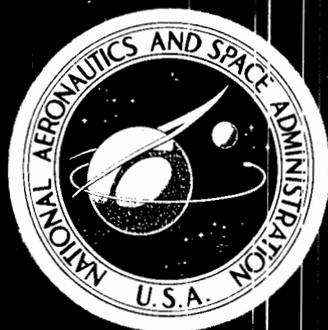


*National Aeronautics
and Space Administration*



BUDGET ESTIMATES

FISCAL YEAR 1975
Volume II

CONSTRUCTION OF FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

GENERAL STATEMENT

This appropriation provides for contractual services for the design, major rehabilitation, and modification of facilities; the construction of new facilities; minor construction; the purchase of related equipment and advanced design related to facilities planned for future authorization.

The program for 1975, in many aspects, reflects a continuation of prior years' endeavors, especially in regard to:

- a. Space shuttle facilities
- b. Facility rehabilitation and modification and minor construction programs
- c. Facility planning and design.

As has been forecast, FY 1975 space shuttle facility requirements are increased over the amounts approved for FY 1974 and prior years. These requirements for unique shuttle facilities are time sensitive and are to meet specific milestones established for the first horizontal and manned orbital flights.

Each of the non-shuttle discrete facility projects requested for FY 1975 represent a specific need in support of: (1) Scientific Investigations in Space, (2) Space and Nuclear Research and Technology, (3) Aeronautical Research and Technology, and (4) Supporting Activities.

The FY 1975 Rehabilitation and Modification of Facilities program continues the objective of preserving and enhancing the utilization of existing facilities. This is a most effective program in terms of results achieved and essential in light of the extensive amount of work of this nature yet to be undertaken. The inclusion of foreseeable programmatic facility projects is more evident this year, reflecting the relative increased urgency of these requirements. The Minor Construction program is largely programmatic as in the past, either directly or as indirect program support, and is also an essential program providing the means to accomplish the smaller facility projects of this type.

The FY 1975 request for Facility Planning and Design funds reflects the future years redirection in forecasting space shuttle facility requirements. It also provides for advance planning funds for three proposed large aeronautical facilities, on which extensive planning is needed prior to development of a budget request to fund construction of these facilities.

The request for FY 1975 is \$151,490,000, an increase of \$50,390,000 over the amount appropriated for FY 1974. Outlays are estimated to be \$102,000,000 in FY 1975, an increase of \$27,000,000 over the estimate for FY 1974.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

PROPOSED APPROPRIATION LANGUAGE

CONSTRUCTION OF FACILITIES

For advance planning, design, rehabilitation, modification and construction of facilities for the National Aeronautics and Space Administration, and for the acquisition or condemnation of real property, as authorized by law, [\$101,100,000] \$151,490,000, including [(1) \$660,000 for replacement of transportation facility, Goddard Space Flight Center; (2) \$710,000 for rehabilitation of vibration laboratory, Goddard Space Flight Center; (3) \$740,000 for modifications of and addition to 25-foot space simulator building, H. Allen Smith Jet Propulsion Laboratory; (4) \$580,000 for modification of planetary mission support facilities, H. Allen Smith Jet Propulsion Laboratory; (5) \$2,410,000 for rehabilitation and modification of 600 p.s.i. air supply system, Langley Research Center; (6) \$1,620,000 for construction of systems engineering building, Langley Research Center; (7) \$570,000 for rehabilitation of airfield pavement, Wallops Station; (8) \$575,000 for rehabilitation of communication system, Wallops Station; (9) \$1,885,000 for modification for fire protection improvements at various tracking and data stations; (10) \$980,000 for modification of space launch complex 2 West, Vandenberg Air Force Base; (11) \$1,085,000 for modification of power system, Slidell Computer Complex; (12) \$56,300,000 for Space Shuttle facilities at various locations, as follows: (A) modifications for auxiliary propulsion and power systems test facilities, White Sands Test Facility, (B) modifications for Shuttle avionics integration laboratory, Lyndon B. Johnson Space Center, (C) modifications for radiant heating verification facility, Lyndon B. Johnson Space Center, (D) modifications for the Orbiter propulsion system test facilities, Mississippi Test Facility, (E) modifications for external tank structural test facilities, Marshall Space Flight Center, (F) modification of manufacturing and subassembly facilities for the Orbiter, NASA Industrial Plant, Downey, Calif., (G) modification of and addition to final assembly and checkout facilities for the Orbiter, Air Force plant No. 42, Palmdale, Calif., (H) modification of manufacturing and final assembly facilities for external tanks, Michoud Assembly Facility, (I) construction of Orbiter landing facilities, John F. Kennedy Space Center; (13) \$14,785,000] (1) \$3,660,000 for addition to flight and guidance simulation laboratory, Ames Research Center; (2) \$890,000 for rehabilitation and modification of science and applications laboratories, Goddard Space Flight Center; (3) \$1,220,000 for modifications for fire protection and safety, Goddard Space Flight Center; (4) \$150,000 for acquisition of land, Jet Propulsion Laboratory; (5) \$4,880,000 for addition to systems development laboratory, Jet Propulsion Laboratory; (6) \$3,790,000 for addition for integrated systems testing facility, Jet Propulsion Laboratory; (7) \$935,000 for modification of water supply system, Lyndon B. Johnson Space Center; (8) \$515,000 for modification of 6,000 p.s.i. air storage system, Langley Research Center; (9) \$2,990,000 for rehabilitation of 16-foot transonic wind tunnel, Langley Research Center; (10) \$2,580,000 for modification of

propulsion systems laboratory, Lewis Research Center; (11) \$660,000 for modification of rocket engine test facility, Lewis Research Center; (12) \$4,060,000 for construction of X-ray telescope facility, Marshall Space Flight Center; (13) \$1,370,000 for modification of beach protection system, Wallops Station; (14) \$6,040,000 for construction of infrared telescope facility, undesignated location; (15) \$1,430,000 for modifications for fire protection and safety at various tracking and data stations; (16) \$86,020,000 for Space Shuttle facilities at various locations, as follows: (A) modification of the vibration and acoustic test facility, Lyndon B. Johnson Space Center, (B) modifications for crew training facilities, Lyndon B. Johnson Space Center, (C) construction of materials test facility, White Sands Test Facility, (D) construction of Orbiter horizontal flight test facilities, Flight Research Center, (E) modifications for dynamic test facilities, Marshall Space Flight Center, and NASA Industrial Plant, Downey, California, (F) modifications for solid rocket booster structural test facilities, Marshall Space Flight Center, (G) construction/modification of solid rocket motor production and test facilities, undesignated locations, (H) construction of Orbiter landing facilities, John F. Kennedy Space Center, (I) construction of Orbiter processing facility, John F. Kennedy Space Center, (J) modifications to launch complex 39, John F. Kennedy Space Center; (17) \$14,900,000 for minor rehabilitation and modification of facilities at various locations; [(14) \$4,600,000] (18) \$4,500,000 for minor construction of new facilities and additions to existing facilities at various locations; [(15) \$13,600,000] and (19) \$10,900,000 for facility planning and design not otherwise provided for; to remain available for obligation until June 30, [1976] 1977: Provided, That, notwithstanding the [limitations] limitation on the availability of funds appropriated under this head by this [or the corresponding] appropriation [acts for the fiscal years 1973 (86 Stat. 544-545) and 1972 (85 Stat. 277)] act, and except with respect to items [(13)] (17) through [(15)] (19) above, [items (22) through (24) of the cited fiscal year 1973 act, and the items for "rehabilitation and modification of facilities" and "facility planning and design" of the cited fiscal year 1972 act,] when any activity, for which appropriations under this head made by this [or the cited acts] act are available, has been initiated by the incurrence of obligations therefor, the amount available for such activity shall remain available until expended. (42 U.S.C. 2451, et seq.; Department of Housing and Urban Development; Space, Science, Veterans, and Certain Other Independent Agencies Appropriation Act, 1974; additional authorizing legislation to be proposed.)

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

Program and Financing (in thousands of dollars)

Identification code 27-00-0107-0-1-250	Budget plan (amounts for construction of facilities actions programed)			Costs and obligations		
	1973 actual	1974 estimate	1975 estimate	1973 actual	1974 estimate	1975 estimate
Program by activities:						
1. Manned space flight.....	29,325	56,300	86,020	9,706	45,000	68,000
2. Scientific investigations in space.....	11,205	2,030	18,770	8,516	10,000	6,000
3. Space applications.....		900		608	400	400
4. Space and nuclear research and technology.....			660			300
5. Aeronautical research and technology.....	12,935	2,410	9,745	9,725	8,000	9,000
6. Supporting activities.....	25,260	39,380	36,295	24,309	21,600	28,300
Total program costs, funded.....	78,725	101,100	151,490	52,864	85,000	112,000
Change in selected resources (undelivered orders).....				16,461	47,400	44,000
10 Total.....	78,725	101,100	151,490	69,325	132,400	156,000
Financing:						
21 Unobligated balance, start of year: For completion of prior year budget plans.....				-63,197	-73,997	-42,697
22 Unobligated balance transferred from other accounts.....				-1,400		
24 Unobligated balance, end of year: For completion of prior year budget plans.....				73,997	42,697	38,187
Budget authority.....	78,725	101,100	151,490	78,725	101,100	151,490
Budget authority:						
40 Appropriation.....	77,300	101,100	151,490	77,300	101,100	151,490
42 Transferred from other accounts.....	1,425			1,425		
43 Appropriation (adjusted).....	78,725	101,100	151,490	78,725	101,100	151,490
Relation of obligations to outlays:						
71 Obligations incurred, net.....				69,325	132,400	156,000
72 Obligated balance, start of year.....				43,539	68,203	125,603
74 Obligated balance, end of year.....				-68,203	-125,603	-179,603
90 Outlays.....				44,661	75,000	102,000

