulty in obtaining parts for the outdated equipment. This equipment must be repaired at this time to increase the reliability to an acceptable level required by the programmatic computer and data reduction operations being conducted in these buildings. The delay in providing for this repair will result in the continuation of the present unsatisfactory conditions, increased downtime and maintenance cost, more expensive cost in the future, and inadequate support of operational spacecraft programs.

2. Repair of Roofs, Instrument Construction and Installation Laboratory, Building 5, Business Operations Building, Building 18, and Meteorological Systems Development Laboratory, Building 21 395,000

This project involves the repair of approximately 145,000 square feet (13,470 square meters) of roof surfaces of Buildings 5, 18, and 21 at GSFC. This work includes the removal of the deteriorated roofing material and insulation, and the installation of new material. This work also includes the repair of the flashing, exterior siding, masonry work, and the roof drainage where necessary. A moisture invasion and leak locating survey was conducted of 750,000 square feet (69,675 square meters) of built up roofing serving the GSFC facilities. This survey revealed chronic cracking of roofing felts, severe edge and drain flashing failure, and blisters on the roofing of these buildings. These roofs have further deteriorated since the survey and now require extensive repair work to restore them to acceptable conditions. Roof deterioration due to normal aging and necessary roof traffic has resulted in an increasing frequency of roof leaks. This condition has resulted in extensive maintenance costs and threatens scientific and building equipment and related programmatic test operations being conducted in these buildings. For these reasons, Buildings 5, 18, and 21 were selected as the most urgent need for roof repair. The remaining buildings surveyed have been repaired or are in a more favorable condition and major roofing repairs can be deferred.

C. <u>Jet Propulsion Laboratory (JPL)</u> .... <u>850,000</u>

1. Repair to Exteriors of Various Buildings 400,000

This project provides for the repair, protection and exterior sealing of four buildings. The work involves the exterior painting of approximately 130,300 square feet (12,100 square meters) of surface. The areas include the Space Science Instrument Systems Laboratory, Building 168, at 36,600 square feet (3,400 square meters); the Engineering Office Building 169 at 33,700 square feet (3,100 square meters); the Physical Science Laboratory Building 183, at 40,500 square feet (3,800 square meters); and the Procurement Office

Building 190, at 19,500 square feet (1,800 square meters). Also included is the caulking of 55,700 linear feet (17,000 meters) of curtain wall joints in all four buildings and the epoxy pressure grouting of 4,400 linear feet (1,300 meters) of cracks in the concrete structure of Building 168 at 2,100 linear feet (600 meters), and Building 169 at 2,300 linear feet (700 meters). This work, which supplements the roof repairs done several years ago, will complete the sealing and waterproofing of the exterior surfaces of these four major structures at JPL. The exterior painting and sealing of the minor structure cracks of these buildings has not been done since the 1967-1969 period. The present paint is long overdue for recoating, repairing and applicable procedures to bring it up to a quality surface. In particular, attention must be paid to the curtain wall construction of these buildings which, over the years, tends to deteriorate and, with dried out caulking, induces cracks that permit the entrance of rain water at numerous locations. This, in turn, accelerated rusting and structural and wall/column deterioration. This work is basic to the long term preservation of these facilities.

2. Repair to Roofs on Various Buildings 220,000

This project provides for the repair, replacement and modification to the roofs of four buildings. Replacement of roofing is proposed for 12,400 square feet (1,200 square meters) of the 25-foot Space Simulator, Building 150; 4,100 square feet (400 square meters) for the west portion of the Engineering/Mechanics Building 157; and 3,400 square feet (300 square meters) of the penthouse area of the Telecommunications Building 238. Some 10,200 square feet (900 square meters) of the Materials Research Processing Laboratory, Building 158, will have a new roof installed along with demolition of abandoned cooling towers thereon, replacement of parapet caps and resloping of the roof for proper drainage and raising of the air handler equipment thereon. The roofs of these four buildings, in the areas specified, are in extremely poor condition. The recent winter rainstorms caused numerous leaks that penetrated the interior of the buildings to the extent that water had to be mopped up in Building 158. Also, leakage was evident in the other buildings. This specific work is essential now and of sufficient urgency that it must be included in this request at this time. It is felt that further deterioration of the roofs would provide an untenable situation for the tenants on the upper floors of these buildings and compound the deterioration of these facilities.

3. Repair of Roads, Table Mountain, California.... 230,000

This project provides for the repair of approximately 140,000 square feet (13,000 square meters) of badly damaged roads and the rerouting of approximately 7,000 square feet (650 square meters) of existing road at Table Mountain, California. The Table Mountain Facility is a government-owned site which is used to support JPL programs through astronomical observations/research, and for the development and testing of solar power devices for spacecraft applications. The roads within the main complex all require the removal of existing paving, removal of all wet base material and replacing it with suitable material, compaction of new base, and the installation of a new 3-inch (7.6-centimeters) asphaltic concrete surface with a seal coat. The road to the Users' Area will need a slurry coat on existing surface only. A portion of the existing boundary road will be rerouted through the complex. A recent inspection of the road conditions at Table Mountain disclosed that, in all cases, the roads showed excessive cracking and breaking due to unstable base material. These roads require this repair in order to place them in a more safe and satisfactory condition. The area of Table Mountain is subjected to extremes in climate from very hot to very cold and from very wet to very dry, and general maintenance would not be adequate to repair them to an acceptable condition.

D. Johnson Space Center (JSC) 910,000

1. Repair of Steam, Chilled Water, and Compressed Air Systems, Building 24 Complex 200,000

This project addresses a long-range requirement for the repair of various components of JSC's primary utilities generation and transmission systems located in the Central Heating and Cooling Plant, Building 24, and associated utility tunnels and cooling towers. The work includes repair of three central utility air compressors, heat exchangers, controls, a water pump, and cooling water piping in the compressed air generation system of Building 24. The work also includes replacement of approximately 10 expansion joints with loops, repair or replacement of 10 valves, and repair of pipe insulation in the steam and condensate lines located in the utility tunnel system. Work on the chilled water system includes repair or replacement of 10 chilled water and condenser water valves in the utility tunnel system, and replacement of insulation on one chiller evaporator and economizer located in Building 24. The project also includes repair of four 200-horsepower condenser water pumps located at the cooling tower. Though there have been no breakdowns or outward signs of trouble, this is the time when these components have reached their normal life expectancy based on experience and manufacturers' recommendations. This work is beyond the scope and capability of the annual maintenance program. The purpose of this project is to maintain the reliability, efficiency, and safety requirements of the installation's basic utility systems that are generated and distributed from the Central Heating and Cooling Plant. These systems are essential ingredients of the Center's energy conservation program and must be maintained in optimum operating condition.

2. Repair of Roofs, Various Buildings 250,000

This project addresses a long-range requirement to progressively repair the roofs of buildings at the Johnson Space Center. This project provides for roof work on Buildings 9, 351, 352, 353, 354 and 380. The work will consist of removing and replacing roofing material, resealing and caulking perimeter flashing and flashing at roof penetrations, and replacement of roof insulation board as required. Moisture relief vents will be provided where excessive moisture collects. A total of approximately 46,800 square feet (4,348 square meters) of built-up roofing and approximately 1,163 linear feet (354 meters) of neoprene flashing will be replaced on Buildings 9 (Technical Services Facility) and 380 (Hazardous Material Storage Facility). A total of approximately 19,300 square feet (1,793 square meters) of acid resistant elastomeric sheeting and approximately 1,263 linear feet (385 meters) of neoprene flashing will be replaced on Buildings 351, 352, 353 and 354, in the Thermochemical Test Area. Work on Building 380 includes the addition of alight-weight concrete fill on the roof slab and installation of a built-up roof. This project is essential to the continued operation of these JSC facilities. Over the past 12 years, the normal aging process together with various building modifications affecting the roofs and the presence of numerous roof penetrations have combined to significantly reduce the integrity of the roofs. Weathering, blistering, and flashing failures have resulted in numerous leaks and moisture penetrations. This project is needed to preclude damage to the building structures, as well as damage to interior ceiling panels, electrical panels, and sensitive equipment and electronics.

3. Repair of the Electrical Distribution System.. 230,000

This project addresses a long-range requirement to replace deteriorated feeder cables in the Center's electrical distribution system. The work includes replacing approximately 19,050 linear feet (5,806 meters) of existing 15-KV, 400 mcm, underground cable, extending from the substation to the utility tunnel, identified as feeders 1-8, 2-6, 2-7; the cable from the substation to Building 222 (feeder 3-1); and the cable from the substation to Buildings 32 and 36 identified as feeder 2-12. The existing cable in the Center's electrical distribution system has been in continuous service for the past 12 years, during which time a large amount of unscheduled maintenance has been required. Past faults have been repaired as they have occurred, but these repairs have not been of the magnitude to prevent future failures of a potentially extensive nature. The defective condition of the cable, at this stage, indicates that replacement is now required to assure the desired degree of reliability of power to the Center's facilities to avoid any major program impacts.

4. Repair of Roofs, NASA Industrial Plant, Downey, California............................ 230,000

This project provides for the repair of roofs of Buildings 001 and 290 at the NASA Industrial Plant, Downey, California. The work includes the repair/replacement of 29,000 square feet (26,941 square meters) of roofing, with associated flashings and drains on Buildings 001 and 290. These buildings house important functions that support the Shuttle manufacturing program. By 1980, the roof of Building 001 will be 18 years old, and the roof on Building 290 will be 17 years old. Both roofs are in a badly deteriorated condition. The roofs on both buildings have a history of numerous leaks and have required extensive maintenance over the years. Delay in reroofing beyond 1980 could cause damage to building structure, roof insulation, ceilings, walls, and floors, as well as costly test equipment and flight-type hardware.

E. Kennedy Space Center (KSC) 185,000

1. Repair Roofs, Flight Crew Support Building (M7-409) and Central Supply Building (M6-744) 185,000

This project will provide for the repair of 85,000 square feet (7,897 square meters) of 5-ply built-up roofing, with associated base flashing, gravel stop, gutters, and downspouts on the Flight Crew Support Building and the Central Supply Building. Also included is the repair and recoating of 74,000 square feet (6875 square meters) of metal roof on the Central Supply Facility. These roofs will be 16 years old by 1980 and will require more extensive repair later if the work is not accomplished in this time frame. The roof of the Flight Crew Support Building has deteriorated to a point where it is spongy and has some blisters. Leaks occur occasionally, but the portion of the roof to be replaced has deteriorated to a point where serious leakage during inclement weather will occur more frequently. The roof of the Central Supply Building has numerous leaks which occur during both mild and heavy rainy weather. The extent of leaks and deterioration of the roof assemblies makes this repair necessary, especially since many items stored in this facility are vulnerable to water damage. "Stop-gap" measures have been taken to control the leaks, but they are only temporary measures and usually are not very effective. The only solution is the replacement of the built-up roofs and a complete rework and coating of the metal roof as this project plans.

F. Langley Research Center (LaRC) 1,470,000

1. Repair of Potable Water Piping, West Area.... 440,000

This project provides for the replacement of three potable water supply lines in the following locations; (1) Utility Tunnel No. 2 between Buildings 1215 and.1244; (2) along Ames Road from Building 1232 to the 10-inch (25.4 centimeter) diameter line near the Gregg Road intersection; and (3) along Durand Road then across Marvin Road past Building 1206 down to Servil Road between Buildings 1169 and 1245. A total of approximately 5,800 linear feet (1,768 meters) of 6- and 8-inch (15.2 and 20.3 centimeter) diameter water lines and associated valving will be replaced. The existing cast iron pipe lines have been in service for up to 30 years and have had numerous breaks resulting in interruption of services,' as well as becoming a high maintenance item. As a consequence of the age of these pipes, there exists a significant amount of corrosion and buildup in the lines resulting in poor water with inadequate pressure.

2. Repair of the Air and Steam Lines Serving the Vicinity of Building 1154 390,000

This project provides for the replacement of approximately 2,000 feet (610-meters) each of the 5,000 psi (34,000,000 newtons per square meter) airline, 100 psi (689,000 newtons per square meter) airline and the steam and condensate lines serving the vicinity of Building 1154. The lines will be installed in a shallow concrete trench having removable lids. They will be extended from Utility Trench No. 4. This work involves the replacement of valves, controls, flanges, and auxiliary equipment. The existing 5,000 psi airline was installed in 1960. Portions of the line pass through a marshy area having a saline environment resulting in corrosion of the line. As a result, there have been several failures requiring downtime that has impacted the utilization of the affected facilities. The 100 psi airline will replace a reducing station to minimize the use of the high pressure system for low pressure service. The insulated steam and condensate lines will be installed from Utility Tunnel No. 4 to the existing boiler located in Building 1154.

3. Repair of Heat Exchangers in Building 1247E 180,000

This project provides for the repair of two heat exchangers in the Compressor Facility, Building 1247E. The heat exchangers function with the compressors that provide high pressure air to most of the research facilities. These heat exchangers are 25 years old and have seriously deteriorated due to their age. Many repairs have been performed to plug the failing tubes. However, it is not cost effective to continua this operation because they can no longer provide adequate cooling.

4. Repair of the Instrument Research Facility, East Wing, Building 1230 460,000

This project provides for the repair of approximately 37,000 square feet (3,473 square meters) of laboratory and office space of the Instrument Research Facility, East Wing. The exterior repair will consist of replacing deteriorated wood window frames with insulating glass window/aluminum frame units, insulating exterior walls, and replacing exterior doors. Interior repairs to the mechanical systems to pravide the required environmental control will include the conversion of the existing two-pipe induction units to a four-pipe system, utilizing modified existing central equipment. This facility was constructed in 1950 and has been modified and adapted to serve various programs for almost 30 years. This project will correct serious deficiencies that require immediate attention.

G. Lewis Research Center (LeRC) 830,000

1. Repair of Icing Research Tunnel, Building 11 380,000

This project provides for the repair of the 34-year old Icing Research Tunnel, Building 11, necessary to reduce maintenance and to eliminate the potential development of safety problems resulting from corrosion of the tunnel structure. Included is the replacement of deteriorated corner turning vanes (including the associated steam heating system) and fan inlet screen; repair of the corroded tunnel structure; replacement of obsolete electrical switchgear and drive motor auxiliary equipment controls; and repair of the tunnel interior lighting system. The moist operating conditions of this tunnel have resulted in severe corrosion of the tunnel structure. Complete replacement of many structural components is necessary. The tunnel lighting, corner turning vanes, and fan inlet screen are similarly deteriorated. Although maintenance work has extended the useful life of this facility, major repairs are needed now to correct the present deficiencies. This tunnel, which is unique within NASA and is also the largest operating icing research tunnel in this country, supports on-going research under the Interagency and Industrial Assistance and Testing program. Typical of this research is the testing of more efficient wing heating systems; new anti-icing aircraft radio antennas, data probes, and engine components; and new pneumatic wing deicers. New areas of interest, which include icing research directed toward all-weather helicopter operation, low flying cruise missiles, and windmills for electric power generation, have increased the utilization of this facility. This repair work will restore the structural integrity and performance characteristics of this facility.

2. Repair of Roofs, Various Buildings.. 270,000

This project provides for the replacement of the roofs on Buildings 16, 66, 87, and 5 (Southwest Wing only), and a portion of the roof on Building 5 (Central Section) totaling 72,800 square feet (6,760 square meters). These roofs will be completely removed down to the support structures and new roofing systems will be installed. The new roofs will have thermal insulation as required to meet the current energy conservation standards and, where necessary, will be treated to withstand heavy traffic. Railings will be provided where necessary to meet Occupational Safety and Health Administration (OSHA) standards. Roof penetrations will be either eliminated or revised to meet current LeRC penetration standards. The roofs of these buildings, as included in this project, are from 23 to 36 years old. Separated flashing, roof surface blisters and punctures, and damage due to traffic have resulted in water saturated insulation. This condition increases heat losses while contributing to further roof degradation. Although routine repair and periodic maintenance of the roofs on these research facilities has been accomplished, these roofs have deteriorated to the point where complete replacement is necessary. In addition, this project provides for necessary localized repairs on over 500,000 square feet (46,450 square meters) of roofs that have been recently replaced. This work will also result in an estimated annual energy savings of 2.6 billion BTU per year or about $10,000 per year.

3. Repair of Exterior Surfaces, Various Buildings and Piping Systems...................... 180,000

This project provides for the exterior surface repair of the 10-Foot x 10-Foot (3-Meter x 3-Meter) Supersonic Wind Tunnel (SWT) Loop, Building 85 (tunnel and building portions); the 10-Foot x 10-Foot SWT Secondary Compressor and Drive Building, Building 87; the 10-Foot X 10-Foot SWT Main Compressor and Drive Building, Building 90; the 10-Foot X 10-Foot SWT Exhauster Building, Building 114; and all major Central Air System combustion air and altitude exhaust piping. Included is the surface preparation and coating of corroded exterior metal surfaces. Surface repair of exterior iron, steel, and other metals at LeRC is required on approximately 7-year intervals to avoid serious corrosion of structures and piping and to preserve the aesthetic value of the Center. Many of the facilities at LeRC consist essentially of exterior metal surfaces. This is particularly true of the 10-Foot x 10-Foot SWT and the Central Air System piping. The massive tunnel sections and the network of large and small diameter air piping routed throughout the Center are plainly visible and, like all exterior surfaces at LeRC, are subjected to the extreme weather conditions and corrosive industrial atmosphere of the Cleveland, Ohio area. Some of the surfaces included in this project are already showing signs of deterioration such as thin finish coats; exposed or peeling undercoats; rusted joints, seams, and brackets; and rust-streaked surfaces. To preserve the Government's investment in facilities, LeRC has established a 7-year cycle for these necessary repairs. These facilities will reach the end of their 7-year interval in FY 1980.

H. Marshall Space Flight Center (MSFC) 1,305,000

1. Repair High Pressure Gas System 450,000

This project involves the repair and refurbishment of the 5,000 psi gaseous nitrogen and 3,500 psi "flight grade" air systems in twelve buildings throughout the Center. Included will be localized repair, refurbishment or replacement of the high pressure control systems, pumps, storage vessels, components, distribution piping, regulators, and valves. There is one high pressure gaseous nitrogen pumping station, two "flight grade" air pumping stations, 95,000 linear feet (28,956 meters) of primary distribution system and thirty high pressure reducing stations in these systems. This entire complex services the Marshall Center test stands, shops, laboratories and support facilities. The system will be recertified from other resources to permit full operational use upon completion of this project. These systems were installed in the 1950's and have deteriorated through age and heavy cyclic use. They are now at the end of their 20-year design life. Radiographic inspections of the systems have revealed deterioration in welds, and portions of the systems have been down rated and can only be operated at reduced pressures. Deterioration of these systems seriously affects the reliability required to support research and development associated with on-going and future programs. The nitrogen and air systems continually lose pressure through various leaks. Failures and serious defects in the systems are being found and corrected at an increasing rate by "breakdown" maintenance. This, coupled with the known age and validated "real life" condition, confirms the need for this planned repair work by not later than the FY 1980 time frame.

2. Repair High Pressure Water System Valves 200,000

This project provides for the repair of large valves in the high pressure water system servicing the MSFC test areas. Included are: seven 16-inch (40.6 centimeter) manual gate valves located in the fire protection system in the east test area; one manual and eight electrically operated 30-inch gate valves and nine 8-inch (20.3 centimeter) bypass valves located on the 30-inch (76.2 centimeter) main feeding the test facility in the east area; and three 20-inch (50.3 centimeter) gate valves located at Building 4572 (Propulsion and Structural Test Facility). Fire protection in the test area is hampered by deteriorating valves and lines, particularly in the east test area. Most of the test area high pressure water system was installed in the late 1950's without proper cathodic protection. As a result, the valves have deteriorated, are now leaking badly and must be repaired in the near future, as fire protection must be provided continuously to protect costly government equipment and facilities. Repair of the 30-inch valves is required to maintain cooling capability essential to fulfilling minimum test capability projected in the 1980 time frame.

3. Repair Air-conditioning Components 300,000

This project will repair major air-conditioning system cooling towers and chillers by replacement with substantially equivalent units. Four cooling towers, with a total capacity of 875 tons, are to be replaced. In addition, two water-cooled chillers with a total capacity of 425 tons are to be replaced. Also included will be miscellaneous piping, valves, and electrical work necessary to complete the work. This equipment ranges in age from 15 to 30 years but had an original design life of only 10 years. The equipment is in a very deteriorated condition and requires continual heavy maintenance to keep it operable. It is more economical to replace the components than to continue the "patchwork" repairs. All of the facilities supported by these components are in direct support of the Space Shuttle and Spacelab programs and various other research and development efforts essential to future programs. This repair work is essential in the FY 1980 time frame.

4. Exterior Repairs, Various Buildings 355,000

This project provides for the repairs to and painting of approximately 460,000 square feet (42,734 square meters) of exterior walls, doors, windows and other surfaces of Buildings 4476 (Environmental Test Facility), 4550 (Structural Test Facility), 4707 (Shop and Assembly Building), and 4760 (Surface Treatment Facility). Work includes surface preparation, minor repairs, caulking and application of 2 coats of paint. Protective painting guards against the cumulative damaging effects of wear, deterioration and weather, and preserves the facility's capability for prolonged operation.' The exterior surfaces are peeling, moisture is getting into the wood and other surfaces, and the caulking has deteriorated to a point where little protection is provided. There is some evidence of deteriorated wood where there has been direct exposure to the elements. Continued deferral will not be cost effective due to further deterioration and corrosion, and more extensive surface preparation will be required.

I. Michoud Assembly Facility (MAF) 990,000

1. Repair of Cooling Towers... 360,000

This project includes the repair of three cooling towers, 11127, 11202 and 11352, that support Shuttle operations at MAF. Two of the towers were constructed in the 1963/1964 time frame and the third dates from 1952. Towers 11127 and 11202 directly support the production of the External Tank (ET). Cooling tower 11352 supports the cooling system of Building 350 that will house the engineering and management staff of both NASA and the prime contractor on the ET, as well as other Government tenants. Cooling tower 11202 is a single "point-of-failure" for the chilled water system that is required to maintain the production plant environment within the limits required. The last major repair of this tower was in 1964. Some 30 to 50 percent of the structural members must be replaced. Loss of baffles and wall members (approximately 20 percent) have caused a serious loss in the energy efficiency of the unit. Repair of the structure and replacement of the fan motors will return the efficiency of the unit to its original capability. Cooling'tower 11127 supports both the cooling and process systems in Buildings 110 and 130. These systems in turn directly support production cells and/or equipment for the manufacture of the ET. Constant exposure to the condenser water has caused deterioration to structural members, heaters, wall decking and basins. This repair work will improve the energy efficiency of the tower and the systems it supports as well as its reliability. Cooling tower #352, like the other two towers, requires replacement of rotted decking, head boards and structural members. Walkways and platforms required to service the unit must also be replaced. In this unit the motors and fan gear boxes will be repaired. The distribution headers and basins will be repaired. In all three cooling towers the fire protection system will be inspected and repaired. Control systems will be adjusted or replaced. This work is badly needed to insure reliability of the towers for the ET production and improvement of the energy efficiency and reliability of the systems.

2. Repair of Asphalt Roadways and Parking Areas................. 210,000

This project is part of an integrated repair program of the asphalt roadway and parking area designed to maintain these surfaces with a minimum expenditure of funds. The unstable soil conditions in the New Orleans area, with the large amount of rainfall and high temperature, contribute to a rapid deterioration of the roadways and parking areas. Previously deferred funding of this project has resulted in greater effort now to return these surfaces to an acceptable standard. Further delay in repairing these surfaces could mandate complete rebuilding. In this phase of the project approximately 60,000 square yards (50,160 square meters) of roadways and parking areas will be overlaid with asphalt concrete, with the associated prime and seal coats. Roads and parking areas included are Jupiter Avenue from Mercury Boulevard to and including Lots L, J, G and C; and Saturn Boulevard from Mars Drive, east 900 feet (274 meters).

3. Repair of Various Buildings 420,000

This project provides for the repairs to the exteriors of the Main Manufacturing Building 103, Vertical Assembly Building 110, and the Laboratory Building 111, which are the major manufacturing buildings at MAF for the production of the External Tank. Steel surfaces of metal and asbestos siding have suffered wind and weather damage. Repair of the damaged sections and application of protective coatings to the exterior building walls and doors is required to insure the integrity of the buildings and prevent further deterioration which would require extensive replacement of siding and doors. Damaged or loose asbestos and metal siding shall be replaced or secured. Approximately 20,000 square feet (1,858 square meters) of metal surface require sand blasting with other areas to be scraped and cleaned. Protective coating will be applied to 320,000 square feet (29,728 square meters) of surface.

J. National Space Technolonv Laboratories (NSTL) 1,035,000

1. Repair to Navigation Lock and Bascule Bridge 350,000

This project provides for the repair of the NSTL Navigation Lock and Bascule Bridge. The work includes dewatering the lock in order to repair needed component hardware such as upper and lower gate seals, bearings, sills, grease lines, and cathodic protection system, as well as providing protective coatings as needed. Also included is the repair of tainter valves, gates and underwater piping. The dewatering process will require the placement of structures in the canal upstream and downstream of the lock in order to barricade water flow. A recent inspection has been performed and recommendations for these repairs has been validated. This indicates that the dewatering, inspection and underwater repairs must be accomplished by 1980. The lock has not had this type of overall repair since completion of construction in 1965. Operational failure of bridge and/or lock could impair delivery of cryogenics by barge which directly support the Shuttle Test Program. This bascule bridge is the only access to NSTL from the South.

2. Repair of High Pressure Gas System Valves.............................. 485,000

This project will provide for the repair of high pressure gas system relief valves within the Shuttle Test Complex, cross country systems and base facilities. The work includes valve rework, repair, and certification. The scope of this effort meets 1980 requirements only, and will be a major continuous cyclic repair program to be accomplished on a year-to-year basis. During the reactivation of the high pressure gas system for Space Shuttle Main Engine, a large number of these valves and system components were replsced. However, because of the heavy test load involving 2 to 4 test firings per week, and because these components are continuously subjected to very high pressure, the repair cycle is most important. Based on experience since the start of engine development testing, it became clear that such cyclic repair on many system components would be required no later than each 4-5 years. Since the test program started in FY 1975, the initial phase of valve and component work will be necessary in FY 1980.

3. Repair of Diesel Engines 200,000

This project provides for the repair of fourteen diesel engines which drive high pressure water pumps and provide back-up power. There are 10 water pump engines rated at 4,460 horsepower each and 4 power generator engines rated at 2,120 horsepower each. These engines will have a detailed inspection, and the resulting repairs to include necessary replacement of parts and components will be accomplished in accordance with the manufacturers' recommendations and useage experience. These engines are necessary to support the Shuttle Engine Test Program. The ten diesel engines are used to pump high pressure industrial water to the test stand deflectors at a rate of 300,000 gallons per minute. The other four provide back-up power during test period in the event of commercial power failure. These engines have been subjected to heavy and continuous usage since their last major overhaul in 1974. Because of this heavy usage over the past four years, inspection and repair will be required during 1980. The test workload is such that engines must be serviced in sequence and thus will require a full year implementation cycle. The loss of any of the diesel engines would result in a compromise of the Shuttle Engine static firing program at NSTL.

K. Wallops Flinht Center (WFC) 1.200.000

1. Repair of Airfield Facilities..... 440,000

This project provides for the most urgent repair of the airfield facilities. This work includes the repair of the deteriorated pavement and the overlay of four inches (10.2 centimeters) of bituminous concrete of approximately 12,800 square yards (10,702 square meters) of the south 800-feet (244 meters) of Runway 17/35. In addition: this work includes the repair of ramp areas around the Aircraft Control Tower, Building A-I, Fire Control Station, Building B-129, and the Fuel Tanks, E22 and E23, and the overlay with two-inches (5.1 centimeters) of bituminous concrete of approximately 29,000 square yards (24,247 square meters) of pavement. The related aircraft surface markings and improvements to the shoulder areas are included in this work. The repair of the airfield paving at the south end of Runway 17/35 and the ramp areas by Buildings A-1 and B-129 is necessary to maintain an acceptable surface quality that is conducive to aviation safety. Spalling is occurring in this area and the resulting loose debris is increasing the probability of damage to conventional and research aircraft. Surface markings are required to provide clear direction for aircraft ground control. The repair of these airfield facilities is necessary at this time to stop further pavement deterioration and more extensive and costly future repairs, and to provide adequate support for research aircraft operations.

2. Repair of Roads...... 285,000

This project provides for the repair of the principal roads on the Center and the island launch area. This repair work includes the overlay of two inches (5.1 centimeters) of bituminous concrete on approximately 40,000 square yards (33,444 square meters) of the main entrance to the Center, Stubbs Boulevard, Fulton, Wormhoudt, Bond and Bliss Streets. The drainage of the island road will be improved and a two-inch (5.1 centimeter) bituminous surface course will be applied to approximately 8,500 square yards (7,107 square meters) of pavement. In addition, this work will include the related repair of the curbs, sidewalks, and shoulder areas of these roads. These repairs are the result of a study of the existing conditions of the primary roads of the Center. Since 1959, maintenance of the primary heavy traffic roads of WFC has been by sealing and other short term measures. Major repairs are needed at this time to correct settlement, protect the subgrade, and provide adequate drainage. The Wallops Island road is the only access to the launch facilities and it has deteriorated to a condition that this repair work is necessary to provide a suitable surface for the transportation of research rocket motors. Some additional repair effort will be necessary in future years for the remaining roads and parking areas of the Center.

3. Repair of Various Roofs......... 175,000

This project involves the necessary repair of the roofs on Buildings N-162, V-45, V-50, V-55, W-65, X-15, X-35, and X-85 at WFC. These repairs include the installation of new roofing, insulation and related work on some 75,500 square feet (7,014 square meters) of roof surfaces on these buildings. This repair project is the result of a study of the roof conditions at the Center. This study indicates the roofs of these buildings have deteriorated to an extent that the repair work is beyond normal maintenance, and a major repair effort now is necessary. Deferral of this repair project will require more extensive and costly repair work at a later date, with the potential of water damage to the interior furnishings and equipment of the buildings caused by leaks.

4. Repair of Steam and Condensate Distribution System 300,000

This project provides for the repair of the steam and condensate distribution system at WFC. The work includes the repair of approximately 5,600 feet (1,707 meters) of steam and condensate piping, valves, expansion joints, and related equipment. The existing steam and condensate system serving the principal buildings of the Center was installed in 1958 and has deteriorated to the extent that continual repairs are required to maintain the steam service. The repair of the steam and condensate distribution system will provide better steam service and conserve energy and water resources by eliminating the waste due to leaks. This repair project is needed at this time to reduce maintenance, improve operating conditions, and reduce the consumption of energy at WFC.

MISCELLANEOUS PROJECTS LESS THAN $150,000 EACH	1,350,000
TOTAL	12,000,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that between $10 and $15 million per year will be required for the continuation of this facility repair program. It must be recognized that this is the initial year for a centrally managed repair program and that prior experience with Rehabilitation and Modification Programs indicates that early requirements tend to be conservative and may be underestimated.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

REHABILITATION AND MODIFICATION

Summary of Project Amounts by Location:

	Amount (In dollars)	Page No.
Ames Research Center	1.725. 000	CF 13-4
Dryden Flight Research Center	555. 000	CF 13-6
Goddard Space Flight Center	1.440. 000	CF 13-7
Jet Propulsion Laboratory	1.140. 000	CF 13-9
Johnson Space Center	1.845, 000	CF 13-11
Kennedy Space Center	315. 000	CF 13-15
Langley Research Center	1,640. 000	CF 13-16
Lewis Research Center	1,010,000	CF 13-17
Marshall Space Flight Center	2.050, 000	CF 13-19
Michoud Assembly Facility	530. 000	CF 13-21
National Space Technology Laboratories	550.000	CF 13-22
Wallops Flight Center	785. 000	CF 13-23
Various Locations	3.805. 000	CF 13-24
Miscellaneous Projects Less than $150.000 each	2.400. 000	CF 13-25
Total	19,790,000	CF 13

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE:	Rehabilitation and Modification of Facilities not in Excess of $500.000 Der Project
INSTALLATION:	Various Locations
	FY 1980 CoF ESTIMATE: $19.790.000
FY 1978: $18,900,000	FY 1979: $15,300,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller

SUMMARY PURPOSE AND SCOPE:

This program is to provide for the rehabilitation and modification of facilities at NASA field installations and Government-owned industrial plants engaged in NASA activities. Included in this project are those priority rehabilitation and modification facility needs for FY 1980 that can be foreseen at the time of the submission of these estimates, and that are estimated not to exceed $500,000 per project. The purpose of this program is to protect, preserve, and enhance the capabilities and usefulness of existing NASA facilities, and to ensure the continued safe, economical, and efficient use of the physical plants. Each of the individual items contained in this year's request for facility rehabilitation and modification work is in itself a proper facility project. Each represents the consistent application of the approved and accepted definition, and, in this context, each includes all of the facility work that needs to be done in the budget time frame, or all of the facility work that can be done in that time frame, as limited by constraints other than availability of resources. Each individual item has been evaluated against applicable need dates, time lines, and the ability to place the planned work under contract in the budget time frame.

In addition to the usual rehabilitation and modification requirements to the physical plant, the Agency continues to emphasize the identification of projects that relate directly to the conservation of energy at the various field installations. This particular program is now specifically directed toward the general nonprogrammatic or institutional segments of NASA facilities; however, additional attention is also given to facility modification requirements generated by specific programs or projects.

The $19,790,000 request for FY 1980 is for those projects that must be done in direct support of critical programmatic and institutional requirements. This request also involves approximately $6.5 million for projects related to energy reduction which in itself testifies to the pressing nature of these needs.

PROJECT JUSTIFICATION:

At its initial cost, the existing NASA physical plant totals about $6.0 billion (September 30, 1978). A continuing program of rehabilitation and modification of these facilities is required to:

a. Protect the capital value represented by these facilities and to overcome the cumulative effects of wear and deterioration.

b. Ensure the continued and reliable availability of these facilities as well as their operational capabilities, as applicable.

c. Improve the capabilities and usefulness of these facilities in terms of NASA mission accomplishment, and overcome the aggregate effects of obsolescence.

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

e. Provide for significant reductions in energy consumption through the initiation of energy conservation projects and the provision of updated and improved utility control systems.

This program includes only facility rehabilitation and modification work having an estimated cost not in excess of $500,000. 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. Rehabilitation and modification work estimated to cost more than $500,000 is reflected as a separate major CoF line item project. Not included in this project are the minor construction (new construction and additions) and repair of facilities projects that are required in FY 1980. Provision for these requirements are made under separate programs which are also included in these CoF estimates.

PROJECT DESCRIPTION:

Proposed rehabilitation and modification items for FY 1980 are outlined under "PROJECT COST ESTIMATE"; they total $19,790,000. This includes a total of approximately $3,545,000 which has been deferred from the FY 1979 program due to the budget reductions. This request is for projects that must be done in this time frame and their deferral would create high risks or consequences. These would impact on program schedules and critical institutional facilities requirements in support of Agency mission goals and objectives. Also included in this request are direct energy projects associated with buildings and other types of facilities.

Of the total projects listed, $17,390,000 represents separate projects at designated NASA installations. The remaining $2,400,000 relates to those smaller rehabilitation and modification projects estimated to cost less than $150,000, the nature and purpose of which are the same as for that work specifically delineated but which, because of their individual smaller sizes, are not listed separately. At this time, the projects in this total package are considered to be of the highest priority. They have been carefully selected from lists totalling about $47 million including $3,545,000 of pressing requirements deferred from the FY 1979 Program. This FY 1980 listing thus represents a modest increment in relation to the existing total backlog of this type of work for which provisions must be made over the next several years.