Note.—Reconciliation of budget plan to obligations:

	1973 actual	1974 estimate	1975 estimate
Total budget plan.....	78,725	101,100	151,490
Deduct portion of budget plan to be obligated in subsequent years.....	44,409	32,900	25,490
Add obligations of prior year budget plans.....	35,009	64,200	30,000
Total obligations.....	69,325	132,400	156,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

SUMMARY OF THE BUDGET PLAN BY LOCATION

<u>Location</u>	<u>Fiscal Year 1973</u>	<u>Fiscal Year 1974</u>	<u>Fiscal Year 1975</u>
Ames Research Center.....	\$3,250,000	---	\$3,660,000
Goddard Space Flight Center.....	590,000	\$1,370,000	2,110,000
Jet Propulsion Laboratory.....	610,000	1,320,000	8,820,000
Johnson Space Center.....	585,000	---	935,000
John F. Kennedy Space Center, NASA	10,140,000	---	---
Langley Research Center.....	4,290,000	4,030,000	3,505,000
Lewis Research Center.....	9,710,000	---	3,240,000
Marshall Space Flight Center.....	---	---	4,060,000
Wallops Station.....	350,000	1,145,000	1,370,000
Various Locations.....	---	3,950,000	7,470,000
Space Shuttle Facilities.....	27,900,000	56,300,000	86,020,000
Rehabilitation and Modification...	11,580,000	14,785,000	14,900,000
Minor Construction.....	1,720,000	4,600,000	4,500,000
Facility Planning and Design.....	<u>8,000,000</u>	<u>13,600,000</u>	<u>10,900,000</u>
Total Plan.....	<u>\$78,725,000</u>	<u>\$101,100,000</u>	<u>\$151,490,000</u>

SUMMARY OF THE BUDGET PLAN BY PROGRAM OFFICE

Office of Manned Space Flight.....	\$29,910,000	\$57,385,000	\$86,955,000
Office of Space Science.....	11,690,000	4,815,000	22,400,000
Office of Aeronautics and Space Technology.....	15,825,000	4,030,000	10,405,000
Office of Tracking and Data Acquisition.....	---	1,885,000	1,430,000
NASA Comptroller.....	<u>21,300,000</u>	<u>32,985,000</u>	<u>30,300,000</u>
Total Plan.....	<u>\$78,725,000</u>	<u>\$101,100,000</u>	<u>\$151,490,000</u>

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

BUDGET PLAN BY LOCATION AND PROJECT

<u>Prog Off</u>		(Thousands of Dollars)		
		<u>FY 1973</u>	<u>FY 1974</u>	<u>FY 1975</u>
	<u>Ames Research Center</u>	<u>3,250</u>	<u>---</u>	<u>3,660</u>
AST	Addition to flight and guidance simulation laboratory.....	---	---	3,660
AST	Rehabilitation and modification of aeronautical airborne science and support facilities.....	1,065	---	---
AST	Rehabilitation of unitary plan wind tunnel model support, control systems and model preparation areas.....	760	---	---
MSF	Addition to high pressure air supply systems.....	1,425	---	---
	<u>Goddard Space Flight Center</u>	<u>590</u>	<u>1,370</u>	<u>2,110</u>
SS	Rehabilitation and modification of science and applications laboratories...	---	---	890
SS	Modifications for fire protection and safety.....	---	---	1,220
SS	Replacement of transportation facility....	---	660	---
SS	Rehabilitation of vibrations facility.....	---	710	---
SS	Rehabilitation and modification of utility systems.....	590	---	---
	<u>Jet Propulsion Laboratory</u>	<u>610</u>	<u>1,320</u>	<u>8,820</u>
SS	Acquisition of land.....	---	---	150
SS	Addition to systems development laboratory (SDL).....	---	---	4,880
SS	Addition for integrated systems testing facility.....	---	---	3,790
SS	Modification of and addition to 25-foot space simulator building.....	---	740	---
SS	Modification of planetary mission support facilities.....	---	580	---
SS	Rehabilitation and modification of roadway systems.....	610	---	---

SUM 7

<u>Prog</u> <u>Off</u>		(Thousands of Dollars)		
		<u>FY 1973</u>	<u>FY 1974</u>	<u>FY 1975</u>
	<u>Johnson Space Center</u>	<u>585</u>	<u>---</u>	<u>935</u>
MSF	Modification of water supply system.....	---	---	935
MSF	Modification of fire protection system...	585	---	---
	<u>John F. Kennedy Space Center, NASA</u>	<u>10,140</u>	<u>---</u>	<u>---</u>
SS	Modification of and additions to space- craft assembly facilities.....	8,100	---	---
SS	Modification of Titan Centaur facilities.	2,040	---	---
	<u>Langley Research Center</u>	<u>4,290</u>	<u>4,030</u>	<u>3,505</u>
AST	Modification of 6,000 p.s.i. air storage system.....	---	---	515
AST	Rehabilitation of 16-foot transonic wind tunnel.....	---	---	2,990
AST	Rehabilitation and modification of 600 p.s.i. air supply system.....	---	2,410	---
AST	Construction of systems and engineering building.....	---	1,620	---
AST	Modification of central air supply system.....	1,175	---	---
AST	Environmental modification for utility operations.....	650	---	---
AST	Rehabilitation of full scale wind tunnel.	2,465	---	---
	<u>Lewis Research Center</u>	<u>9,710</u>	<u>---</u>	<u>3,240</u>
AST	Modification of propulsion systems laboratory.....	---	---	2,580
AST	Modification of rocket engine test facility.....	---	---	660
AST	Modification of high temperature and high pressure turbine and combustor research facility.....	9,710	---	---
	<u>Marshall Space Flight Center</u>	<u>---</u>	<u>---</u>	<u>4,060</u>
SS	Construction of X-ray telescope facility.	---	---	4,060

SUM 8

<u>Prog</u> <u>Off</u>		(Thousands of Dollars)		
		<u>FY 1973</u>	<u>FY 1974</u>	<u>FY 1975</u>
	<u>Wallops Station</u>	<u>350</u>	<u>1,145</u>	<u>1,370</u>
SS	Modification of beach protection system..	---	---	1,370
SS	Rehabilitation of airfield pavement.....	---	570	---
SS	Rehabilitation of communications system..	---	575	---
SS	Warehouse replacement.....	350	---	---
	<u>Various Locations</u>	<u>---</u>	<u>3,950</u>	<u>7,470</u>
SS	Construction of infrared telescope facility.....	---	---	6,040
TDA	Modifications for fire protection and safety at various tracking stations.....	---	1,885	1,430
SS	Modification of space launch complex 2 West, Vandenberg Air Force Base.....	---	980	---
MSF	Modification of power system, Slidell Computer Complex.....	---	1,085	---
MSF	<u>Space Shuttle Facilities</u>	<u>27,900</u>	<u>56,300</u>	<u>86,020</u>
	Construction of orbiter landing facilities (KSC).....	---	17,300	15,880
	Construction of orbiter processing facility (KSC).....	---	---	13,380
	Modifications to launch complex 39 (KSC).	---	---	42,690
	Modifications for dynamic test facilities (MSFC; Downey, California).....	---	---	3,920
	Construction of orbiter horizontal flight test facilities (FRC).....	---	---	1,940
	Modifications for crew training facilities (JSC).....	---	---	420
	Modification of the vibration and acoustic test facility (JSC).....	2,770	---	410
	Construction of materials test facility (WSTF).....	---	---	790
	Modifications for solid rocket booster structural test facilities (MSFC).....	---	---	2,590
	Construction/modification of solid rocket motor production and test facilities (location to be selected).....	---	---	4,000
	Modifications for auxiliary propulsion and power systems test facilities (WSTF).....	---	1,290	---