As indicated above, the projects in this request are considered to be of the highest priority on the basis of relative urgency and expected return on the investment involved. It is recognized, however, that during the course of the year some rearrangement of priorities may be necessary. It is also realistic to assume that a change in some of the items to be accomplished within the allocated resources may be required. For the purpose of justifying this estimated facilities rehabilitation and modification requirement, a tentative listing of projects is set forth under "PROJECT COST ESTIMATE." This work will be accomplished on a priority basis. The total of $17,390,000 of separate projects relates to the following broad categories of facilities:

a.	Utility Systems	3,790,000
b.	Fire Detection/Protection Systems	1,580,000
c.	General Purpose Buildings	6,085,000
d.	Technical Buildings/Structures	5,935,000

The additional lump sum estimate of $2,400,000 for smaller projects thus provides a total of $19,790,000 for this program.

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC) 1,725,000

1. Modification to the 2x2-Foot Wind Tunnel, Building N-222 480,000

This project provides for the modification of the 2x2-Foot Wind Tunnel, Building N-222. This work includes replacing the four inadequate 1,000 horsepower (746 kilowatts) motors with four 1,500 horsepower (1,119 kilowatts) motors and the addition of an acoustic enclosure around the wing tunnel structure. This work also will include the modification of 2,000 square feet (186 square meters) of the test chamber. The existing four 1,000 horsepower motors are no longer able to supply the increased requirements of planned research programs. Many of the test program runs are now accomplished by operating at a 50 percent overload. The facility is shutdown often to cool the drive system, thereby delaying test program progress. Repair and maintenance requirements, resulting from the overload operation, are severely impacting research progress. During a period of over 12 months, one-third of the available test time was spent in motor repairs. Replacement parts for major components are no longer available. Recent environmental noise regulations require that the 2x2-Foot Wind Tunnel sound levels be reduced. The acoustic enclosure around the structure will reduce the noise level. The 2x2-Foot test chamber is inadequate for its present use. Modern electronic data equipment and other sophisticated test support equipment overcrowd the space. Modification of this space will provide for better utilization. The work in this facility supports rotorcraft aerodynamic performance programs, turbulent-flow programs and airfoil aerodynamic programs. Significant testing and analysis is performed in relation to both subcritical airfoils. These modifications will **allow** for continuation of research in these areas.

2. Modification of the Radiation Facility, Building N-237 300,000

This project provides for modification to the Radiation Facility, Building N-237, Room 164, to accommodate the gas test cell now located in Building N-245, Room 182. In its present location, this cell is too close to personnel and is hazardous in the event of an internal explosion. Modifications include removal of old equipment in Room 164 and installation of a combustible gas monitoring system, a gas cell temperature sensing and control system, and new vacuum pumps. The gas test cell is used to determine the absorption of electromagnetic radiation in gases which are known or postulated to exist in the atmospheres of the outer planets of the solar system. The test cell consists of a 12-inch (30.5 centimeter) diameter, 82-foot (250 meter) long tube which has the capability to be charged with a gas of composition, temperature and pressure representative of a planet's atmosphere. Building N-237 has several test rooms specifically designed to withstand an accidental or sudden internal over-pressure that might occur with an explosion or release of high pressure gas.

3. Modification of the Life Sciences Research Laboratory, Building N-239 300,000

This project provides for the modification of computer space in the Life Sciences Research Laboratory, Building N-239. This modification of 7,500 square feet (700 square meters) of space includes improvements to the electrical, mechanical and fire protection systems. A raised floor system will be installed in the computer area. New partitions and ceilings are included in the modification. This work is necessary to support the. Human Factors Research full mission simulation studies now being performed in Building N-239. A considerable portion of the computational equipment used in support of these programs has reached the end of its useful life and is being replaced. This project is necessary to support new computer equipment planned to be installed during the FY 1981 time frame.

4. Modification for the Airframe/Propulsion Calibration Laboratory, Building 207 425,000

This project provides for the modification of 1,800 square feet (170 square meters) of space in Building N-207. The Building's 1x3-Foot (.3x.9 meter) wind tunnel test section, aftercooler and return loop will be dismantled and removed. A calibration chamber will be fabricated and installed at the inlet side of the wind tunnel compressors as well as the installation of new exhaust piping. Room partitions will be added to divide the area into several rooms. A two-inch (5 centimeter) high pressure air line from the adjacent Hypervelocity Free. Flight Facility, Building N-237, will be installed with provisions to attach an existing one megawatt portable air heater to the line. This modification is needed at this time to provide the proper pressure, environment and means to accurately calibrate the thrust and airflow characteristics of the advanced turbine powered propulsion simulators prior to testing in the 11-Foot Unitary Plan Wind Tunnel and the 12-Foot Wind Tunnel. These calibrations are required so that aircraft drag can be obtained prior to wind tunnel measurement. No facility presently exists to perform these tests. Since the calibration for each simulator is unique, specialized equipment is needed. Because of the unique tests, performing this testing at another facility would b'ecome prohibitive.

5. Modification of HVAC Systems In Various Buildings 220,000

This project provides for the modifications of the heatinq, ventilating, and air-conditioning (HVAC) systems in five buildings to improve the operating conditions. The buildings to be modified are the Administration Building, Building N-202; Headquarters' Army Research and Technology Laboratory, Building N-207; 40-Foot x 80-Foot Wind Tunnel, Building N-221; the Unitary Plan Wind Tunnel, Building N-227; and the System Development Facility, N-242. Modifications will include improvements to the controls, ductwork, timers, and other related equipment to permit building zoning for specialized equipment and more efficient utilization of energy. Also included will be provisions for economizer systems for the buildings which operate on a 24-hour, seven-day per week basis. This work will result in more efficient utilization of energy and produce an annual savings of 1,890,000 kWh of electricity resulting in a simple payback of approximately 5 years.

B. <u>Drvden Flight Research Center (DFRC)</u> .... <u>555,000</u>

1. Modification of Fire Water System 255,000

This project provides for the modification to the water system at the Dryden Flight Research Center (DFRC). This work will include the installation of a new 500,000-gallon (1,890 kiloliters) welded steel ground water storage tank near the existing pumphouse, Building 4853. The new water storage tank will be connected to the adjacent existing 20-inch (51 centimeters) diameter water supply system. The existing and new valving and piping will be arranged to permit the existing two 5,000 gpm (189 kl pm) diesel engine pumps in Building 4853 to supply water to the main building complex and the flight test area. The existing water supply system for the Center is provided by a single 20-inch (51 centimeters) underground fire protection main of approximately 11,800 feet (3,600 meters) in total length to the storage reservoir. If the 20-inch (51 centimeters) main breaks at any point in its almost one mile length between the main complex and the reservoir, there will be no fire protection water available to the Center. The installation of the 500,000-gallon (1,890 kiloliters) water reservoir is more economical than the construction of a second or "loop" water main, and will provide more than the minimum water storage requirements for an adequate level of fire safety.

2. Modification of Utility Control Systems 300,000

This project provides for continued facility modifications of the Utility Control System (UCS). The modification work includes the installation of a central station minicomputer and operator's console to be located in the Research Development and Test Facility, Building 4800. The utility systems that will be monitored and controlled include heating, ventilating, air conditioning, lighting, electrical power, and fire detection in various buildings. The existing centralized surveillance monitoring and fire alarm detection systems will be integrated with this UCS. The installation of sensing and control will conserve energy resources, and reduce maintenance and operating manpower, thus contributing to better management of the Center's facilities within energy reduction goals and manpower guidelines. This effort has a simple payback period of less than three years.

C. Goddard Space Flight Center (GSFC) 1,440,000

1. Modifications for Fire Protection and Safety 460,000

This project provides for the modifications to various facilities so as to achieve an improved level of fire protection and safety. This work includes the installation of automatic sprinkler protection in portions of 24 buildings totaling approximately 200,000 square feet (18,580 square meters). This project completes the installation of automatic sprinkler protection for all buildings. The Center requires a high level of installed fire suppression to provide an adequate level of protection for the high value electronic and research equipment, scientific experiment development, spacecraft operations control centers, and the NASA-wide tracking and communications center. This level of installed fire protection is necessary to protect the research equipment during periods when the buildings are unoccuppied. .In addition, the fire protection services are provided from an off-site organization and the nearest component is located approximately two miles (3.2 kilometers) from the Center. This work was not accomplished in the areas involved when the remainder of the building was provided with sprinkler protection since the utilization did not warrant the investment in sprinkler protection. Modification and improvements to these areas have changed the conditions and automatic sprinkler protection is now required.

2. Modification of Air-conditioning Systems, Building 3 240,000

This project provides for the modifications to the air-conditioning systems in the Central Flight Control and Range Operations Laboratory, Building 3. This modification of two of the most inadequate air conditioning systems will be accomplished by the installation of new equipment of greater capacity. In addition, a new air handling system will be installed to provide a suitable environment for the computer equipment which has been installed in space originally planned for offices. Building 3 was built in 1961 to provide laboratory and office space for spacecraft mission tracking, data reduction, operations, and control. Since that time, several modifications have been made to the air-conditioning systems to provide for installation of additional computers and related equipment to support new spacecraft programs. The existing systems now are unbalanced, inadequate and require extensive maintenance. This project is the initial effort of a planned program to correct these deficiencies and must be accomplished at this time to insure continued operation of the facility. The computers and control centers operate twenty four hours a day, seven days a week. Modifications to the air-conditioning systems must be planned and accomplished while continuing the real-time tracking and control operations conducted in Building 3. The completion of these modifications will permit further improvements to the air-conditioning system to support planned free flyer spacecraft program operations in this vital facility effectively.

3. Modifications for Energy Metering 350,000

This project provides for the modification of the utility systems serving 19 principal buildings by the installation of steam and condensate meters. The steam system serving 18 buildings which has a peak steam flow rate of over 1,500 pounds (680 kilograms) per hour will be modified to include steam and condensate flow meter's. In addition to these buildings, steam and condensate meters will be placed in the three major steam supply lines from the Central Heating and Refrigeration Plant, Building 24, to the buildings. This project is the result of an analysis of the steam consumption and services lines of 23 principal buildings and Building 24 at the Center. This analysis determined the need for additional means in order to monitor the consumption of steam in these 19 buildings for effective energy management. The installation of meters in these facilities will provide the capability of monitoring energy consumption in each building and will enable the identification of high energy consumption problem areas. These meters will provide verification of the results of corrective energy conservation measures and the capability to make final adjustments in building system operation to optimize energy utilization.

4. Modifications to Various Buildings 390,000

This project provides for the modifications to the electrical and heating, ventilating and air conditioning (HVAC) systems in various buildings. The electrical modifications include the replacement of 1,020 incandescent, lighting fixtures with 670 fluorescent fixtures in the Network Test and Training Facility, Building 25. Included are the related modifications to the electrical power system and the replacement of approximately 33,000 square feet (3,066 square meters) of ceilings. The electrical modifications included the installation of 55 light sensing photo cells in the lobbies and stairways of some 15 buildings to turn off unnecessary lights. The HVAC distribution system for cooling computer spaces in Building 25 will be modified to eliminate reheating by mixing the return air with conditioned air and installing additional cooling coils. The HVAC system will be further modified by replacing seven electric reheat coils with a hot water modulating system. This project is the result of a survey of the electrical and environmental control systems of 21 major buildings of over 30,000 square feet (2,787 meters) at the Center to improve operating conditions. These modifications to the electrical snd HVAC systems were selected to improve the working conditions and system operation, are cost effective, and will reduce energy consumption and maintenance costs. This work is estimated to result in an annual savings of 4,500 gallons (17,032 liters) of fuel oil and 1,356,000 kWh of electric power with a payback of 4 years. Further modifications to the HVAC system in various buildings and the central heating and hot water systems are being investigated and may be considered as a future years project.

D. Jet Propulsion Laboratory (JPL) 1,140,000

1. Modifications to Space Flight Operations Facility, Building 230 225,000

This project provides architectural, electrical and mechanical modifications of approximately 20,000 square feet (1,858 square meters) of space required for the consolidation of "real time" computers, operations, operations control and related support areas to the first floor of Building 230. This work is a part of the overall plan for improving the Space Flight Operations Facility for more efficient support for future flight Projects. The many computers which comprise the computing system for real time operations are currently scattered throughout Building 230. In order to provide for economy of operations of these systems, they must be physically consolidated. This is especially important as flight project tasks progress into longer term operations support. Locating real time operations onto the first floor of Building 230 will result in a more stable usage plan for the building and provide the long term result of minimizing reconfigurations and reducing manpower requirements. The work will support Voyager Saturn encounter, Galileo and future projects.

2. Rehabilitation of 25-Foot Space Simulator System, Building 150.......................... 495,000

This project provides for the rehabilitation of the present instrumentation system in Building 150 by providing a new data system that will be configured with remote terminals and will serve as a central data handling system serving the other test areas with adequate data acquisition and processing capability. The new system will measure the output voltage of up to 1,000 separate data sources as well as acquire digital data from spacecraft telemetry. The data received will be handled through a large data processor and also processed in real time to provide outputs on data display devices. This system will provide unit level redundancy to allow simultaneous multi-test operation and will have the capability of storing temporary data to provide trend analysis. Simulation of space and solar environment for testing spacecraft at JPL is done in Building 150 Space Simulator Facility. Because of the large number of measurements required for testing of this type, a data acquisition system is also required. Basically, the data system's function is to record and display those parameters that describe the spacecraft's environment and the spacecraft's response to that environment. This requires the capability to record large quantities of data over relatively long periods of time, displaying periodically or on demand that information needed to monitor test conditions. It must also have the capability to be programmed to annunciate out-of-tolerance conditions of preselected parameters.

Reliability of the system is of the greatest importance. Failure of the system could mean loss of temperature control and damage to the spacecraft. A failure could cause a test delay or even necessitate a retest which would cost about $24,000 for each additional day of testing.

The present data system has become unreliable. It was installed in 1969 and has had approximately 25,000 hours of operation. The digital tape recorder, high-speed printer, and digital logic elements are no longer in production and spares are not available and there is no back-up hardware in this system. During the Voyager spacecraft thermal control test the data system failed in ten independent modes, all attributable to the aged condition of the equipment.

The present system has only the capacity of monitoring 500 channels and recording sbout 750 channels; this is too limited for the present day requirements. The existing capability for processing data while a test is in progress is extremely inefficient. A Data Acquisition System that will make measurements of the output voltage of up to 1,000 separate data sources and acquire digital data from spacecraft telemetry is required. The system is needed for the Galileo project and the Infrared Astronomy Satellite (IRAS) and Solar Power projects. As previously stated, a high probability of failure exists each time the existing system is used. These failures will result in time delays and great financial losses due to test delays and retests, damage to the spacecraft, and flight schedule delays. The inadequacies of the existing system require that this rehabilitation work be accomplished in order that this Space Simulator Facility can effectively/efficiently support research mission requirements.

3. Modifications to Materials Research Processing Laboratory, Building 158................. 170,000

This project provides for the facility modifications of 715 square feet (664 square meters) of laboratory space in Rooms 101C and 101G of Building 158 to a clean room environment for the purpose of producing hybrid circuit elements. A controlled atmospheric furnace and chemical fume hood will be installed in Room 101G along with a filtration and purge system. Room 101C will have local filtration hoods, air exhaust hood, 40 linear feet (12.2 meters) of laboratory benches with overhead air supply, 26 feet (7.9 meters) of wall mounted cabinets, several microscope-type bonding, welding and inspection stations, a new "clean" floor covering plus drop ceiling throughout the entire area. The light arrangement will also be revised. The area of hybrid electronics deals with the vast practical development of discrete elements and assembled boards/components below the system level and is continually increasing its range of application in spacecraft electronics systems. The JPL development tasks aim at specific new materials, fabrication techniques or feasibility demonstrations so that contract requirements can be intelligently established for vendor fabricated spacecraft elements as well as in-house instrument devices/systems. In addition to maintaining an "up-to-date" limited volume in-house fabrication capability to support this prototype development, another major effort involves evaluation, failure analysis and emergency repairs to flight qualified components. These latter functions are often required on a "crash" basis during last minute spacecraft checkout at the Spacecraft Assembly Facility or at the Kennedy Space Center. Vendor support is usually administratively or technically unable to meet project schedule restraints and JPL must solve the technical problems and perform the necessary repairs in time. . Historically, this effort has required the flight project office to waive all quality assurance and cleanliness requirements, as placed on the original vendor, so that the work could be done at JPL. This proposal effectively cleans up the existing facility area so that the product can be considered of flight quality.

4. Modifications to Boiler Rooms, Various Buildings 250,000

This project provides for the modifications to various boiler rooms and the relocation of heating equipment therefrom to achieve compliance with existing mechanical codes and to eliminate potential safety problems due to improper sources of sombustion air. The situation in three buildings (the Engineering Office Building 138, Solid Propellant Engineering Laboratory Building 197, Telecommunication Building 238) can be corrected by the addition of automatic fire doors and ventilation duct fire damper to effect separation of the boiler areas. The Fabrication Shop Building 103 will require enlargement of its attached boiler room and the consolidation of two small boilers into a single larger unit. The Environmental Laboratory, Building 144 will require the installation of a new boiler, hot water pump(s) and related piping/breeching. Relocation of the new diesel fuel tank to the same vicinity is also required. At the Space Sciences Instrument Systems Laboratory, Building 168 both the boiler and the domestic hot water heaters must be removed from the existing mechanical rooms and mounted on a newly constructed overhead deck between Buildings 168 and 169 where access to services and existing piping is reasonable. In effect, an external boiler room of less than 300 square feet (28 square meters) is created over the loading dock as there is no physical or economically viable solution within the confines of either existing buildings.

This project is required to bring the referenced buildings into compliance with existing mechanical codes which does not permit boilers to be located in machinery rooms containing refrigeration equipment. Leakage of "Freon" type refrigerants in the presence of moisture, produces accelerated corrosion of ferrous material, while exposure to flame temperatures in excess of 800°F (426°C) results in chemical changes that generate poisonous gases. This project will eliminate the most significant potential hazards of this type at the Jet Propulsion Laboratory.

E. Johnson Space Center (JSC) 1,845,000

1. Modifications for Life Sciences Experiments Development and Integration Facility, Building 36 405,000

This project modifies approximately 13,000 square feet (1,208 square meters) of the high bay wing of the Bioengineering and Test Support Facility, Building 36. This will provide a Life Sciences Experiments Development and Integration Facility. The work includes modifications to high bay, shop, office, laboratory, and class 100 clean room areas in the building. Approximately 6,000 square feet (557 square meters) will be modified to provide new class 100,000 clean areas to support integration, mockup, and checkout functions. The area around the integration inockup will be provided with support utilities. R&D funded computers will be installed on the second floor and necessary computer flooring, air-conditioning, and support utilities will be provided by this project. Minor modifications in the existing class 100 clean room will be provided for "mini-lab" buildup. High pressure bottle manifolds and vacuum pumps will be provided adjacent to the building. Utility trenches will be modified by adding high pressure utilities, compressed air, vacuum, sanitary sewer, and cable trays. An existing "laydown area" will be modified by extending existing utilities to provide a trailer parking area to house the animal specimens used in several of the proposed experiments. Areas adjacent to the class 100 clean room will be generally modified and upgraded by painting, relocating power and telephone receptacles, and replacing floor and ceiling tiles. This project is required to support the NASA Integrated Life Sciences Experiment Program. The Johnson Space Center has been designated as the lead project management Center and is responsible for the development of experiments and for the integration of all NASA life sciences experiments. Under this project, experiments and/or equipment developed at Ames Research Center or other laboratories will be shipped here and the equipment will be combined with JSC developed items for integration into the Shuttle spacelab. Following this activity, the life sciences payload will be shipped to KSC for further integration and launch into space. To carry out this task, JSC requires a facility for both development and integration of life sciences payloads. This project will provide space for development, test, integration, checkout, and crew training with flight equipment. The facility will also be used for shipping and receiving; equipment storage; specimen examination, test and holding; experiment test and checkout; component integration, and science data monitoring. This will be the only NASA facility available to allow crew members and support teams to train in a "hands on" environment operating the life sciences experiments in an operational mode. Present plans are to support one dedicated spacelab payload every 18 months beginning late in calendar year 1981 through calendar year 1991. Additional "mini-lab" and "carry-on" laboratories will be supported as approved by the program. To support laboratory preparation activities, all construction activation and checkout must be completed in calendar year 1980.

2. Modifications to the 20-Foot Diameter Altitude Chamber, Life Systems Laboratory, Building 7.. 320,000

This project provides for modifications to the 20-foot diameter altitude chamber in the Life Systems Laboratory, Building 7, to support system testing. Certain changes to the chamber interior are required to accommodate the regenerative subsystem test articles on the ground level of the main chamber compartment and to provide for a large isolated volume for gas mixing in the top of the chamber. Modifications to the lower level crew bay area are also needed. This will fnclude modifying the facility open loop environmental control system for sea level operation; installation or relocation of an emergency station inside the chamber, elimination and/or relocation of ultraviolet, thermal, and smoke detectors; and relocation of power distribution cables, Power Outlets, crew bay lights, and additional lights and controls. The upper portion of the 20-foot chamber will be modified by installing a new pressure tight ceiling above the crew bay compartment to create aleaktight mixed gas tank. This new ceiling will meet the pressure vessel requirements of several inches of H_2O above sea level and will have an access port for installation and maintenance. The Government furnished air supply unit with mixing fans, chiller/heater package, and trace gas injection system will be installed on an exterior platform adjacent to the chamber. The air supply unit, ducting will interconnect with the gas chamber and test articles. Operating controls and/or support systems necessary to operate the in-chamber hardware will be provided externally to the chamber.

The 20-foot chamber complex presently has the capability to evaluate closed loop, regenerative life support systems (RLSS) under manned conditions. However, changes to the current 20-foot chamber interior are necessary to support future space programs which will require long duration operation by man in space. Expendable systems are weight prohibitive, therefore, a secure technology base in RLSS is required. The goal of on-going technology programs is to demonstrate that regenerative life support processes have achieved a state of technological readiness capable of supporting man reliably during long term space missions. A key step in the development of this technology readiness will be the manned ground verification tests of an RLSS prior to commitment to a flight hardware program. Shuttle launched flight opportunities for an RLSS in the mid-1980's include a life sciences dedicated spacelab or a space habitability module. The ground test program will require all elements of the RLSS to be packaged and operated in a flight-type configuration to assess integrated system performance and man/machine interfaces. By modifying the chamber, the large volume of the chamber can be used to house the test crewmen in a controlled sea level environment and also to provide an adjacent but separate test volume in which the conditions can be subject to the operation of the closed loop RLSS without endangering crew safety. The concept of having the crewmen perform all operational tasks associated with living on an RLSS while a space environment is maintained, allows emergency and/or unexpected situations to be simulated. In addition, to accurately evaluate overall efficiency of the closed loop system and quantify low level subsystem leakage for an atmospheric composition balance, a relatively large, isolatable test area is required. Modifications to the 20-foot diameter altitude chamber is the most economical method available to accomplish these developmental objectives. Initial hardware is scheduled to be delivered in February 1980, and installation must begin in October 1980, to meet an August 1981 operational date.

3. Rehabilitation and Modification of Heating, Ventilating, and Air-conditioning (HVAC) Systems, Various Buildings 475,000

This project is a portion of a long-range program for rehabilitation and modification of HVAC systems in various buildings at JSC. The modifications include installation of new control systems for the air handlers in Buildings 11 and 14, and the rework of fan and filter sections of an air handler in Building 16 to permit filter changes with the unit operating. Rehabilitation work will also be accomplished in 14 other buildings. This latter work includes repair and/or replacement of steam stations, condensate return units, valves, pumps, compressors, condensors, coils, air handler casings and structures, and fan assemblies; calibration of instrumentation; and insulation and painting of ancillary equipment. This rehabilitation and modification work is required to provide for the more efficient operation of the heating and cooling system controls in Buildings 11, 14 and 16. Various heating and cooling system components in the other buildings are rapidly deteriorating and approaching the end of their life expectancy and, consequently, most of the residual work is essential now. Effective energy conservation requires that these systems operate within specifications. A system's performance efficiency is attsinable only when components are in good condition.

4. Modifications to Blowdown Water Treatment Facility, Building 223, Sewage Treatment Plant 180,000

This project will provide for modifications to the existing cooling tower "blowdown" water treatment facility. The work includes a new filtration system with automatic backwash capability that will have the capacity to process up to 150 gallons per minute of influent. The caustic soda system will be modified by replacing one of the existing chemical feed pumps with two larger units. Heaters will be installed on the existing caustic soda storage tank to maintain the liquid at a minimum temperature of 70°F. The existing sludge drying beds also require modifications to improve sludge removal. A flow control device will be installed at Building 24 (Central Heating and Cooling Plant) to provide constant flow of blowdown water to the treatment facility at the Sewage Treatment Plant. The existing facility for treating blowdown water from Building 24 cooling towers was designed in 1974 to comply with the then current Texas Water Quality Board (TWQB) requirements for hazardous metal content of facility effluent. Since that time, the TWQB has introduced an "order-of-magnitude" reduction in the maximum permissable content of chromium that can be contained in the effluent to less than 0.5 parts per million (ppm). The existing facility reduces the chromium and zinc content of the effluent to well below the allowable limits of the 1974 regulations. However, the effluent from the facility will not consistently meet requirements of present TWQB discharge requirements or conform with the potential Environment Protection Agency requirements for control of heavy metals discharged at a point source. Implementation of these modifications will provide a facility that will meet all existing and projected requirements for control of heavy metals discharged at the point source.

5. Modification of Air-conditioning Systems, NASA Industrial Plant, Downey, California 465,000

This project provides for the modification of existing air-conditioning systems in various buildings at the NASA Industrial Plant, Downey, Cslifornia, for the purpose of energy conservation. The work includes modifications and/or additions to the control systems, ductwork, dampers, and insulation to provide "economy cycle" operation for all air handlers in Buildings 001, 009, 287, 288, and 290, plus 17 air handlers in Building 006. "Economy cycle" operation affords the optimum utilization of the outside ambient atmospheric conditions. When cooling is required in a building and the outside conditions are cooler than those inside, the cooler outside air is drawn into the building to provide all or part of the required cooling. The same principle is followed to satisfy the requirements for heating. The modification of air handlers for the "economy cycle" operation capability will reduce natural gas and electricity consumption by a total of 129x109 Btu annually resulting in a payback of approximately 1 year. This, then, is a primary energy reduction project which should be accomplished at the earliest date.

F. Kennedy Space Center (KSC) 315,000

1. Modifications to Nitric Acid Storage and Pumphouse Facilities to Provide Chemical Waste Treatment Facility 315,000

This project will provide for the modifications to the Nitric Acid Storage (1050B) and Pumphouse (1050A) facilities on the Cape Canaveral Air Force Station (CCAFS) to provide a chemical waste treatment capability. The 4,860 square foot (451 square meter) acid storage facility will be modified to include a chemical processing area to house equipment, including nine holding tanks, two processing tanks., two pressure tanks, four chemical feeders and tanks, two filter presses, eight mixers, two sludge pumps, a gaseous nitrogen system and necessary wiring, controls, piping and valves. The 439-square foot (41 square meter) pumphouse will be modified for a supporting office area and chemical laboratory.

This project is necessary now in order to comply with Federal and State legislation regarding water pollution, air pollution and land fill. The facility will provide an adequate level of treatment so that the produced effluents, emissions, and sludges will not jeopardize the quality of the physical and biological environment and will be responsive to the National. goal of eliminating the discharge of pollutants into navigable waterways by 1985. This facility will provide treatment for chemical wastes in categories 8, 10, and 12. Category 8 wastes are comprised of acidic, basic or aqueous solutions contaminated with metal ions, category 10 wastes are acidic, basic and miscellaneous materials in aqueous solutions and category 12 wastes will be derived from the oxidizer vapor scrubbers used to reduce the sodium sulfate gases generated during the Shuttle loading and deservicing operations. Category 8 and 10 wastes are presently treated at an Air Force pumping station at the northeast tip of CCAFS. The United States Air Force has a National Pollutant Discharge Elimination System (NPDES) permit for this facility which expires in August, 1980. The continued operation of this pumping station is contrary to the National goal of eliminating the discharge of pollutants into navigable waterways; therefore, it will be closed when this facility is completed. Approximately 1,000,000 gallons of category 8 wastes are generated annually by the combined KSC and CCAFS operations. Though presently in small quantities, the cumulative total of category 10 wastes is estimated to be approximately $9.5x10^4$ gallons through 1991. There are presently no facilities for treating the category 12 waste solutions to be generated by the vapor scrubbers. The volume of category 12 wastes generated by the oxidizer vapor scrubbers is estimated to start in 1979 with 4,500 gallons per year and increase to approximately 103,000 gallons per year in 1985 through

1991. The wastes will contain Na_2SO_3, NO_3 and significant amounts of hydroxylamine sulfate and/or related compounds. This project will result in a facility capable of treating these chemical wastes which are derived from such functions as photographic laboratories, Shuttle payload and other institutional programs.

G. Langley Research Center (LaRC) 1,640,000

1. Rehabilitation of Electric Power Distribution System 385,000

This project provides for the rehabilitation of two (2) 110 KV circuit breakers in the Stratton Road Substation (Building 1233), the installation of sections of underground electrical ducts between the main Stratton Road Substation (Building 1233) and three primary substations--Taylor Road Substation (Building 1147), Ames Road Substation (Building 1247F) and Moffett Road Substation (Building 1266)---and the replacement of sections of existing 22 KV feeders "2J" and "2P1." A total of 1,600 linear feet (488 meters) of duct banks, 1,600 linear feet (488 meters) of feeder "2J" and 1,700 linear feet (518 meters) of feeder "2P1" will be installed. Feeder "2J" runs from Building 1233 to the proximity of the 16-Foot Transonic Tunnel (Building 1146) and feeder "2P1" runs from Building 1233 to Building 1147. Several sections of the duct banks between the above substations are nearly full. Installation of these new duct banks is necessary to meet the continued demands placed on the electrical distribution system. Feeders "2J" and "2P1" have corroded as a result of their exposure to the brackish environment encountered in the underground duct system. These lines were installed in 1947 and require replacement in order to allow for safe operation of facilities. The breakers must be replaced to coordinate their safe interruption operation under fault with available power company short-circuit values.

2. Modification to the 55-Foot Vacuum Chamber, Building 1293B 460,000

This project provides for the modification of the 55-Foot Vacuum Chamber by the installation of 250 KW of electric powered quartz lights. They will be arranged in banked assemblies and mounted around the chamber walls with individual electrical controls so that temperature differentials on the test specimens can be achieved. Located behind the test specimens will be a "cold plate" to simulate conditions of deep space in order to obtain higher temperature gradients across the test specimens. An existing hydraulic vibrator will be used to excite a new rotating table upon which a model will be mounted in order to duplicate programmed vibration levels. This facility modification is essential for the successful completion of planned long-range large space structures research efforts. Existing facilities have neither the physical size nor the controlled thermal vacuum vibration capabilities to conduct essential controls and dynamics research work in the early 1980's. Based upon the requirements for the Large Space Structures Program, these facility modifications are the most cost effective means of meeting the requirements.

3. Rehabilitation of Steam and Condensate Lines in the Utility Tunnel 370,000

This project provides for the modification of the steam lines in Utility Tunnels 1, 2, 3, and 4 for a more cost effective energy operation. This modification work will include the addition of about four inches (10.2 centimeters) of fiberglass type insulation on approximately 12,000 linear feet (3,660 meters) of existing steam and condensate lines in four underground tunnels. The existing magnesium oxide insulation on the lines varies from two to four inches (5 to 10 centimeters) of thickness. At the completion of this work, all lines will have a minimum of six inches (15 centimeters) of thickness, except where it is not possible to achieve this thickness. The existing lines were installed at a minimum initial cost with a minimum of insulation. The insulation thickness at that time was adequate since it was compatible with the lower energy costs, and the main interest was low initial capital cost. An assessment of these utility tunnels has been made in order to realize improved energy conservation. These modifications will save approximately $20x10^9$ Btu's annually in fuel oil consumption resulting in a simple payback of less than six years.

4. Rehabilitation of the Data Reduction Center, Building 1268 and the Flight Control Research Laboratory, Building 1268-A 425,000

This project provides for the rehabilitation of electrical and mechanical equipment in the Data Reduction Center, Building 1268, and the Flight Control Research Laboratory, Building 1268-A. This work consists of zoning electrical power and chilled water systems to reduce the impact of utility failures. In addition, the building fire, chilled water and electrical alarm systems will be consolidated into an automatic central alarm system. The building steam supply, which is necessary for humidity control, will be tied into a second trunk line.. Decentralized electrical and chilled water connections are necessary to prevent multiple system power loss. The automatic central alarm system will reduce the time necessary to maintain and monitor a large number of individual indicators. This will allow for the improved safety of both the personnel and equipment in the event of a failure or fire. Additional work will include the structural and architectural rehabilitation of Building 1268.

H. Lewis Research Center (LeRC) 1,010,000

1. Rehabilitation and Modification for Utility Control System 350,000

This project provides for the rehabilitation and modification of the existing utility systems and the utility control system (UCS) at LeRC to enable more cost effective, reliable, and energy conservative operations. This USC work includes the installation of a backup minicomputer and related peripheral equipment, a data plotter, and an uninterruptible power supply for the UCS master control station located in Building 21. Also provided are data acquisition control panels and sensors in ten buildings. The present LeRC UCS accomplishes real time control of the various building utility systems and provides security surveillance of Building 500. This Project will result in major energy savings in the buildings included by optimizing the operation of their heating, ventilating, and air conditioning systems. The minicomputer included will enable continuous operation of the entire UCS during malfunction or shutdown of the existing main computer. The uninterruptible power supply will facilitate programmed shutdown of the UCS during electrical power failures. The data plotter will enable fast and direct printout of the UCS computer stored information for assessment of the UCS operation and the Center's energy usage. In addition to providing increased UCS reliability and conserving energy, this work will reduce the building utility system operation and aaintenance manpower requirement and provide additional system performance data for effective management of the Center's utility systems. The estimated simple payback for this project is three years.

2. Modification of Building Utility Systems 225,000

This project provides for the modification of steam, electrical, and chilled water utility systems in various buildings having over 30,000 gross square feet (2,790 square meters) each. Included is the installation of metering devices which are basic to energy conservation programs. This work is necessary to establish accurate values of energy consumption, evaluate the efficiency of the various systems and help identify cost effective energy saving initiatives. The work includes: (a) composite metering for office, technical facility, and laboratory Buildings 3, 4, 77, 86, 125, and 500/501, (b) steam metering for institutional Buildings 14, 50 and 64, and (c) chilled water metering in primarily institutional Buildings 6, 14, 21, and 60. Because the buildings selected are representative of the other buildings at the Center, this metering will supplement an analytical in-depth energy analysis of all LeRC buildings. This modification work must be accomplished as a prelude to future energy conservation improvements.

3. Modification of Propulsion Systems Laboratory Combustion Air System 435,000

This Project provides a mechanical separator in the 72-inch (1.8-meter) combustion air tie-line from the Propulsion Systems Laboratory Equipment Building, Building 64, to Propulsion Systems Laboratory Test Cells 3 and 4 in Building 125. This separator will remove approximately 98 percent of all rust particles larger than 25 microns from the combustion air under all required flow conditions. The unit will operate from -50 to 600°F (-45 to 315°C) with air flows of 25 to 500 pounds per second (11 to 230 Kilograms per second) at pressures to 40 psig (28 newtons per square centimeter). Rust particles from the piping are presently carried by the combustion air stream into tho research gas turbine test engines and associated instrumentation. The potential for engine failures increases as rust accumulations restrict turbine cooling passages and coat blades and vanes. Research operations are hampered by rust induced instrumentation problems such as plugged pressure probes, thermocouple failures, and destroyed strain gages. Removal of these rust particles as provided for by this project will reduce engine wear and instrumentation failures in addition to decreasing the pcssibility of rust induced engine failures. This will result in more efficient research and energy conservation since repeating of research runs will be minimized.