SUM 9

Bud Prog
Acty Off

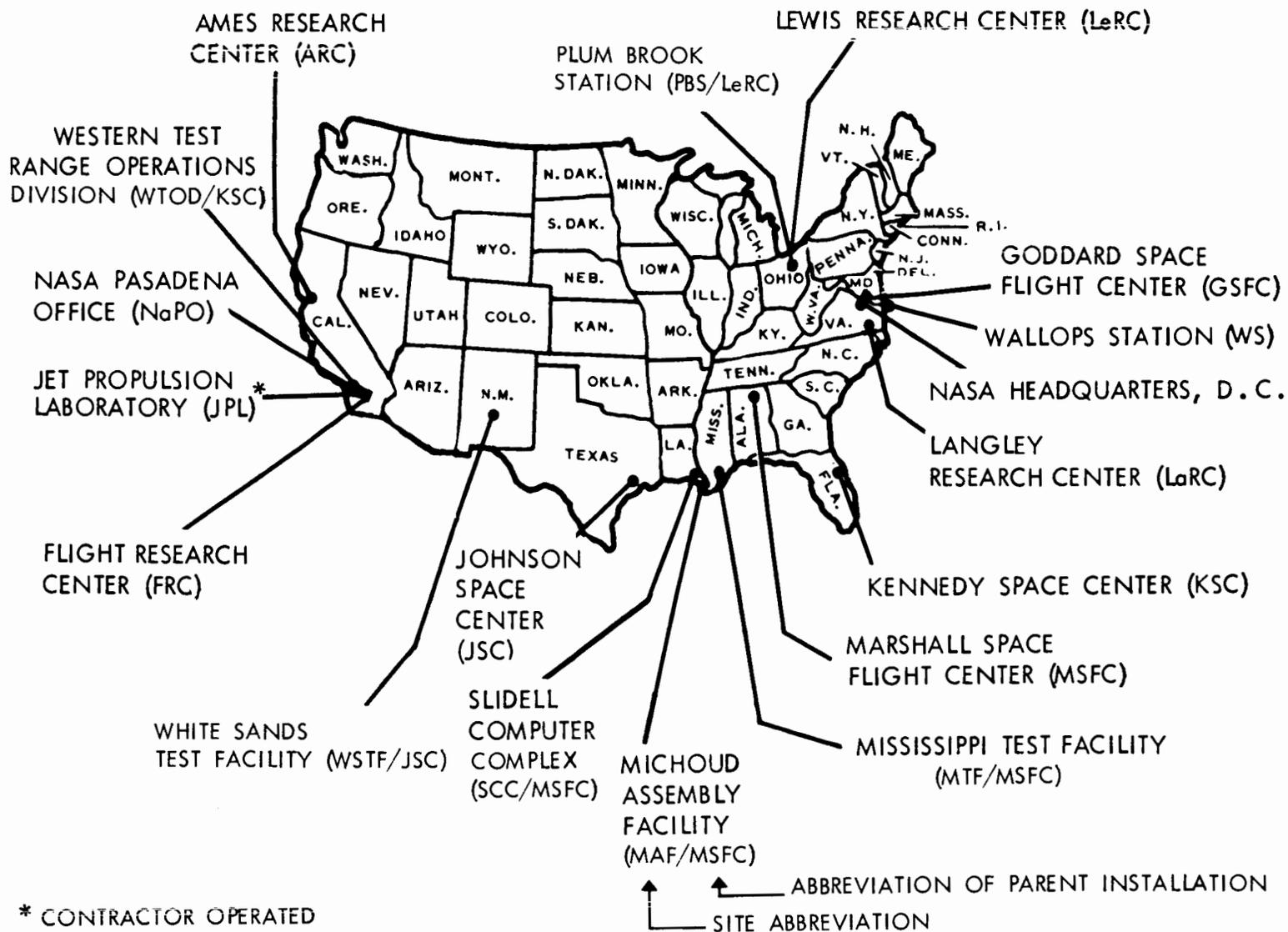
(Thousands of Dollars)
FY 1973 FY 1974 FY 1975

Space Shuttle Facilities (Cont'd)

	Modifications for shuttle avionics integration laboratory (JSC).....	---	1,240	---
	Modifications for radiant heating verification facility (JSC).....	---	1,260	---
	Modifications for the orbiter propulsion system test facilities (MTF).....	---	11,300	---
	Modifications for external tank structural test facilities (MSFC).....	---	4,400	---
	Modification of manufacturing and sub-assembly facilities for the orbiter, NASA industrial plant, Downey, California.....	5,000	2,650	---
	Modification of and addition to final assembly and checkout facilities for the orbiter, Air Force Plant #42, Palmdale, California.....	---	7,350	---
	Modification of manufacturing and final assembly facilities for external tanks (MAF).....	4,320	9,510	---
	Modification of the entry structures facility (LRC).....	1,635	---	---
	Modification of acoustic model engine test facility (MSFC).....	2,430	---	---
	Main engine sea level test stands (MTF).	3,020	---	---
	Rehabilitation of propellant and high pressure gaseous systems (MTF).....	1,160	---	---
	Modification of the structures and mechanics laboratory (MSFC).....	4,700	---	---
	Addition for electrical power laboratory (MSFC).....	320	---	---
	Addition for systems integration and mockup laboratory (JSC).....	2,545	---	---
COMP	<u>Rehabilitation and Modification of Facilities at Various Locations</u>	<u>11,580</u>	<u>14,785</u>	<u>14,900</u>
COMP	<u>Minor Construction of New Facilities and Additions to Existing Facilities at Various Locations</u>	<u>1,720</u>	<u>4,600</u>	<u>4,500</u>
COMP	<u>Facility Planning and Design</u>	<u>8,000</u>	<u>13,600</u>	<u>10,900</u>
	TOTAL PLAN.....	<u>78,725</u>	<u>101,100</u>	<u>151,490</u>

SUM 10

LOCATION OF NASA MAJOR AND COMPONENT INSTALLATIONS



RECORDED VALUE OF CAPITAL TYPE PROPERTY
(IN-HOUSE AND CONTRACTOR-HELD)
AS OF JUNE 30, 1973
(DOLLARS IN THOUSANDS)

Reporting Installation	Real Property					Equipment 2/	Fixed Assets in Progress	Grand Total
	Land	Buildings	Other Structures and Facilities	Leasehold Improvements	Total			
OFFICE OF MANNED SPACE FLIGHT	\$ 107,471	\$ 737,019	\$ 641,473	\$ 3,776	\$ 1,489,739	\$ 1,722,742	\$ 37,704	\$ 3,250,185
Kennedy Space Center	72,171	291,191	317,001	-	680,363	562,581	9,196	1,252,140
KSC - Florida	72,171	291,191	317,001	-	680,363	122,636	8,896	811,895
Western Test Range Operations Division	-	-	-	-	-	-	-	-
Lompoc, California	-	-	-	-	-	6,351	300	6,651
Various Locations 1/	-	-	-	-	-	433,594	-	433,594
Johnson Space Center	9,029	179,061	53,014	-	241,104	605,637	14,149	860,890
JSC - Houston, Texas	5,459	145,355	31,139	-	181,953	328,162	14,149	524,264
White Sands Test Facility	-	-	-	-	-	-	-	-
WSTF - Las Cruces, New Mexico	-	8,690	16,855	-	25,545	35,395	-	60,940
Various Locations 1/	3,570	25,016	5,020	-	33,606	242,080	-	275,686
Marshall Space Flight Center	26,271	266,767	271,458	3,776	568,272	554,524	14,359	1,137,155
MSFC - Huntsville, Alabama	-	114,918	52,407	-	167,325	252,993	3,561	423,379
Michoud Assembly Facility	-	-	-	-	-	-	-	-
MAF - New Orleans, Louisiana	7,505	64,759	25,961	-	98,225	52,547	356	151,128
Mississippi Test Facility	-	-	-	-	-	-	-	-
MTF - Bay St. Louis, Mississippi	18,703	60,780	169,674	-	249,157	37,413	4,096	290,566
Slidell Computer Facility	-	-	-	-	-	-	-	-
SCF - Slidell, Louisiana	63	4,492	879	-	5,434	20,481	-	25,915
Various Locations 1/	-	21,818	22,537	3,776	48,131	191,090	6,346	245,567
OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY	6,113	513,245	228,880	139	748,377	437,674	56,160	1,242,211
Ames Research Center	2,373	180,858	4,487	-	187,718	100,011	17,042	304,771
ARC - Moffett Field, California	2,373	180,733	4,487	-	187,593	96,056	17,042	300,691
Various Locations 1/	-	125	-	-	125	3,955	-	4,080
Flight Research Center	-	8,989	2,571	-	11,560	52,882	539	64,981
FRC - Edwards, California	-	8,981	2,571	-	11,552	49,078	539	61,169
Various Locations 1/	-	8	-	-	8	3,804	-	3,812
Langley Research Center	116	123,301	150,833	-	274,250	145,256	26,083	445,589
LaRC - Hampton, Virginia	110	107,897	150,808	-	258,815	125,326	26,083	410,224
Various Locations 1/	6	15,404	25	-	15,435	19,930	-	35,365
Lewis Research Center	3,624	200,097	70,989	139	274,849	139,525	12,496	426,870
LeRC - Cleveland, Ohio	315	116,935	52,812	139	170,201	74,052	10,980	255,233
Plum Brook Station	-	-	-	-	-	-	-	-
PBS - Sandusky, Ohio	3,309	83,162	18,177	-	104,648	12,709	1,516	118,673
Various Locations 1/	-	-	-	-	-	52,764	-	52,764
OFFICE OF SPACE SCIENCE	3,904	178,027	171,787	568	354,286	787,069	22,502	1,163,857
Goddard Space Flight Center	1,661	91,769	62,329	81	155,840	534,371	10,183	700,394
GSFC - Greenbelt, Maryland	1,308	74,387	15,386	81	91,162	186,804	5,240	283,206
Tracking Stations (Excl. DSN) 3/	353	17,294	46,898	-	64,545	294,395	4,943	363,883
Various Locations 1/	-	88	45	-	133	53,172	-	53,305
Jet Propulsion Laboratory	1,067	63,133	63,232	487	127,919	204,856	10,145	342,920
JPL - California	1,067	52,660	8,040	487	62,254	128,782	10,145	201,181
Tracking Stations (DSN) 3/	-	10,473	55,192	-	65,665	76,074	-	141,739
Wallops Station	1,176	23,125	46,226	-	70,527	47,842	2,174	120,543
WS - Wallops Island, Virginia	1,176	23,125	46,226	-	70,527	47,595	2,174	120,296
Various Locations 1/	-	-	-	-	-	247	-	247
OTHER	-	-	-	-	-	38,186	-	38,186
NASA Headquarters	-	-	-	-	-	38,186	-	38,186
Washington, DC	-	-	-	-	-	3,251	-	3,251
Various Locations 1/	-	-	-	-	-	34,935	-	34,935
GRAND TOTAL	\$ 117,488	\$ 1,428,291	\$ 1,042,140	\$ 4,483	\$ 2,592,402	\$ 2,985,671	\$ 116,366	\$ 5,694,439

1/ Includes Capital Type Property in Possession of Contractors at Various Locations.

2/ Includes Contractor-Held Special Test Equipment (\$747,008).