I. Marshall Space Flight Center (MSFC) .... 2,050,000.

1. Modification to Power System in Computer Facility, Building 4663, B Wing 250,000

This project provides for modifications to the existing power system serving primary computers housed in the Computer Facility, Building 4663, B Wing, by installing an uninterruptible power supply system. This system is to be comprised of static rectifiers, static inverters, lead-calcium batteries, electronic oscillators and controls, capacitors, circuit breakers and other electrical components which will provide approximately 250kw for a five-minute duration upon interruption to the commercial power supply. Computers housed in Building 4663 support all major Center programs in such areas as trajectory calculations, structural analysis, and real time data reduction and information systems. Inefficient computer operations impact the Center's ability to accomplish its assigned mission. Variations in the commercial primary electrical source cause unreliable computer operation. A variation of only a few cycles duration results in a loss of hundreds of bits of information with associated costs in lost productive operational time. Cost to restore operations after momentary electrical outages in the past two years has averaged $85,000 each year. The planned uninterruptible power system (UPS) will eliminate variations in primary power to computer equipment in all but the most unlikely cases with a payback of less than 3.5 years.

2. Rehabilitation of Central Fire Surveillance System, Communications Facility, Building 4207 450,000

This project provides for the replacement of the present fire surveillance programmable general processor, installed in 1969, with two redundant general processors and expansion of the present general surveillance of 85 to 90 buildings. Also included is the installation of an automatic fire suppression system in 13,000 square feet (1,207 square meters) of space located in Building 4207, in accordance with the NFPA Code. The existing equipment is obsolete, and has been modified and patched repeatedly to conform with changes in building configurations and status. Further modification is technically impractical and will seriously affect the system reliability. Conformance with the National Fire Code requires the installation of a redundant system. Replacement parts are not in production or available for the present processor, making maintenance and repair very difficult. The capacity of the present system is not adequate to provide central coverage of the additional buildings. Building 4207 is the communications center for MSFC; its function is vital to the accomplishment of missions assigned to MSFC. This building is not presently protected by a fire suppression system. Fire damage to expensive communication equipment would seriously interrupt Center operations and the transmission of test data.

3. Modifications and Consolidation of Surface Treatment Plant, Building 4760 450,000

This project provides for consolidation of existing surface treatment, cleaning, and plating activities; and for modifications to perform industrial waste treatment in Building 4760. The existing surface treatment area will be converted to a stand-by condition and a partition will be constructed between the surface treatment area and the plating area to allow for reduced ventilating and heating requirements. The plating area power, piping, heating and ventilating systems will be modified to accommodate a revised tank arrangement. Nine of the existing tanks in the evacuated surface treatment area will be utilized to provide for industrial waste treatment and three are to be modified to provide the pickle/passivation capability disrupted by the industrial waste treatment modifications.

The existing facility was sized for processing large items of space hardware at a high rate. The HVAC system was designed for 100 percent fresh air intake and runs continuously, seven days a week, 24 hours a day, for personnel health and safety reasons. Current planning and future requirements do not forecast the need for the facility as originally designed. MSFC has received an EPA discharge permit requiring that certain effluent limitations for industrial waste be maintained after July 1977. This project will meet these EPA requirements.

4. Modification of Materials Laboratory, Building 4612.................................... 450,000

This project provides for the modifications of approximately 23,400 square feet (2,173 square meters) of the Materials Laboratory, Building 4612, to accept laboratory and processing equipment, and office functions now located in Building 4711. The work will include modifications to the water, electrical, gaseous nitrogen, shop air, and air-conditioning systems. Also included are general repairs, some partition relocation and necessary painting. The closing of Building 4711 will involve the relocation of 50 people to Building 4612 with associated laboratories and equipment. The project is necessary to permit the consolidation of laboratory functions which will promote more efficient laboratory work in support of: Shuttle External Tank Improved Thermal Protection System Tests, Shuttle Growth Systems and Model Tests, Shuttle Flight Problem Solution Tests, Space Processing, Spacelab Development, Space Industrialization, Energy Research, Large Space Structures, and Space Telescope. The combined facility will result in better management control, eliminate duplication of equipment and result in a major energy and maintenance cost savings of approximately $180,000 per year. This project will bring together, into a central location, the highly qualified and experienced engineering and scientific personnel of the Materials and Processes Laboratory who have extensive experience in performing direct research and development work in material science, product/process engineering and materials application relative to design and development of space hardware and in space experiments.

5. Modification of Air-conditioning System, Administration Building 902, Slidell Computer Complex 450,000

This project provides major modifications to the air-conditioning system serving Building 902. The work includes: reduction of excess air flow by deactivating and/or removing selected air handling units, rework of existing ducting, plenums, remaining air handling units, and raised flooring to meet current needs. Also included is the installation of new air handling units and modification to piping and control systems. The existing system was designed to provide maximum cooling and dehumidification for computer areas. However, a large portion of the original computer area has now been converted to office space, sitting on the old computer flooring. This has resulted in extensive personnel complaints due to the continued operation of the underfloor system for computer support. Further, the use of solid state circuitry in the computers has reduced the heat load in the remaining computer areas, and the principal requirement for the air-conditioning system is now for comfort. Therefore, these system changes are necessary, not only for personnel comfort, but also for energy conservation. The system was installed in 1962-1964 and, though operating well now, would be ready for replacement in the near future. Modifications at this time will result in an annual energy savings totaling over $106,000, and will have a payback period of approximately 4 years.

J. Michoud Assembly Facility (MAF) 530,000

1. Modification to HVAC Systems, Special Work Areas, Main Manufacturing Building 103 300,000

This project provides for modifications to the heating, ventilating and air-conditioning (HVAC) systems in the captive areas of Building 103, including the ET contractor, Weld Development Laboratory, Material and Process Laboratory, Shuttle Test Equipment (STE) Cable Fabrication Area, Tube and Valve Clean Area, Quality Assurance Lab and Meteorology Laboratory. The work includes installation of automatic and manual timers on the packaged air-conditioning units in the ET contractor area; installation of a 2-speed fan motor on an existing air handling unit in the Weld Development Laboratory with a time clock to shut down the air handler at night, also, conversion of the existing coil and reheat system in this lab to a demand system with humidity override; installation of an automatic time clock to shut down air handling unit during off-shift operations in the Material and Process Laboratory; installation of a 2-speed fan motor on an air handling unit in the STE Cable Fabrication Area along with an air by-pass control and an automatic time clock to shut down the unit at night; installation of 2-speed fan motors on seven air handling units in the Tube and Valve Clean Area, along with by-pass controls and ducting for return air, time clocks to shut down air handlers on off-shift operations, and automatic fan controls on a degreaser; installation of 2-speed fan motors on three air handling units in the Quality Assurance Laboratory along with by-pass controls for day/night operation and time clocks to shut down air handlers at night; and installation of 2-speed fan motors on four air handling units in the Meteorology Laboratory along with by-pass controls for day/night operating and time clocks to shut down air handlers at night. Energy savings will be approximately 108 X 10^9 BTU annually resulting in a payback of less than 1 year. Consequently, this is a sound and prudent project.

2. Modifications to Lighting, Office and Engineering Building 350 230,000

This project provides for the removal and replacement of fixture lens', cleaning reflective surfaces, and relamping all light fixtures in all office and computer areas in Building 350. These fixtures and lens' have darkened and deteriorated with 14 years of age and require a complete cleaning and lens replacement to achieve the desired level of illumination for general office areas and to decrease the quantity of electricity required for that illumination. This project will result in an .energy savings of 1,760,000 KWH annually for a payback period of approximately 3 years.

K. <u>National Space Technoloav Laboratories (NSTL)</u> .... <u>550.000</u>

1. Rehabilitation and Modification to Main Cafeteria, Building 1100 170,000

This project provides for the rehabilitation and modification to the main cafeteria to include the removal of the existing dishwasher, vent system, work tables, spray and food waste disposer, and the installation of a new dishwasher, work table, soiled dish conveyor system, and waste disposal system. Also included will be modifications to the floor and drainage system in the kitchen and restrooms. These replacements are necessary to increase the serving capability from 600 to 1,000 meals per day, which has resulted principally from the addition of other Government organizations on-site as tenants. The existing soiled dish retrieving system is a manual operation which shows little or no planning in layout and/or operation. It has become evident that a conveyor system, along with a new, improved and relocated spray and waste disposal system is necessary to handle the additional personnel in a sanitary, efficient manner. The existing dishwasher is obsolete, deteriorated and too small to support the increased loading. The new dishwasher will be larger, will greatly reduce drying time and will not require a vent system. The floor drains are located at high points in the floor and the water must be manually mopped to the drains. Completion of this project will result in a labor reduction of one man-year in the kitchen area and capability to meet the total requirements of the increased population of NSTL in a fast, efficient and sanitary manner.

2. Modification of Interior Lighting Systems of Various Buildings 380,000

This project is for the modification of the interior lighting systems of Buildings 1000, 1100, 1105, 1200, 2204, 3202, 3203 and 8100 at NSTL to provide localized switching for individual offices and other areas. The system will be a low voltage lighting control system with low voltage operation of relays controlling the 277 volt AC power to the light fixtures. Work will also include the removal and replacement of approximately

5,000 polystyrene lens with low attenuation acrylic lens, and the disconnecting of approximately 1,600 fixtures. When these buildings were constructed 10-12 years ago, it was the general practice that, in the interest of fluorescent bulb life and economy and low energy cost, lights be left on 24 hours per day. Therefore, only minimum or no switching was provided, and only the panel circuit breakers located in mechanical equipment rooms can control the lighting. Most of these areas are off-limits to other than maintenance personnel. By providing room or area switching, many areas not in constant use can normally be switched off, thus reducing electrical consumption. Because of the higher light transmission of the acrylic lens, the replacement of the polystyrene lens with the more efficient acrylic lens will permit the disconnecting of approximately 1600 lamps which results in a lower power consumption. At the time of original installation, the only plastic lens available was generally of polystyrene, a material that yellowed very early and reduced lighting levels considerably. The simple payback for this project is less than 4 years.

L. Wallops Flight Center (WFC) 785,000

1. Rehabilitation of Headquarters Building, Building F-6 355,000

This project provides for the rehabilitation of 14,400 square feet (1,338 square meters) of the Headquarters Building, Building F-6, to improve the facility's condition. The exterior rehabilitation includes the installation of new doors and windows. The interior rehabilitation includes the installation of new lighting fixtures, flooring, ceilings, insulation, wall finishes, and revisions to the restrooms. This rehabilitation also includes the installation a new energy efficient central heating, ventilating, and air conditioning (HVAC) system. Building F-6 was constructed in 1946 and has deteriorated through aging and utilization. The mechanical and electrical equipment are antiquated and inadequate. This rehabilitation of the doors and windows, insulation, and the new central HVAC system will provide a more energy efficient facility. These improvements to this thirty-year-old building are needed at this time for more effective utilization of space, to save energy, and to provide better working conditions for the Center's personnel.

2. Rehabilitation of Instrument Service Calibration and Chemistry Laboratories, Building F-160 430,000

This project involves the rehabilitation of 11,800 square feet (1,093 square meters) of space in the southwest end of the Instrument Service Calibration and Chemistry Laboratories, Building F-160. This rehabilitation includes the installation of new partitions, ceilings, flooring, lighting, and the related electrical work. Related work to the mechanical and HVAC systems will also be included. This rehabilitation work will provide improved office and research support laboratory space. Building F-160 was constructed over 20 years ago for other purposes and in its present condition, is inadequate. This project is needed at this time for effective utilization of the space and to improve the working conditions.

M. Various Locations 3,805,000

1. Rehabilitation and Modification of Various Buildings at Goldstone Complex 260,000

This project provides for rehabilitation and modification of various buildings at the Goldstone Deep Space Communications Complex. The work will include rehabilitation and modification of roofs, walls and ceilings, vestibules, weather stripping and other associated types of work. The air-conditioning equipment will be rehabilitated with the installation of economizer cycles; ductwork will be modified to provide improved HVAC balancing, snd obsolete control equipment will be replaced with more efficient control systems. Also, the lighting equipment will be modified from incandescent to fluorescent with reduced lighting levels, timer controls and daylight turnoff sensors. This project will rehabilitate buildings due to normal wear and tear, and will reduce operating and maintenance costs due to the reduction in maintenance, labor and spare parts. In addition, this work is required to insure that these buildings continue to support NASA missions in a reliable manner and at minimum operating costs. The costs of this project will be amortized by the savings in operations, maintenance and fuel costs.

2. In addition to the projects normally identified for inclusion in the FY 1980 program, the following is a listing of FY 1979 budgeted items which cannot be undertaken now due to reduction in appropriation and availability of other current resources for this type of work. The more definitive explanation of this work is the same as was included in the FY 1979 budget listing except for the inclusion of additional cost escalation to the FY 1980 time frame 3,545,000

   a. Modifications to Spacecraft Operations Facility, Building 14, Goddard Space Flight Center .... (480,000)

   b. Rehabilitation oF the Natural Gas Distribution System, Johnson Space Center .... (210,000)

   c. Modification of Heating, Ventilating and Air-Conditioning Systems in Building 1148, 1212, 1212B, and 1244, Langley .Research Center .... (315,000)

   d. Rehabilitation and Modification of Library Services Building 60, Lewis Research Center .... (490,000)

   e. Modification of Propulsion Systems Laboratory (PSL) Equipment, Building 64, Lewis Research Center .... (165,000)

f. Rehabilitation of Structures and Mechanics Laboratory, Building 4619, East End, Marshall Space Flight Center .... (420,000)

g. Rehabilitation of High Temperature Hot Water (HTHW) Generating System in Central Heating Plant, Building 3204, National Space Technology Laboratories .... (410,000)

h. Rehabilitation and Modification of the Technical Support Shops and Office Building, F-10, Wallops Flight Center .... (405,000)

i. Modification for Utility Control Systems at Goldstone Complex, Various Locations

(1) Pioneer DSS-11 .... (265,000)

(2) Venus DSS-13 .... (200,000)

(3) Apollo STDN .... (185,000)

The above projects must be considered on a high priority basis for accomplishment in the FY 1980 time frame to preclude deterioration of the basic facility plant. Deferral of these projects will cause further deterioration of the facilities identified resulting in increased energy/maintenance costs and decreased operational efficiency. In addition, the required work associated with these rehabilitation and modification projects will also increase in cost due to the future escalation of various construction wage and material prices. An additional concern is the higher potential of "unscheduled breakdowns" with their probable impact on missions. The further deferral of these projects will drastically tax the viability and effectiveness of this most essential Rehabilitation and Modification Program. This is especially so when considered in light of the already constrained facility maintenance and repair resources. Finally, the sequential deferral of these projects cannot help but have serious overall negative impact on this essential integrated program which is directed toward the preservation and enhancement of NASA's basic facility plant.

MISCELLANEOUS PROJECTS LESS THAN $150,000 EACH 2,400,000

TOTAL 19,790,000

It is estimated that between $18 and 22 million per year will be required for the continuation of this facility rehabilitation and modification program.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

MINOR CONSTRUCTION

	Amount (In dollars)	Page No.
Summary of Project Amounts by Location:		
Ames Research Center...	480,000	CF 14-2
Dryden Flight Research Center...	325,000	CF 14-3
Goddard Space Flight Center...	550,000	CF 14-4
Jet Propulsion Laboratory...	1,145,000	CF 14-6
Johnson Space Center...	120,000	CF 14-9
Kennedy Space Center...	240,000	CF 14-9
Langley Research Center...	415,000	CF 14-10
Marshall Space Flight Center...	225,000	CF 14-11
Total...	3,500,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE:	Minor Construction of New Facilities and Additions to Existing Facilities. Not in Excess of $250,000 Per Project
INSTALLATION:	Various Locations
	FY 1980 CoF ESTIMATE: $3,500,000
FY 1978: $5,950,000	FY 1979: $4,200,000

COGNIZANT INSTALLATIONS/LOCATION OF PROJECT: Various Locations

COGNIZANT HEADQUARTERS OFFICE: Office of the Comptroller

SUMMARY PURPOSE AND SCOPE:

This project provides for minor facility construction at NASA field installations and Government-owned industrial plants engaged in NASA activities. It includes minor facility projects involving the construction of new facilities or additions to existing facilities, each project of which is estimated not to exceed $250,000. Such minor construction is necessary in FY 1980 to improve the usefulness of NASA's physical plant by making it possible to accomplish needed adjustments in the utilization and augmentation of its capabilities.

The $3,500,000 request for FY 1980 is composed of those projects that must be accomplished to meet critical programmatic and institutional requirements in direct support of mission goals and objectives.

PROJECT JUSTIFICATION:

The existing NASA physical plant is impacted by changing utilization and adaptations required by changing technology and mission needs, as well as by new facility requirements generated by research, development, test, and similar activities. Items included in this project reflect work which must be accomplished in FY 1980 to meet general requirements or technical facilities needs.

This work is required to support specific institutional, research or development programs which could be adequately identified at the time of submission of this budget estimate. Items of work proposed to be accomplished within this program for FY 1980 have been carefully selected from a list totaling about $5 million. This selection has been made on the basis of the relative urgency of each item and the expected return for its accomplishment in relation to the investment involved. It is recognized, however, that during the course of the year some rearrangement of priorities may be necessary and that changes may be required in some of the items to be accomplished within the resources allocated.

PROJECT DESCRIPTION:

Proposed minor construction items for FY 1980 are outlined under "PROJECT COST ESTIMATE" and total $3,500,000. The projects will provide for minor construction of new facilities and additions to existing facilities not in excess of $250,000 per project. These projects represent requirements that must be met in this time frame and will have a direct impact on mission goals and objectives. Their deferral or disapproval could critically affect program schedules associated with approved mission requirements as well as the institutional base which is vital to the operation of the installations.

The FY 1980 request for minor construction work, which is at a reduced level compared to recent prior year amounts, is directed only to the most urgent needs for work of this type in continuation of this essential program at the NASA installations.

PROJECT COST ESTIMATE:

A. Ames Research Center (ARC) 480,000

1. Construction of an Extension to Aircraft Ramp 240,000

This project provides for the extension of the existing aircraft parking ramp Number 2. The new ramp will consist of 4,445 square yards (3,718 square meters) of concrete near the Aircraft Servicing Facility, N-248 and the existing ramp. Included in this project is the extension of the storm drainage system. Additional aircraft parking space is needed to accommodate the increased number of aircraft that are being assigned to ARC. Presently, some thirteen helicopters, research and support aircraft are assigned to ARC. As a result

Of expanding program activities for the Vertical Take-Off and Landing (VTOL) research, an additional eleven aircraft will be assigned to ARC. These additional aircraft will require this ramp space due to the increase of research operations, and to assure safe and efficient aircraft ground operations.

2. Construction of Space Projects Facility **240,000**

This project provides for the construction of a Space Projects Facility to provide space for conference rooms and general offices. This facility will be a single story concrete building *of* approximately **4,200** square feet (390 square meters) to be located between the Flight Projects Facility, Building **N-244** and the Space Science Research Laboratory, Building **N-245.** Included in this work will be suitable electrical power, lighting and HVAC systems. This building will alleviate the existing overcrowded, inefficient arrangement of personnel presently in Building **N-244** and trailers. This project will allow for the elimination of the two trailers presently used as permanent offices and housing of approximately **20** people. This new facility is necessary to support expanding programs associated with the Space Projects Division and the Reliability and Quality Assurance Office. Such programs as Galileo, Mars Penetrator and Spacelab Infrared Telescope will require additional space fur personnel during peak manning periods. Present overcrowded conditions do not allow for the increase in personnel planned as s result of the above programs. This project will provide relief from existing overcrowded conditions and provide for peak office space requirements generated by project programs.

B. Drvden Flight Research Center 325,000

1. Construction of Addition to the Aircraft Construction and Modification Hangar, Building **4801** **185,000**

This project provides for the construction of a **2,320-square** foot **(215** square meter) addition to the east side of Building **4801,** which will house the F-15 Aircraft Simulator. The addition will consist of a pre-engineered metal building on a concrete slab, and will be provided with adequate heating, cooling, lighting, fire protection, and electrical power. The existing east wall will be modified to eliminate one column to allow entry of the aircraft. The wall of the addition will be designed in a manner so that the aircraft simulator may be removed. The **F-15** program consists of controlling the engine, inlet and flight control systems in an integrated manner using an aircraft-mounted computer. The capability of verifying the correctness of the software prior to flight is fundamental to the program and requires the simulation of major flight elements. It is imperative that the structure, which houses the **F-15** simulator, be in proximity to the existing simulators that are located in Building 4801 in order that existing available electric snd hydraulic power and data cables may be utilized.

2. Construction of Addition to Central Hydraulic System 140,000

This project provides for the addition of the existing Central Hydraulic System to service the Aircraft Construction and Modification Hangar Building 4801. The existing Central Hydraulic System, which was provided for with FY 1978 funding, consists of four modular pump units, a 600-gallon (2.3 kiloliters) central hydraulic reservoir and a hydraulic fluid distribution piping system to the Main Hangar Building 4802. The pump units and reservoir are housed in a soundproof pump house adjacent to Substation No. 1. The system's extension will consist of an additional pumping module housed in the existing hydraulic pump house, high pressure supply and return piping to Building 4801 and four wall-mounted quick disconnects in Building 4801. The present portable units now used to supply hydraulic fluid are old, noisy and difficult to maintain. Due to the age of these units, replacement parts are no longer in stock and it has become necessary to cannibalize some units to keep others in operation. The decreasing reliability and increasing maintenance requirements of these portable units are of major concern. In addition, they are extremely noisy, especially when operated inside a hangar. The noise, which exceeds the acceptable 85 dB level, is such that it interferes with normal speech communications in the hangar. To reduce the noise level, some of the continuous duty units have been enclosed in air conditioned "sheds" which occupy limited hangar floor space. The central system will have increased capability, will eliminate noise hazards, provide increased reliability/flexibility, and will require minimum maintenance.

C. Goddard Space Flight Center (GSFC) 550,000

1. Construction of Addition to Instrument Construction and Installation Laboratory, Building 5 150,000

This project provides for the construction of an addition to the west wing high bay of the Instrument Construction and Installation Laboratory, Building 5. This addition will be approximately 1,800 square feet (167 square meters) on a concrete slab floor with a 32-foot (9.8 meter) eave height of steel frame and insulated siding to match the existing building. Electrical power, lighting, heating, ventilating, and fire protection systems will be included. The work also includes the installation of a 25-foot (7.6 meter) high roll up door and an electrically operated 5-ton (4,536 kilogram) monorail hoist for the handling of payloads. The Sounding Rocket program is an on-going program with various payloads becoming more complex; and, it is expected to continue for an indefinite period of time. The construction of the addition to Building 5 is required to improve the handling of Sounding Rocket payloads. The present configuration of Building 5 requires the penetration of the Sounding Rocket Integration Area during payload handling with the potential of contamination of the facility. Construction of this addition to Building 5 will provide improved conditions for the handling of Sounding Rocket Payloads, and reduce the potential of contamination of the existing facilities.

2. Construction of S-Band Simulation Operations Center 155,000

This project provides for the construction of a S-Band Simulation Operations Center (SOC) near the Network Training and Test Facility, Building 25. This work will include the construction of a concrete foundation to support a IO-foot (3 meter), S-Band Parabolic antenna and a 600-square foot (56 square meter) concrete apron to support an electronic equipment van. Clearing, grading and the construction of an access road of approximately 500 feet (152 meters) to the site will be included. Electrical power, grounding services and signal cables will be extended to the site. The SOC is needed to emulate the Tracking and Data Relay Satellite Systems (TDRSS) user spacecraft to the control centers for the purposes of training, hardware and software checkout. The SOC will also be used to provide an alternative comparative test of the total TDRSS system through to the user by emulating the spacecraft. There are no other complete end-to-end simulation facilities available. The IO-foot S-Band Parabolic antenna and the electronic equipment van are being provided by other means.

3. Construction of Addition to Road No. 1.. 245,000

This project provides for the construction of a two-lane addition'to Road No. 1 to the northwest part of the Center. The 22-foot (6.7 meter) wide roadway will extend from the intersection of Road No. 10 approximately 2,200 feet (670 meters) to connect to Road No. 4. The two-lane roadway will include 4-foot (1.2 meter) wide shoulders and be constructed with a 9-inch (22.9 centimeter) asphalt overlay,surface. This work will also include the necessary grading, drainage, landscaping, and lighting. The construction of an addition to Road No. 1 is the result of a traffic survey of the existing conditions at the Center. This survey indicated the need for an additional road in the northern part of the Center due to the increased personnel density in Buildings 5, 7, 10, 15, and 28, and to improve the access of emergency vehicles to Buildings 19 and 20. The addition to Road No. 1 is in accordance with the Master Plan and is needed at this time to improve the overall traffic conditions at the Center. Failure to provide this needed roadway addition will continue to increase the traffic congestion at the Center, and require further maintenance to the present road system due to the heavy vehicle loading beyond the planned capacity.

D. Jet Propulsion Laboratory (JPL) 1.145,000

1. Construction of Addition to Laser Research Building 149 245,000

This project provides for the construction of a 2,960-square foot (2,748.8 square meter) two-story addition to Building 149 to house laser research activities which are now in inadequate facilities. The first floor will be at ground level and the existing 16-foot (4.9 meter) door will be relocated to the east exterior wall of the addition. The addition will contain 1,480 square feet (1,374.9 square meters) of laboratory space on the ground floor and a similar amount of office space on the second floor. The exterior walls of this new addition will be concrete block, and the second floor and roof framing will be light weight steel trusses with steel decks and light weight concrete slabs. An exterior stairway, on the north face of the new addition, will provide access to the second floor. Activities relating to high energy lasers are located in the Laser Group at JPL. This group has pioneered in the development of metal vapor lasers, and has been instrumental in bringing to fruition the copper halide laser, which is currently under intensive study at JPL. Experiments relating to the development of these lasers are currently being carried out in Buildings 107, 134, and 192. The Electric Propulsion Laboratory, Building 192, will not be available to the Laser Group because of the expansion of electrical propulsion work in that building. The Plasmadynamics Laboratory, Building 107, and the Thermonic Assembly Laboratory, Building 134, were constructed in 1945 and 1954 respectively. All major support, equipment in Building 107, such as the vacuum pumps, distilled water cooling system and the one megawatt power supply, are over ten years old and require major reconditioning. In addition, Buildings 134 and 107 are scheduled to be demolished. Future laser work will require the construction of large lasers with the attendant safety problems associated with chemically toxic lasants, high voltage power supplies and high intensity laser emission necessitating the use of extensive room partitions, upgrading of the air-conditioning system and new modular designs for safeguarding electrical power supplies. To satisfy these requirements, it is necessary that this increased laboratory space be provided.

2. Construction of Addition to Blockhouse, Building E-22, Edwards Test Station 215,000

This project provides for the construction of a 1,050-square foot (98 square meter) addition to Blockhouse, Building E-22, to provide area in this central control building to house the remote control and instrumentation equipment for hazardous test operations. The proposed addition will be constructed of concrete masonary units to match the existing structure.

An entrance, loading dock, service area, darkroom and men's and women's toilets will be provided. A computer floor will also be installed over the total area of the existing floor in Building 22. The added Building area will permit the relocation of the men's toilets and the darkroom to allow for expansion of the computer floor area to accommodate the modernization of the remote controls for D and C stands and the central recording equipment common to all testing activity. The existing building layout does not allow for the location of necessary tape recorders or remote controls for C and D stands. In order to do this, the existing toilets and darkroom facilities will have to be relocated and an additional area will have to be constructed to provide work area and "office" space. The existing equipment access to the building is poor as there is no way to lift heavy equipment up to the floor level. The existing raised computer floor area is too small, poorly constructed and outdated. A new, modern modular computer floor is required to support the heavier equipment. This addition and modification is necessary in order to allow the building to accommodate the necessary remote controls in a functional and seismically secure installation.

3. Construction of Addition for Fuel Conversion Laboratory, Building 148.................. 245,000

This project provides for the construction of three area additions to the existing Conversion Laboratory, Building 148, in support of on-going fuel conversion research programs. These additions consist of a 500-square foot (46.5 square meter) new mezzanine along the west end of the existing high bay, a new 600-square foot (55.7 square meter) second floor over the one-story west wing of the building, and a new 1,200-square foot (111.5 square meter) two-story addition attached to the west of the west wing of the existing structure. The new two-story portion would be a 15-foot by 40-foot addition. The foundations, first floor, columns, beams, and second floor will be poured-in-place concrete. The structural framing above the second floor line, on all additions, will consist of steel framing and metal studs. The 600-square foot (55.2 square meter) new addition on the first floor will be metal louver fillers between the concrete columns. This space will be used for storage and operating of equipment that requires the open space and ventilation that this'space will offer. The new 1,200 square feet (92.9 square meters) of space over the existing first floor and the 600-square foot (55.7 square meter) new addition would be used for laboratories and office space. The 500-square foot. (46.5 square meter) mezzanine would be developed into a laboratory area. Appropriate heating, ventilating, air conditioning, electrical services, and lighting would be provided.

This facility is currently used to support several NASA fuel research programs including (1) hydrogen generator development for aircraft/automotive applications, (2) vehicle emissions and performance characterization, and (3) fuel processing of alternate fuels for fuel cells. The facility contains seven separate test bays with two control rooms and supporting control and instrumentation. The facility contains one light machine shop and a light fabrication area.

Of the seven test areas in the facility, only two are available for hydrogen generator development and fuels processing. For the past three years, the Fuels Processing Group has averaged three to four separate programs which requires sharing of the two test and fabrication areas. The availability of two additional test areas and one adjacent control area will provide for concurrent test capabilities. The time sharing of the control data acquisition system and gas analysis systems will be continued.

The expensive and non-productive time sharing of test areas will be eliminated. The practice of reconfiguring a test area for support of multiple programs is often more expensive and time-consuming than the actual tests and will be eliminated by the proposed addition. This will provide adequate test and supporting installation and assembly area for the continuing three fuel processing programs with two additional energy programs planned in the catalytic combustion and ultra-rich, partial oxidation area.

4. Construction of Two Illuminator Towers, Building 212 245,000

This project provides for the construction of two Illuminator Towers at the Antenna Laboratory, Building 212. The work includes the construction of one 38-foot (11.59-meter) high tower and one 48-foot (14.63-meter) high tower using structural steel on concrete footings.

Work platforms connected by stairs will permit access to all portions of the towers. Platforms will be equipped with kick plates and hand rail stairs, and platform design detail will conform to OSHA requirements. Minimal lighting will be supplied for night work capacity. There are three temporary illuminator towers at the Mesa Range that are used for testing and verifying the accuracy of the antennas used on the spacecraft. These existing towers are constructed of tubular aluminum scaffolding. Vertical members are connected by slip fit and pin stays. Horizontal members and cross bracing are held together by clamps and/or thru-bolts. This type of construction is for temporary scaffolding and not for the rigidity required for the verification of antenna operations. Any wind will cause these towers to oscillate, thus making it difficult, if not impossible, to obtain accurate measurements of the antenna. The existing structures are in violation of OSHA requirements. This project work also includes the demolition of the three existing temporary towers.

5. Construction of Propellant Processing Building, Edwards Test Station (ETS) 195,000

This project provides for the construction of a 330-square foot (30.7 square meter) building for oxidizer grinding with double base propellants plus the necessary access road and utilities. The building will be constructed of concrete block and will have a blow-out wall. The building will be insulated and temperature stablized using hot water heating and direct expansion cooling equipment. Necessary safety items, sprinklers and exhaust systems are part of this project. The proposed facility is planned as part of the "batch production" sites for double base propellants at the Edwards Test Station (ETS). These propellants are coming under intensive R&D development and there are being required for retro motors on long-range missions. Facilities need to be made available to safely handle the quantities of fuel involved in the anticipated processing operations. Siting of these facilities will be in accord with safety criteria requirements as shown on the ETS Master Plan.

E. Johnson Space Center (JSC) 120,000

1. Construction of Additions to Manned Space Flight Exhibit Complex 120,000

This project will provide for the expansion of the Manned Space Flight Exhibit Complex. It will provide restrooms for visitors, a landscaped area for picnics and an astronaut display. The work will include site grading at the Saturn V display area and extending underground storm drain lines to new area inlets. Outdoor lighting will be provided for the entire exhibit complex. The project also will include construction of a masonry restroom facility. Electric heating will be provided, and existing water and sewer lines will be extended to serve the structure. In addition, a landscaped area including sidewalks, benches and tables will be provided. Further, an astronaut display will be constructed, consisting of concrete panels to accept engraved metal plaques and/or sculptures to be otherwise provided. In order that a proper display will be available for suitable public use, adequate drainage at the Saturn V display area and expansion of the facilities of the Manned Space Flight Exhibit Complex will be required. The restrooms are necessary for practical reasons, as well as convenience, since it is the point where visitor tours at the Center begin and end. With these new provisions, the use of restrooms in buildings on the tour route, and the resultant straying of visitors, will be significantly reduced. At present, visitors with picnic lunches eat throughout the JSC grounds. A specifically designated area with landscaping, tables and benches will provide a central, controlled place for this type of activity and thus reduce sanitation and litter problems.

F. Kennedy Space Center (KSC) 240,000

1. Construction of Shelter for Oil Atomization Air Compressors, Central Heating Plant, Building M6-595 80,000

This project will provide for the construction of a 684-square foot (63.5 square meter) available prefabricated metal shelter at the Central Heating Plant. It will be erected on new foundations and concrete slab. The partially open-sided shelter has dimensions of 18 feet by 38 feet (5.5-meters by 11.6-meters) and is presently in a dismantled condition. Two new compressors for oil atomization will be installed in the shelter The compressors are rated at 235 SCFM at 160 psig each, with 60 horsepower motors. Also included will be 2 new 300-gallon, 200-psig air receivers, with necessary controls, power and piping. The central heating plant boilers burn fuel oil atomized with compressed air. This is presently supplied by a 13-year old reciprocating compressor which was refurbished in 1976, and relocated from Launch Complex 19. However, this system is unable to meet the pressure demand of the boilers. Insufficient air supply or too low a pressure results in poor burning of fuel, black smoke and inefficient boiler operation. This causes the operation of two boilers when one would normally be adequate. The shelter will provide environmental protection for the air compressors and will also provide storage space for existing and future mobile boilers. At present, the existing air compressor and mobile boilers are located outdoors without shelter, and are subject to accelerated undesirable corrosive effects of the humid local weather.

2. Construction of Automotive Maintenance Facility 82,000

This project provides for the construction of a 1,536-square foot (143 square meter) prefabricated metal structure to provide a tire and front-end alignment shop in the GSA Motor Pool. The 32-foot by 48-foot (9.8-meter by 14.6-meter) building will be erected utilizing available steel framework and roof panels from a prefabricated structure which is in storage at KSC. It will be erected on new concrete foundations and floor slab. New metal siding and doors will be provided, and shop air and electrical power will be extended from a nearby building. The present tire shop is capable of handling only a small portion of the required tire inventory, with tire installation being accomplished Gut-Of-doors. Front-end alignment is now performed in a much needed bay in the main shop; however, the equipment will be relocated to this facility. The present operation is extremely inefficient. A savings of one man-year will be realized by consolidation of all related tire functions into a single work area. The project will result in the disposal of three wood-framed office type trailers and three wooden tire storage bins. The existing tire operation is inadequate and this function should be located in a facility with a dedicated alignment bay.

3. Construct Sanitary Sewer Line to LC-39 Press Site 78,000

This project provides for the construction of approximately 1,400 feet (427-meters) of 6-inch gravity sanitary sewer line from the Launch Complex 39 press site area to lift station 4E southeast of the Launch Equipment Shop which leads to an existing sewage treatment plant. The existing package sewage treatment plant, which now supports the press site, then will be removed and disposed of. This was a used surplus plant when it was installed at the Press Site in 1966. The plant has deteriorated to a point where it is unreliable and requires frequent maintenance. It is planned to continue use of this area through the Space Shuttle era; therefore, this plant must be replaced to provide adequate sewage disposal facilities in this location. Replacement with a gravity sewer line will be approximately half the cost of a new package plant and will be relatively maintenance free.

G. <u>Langley Research Center (LaRC)</u> .... <u>415.000</u>

1. Construction of a Personnel Division Building Addition to Building 1195-C 240,000

This project will provide for a 5,000-square foot (465 square meter) addition to the Financial Management, Training and Classification Building. This addition will be a simple design using demountable partitions. Exterior finish materials will match existing face brick and window designs in the building. This addition will contain offices, a conference room and restrooms for the Training and Classification Branches (approximately 25 people) of the Personnel Division. The Classification Branch is presently located in the Library, Building 1194. Because of expanding operations in the library, this Branch must be relocated. The Training Branch is presently housed in Building 1195-X. The existing space is considered substandard. Movement of these branches into Building 1195-C will provide the Division a more cost effective operation by consolidating these organizational units into one functional area.