3/ DSN - Deep Space Network.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

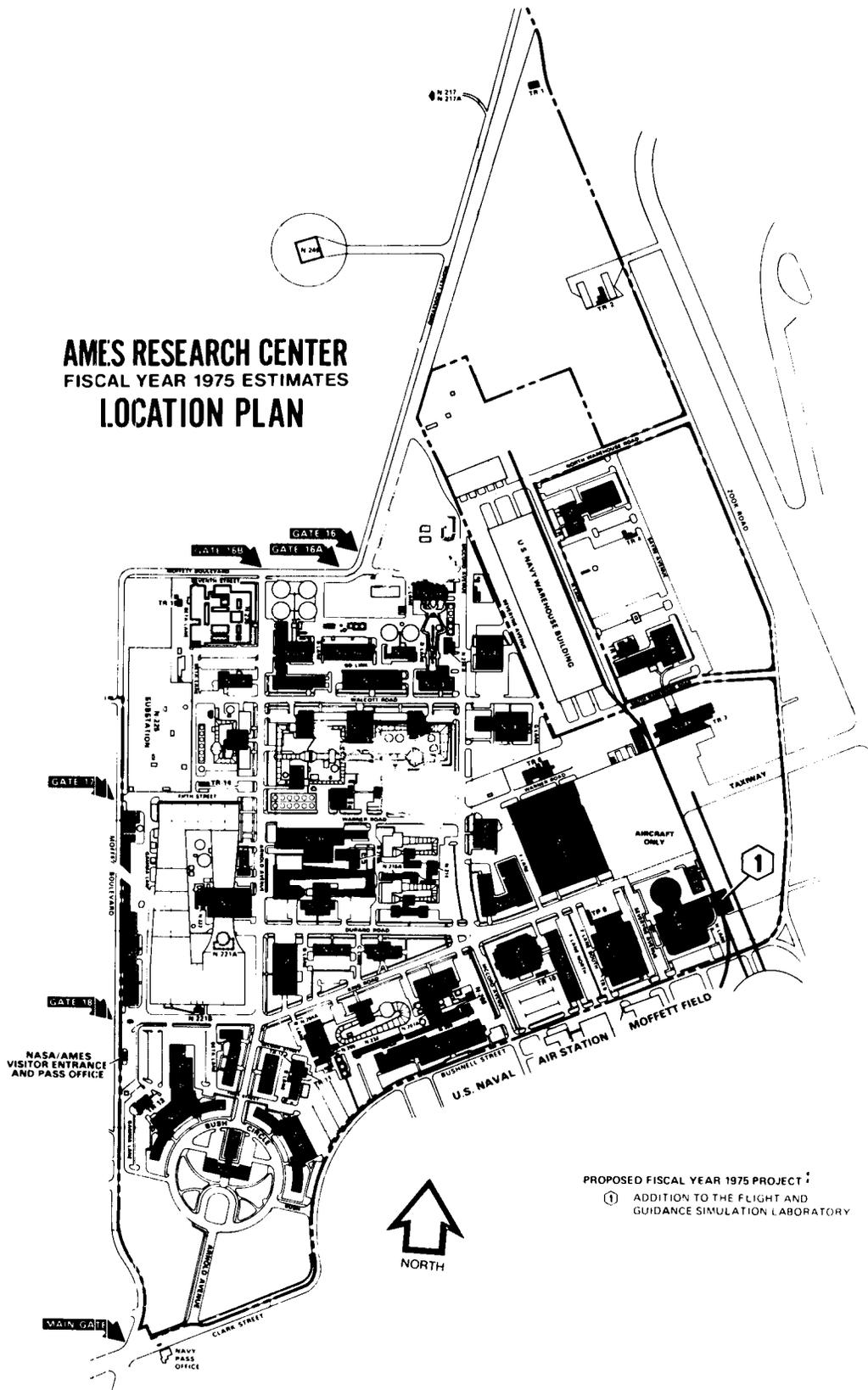
FISCAL YEAR 1975 ESTIMATES

SUMMARY

Ames Research Center

	<u>Amount</u>	<u>Page No.</u>
Location plan.....		CF 1-1
<u>Office of Aeronautics and Space Technology:</u>		
Addition to flight and guidance simulation laboratory.....	<u>\$3,660,000</u>	CF 1-2

**AMES RESEARCH CENTER
FISCAL YEAR 1975 ESTIMATES
LOCATION PLAN**



PROPOSED FISCAL YEAR 1975 PROJECT
 ① ADDITION TO THE FLIGHT AND GUIDANCE SIMULATION LABORATORY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Addition to Flight and Guidance Simulation Laboratory</u>
LOCATION	<u>Ames Research Center</u>
	FY 1975 CoF ESTIMATE <u>\$3,660,000</u>

COGNIZANT INSTALLATION: Ames Research Center

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

COGNIZANT PROGRAM OFFICE: Office of Aeronautics and Space Technology

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$405,759
Construction	<u>17,033,000</u>
Total FY 1974 and Prior Years	<u>\$17,438,759</u>

SUMMARY PURPOSE AND SCOPE:

This proposal provides for a major extension of the existing capability in flight simulation. The motion generator of this simulator would have six degrees of freedom with vertical travel being the dominant mode. This new capability will be used for high fidelity simulation of aircraft maneuvers and tasks, primarily in the longitudinal degrees of freedom. The main emphasis of the use of this facility will be on approach and landing maneuvers where existing simulators are inadequate. The project includes a building addition to the existing Flight and Guidance Simulation Laboratory, the provision of a new motion generator, and the installation of connecting links to existing visual image generating equipment and the simulation computer.

PROJECT JUSTIFICATION:

The importance of translational motion cues to pilot response has been shown by recent vestibular response research and by experience with sophisticated flight simulators. Because of its ability to realistically provide these cues for lateral motion, the use of the existing Flight Simulator for Advanced Aircraft (FSAA) is in heavy demand by the aircraft

industry and other governmental agencies. Applications in recent years have been in areas of developmental research (F-14, B-1, AX) by NASA, DOD and industry and in establishment of certification criteria by NASA and FAA.

However, the present FSAA was designed to study situations requiring large lateral motion and its limited vertical motion capability (± 5 ft., 1.52 m) cannot provide acceptable motion cues to the pilot in certain important operational modes, particularly during landing. Here the inability of all existing flight simulators to provide adequate vertical motion cues has resulted in the need to continue very expensive flight testing techniques. The Vertical Motion Simulator will provide the vertical motion capabilities needed in areas such as: (a) certification criteria for automated flight modes of future aircraft, especially V/STOL aircraft; (b) study of configurations and operating modes of future military aircraft including Sea Control Ship Aircraft; (c) definition of a new generation of low cost training simulators for advanced civil and military aircraft to reduce high costs of flight training; and (d) investigation of terminal area flight procedures. The proposed Vertical Motion Simulator will satisfy these needs economically by utilizing existing equipment and off-the-shelf hardware wherever possible.

Experience indicates that reductions of 50 to 100 hours in an aircraft development program are to be expected through use of simulation techniques. With flight experiment costs of approximately \$50,000 per flight hour (F-14, Boeing 747, DC-10), cost reduction of \$2 to \$5 million for each program are indicated. Cost pay back analyses based on these considerations for programs like Tilt Rotor, commercial STOL transports, military aircraft such as "high-g" fighters and Sea Control Ship Aircraft and supersonic aircraft, both commercial and military, indicate that about a 4-year "break even" may be anticipated. Additionally failure modes, too hazardous for actual flight, can be evaluated. In these failure modes instances the loss of one aircraft could well offset the total cost of the requested facility.

PROJECT DESCRIPTION:

The simulator will consist of a fully outfitted multi-man cab mounted on a six degree of freedom motion generator with large vertical and lateral motion capabilities. A commercially available motion generator with six degrees of freedom will be mounted on the lateral platform to provide the rotational and longitudinal motions. In synthesizing the simulation system, several existing facilities will be utilized. The Ames S-16 simulator will be dismantled and the cab complete with instruments and a visual display system will be mounted on the commercial motion generator. The present Ames Sigma 8 (DISC-C) computer will be used to drive simulations on the motion generator. The location near the FSAA will minimize complications of long lines to the computer and visual image generating equipment.

CF 1-3

Based on preliminary engineering estimates, predicted performance characteristics of the new motion generator are as follows:

<u>Mode</u>	<u>Displacement</u>	<u>Velocity</u>	<u>Acceleration</u>
Vertical	± 30 ft.	20 ft/sec.	1.02 G (33 ft/sec ²)
Lateral	± 20 ft.	10 ft/sec.	.75 G (24 ft/sec ²)
Longitudinal	± 4 ft.	2 ft/sec.	± .5 G (16 ft/sec ²)
Roll	± 22°	± 15°/sec.	± 50°/sec ²
Pitch	+26°, -24°	± 15°/sec.	± 50°/sec ²
Yaw	± 29°	± 15°/sec.	± 50°/sec ²

The simulator will be installed in the new addition to the Flight and Guidance Simulation Laboratory (Bldg. N-243). The building addition will consist of a motion generator tower, approximately 62-feet (18.9 m) long by 30-feet (9.14 m) wide by 90-feet (27.4 m) high, connected to the existing building at the second story level. This second story level construction will contain control, loading, observation rooms, and an experimenter's control station. Existing bays of the building will be used for servoamplifier and power conversion equipment and will also provide space for support personnel.