2. Construction of Addition to the Ceramic Heated Combustion Facility, B-1263 175,000

This project provides for an addition of 150 square feet (13.9 square meters) to the test room. In addition, associated equipment such as an air ejector system to allow operation at low static pressures of two to five psi, and a baffle to eliminate ceramic dust are also included. The associated equipment will allow control of the test stream turbulence level. It will also provide a system to inject various contaminate gases into the test stream to allow the study of the effect of Contaminate on ignition and combustion. This work is performed in order to evaluate the effects of both turbulence and contaminate on supersonic combustor performance. This facility is unique in that both temperatures and pressures can be achieved simultaneously in a clear atmospheric environment minus the presence of water vapor.

H. Marshall Space Flinht Center (MSFC) 225,000

1. Addition to the Photographic Laboratory, Building 4353 225,000

This project will provide for the construction of a 5,000-square foot (465 square meter) addition to the existing Photographic Laboratory, to replace a 37-year old wing. Upon completion of this project, the existing wing will be demolished. The new addition will be a masonry and steel frame single story structure. It will include an office area, dark rooms, restrooms, storage rooms, and entrance foyer. The existing Photographic Laboratory consists of approximately 21,000 square feet (1,951 square meters) of space of which some 10,000 square feet (930 square meters) were built in 1962, and will be retained for photographic processing. The other 11,000 square feet (1,021 square meters) is obsolete World War II mobilization type construction which has deteriorated to a point that improvement is necessary and replacement with a 5,000-sauare foot structure (to meet the actual needs) is more economical than to rehabilitate the existing larger structure. This is a wooden structure in which the structural, HVAC and electrical systems have deteriorated through wear and tear, old age and obsolescence. There are no vacant MSFC facilities which are large enough to accommodate the total photographic function that can be modified at an equivalent cost. Therefore, this construction is needed in the FY 1980 time frame to preclude the necessity of further costly repairs to maintain the existing rundown facility in its present unsatisfactory condition.

TOTAL.. 3,500,000

FUTURE CoF ESTIMATE FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that between $3 and $5 million per year will be required for the continuation of this essential minor construction work at NASA field installations and Government-owned industrial plants engaged in NASA activities.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

SUMMARY

FACILITY PLANNING AND DESIGN

	Amount (In dollars)	Page No.
Regular Requirements:	9,850,000	
Master planning	300,000	CF 15-2
Sustaining engineering support	1,750,000	CF 15-3
Preliminary engineering reports and related special engineering support	2,500,000	CF 15-6
Final design	5,300,000	CF 15-7
Other Requirements:	4,150,000	
Shuttle facility planning and design	700,000	CF 15-7
Spacelab/payloads facility planning and design	300,000	CF 15-8
Energy reduction analysis and support	1,150,000	CF 15-8
Numerical aerodynamic simulation facility planning and design	2,000,000	CF 15-10
Total....	14,000,000	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1980 ESTIMATES

PROJECT TITLE: Facility Planning and Design	
	FY 1980 CoF ESTIMATE: $14,000,000
FY 1978: $11,780,000	FY 1979: $10,650,000

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 that are required to implement construction projects.

d. The accomplishment of facilities siting and other investigations, as well a.s the accomplishment of special facilities studies and reports.

This request for facility planning and design resources for FY 1980 is composed of two major segments:

a.	Regular requirements	- $9,850,000
b.	Other requirements	- $4,150,000
	Total	$14,000,000

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

1. REGULAR REQUIREMENTS.. 9,850,000

A. Master Planning.. 300,000

This portion of the requirements provides for the updating and further development of existing master plans for the field installations, including facility studies and site investigations. Documentation will define facility parameters within which subsequent engineering efforts will be based for future development. This also provides for the documentation of existing plans where actions or deviations from previous plans have not been recorded for the various field installations.

Master plans at the various field installations are generally updated at cyclic 3-year intervals. Approximately one-third of the field installations are involved in any one fiscal year, keeping the level of effort relatively modest and constant. These plans provide for the orderly consideration of the allocation, proper arrangement, and efficient correlation of land areas and structures to serve the purpose of the various installations. Representative master planning activity candidates for FY 1980 are:

(1) Ames Research Center

This will be a major update to define latest NASA/adjacent community planning and utilization interfaces, 40x80-Foot Wind Tunnel expansion needs and impacts, and other land planning factors. It will include off-site activities, updating of the 5-Year Plan data and definition of tenant facility needs and uses, especially those associated with occupancy by the US Army.

(2) Jet Propulsion Laboratory

This envisions only a minor update to show latest utilization as impacted by Department of Energy's energy programs, leased space holdings and use in graphic form, and an update of master planning data.

(3) Kennedy Space Center

This will be a normal inventory update to include new Shuttle and Payload facilities, to incorporate the utilization planning for those Cape Canaveral Air Force Systems facilities NASA will require as the Shuttle moves into the operational phase.

B. Sustaining Engineering Support.. 1,750,000

Provisions for facility studies and specific engineering support continue to take on an added importance which has been evidenced in recent years, and must be given further high priority throughout FY 1980. These efforts are of utmost importance due to the more unpredictable cost situation which currently exists and may continue; cost trends in construction materials and fuels; the continuing importance of energy conservation and efficiency; and the operation and maintenance cost for the physical plant. This also includes provisions for maintaining a current engineering data base and updated construction specifications for utilization by the various field installations.

The following items are included in the FY 1980 requirements:

(1) Building Research Advisory Board Support

This covers annual support to the Federal Construction Council's (FCC) operations and provides special studies that the Council will perform throughout FY 1980 to help advance the science and technology of Federal Government building and construction. The FCC is a committee of the Building Research Advisory Board, National Academy of Sciences, and its activities are supported by several Federal Agencies including NASA.

(2) Utilities Services/Rates Analysis

This provides for continuous services in support of utilities and utility systems which include technical counseling, surveillance and recommendations with regard to utility rates, contract negotiations, systems, operations and control. These services are an annual requirement and will continue in importance as long as energy costs continue to escalate.

During FY 1978 these resources have enabled the Agency to properly realize fair and reasonable rates that are offered to our field installations by utility companies. Several major utility contract negotiations have received very valuable technical assistance from the expertise that these resources provided. At Ames Research Center (ARC) and Langley Research Center (LaRC), major electric utility contract negotiations are presently underway, and it is anticipated that one or two major utility contracts per year will require expert technical input as utility contract renewals move through a normal cycle throughout the Agency.

Also, these resources provided for an initial study to more accurately forecast utility costs and rates so that better and more reliable utility budget requirements can be established. Resources will be required to continually update these projections twice each year in order to maintain a high level of credibility and use.

Another significant use of these services is the establishment and implementation of NASA's utility control and management system which will require close coordination and technical input during the several years of its installation and checkout as a functioning system.

These and other similar utility system services are provided for by these resources in order to properly manage this function.

(3) Design Specifications Update and Support

This provides for the continuation of engineering services for the updating and refining of the Agency-wide construction specification system. This system combines a catalog of preapproved standard construction specifications, and a cost effective program for selective retrieval and printout of bid specifications. These standardized specifications are used by Architect-Engineer firms to produce bid documentation which is uniform throughout the Agency and easily updated.

(4) Facility Operation and Maintenance Analysis

This provides for continued engineering support in implementing improvements at the NASA field installations relative to manpower utilization, work control systems, preventive maintenance, facilities management and reporting systems. The improvements will also involve techniques that will be used to identify where and how increases in productivity may be possible by the use of earlier but still reliable measurement methods. Also included in this activity will be some 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.

(5) Value Engineering Cost Validations and Analysis

This will provide for engineering services to improve, whenever possible, 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. It will also provide services necessary to more accurately predict and validate facility costs which will aid in resources planning for the various field installations.

(6) Facilities Utilization Analyses

Provides for the analysis of Agency-wide facilities utilization data covering: (1) office and other types of building space; (2) utilization data on designated major technical facilities, and (3) special utilization studies of comparable technical facilities such as wind tunnels. This analysis provides for the review of data assembled in various formats, thereby permitting: (1) insights into, and development of, better methods of identifying underutilized facilities; (2) improved techniques of quantifying their level of use; and (3) actions for improved utilization. This work also provides for special reviews of each installation's inventory data base in support of the facilities utilization program. These surveys are necessary to validate the reported data especially in relation to a specific problem or need, and thus assist in the provision of a credible foundation for plans to further improve the utilization of facilities.

(7) Environmental Studies

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

- New Federal, State and Local environmental regulations, emission standards and environmental management planning programs that must be considered at various installations.

- Changes that may take place at some NASA installations resulting from new or expanded program activities, new facilities, or major changes in site expansions.

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

The early identification of any 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 and accurate information to ensure compliance with all legal and regulatory requirements which are rapidly becoming most imposing and complex.

C. Preliminarv Ennineerina Reports and Related Special Ennineerina Support 2,500,000

(1) Preliminary Engineering Reports (PER's) .... (1,800,000)

Preparation of PER's, investigations, and project studies related to proposed facility projects to be included in the FY 1982 and FY 1983 Construction of Facilities programs are provided for by this estimate. These reports are required to permit the early and timely development of the best project required to meet the stated functional need and to provide the related basic data, cost estimates and schedules related to any such future budgetary proposals. This request will provide for PER work associated with proposed subsequent construction except as provided for in "Other Requirements" (Paragraph 2) for Space Shuttle, Spacelab/Payload, and the Numerical Aerodynamic Simulation Facility. For the FY 1982 program, PER work associated with an estimated cost of $25 million of construction for which updated PER's will be needed, and with new projects estimated to cost approximately $45 million for which complete new PER's will be required. The estimated cost for the FY 1982 PER effort is $1,100,000.

An additional $700,000 has been included in this line for the completion of new PER's for approximately $35 million of construction projects which will be high priority candidates for inclusion in the FY 1983 Construction of Facilities program. The activity associated with FY 1983, which will be confined to the most urgent and clear-cut priority candidates, is being undertaken on a limited basis in an attempt to obtain earlier and better definition of programs. It is felt that this will permit better budget estimates, earlier design completion, and thereby result in better and less costly projects. If proven successful, we plan to increase the early detailed review of such candidate projects in future years. This is made essential by the extensive lead time now associated with PER work and the more limited Center capabilities to manage such work on a compressed schedule as we have done in the past.

(2) Related Special Engineering Support.. .... (700,000)

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 have taken on an increased importance in recent years and 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 assessments 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 Design.. 5.100.000

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, Payloads, and the Numerical Aerodynamic Simulation Facility. Amounts required for these efforts are included under "Other Requirements" (Paragraph 2). Projects involved are planned for inclusion in the FY 1981 and FY 1982 programs. In prior submissions, amounts were principally for BY +1. In this submission, early final design for selected high potential BY +2 projects is proposed. This is in accord with the overall plan discussed earlier in the Preliminary Engineering Report estimated to obtain better facilities on line earlier at a lower cost.

The request will provide for final design work associated with cpnstruction proposed for the FY 1981 Program, estimated to cost $75 to $80 million, and for $12 to $15 million of high potential projects proposed for the FY 1982 program. The amount included for FY 1981 candidates and for residual requirements of this nature which have accumulated from prior years' final design activities is $4,500,000. For FY 1982, $800,000 is included and the supporting rationale is much the same as that set out in the PER estimate.

2. OTHER REQUIREMENTS.. 4.150.000

These other facilities planning and design requirements are generated by potential future projects, large in size and of a complex nature. Those in this particular request are primarily associated with future space programs which require a long planning cycle. Early and progressive design work is essential to ensure the ultimate best design, cost estimates and schedules. These projects then require planning effort and associated design lead time well beyond that normally associated with preliminary engineering reports and general type facility projects. For this reason, these requirements must be provided for beyond the regular and most recurrent facility planning and design needs covered show.

A. Shuttle Facilitv Planninn and Desinn.................... 700,000

(1) Shuttle Facilities Final Design.. .... (330,000)

This portion of total facility planning and design required for Space Shuttle is associated with the preparation of final design drawings and specifications required for future construction of Space Shuttle facilities, which in FY 1981 are estimated to cost approximately $33 to $36 million. As in the FY 1979 budget request, design costs are lower than previous years due to the fact that some projects are later phases of earlier projects, and the complete facility was designed at one time with resources requested only as needed to support program milestones. The design effort is mainly related to the operational phase of the Space Shuttle program at Kennedy Space Center and Michoud Assembly Facility. Projects forecasted for FY 1981 may include a third mobile launcher (MLP-3), logistic facilities, and addition to thermal protection system (TPS) cells.

(2) Space Transportation System (STS) Studies and Preliminary Design .... (370,000)

This requirement is associated with the preparation of PER's, the conduct of facilities investigation, and studies for facilities projects which, in most cases, will be included in the FY 1982 Construction of Facilities program. This preliminary work is associated with future construction for that year now estimated to cost approximately $18 to $23 million. Additionally, studies and PER's will be undertaken to examine the facilities needed to enhance the operational phase of the STS. These facilities relate to solid rocket motor storage, external tank (ET) production at increased levels and shops and logistics facilities. PER's in the amount of $250,000 will be required to suppport decisions relating to out-year requirements. In addition, studies estimated at $120,000 will be required in order to provide quick response, cost analysis and trade-off studies of potentially feasible projects.

B. Spacelab/Payloads Facility Planning and Design...... 1001000

As the Space Shuttle Transportation System moves into its operational phase, additional facilities will be required to provide the capability to develop, integrate, and check out scientific, application, and upper stage payloads. This planning requirement relates to the previously mentioned payload requirements. Projects forecasted for FY 1981 include a Level IV Payload Integration Facility,and a Multimission Support Equipment Maintenance Facility. In addition, a PER for a Payload Processing Facility at Vandenberg Air Force Base is forecast.

C. Energy Reduction Analysis and Support 1,150,000

This is a continuation into the second phase of the requirements for energy reduction analysis and support in response to several factors: (1) the increased need and urgency to conserve energy as an essential element of good business and economic viability; (2) the continuing focus and emphasis accorded to energy reduction in building and facilities as an outgrowth of the requirements of Executive Order No. 12003; and (3) the continuing growth of these requirements as reduction efforts continue to expand. This FP&D requirement thus covers those special needs which are frequently related to complex facility studies, analyses, and other preliminary activities leading to the better identification of highly probable cost and energy effective facility projects. These preliminary activities are vital to the total effort of future energy reduction and must be undertaken on a priority basis if long-term energy reduction goals are to be attained.

NASA has continuously intensified its efforts to identify, study and develop new energy reduction initiatives which could most probably result in sound and effective facility projects. In turn, it is anticipated that these resultant projects will reduce and/or limit future energy consumption through improved efficiency and, at the same time, minimize the impact of rapidly rising energy costs. Experience to date continues to demonstrate that these planning resources can produce appreciable energy reductions and can direct investment resources toward the most prudent and cost effective modifications to facilities on some priority basis. As compared to FY 1977 usage, for example, during the first three quarters of FY 1978 approximately $4,200,000 in additional energy costs were avoided during just nine months through the increased effectiveness of energy management and by modest prior investments. An anticipated additional 10 to 15% reduction in NASA's total energy consumption can probably still be achieved through additional planning, resulting in an estimated additional utility cost savings of between $8-12 million per year in terms of average FY.1978 energy costs. These resources for needed anticipated planning are therefore essential since they are the key to the timely identity of the future facility investments. If this identification effort is not accomplished in a timely manner, millions of dollars of additional downstream utility and other costs will be reflected. These resources will be used for the following major areas of effort:

(1) To provide for the second phase of an anticipated multiphase program over the next three years to support and comply with the intent and directed purpose of Federal Executive Order No. 12003. This Executive Order places focus and emphasis on saving energy in existing buildings. NASA has approximately 2,500 buildings with a total. of over 30,000,000 gross square feet of floor area. Of these, there are 226 which contain over 30,000 gross square feet each. This analysis and study effort will continue to provide the necessary "energy audits", engineering services, economic evaluations, and other technical support necessary to initiate the evaluation of these "energy intensive" major buildings and/or central utility plants.

To date, NASA has completed several major energy audits/appraisals of its buildings and facilities. Approximately three major energy components have been reviewed, with an additional 7-8 more NASA Centers yet to be initiated. In addition, a major study effort has been initiated to develop a methodology whereby detailed energy study efforts can be applied in a prudent manner. This new and innovative methodology hopefully will enable NASA to quickly and inexpensively identify its most energy wasteful buildings so that more detailed and costly study efforts can be selectively applied.

The emphasis of this effort will also continue the determination of actual system configuration and thus operational modes and subsequent study alternatives. The heating, ventilating, and air-conditioning systems, lighting, thermal and electrical distribution systems, and any other operations, systems, or functions which require energy utilization/reduction analyses and evaluation will continue to be involved. The present program plan is to develop an intensive three-year investment program that will include all essential and cost effective energy conserving measures in all NASA buildings.

Previous experience and results have indicated that very productive energy conservation initiatives associated with buildings can be identified and that these do result in significant energy savings with normally less than five years but not more than eight years "simple payback". Specifically, these initiatives include control modifications, electrical power reductions, and system optimizations.

(2) To provide for engineering support, studies, and analyses involving changes in criteria and design methodologies, operation and maintenance procedures, improved research testing procedures, facility energy impacts due to new programs as well as cost and energy effective evaluations of investments. Other technical energy investigation and identification efforts, including fuel conversion and application of nondepleting resources associated with NASA's technical/operational facilities are essentially complete. These resources are to provide for some residual efforts and the completion of these studies already underway.