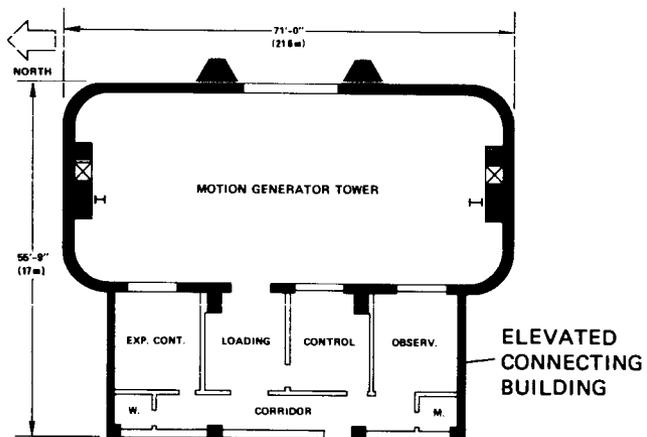
PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$895,000</u>
Site development	LS	---	---	75,000
Building/structure	CF	230,000	\$3.57	820,000
<u>Equipment</u>				<u>2,765,000</u>
Vertical and lateral structure	LS	---	---	1,225,000
Electrical	LS	---	---	925,000
Commercial motion generator	Each	1	\$365,000	365,000
Computer adaptation	LS	---	---	250,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	---
				<u>TOTAL</u>
				<u>\$3,660,000</u>

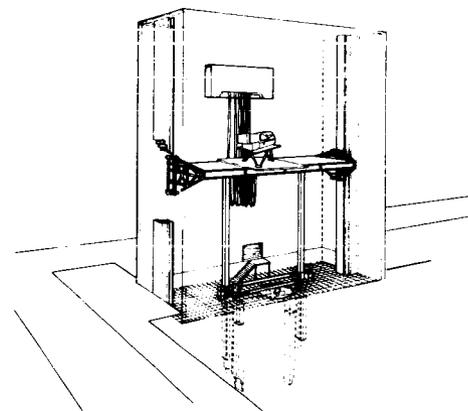
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no presently validated future requirements and none are now envisioned as being needed to complete this facility.

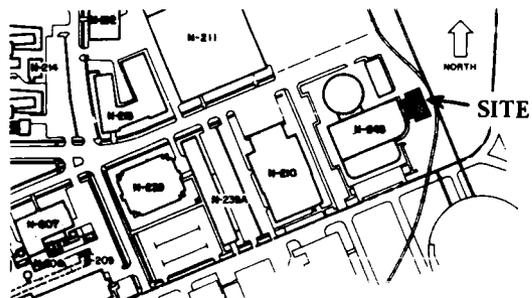
AMES RESEARCH CENTER
 FISCAL YEAR 1975 ESTIMATES
 ADDITION TO THE FLIGHT & GUIDANCE SIMULATION LABORATORY
 (VERTICAL MOTION SIMULATOR)



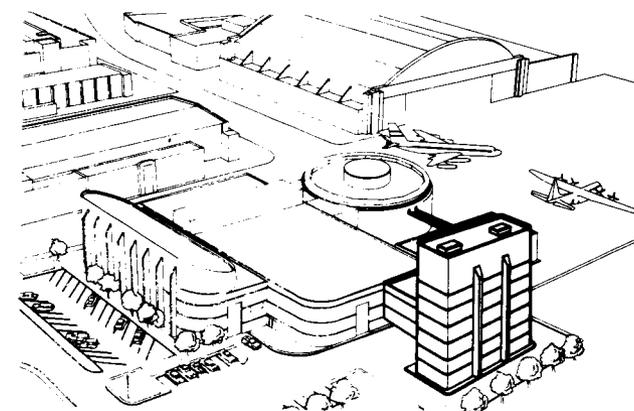
GROUND LEVEL PLAN
 GROSS AREA: 3600 SQ. FT.
 NET USEABLE AREA: 2700 SQ. FT.



MOTION GENERATOR



PARTIAL SITE PLAN



PERSPECTIVE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

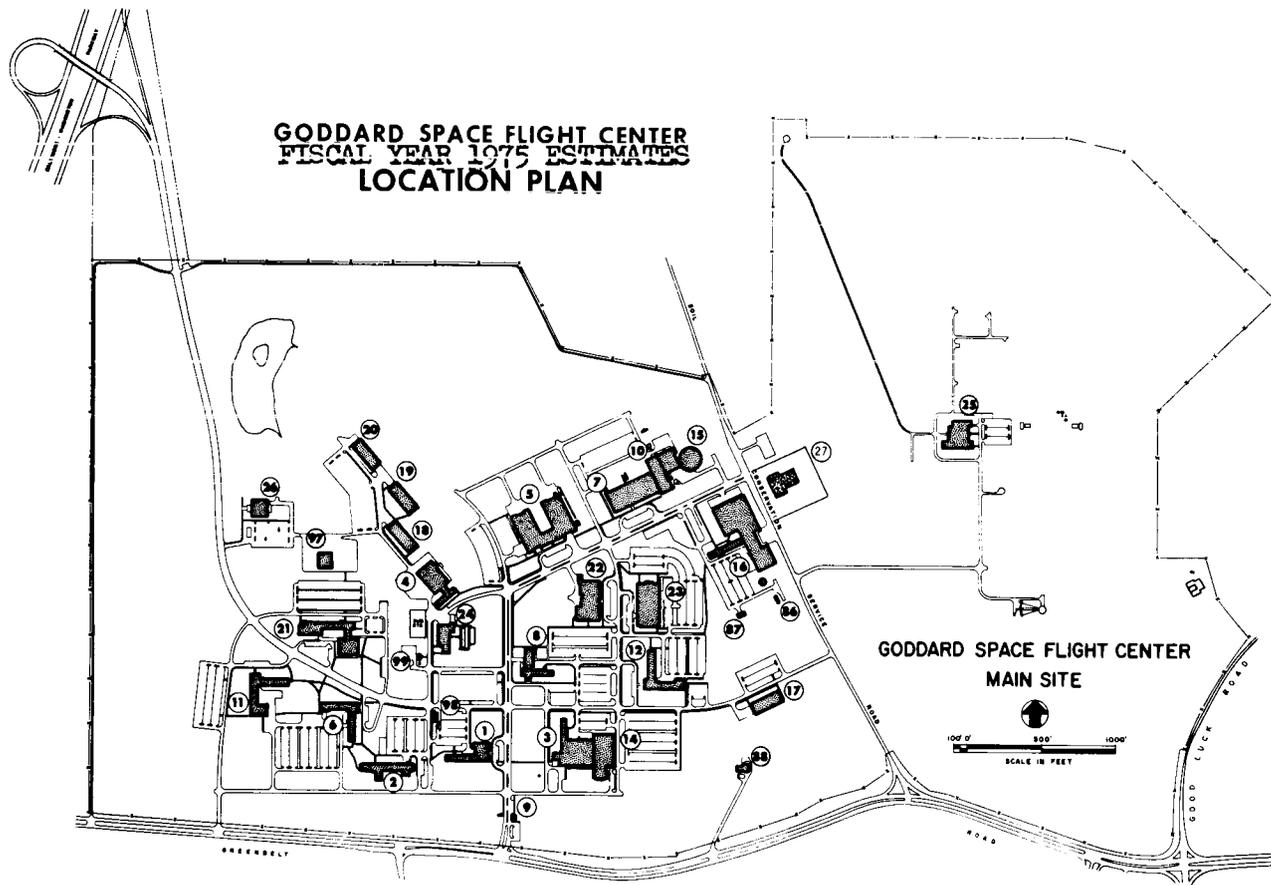
CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

SUMMARY

Goddard Space Flight Center

	<u>Amount</u>	<u>Page No.</u>
Location plan.....		CF 2-1
<u>Office of Space Science:</u>		
Rehabilitation and modification of science and application laboratories.....	\$890,000	CF 2-2
Modification for fire protection and safety.....	<u>1,220,000</u>	CF 2-5
Total.....	<u>\$2,110,000</u>	



- 1 SPACE PROJECTS BUILDING
- 2 RESEARCH PROJECTS LABORATORY
- 3 CENTRAL FLIGHT CONTROL & RANGE OPERATIONS BUILDING
- 4 GENERAL PURPOSE FACILITY BUILDING
- * 5 INSTRUMENT CONSTRUCTION & INSTALLATION LABORATORY
- * 6 SPACE SCIENCES LABORATORY
- 7 PAYLOAD TESTING FACILITY
- * 8 SATELLITE SYSTEMS BUILDING
- 9 MAIN GATE HOUSE
- 10 ENVIRONMENTAL TESTING LABORATORY
- 11 APPLIED SCIENCES LABORATORY
- *12 TRACKING & TELEMETRY LABORATORY
- 14 SPACECRAFT OPERATIONS FACILITY
- 15 LAUNCH PHASE SIMULATOR
- *16 DEVELOPMENT OPERATIONS BUILDING
- 17 MULTI-PURPOSE BUILDING
- 18 BUSINESS OPERATIONS BUILDING
- 19 MULTI-PURPOSE BUILDING
- 20 GEOCHEMISTRY BUILDING
- *21 METEOROLOGICAL SYSTEMS DEVELOPMENT LABORATORY
- *22 MECHANICAL TEST FACILITY & QUALITY ASSURANCE LABORATORY
- 23 DATA INTERPRETATION LABORATORY
- 24 CENTRAL HEATING & REFRIGERATION PLANT
- *25 NETWORK TRAINING & TEST FACILITY
- 26 NASA SPACE SCIENCE DATA CENTER
- 27 MOBILE EQUIPMENT SUPPORT FACILITY
- 86 ANTENNA CONTROL BUILDING
- 87 GAS CYLINDER STORAGE BUILDING
- 88 WWV FACILITY
- 97 MAINTENANCE SHOPS (AUTO)
- 98 BUDGET BUILDING
- 99 CONSTRUCTION FIELD OFFICE

NOTE: Asterisk (*) identifies buildings involved in 1975 project: Rehabilitation and Modification of Science and Applications Laboratories.

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Rehabilitation and Modification of Science and Applications Laboratories</u>
LOCATION	<u>Goddard Space Flight Center</u>
	FY 1975 CoF ESTIMATE <u>\$890,000</u>

COGNIZANT INSTALLATION: Goddard Space Flight Center

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

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$50,000
Construction	<u>----*</u>
Total FY 1974 and Prior Years	<u>\$50,000</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to modify present facilities to provide for better utilization of existing space by rearrangement and consolidation of 30,000 gross square feet (2,787 square meters) of office, laboratory, and storage space (in 7 buildings), and by modification of 29,300 gross square feet (2,722 square meters) of the basement of the Network Test and Training Facility, Building 25. Such rearrangement will permit the more effective use of available facility resources and the elimination of certain leased space as well as achieve a more effective and functionally efficient operation.

PROJECT JUSTIFICATION:

Changes in the Center workload and manpower requirements have taken place over the last five years, and the resultant adjustments progressively have degraded space utilization in certain areas. This can only now be corrected

.....

* Since several buildings are involved, a meaningful determination of previously applied construction funds is not feasible.

by a major modification effort. This project will rehabilitate and modify existing space to allow the rearrangement and consolidation of office, laboratory and storage space in various buildings to provide approximately 59,300 square feet of space. This would enable the release of a presently leased facility at an estimated FY 1975 annual lease cost of about \$250,000. In addition, the consolidation of functions and the relocation of personnel from the leased space to "on-site" space will increase overall operating efficiency.

PROJECT DESCRIPTION:

To provide the on-Center space necessary to vacate 59,300 square feet (5,510 square meters) of leased area, consolidation in existing occupied buildings is necessary. Consolidation changes will be made and rearrangement of existing office space will be accomplished in eight buildings to yield a gross area to house certain off-Center functions. Space will be reassigned in on-Center buildings so as to be compatible with recent organizational realignments.

This project will rehabilitate approximately 29,300 gross square feet (2,722 square meters) of the basement of the Network Test and Training Facility, Building 25, for office and laboratory use. It will include installation of heating, ventilating and air conditioning, upgrading of lighting, fire protection, and provision of partitions.

This project will also modify approximately 30,000 gross square feet (2,787 square meters) of existing space in seven other buildings (Numbers 5, 6, 8, 12, 16, 21, and 22) including rearrangement of partitions, lighting, heating, ventilating and air conditioning to meet the requirements of functions being consolidated.

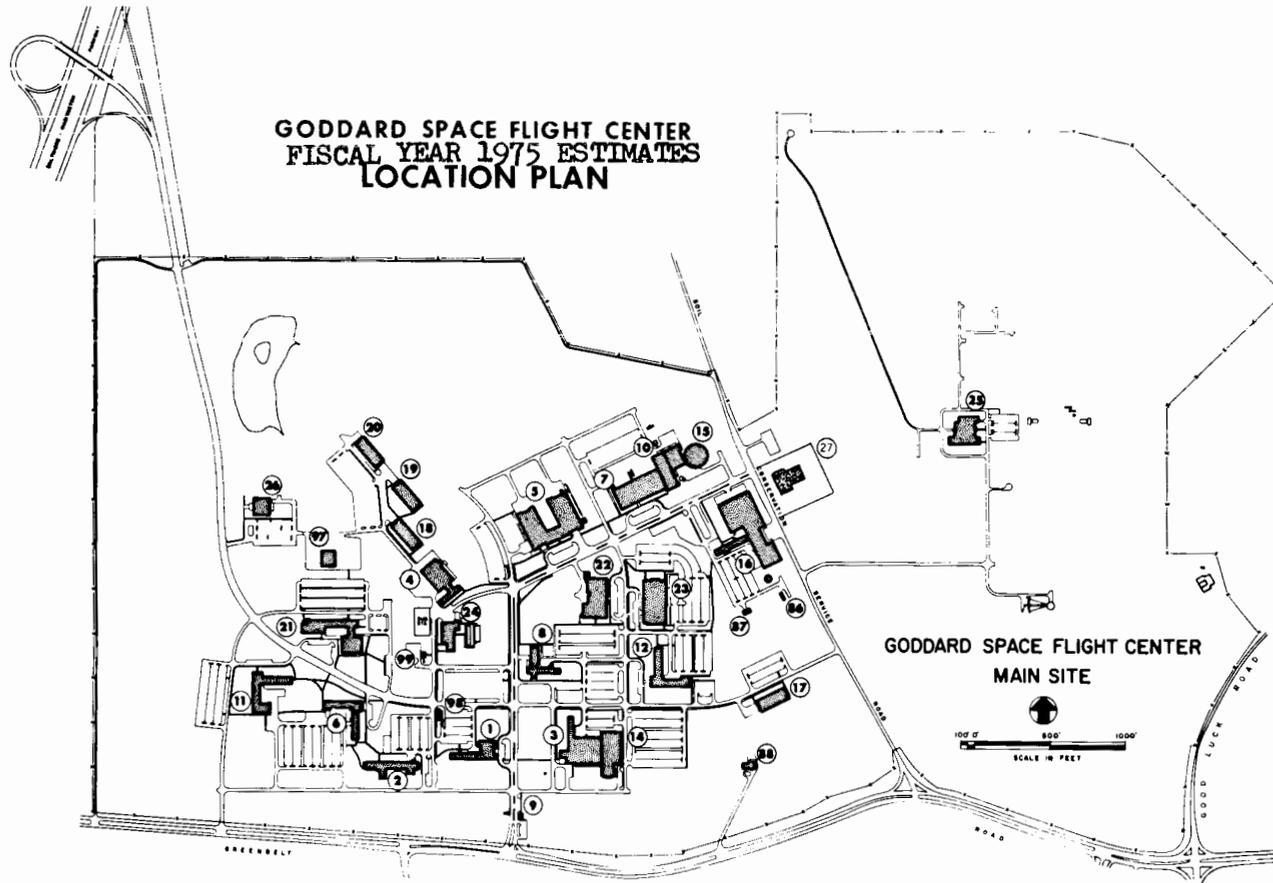
PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$890,000</u>
Modification of building 25	SF	29,300	\$15.00	440,000
Rearrangement of various other buildings	SF	30,000	15.00	450,000
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	---
		TOTAL		<u>\$890,000</u>

Approximately \$200,000 of miscellaneous additional noncollateral storage equipment will be utilized in this consolidation effort.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

This is the first phase of what may be a long term approach toward significant improvement in the utilization of available space at this Center. It is now estimated that about \$2 to 3 million additional will be required for this purpose in subsequent years.



- * 1 SPACE PROJECTS BUILDING
- * 2 RESEARCH PROJECTS LABORATORY
- * 3 CENTRAL FLIGHT CONTROL & RANGE OPERATIONS BUILDING
- * 4 GENERAL PURPOSE FACILITY BUILDING
- * 5 INSTRUMENT CONSTRUCTION & INSTALLATION LABORATORY
- * 6 SPACE SCIENCES LABORATORY
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- 86 ANTENNA CONTROL BUILDING
- 87 GAS CYLINDER STORAGE BUILDING
- 88 WWV FACILITY
- 97 MAINTENANCE SHOPS (AUTO)
- 98 BUDGET BUILDING
- 99 CONSTRUCTION FIELD OFFICE

NOTE: Asterisk (*) identifies buildings involved in FY 1975 project: Modifications for Fire Protection and Safety.

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modifications for Fire Protection and Safety</u>
LOCATION	<u>Goddard Space Flight Center</u>
FY 1975 CoF ESTIMATE <u>\$1,220,000</u>	

COGNIZANT INSTALLATION: Goddard Space Flight Center

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

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$272,200
Construction	<u>1,766,000*</u>
Total FY 1974 and Prior Years	<u>\$2,038,200</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for major fire protection and detection, and safety modifications to various buildings at Goddard Space Flight Center to correct critical deficiencies identified and included in the Center's five year fire protection and safety program. The items in this requirement are identified from the total program presently estimated at \$3,500,000, as the now most critical items due to changes in the utilization of the facilities. Certain of these areas now require additional protection, or new safety provisions in addition to those provided in the initial construction of the facilities. The critical nature of the items included in this project has been evaluated considering the safety of personnel, spacecraft, experimental packages, and high value equipment such as computers. It includes sprinkler protection of "high fuel load areas" such as the carpentry shop, experiments shops, and magnetic tape depository areas.

PROJECT JUSTIFICATION:

The critical requirement for each item included in this project are:

- a. Provisions for smoke evacuation, various buildings

.....
* For fire protection and safety modifications only.

During a fire, the greatest sources of danger to personnel and equipment are smoke and fumes. The present air handling equipment in most of the Center's buildings can be individually set manually for 100% exhaust to evacuate smoke and fumes. This project will provide a central control at the main entrance so that the equipment can be placed on this 100% exhaust mode quickly and without endangering personnel involved.

b. Provision of sprinklers in shop and laboratory area of Building 5, Instrument Construction and Installation Laboratory

In-house manufacture of components for satellite experiments packages is performed in this building. Many of these components are extremely valuable in themselves but of even greater importance is the fact their loss could impact flight schedules. This added protection must be provided to these areas.

c. Exits from OPSCON wing, Building 14, Spacecraft Operations Facility

New exits from the basement of Building 14 are required to allow emergency egress from the basement for the personnel now operating in this area.

d. Penthouse sprinklers, Building 2, Research Projects Laboratory

The Penthouse area is used for storage of high value equipment and scientific apparatus. The area is generally unoccupied and therefore requires basic sprinkler protection.

e. Gas manifolds, eight buildings (2, 4, 5, 10, 11, 15, 21 and 22)

At the present time, compressed gas cylinders are moved manually in and out of laboratories as required. The configuration, weight, and contents of the cylinder constitute a safety hazard. It is preferred practice to locate cylinders for hazardous gases outside of buildings. This element of the project provides for gas manifolds to be located outside the eight laboratory type buildings. It also provides for gas distribution to the using mission support laboratories.

f. Sprinklers for basement, and first floor, Building 8, Satellite Systems Building

Sprinklers are required for these areas of Building 8 because of "high fuel loading" of reproduction shop and auditorium.

g. Battery power for detection systems, various buildings

Fire incidence in certain locations in various buildings throughout the Center could cut the commercial power before any of the fire detection devices were activated. This element provides for backup battery-powered systems for each of the Center's fire detection systems.