D. Numerical Aerodvnamic Simulation Facility Planning and Desinn........................... 2,000.000

These planning and design resources are the first increment of the approximately $6,500,000 required to provide preliminary evaluation and design, preliminary engineering, and final design for construction of a facility (building, equipment and system software) dedicated to the numerical simulation of aircraft aerodynamics and other fluid dynamics applications. This request will provide for engineering support for validation studies, user interface design, preliminary engineering, specifications development, and final design. The cost of construction of the proposed Numerical Aerodynamic Simulation Facility (NASF) at Ames Research Center, Moffett Field, California, is currently estimated to be between $75,000,000 and $90,000,000. This planning and design effort is not intended in any way to reflect a final decision to construct this facility. Rather, it. is directed toward developing planning and design information which can then be the basis for decisions on construction during future budget formulations.

Historically, the design of aerospace vehicles has relied heavily on fluid flow simulations to identify and verify aerodynamic characteristics. At present, these simulations are obtained at great expense in time, energy, and other resources primarily by using scale models in ground-based experimental facilities, such as wind tunnels. The performance of new aerospace vehicles is often compromised by over-design because of test facility limitations. Some of the inherent limitations of these simulations are model size, wall and support interference, aeroelastic distortions and large energy requirements. Many of these limitations can be overcome by solving well-known mathematical equations governing fluid flow using modern numerical calculation methods. This is defined as "numerical simulation" and is in contrast to the ground-based scale model simulation referred to above. The proposed facility will also be capable of providing a significant increase in processing power for a broader scope of related applications such as weather and climate modeling that are based on the same fundamental fluid dynamic equations and numerical solution techniques.

Design validation will provide technical information in the early stages of project development to assure the government best state-of-the-art design. Included in this effort will be: (a) evaluation of preliminary designs, including simulation to verify function and performance estimates; (b) refinement of performance measuring criteria; (c) identification and prototype checkout of critical system components; and (d) assessment of system reliability, availability and serviceability.

The integrated facility design will provide a component description of the total system. This will lead to the identification of hardware and software components. Additionally, it will lead to preparation of the physical requirements of the system in sufficient detail to provide design criteria for the construction of a building to house the system.

User interface design will include programming language development, and subsystem integration involving such items as data security, graphics support, flow simulation model preparation and result analysis, and machine scheduling systems.

Due to the extent and complexity of this project, construction management services will start with the early planning required for smooth implementation of this project. Elements of this planning will include development of a detailed management plan and complementing management systems for total facility construction and system integration; coordination of system engineering and building design activities; and specification of operational procedures for the successive stages of system implementation throughout the construction phase.

Final system design and engineering performed in parallel by at least two competing contractors can begin in 1980 and extend into 1981. The preliminary engineering includes design validation, integrated facility design, and user interface design, cost and schedule. These system design and engineering efforts will provide system architecture, detailed logic design and hardware specification, and critical component prototyping and simulation. At the conclusion of these efforts, and subject to appropriate reviews and approvals, NASA will be prepared to proceed with fabrication and installation of this facility with a management structure and the system specifications necessary to award a construction contract. It also should be noted that by carrying two or more contractors through planning and design phases of project implementation, NASA will be in a position to select, from competing design proposals, the option most beneficial to the government for the contemplated construction phase.

The plan to acquire a numerics1 aerodynamic simulation facility involves three key steps with built-in decision points which allows NASA to proceed with high confidence at each step. The first decision will be made at the conclusion of feasibility and validation studies relative to initiating system design and engineering. At the present time, with all information from these nearly completed study efforts being favorable to proceeding with the project, it is NASA's intention to continue to the second step, partially financed by this budget request. The second decision point relates to the review and evaluation of preliminary design results and the desirability of continuing with the program. The third, occurring tentatively in mid-1981, involves the decision to invite construction contract bids with the intention of awarding a construction contract by late 1981. On this basis, the numerical aerodynamic simulation facility is expected to be ready for fabrication and construction in late 1981 with operational status to be achieved in early to mid-1985. This overall approach assures that only the necessary resources will be committed at each step and thus meet the requirements to successfully complete and implement this project.

As covered above, the implementation of this proposed facility will include the design, engineering, fabrication, assembly and testing of computer hardware and software components of a unique processing system, and the design and construction of a building to house the system and support personnel at Ames Research Center (Figure 1).

A major component of the facility will be a specially constructed Flow Model Processor (FMP), designed to solve the three-dimensional equations of fluid dynamics, including viscous effects, that have been cast in the form of numerical flow models. The FMP (Figure 2) will consist of the high speed processor ensemble, the problem data memory, the staging memory and the FMP control, fabricated from advanced, high speed integrated circuit technology components. By organizing these components in a parallel fashion to permit the simultaneous calculation of several results, the FMP will solve the viscous flow equations at a rate possibly as much as one billion arithmetic operations per second for flow fields described by up to one million discrete points. Numerical flow models will be mapped into the FMP through a programming language that clearly and easily describes the models and at the same time allows optimum use of FMP processor capabilities.

Another major component of the facility is the Support Processor System (SPS), taking advantage of standard off-the-shelf processing, storage, communication display, and peripheral devices, designed to directly support the processing of numerical flow models in the FMP. The SPS (Figure 2) will provide scheduling and data transport control for FMP jobs and provide the user interface. Major processing support capabilities include: (1) flowmodel set-up to prepare and interpret detailed flowmodel descriptions, including specification of numerical algorithms, boundary conditions, turbulence model and various other flow parameters; (2) configuration geometry/grid generation to prepare the numerical description of test configurations and flow model grid systems, including the preparation of graphical displays and interactive user communications for rapid checkout and modification; and (3) aerodynamic data reduction/display to produce graphic displays of selected aerodynamic information including forces, moments, detailed surface and flow pressures, velocities, skin friction, heat transfer and other flow parameters of interest.

The SPS will control the flow of information to and from the FMP and other ancillary processing and data display devices. It will also proviae both short and long-term memory storage for aerodynamic flow models and data. Researchers will gain access to the FMP and support capabilities through a user interface with data communications links to both on- and off-site locations. This access will be interactive and will be managed by operating system software that allows the time sharing of SPS resources among the users.

The third and final major component of the facility is the building in which the numerical aerodynamic simulation facility equipment and personnel will be located. This building (Figure 3) will be specially designed to properly house the FMP, the SPS and other associated fixed equipment. It is presently estimated to consist of approximately 4,931 square meters (52,000 square feet) and will also include space for operating and research personnel.

As previously indicated, this request is part of an overall requirement of approximately $6,500,000 for this planning and design effort. The $2,000,000 requested in FY 1980 will fund all preliminary evaluation and design, and the start of final detailed design. It is presently planned to request in FY 1981 the remainder needed to complete planning and design.

TOTAL.... 14,000,000

AMES RESEARCH CENTER

FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF

NUMERICAL AERODYNAMIC SIMULATION FACILITY

LOCATION PLAN

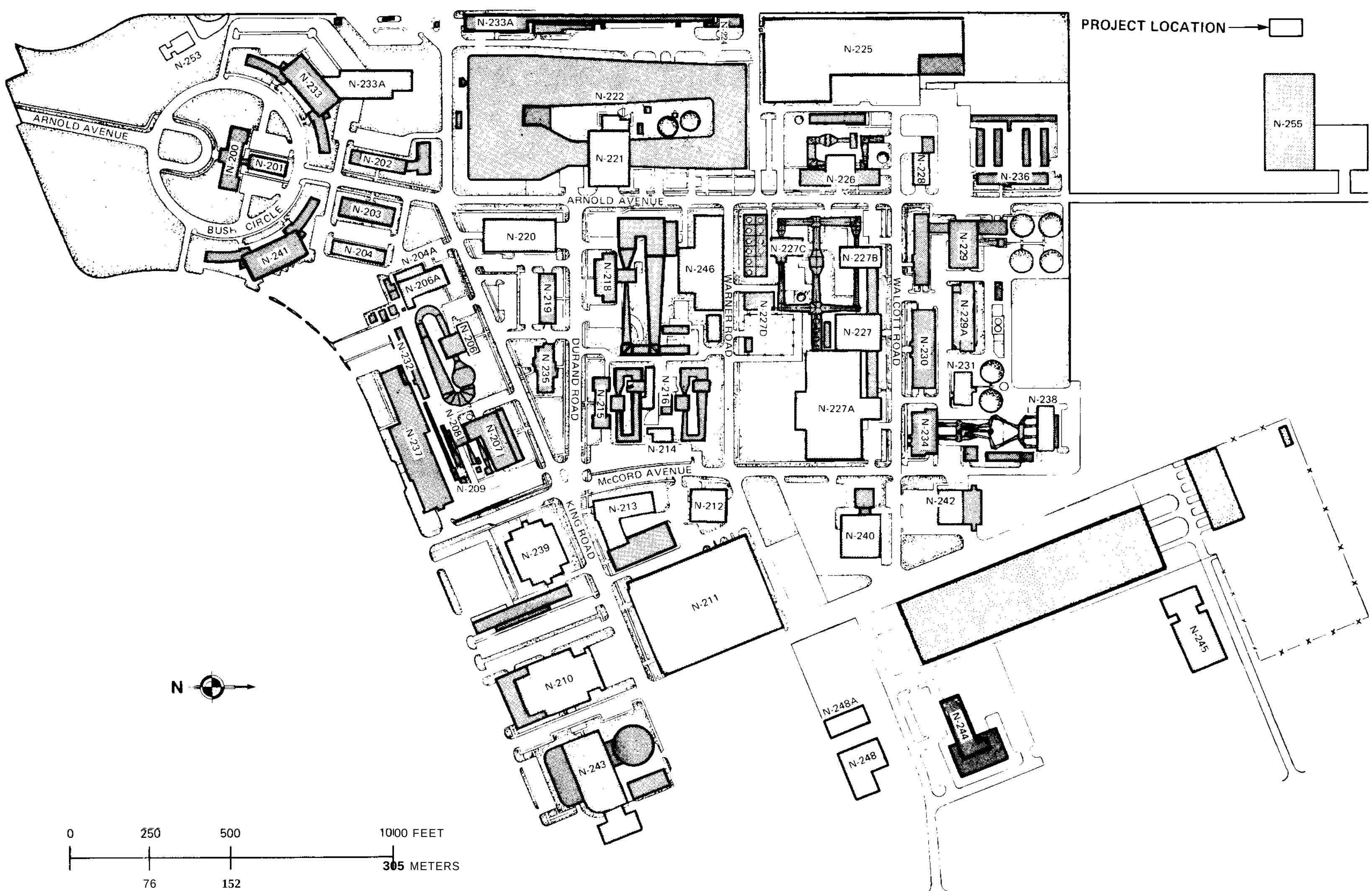


FIGURE 1

AMES RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES

CONSTRUCTION OF
NUMERICAL AERODYNAMIC SIMULATION FACILITY
SCHEMATIC DIAGRAM

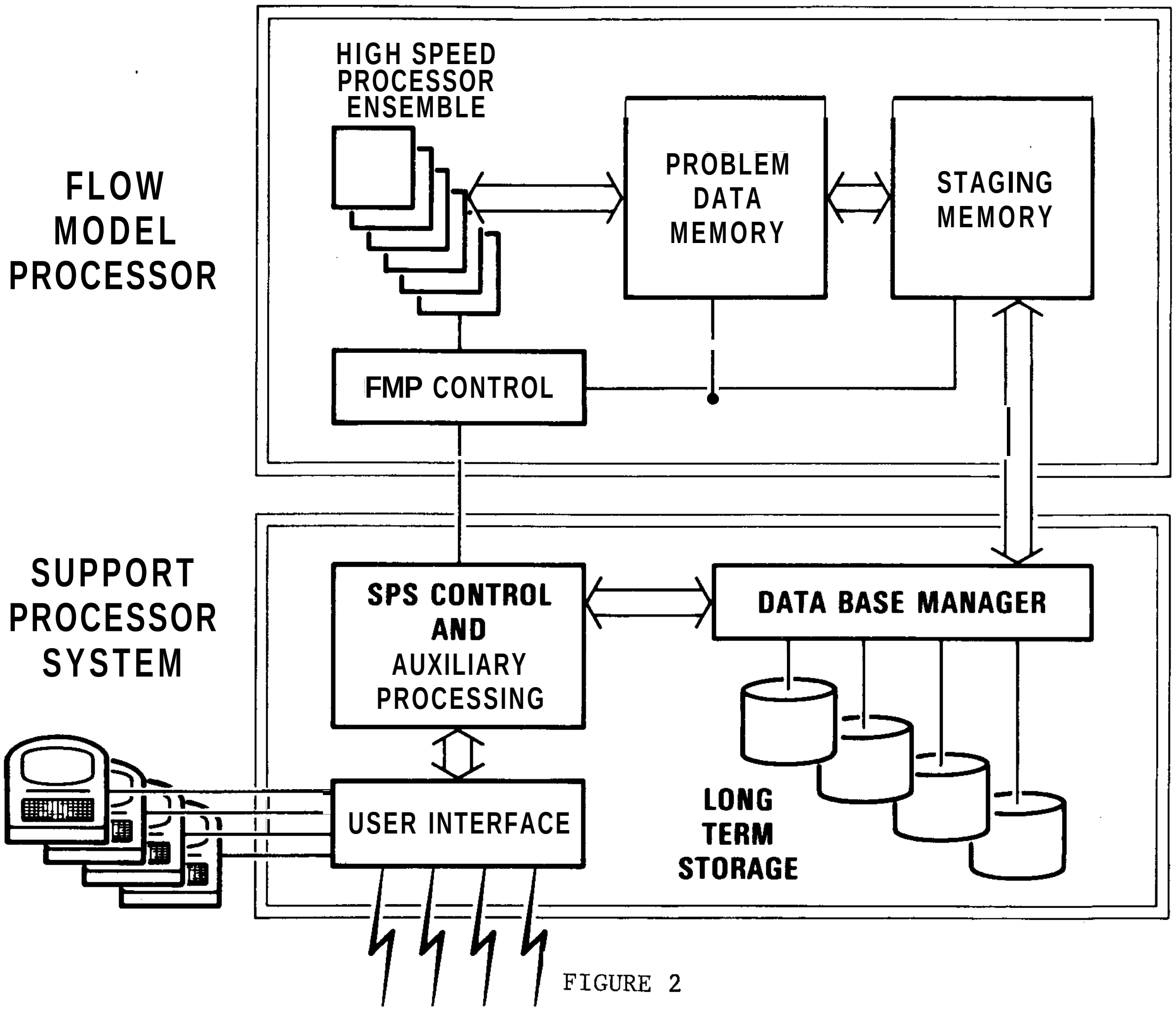


FIGURE 2

CF 15-15

AMES RESEARCH CENTER
FISCAL YEAR 1980 ESTIMATES
CONSTRUCTION OF NUMERICAL AERODYNAMIC SIMULATION FACILITY FLOOR PLANS

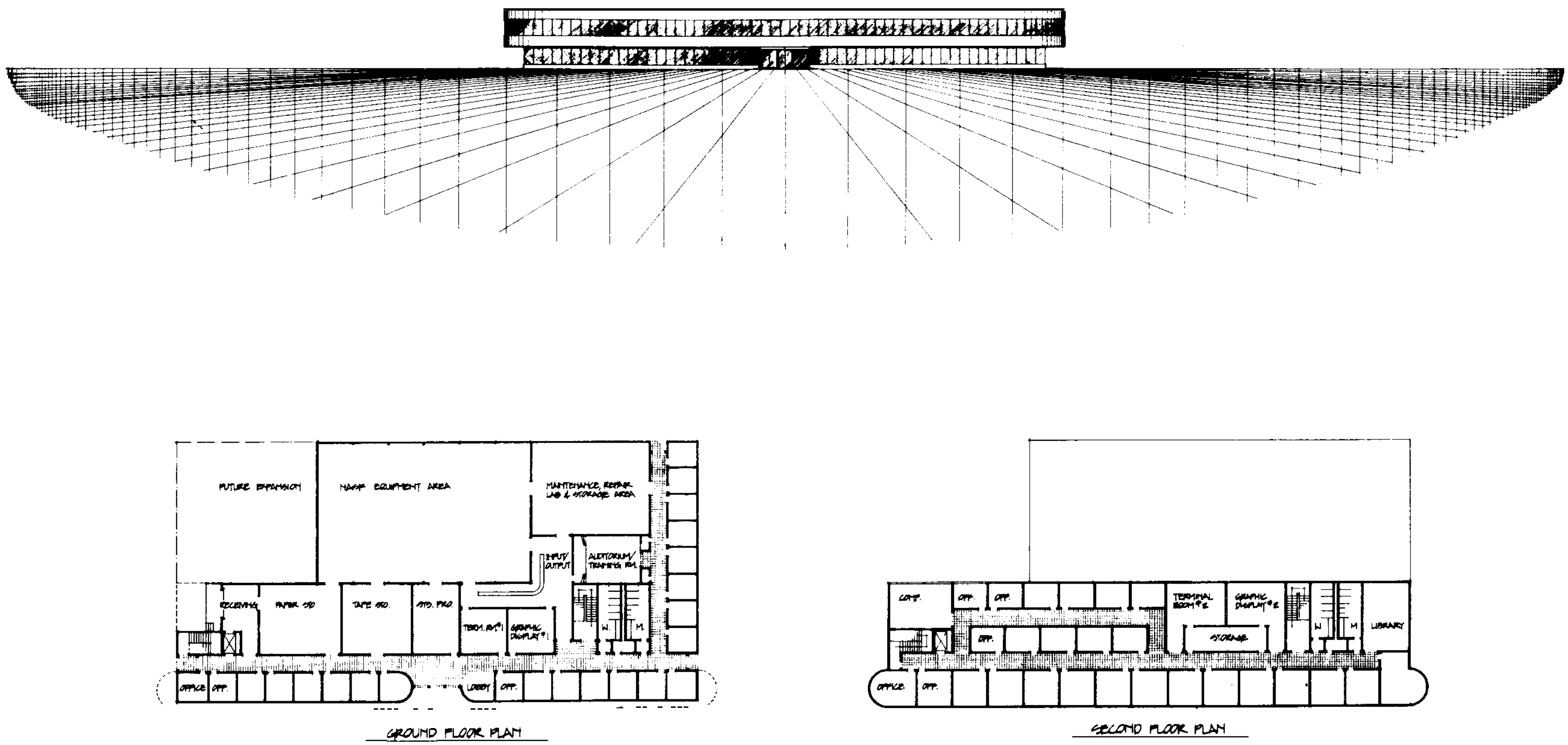


FIGURE 3