- h. Upgrade exits to meet life safety standards, three buildings (1, 21, and 26)

This portion of the project provides for upgrading exits of various buildings to provide a safe egress area in the event of a fire. These are scientific research laboratory type buildings supporting space science research and development.

- i. Upgrade fire protection and detection in computer area

GSFC computers perform an essential, vital function especially during manned missions when the precise tracking and communication data are essential to safety of personnel. It is vitally important that these operations be continuous without interruption throughout the mission. In addition, the equipment is valued at \$120,000,000. This element of the project would provide firewall isolation in all computer areas (nine laboratory buildings). It also provides necessary protection for firewall penetrations for cables and ducts.

- j. Install sprinklers in southeast end of warehouse, Building 16, Development Operations Building

This end of the building has been converted to a quality control inspection area with a "dropped ceiling." Existing sprinkler heads are now above the ceiling to protect that area, however, these should be augmented with additional heads below the ceiling to protect the valuable equipment and flight hardware that is processed through this area.

PROJECT DESCRIPTION:

- a. Provisions for smoke evacuation, various buildings

Provide controls so that building supply air can be turned off and dampers set at 100% makeup air from a central location in each building and at the central desk in Building 24. This element of the project will modify the existing air systems in the Center's 25 main buildings.

- b. Provision of sprinklers in shop and laboratory area of Building 5, Instrument Construction and Installation Laboratory

It is planned to install a wet pipe system throughout Building 5 to correct this deficiency.

c. Exits from OPSCON wing, Building 14, Spacecraft Operations Facility

New exits will be provided from the lower level of the OPSCON wing of Building 14.

d. Penthouse sprinklers, Building 2, Research Projects Laboratory

It is planned to install a wet pipe system in the Penthouse of Building 2.

e. Gas manifolds, eight buildings (2, 4, 5, 10, 11, 15, 21, and 22)

Gas manifolds will be installed external to the eight buildings and piping installed to connect with each using laboratory.

f. Sprinklers for basement and first floor, Building 8, Satellite Systems Building

It is planned to install a sprinkler system in a portion of the basement, and a separate system in the auditorium of Building 8.

g. Battery power for detection systems, various buildings

It is planned to install a battery backup system in ten buildings which have existing detection systems. It will provide an emergency power source of 2 KW per building for these systems.

h. Upgrade exits to meet life safety standards in three buildings (1, 21, and 26)

Existing open stair shafts in Buildings 1, 21, and 26 will be enclosed and fire doors provided to meet fire and safety regulations.

i. Upgrade fire protection and detection in computer areas

It is planned to provide fire rated partitions and fire doors in each computer room in nine buildings. It will also provide controls to enable a manual shutdown of computer hardware in the event of a fire.

j. Sprinklers southeast end of warehouse, Building 16, Development Operations Building

It is planned to install sprinklers below the hung ceiling at the southeast end of the warehouse.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$1,220,000</u>
Smoke evacuation	LS	---	---	219,000
Sprinklers, Building 5	SF	87,350	\$1.66	145,000
Exits OPSCON, Building 14	LS	---	---	31,500
Battery power for detectors	Each	21	3,943.00	82,800
Sprinklers, Building 2	SF	8,915	1.66	14,800
Sprinklers, Building 8	SF	27,890	1.66	46,300
Sprinklers, Building 16	SF	24,100	1.66	40,000
Upgrade computer areas	SF	46,200	6.15	284,200
Gas manifolds	LS	---	---	297,000
Exits, Buildings 1, 21, 26	LS	---	---	59,400
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	---
		TOTAL		<u>\$1,220,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

The present long range fire protection and safety plan includes additional work of this nature estimated at about \$2,500,000.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

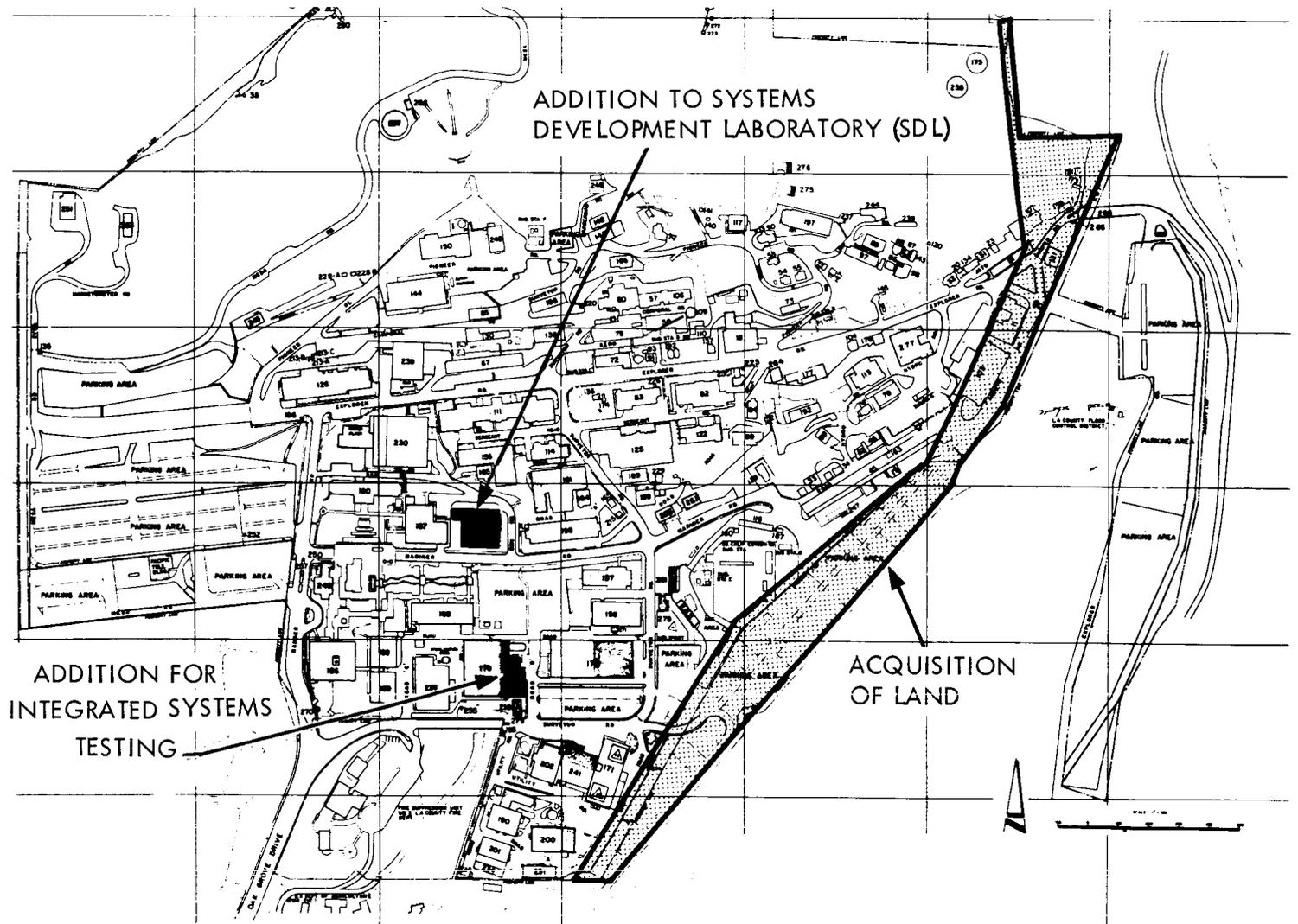
SUMMARY

Jet Propulsion Laboratory

	<u>Amount</u>	<u>Page No.</u>
Location plan.....		CF 3-1
<u>Office of Space Science:</u>		
Acquisition of land.....	\$150,000	CF 3-2
Addition to systems development laboratory.....	4,880,000	CF 3-5
Addition for integrated systems testing facility.....	<u>3,790,000</u>	CF 3-10
Total.....	<u>\$8,820,000</u>	

JET PROPULSION LABORATORY FISCAL YEAR 1975 ESTIMATES

LOCATION PLAN



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Acquisition of Land</u>
LOCATION	<u>Jet Propulsion Laboratory</u>
	FY 1975 CoF ESTIMATE <u>\$150,000</u>

COGNIZANT INSTALLATION: Jet Propulsion Laboratory

LOCATION OF PROJECT: Pasadena, Los Angeles County, California

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	---
Construction	<u>\$1,067,000</u>
Total FY 1974 and Prior Years	<u>\$1,067,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the purchase of two parcels of land totaling 9.5 acres (38,347 square meters) which has been leased from the City of Pasadena since the establishment of the Jet Propulsion Laboratory. One parcel contains an essential parking lot and on the second parcel there are eleven government-owned buildings. It is prudent and cost effective at this time for NASA to obtain title to this property in order to minimize annual leasing expenditures by the government and to insure future control of this important contiguous land.

PROJECT JUSTIFICATION:

For many years these parcels of land have been leased from the City of Pasadena. Eleven buildings and a 540-car parking lot are situated on this land. Recently, the City of Pasadena, in conjunction with other national, state and local government agencies, has been developing a master plan for the development of the Arroyo Seco area which forms the eastern boundary of the Jet Propulsion Laboratory. To facilitate implementation of the Arroyo Seco plan, Pasadena is now moving to rearrange and clear all land titles in the area. They have informed JPL that present leases will not be renewed after June 30, 1975, and that they would prefer to sell the land instead. This project proposes such purchases consistent with the highest and best usage of the area for all concerned.

CF 3-2

PROJECT DESCRIPTION:

The general location of these parcels is shown on the accompanying location plan. They lie on the eastern side of the Laboratory proper and extend from the river bottom, through a fairly level portion, to steep mountainous terrain. All or part of eleven JPL buildings and parking areas for about 540 employee cars are now located on this land.

Prior to June 30, 1970, the original annual lease costs to JPL were \$5,400; since 1970, and running through June 30, 1975, the cost is \$12,190. If leasing is to continue, further increases can reasonably be anticipated.

An appraisal on these parcels was made for NASA early in 1970 and the cost of acquisition was estimated then at \$142,500. Based on this valuation, purchase of the land would be justified on a direct pay-out basis of under ten years. This coupled with the essentiality of parking and the eleven government-owned buildings involved (value \$1.2 million), makes this acquisition both prudent and timely.

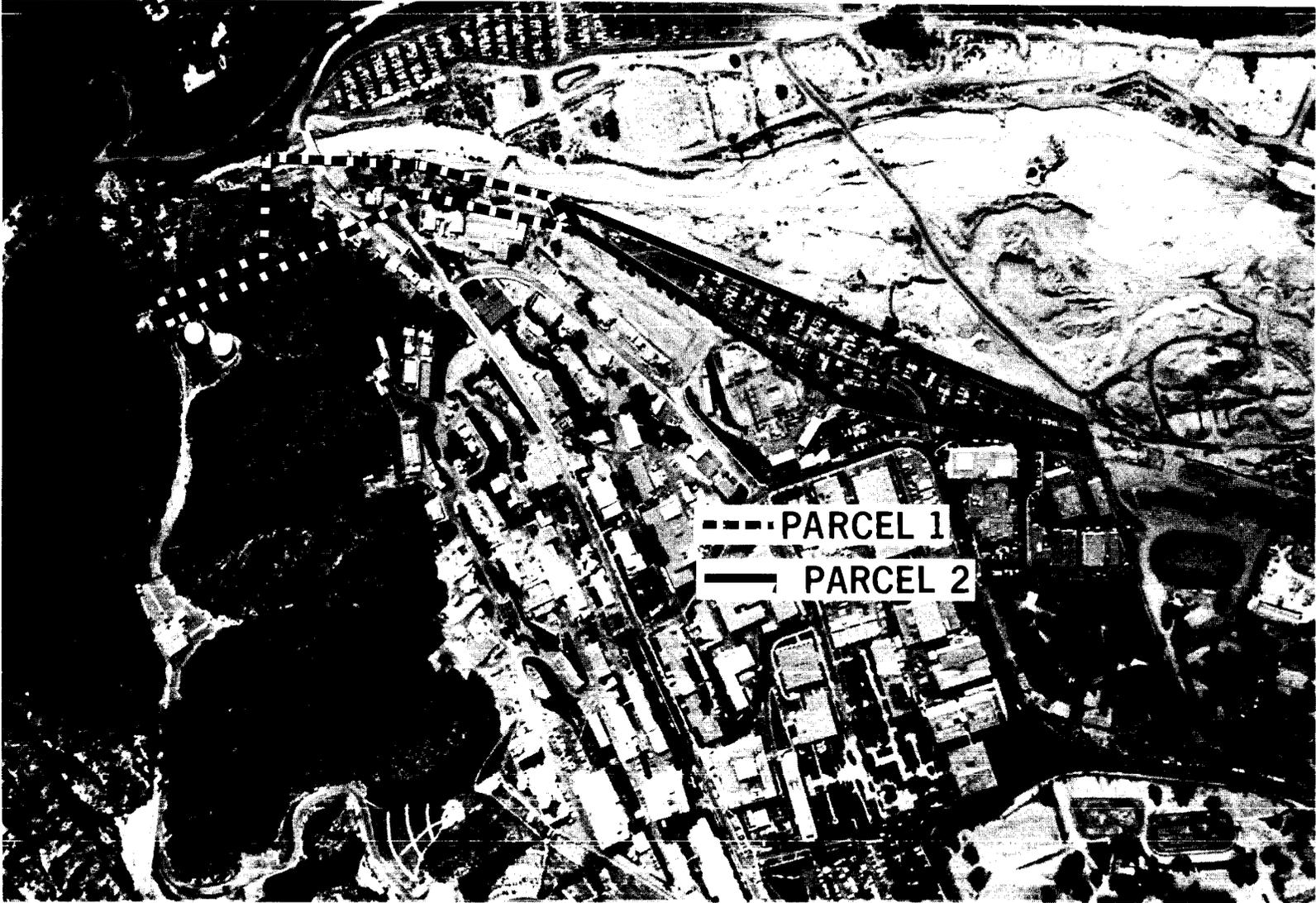
PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>				<u>\$150,000</u>
Parcel	Acres	9.5	\$15,790	\$150,000
<u>Construction</u>	---	---	---	---
<u>Equipment</u>	---	---	---	---
		TOTAL		<u>\$150,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no currently foreseen future funding requirements necessary to complete this project. There may, however, be future requirements for the acquisition of additional land associated with the parking needs east of Arroyo Seco.

JET PROPULSION LABORATORY
FISCAL YEAR 1975 ESTIMATES
ACQUISITION OF LAND



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Addition to Systems Development Laboratory (SDL)</u>
LOCATION	<u>Jet Propulsion Laboratory</u>
	FY 1975 CoF ESTIMATE <u>\$4,880,000</u>

COGNIZANT INSTALLATION: Jet Propulsion Laboratory

LOCATION OF PROJECT: Pasadena, Los Angeles County, California

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$457,604
Construction	<u>1,195,000</u>
Total FY 1974 and Prior Years	<u>\$1,652,604</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the construction of a six-floor vertical addition to the existing two-floor Systems Development Laboratory (SDL). This addition will have the lower three floors initially allocated to direct support of the Viking project mission control activities, while the upper three floors will be of office type construction for personnel supporting the tracking, control and orbit determination functions. The upper three floors will house about 350 employees, most of whom are currently in leased space.

PROJECT JUSTIFICATION:

As a result of expanded Viking 1975 mission operations requirements for the simultaneous control of two orbiters and two landers on Mars, there is a critical need for additional mission support space (computer flooring and special power, air conditioning and communications). This requirement, reflecting revised mission plans, is in addition to that included in the FY 1974 CoF project which provided for modifications in the Space Flight Applications Facility, Building 230, and the Systems Development Laboratory, Building 264, for Viking mission control functions.

Along with the increase in project requirements is the problem of a serious institutional housing shortage which has existed for many years at the Jet Propulsion Laboratory. Several off-site leases provide office and laboratory housing for those people who cannot be accommodated on-site. About 4,500 people require office space at JPL; about 4,000 are housed on-site in buildings and trailers, with the remainder housed in 50,000 square feet (4,645 square meters) of leased space in the Pasadena area at an estimated FY 1975 lease cost of \$300,000 per year.

This constricted laboratory site now houses 370 people in 85 trailers which are crowded in and around existing buildings and are reaching the age where they will need to be replaced. This is a costly and inefficient temporary housing solution and there is no reason to assume that the lease problem could be resolved by further use of trailers.

The majority of the Laboratory's science and engineering personnel are now inadequately housed two or more to an office with less than 100 square feet (9.29 square meters) per person. Such space is not conducive to research endeavors and should be improved. Based on the severe housing problems, inefficiency and cost of trailers, old buildings and leased space, and the urgency of the mission operations and support space requirements of the Viking project, this laboratory addition becomes the keystone to partially resolve this critical situation. The Viking project needs will require the first three floors of the addition through July 1977. Follow-on projects will probably require a similar amount of space; therefore, it is unlikely that a major portion of this space could become available for other purposes. In light of the overall benefits to locate on-site, this project is an essential prudent step to alleviate pressing housing requirements.

Three floors (36,000 net square feet - 3,344.1 square meters) of the six-floor addition will provide computer type space for the Viking and follow-on mission operations and support requirements. The remaining three floors (36,000 net square feet - 3,344.1 square meters) will permit relocating office personnel supporting the tracking, control, and orbit determination functions from leased space, and thus permit a substantial reduction of leased space with attendant cost savings. Extensive studies have been made to evaluate alternative solutions to the mission support requirements, all of which have been found operationally and cost-wise less efficient and would result in the use of additional off-site leases or temporary structures with consequent rental and construction costs and no long term improvement to the space problem.

In summary, the proposed SDL addition will alleviate the long standing institutional housing problem by the addition of approximately 36,000 net square feet (3,344.1 square meters) of office space and provide an annual savings of approximately \$325,000 in lease and other costs. The total

saving in lease and other costs to the Viking project alone is estimated at approximately \$2,000,000. Therefore, in addition to increased efficiency resulting from on-site location, savings from lease and other costs will equate to the construction cost in about five and one-half years.

PROJECT DESCRIPTION:

This project will provide for the construction of a six-story addition to the present two-story Systems Development Laboratory Building, three additional computer floors, and three office floors. The addition will contain approximately 91,600 gross square feet (8,510 square meters) and will be a structural steel framework with concrete floors. It will be completely air conditioned with additional underfloor chilled air for electronic equipment. The building will contain dry laboratories, offices, computer floor space, conference rooms, and related general purpose areas. The computer floor areas will have a raised floor system. The addition will match existing construction.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$4,880,000</u>
Architectural/structural	SF	91,600	\$29.90	2,740,000
Mechanical	SF	91,600	13.00	1,190,000
Electrical	SF	91,600	10.37	950,000
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	---
		TOTAL		<u>\$4,880,000</u>

The mission operations and support area will have approximately \$2,000,000 of Viking project equipment of a noncollateral nature.

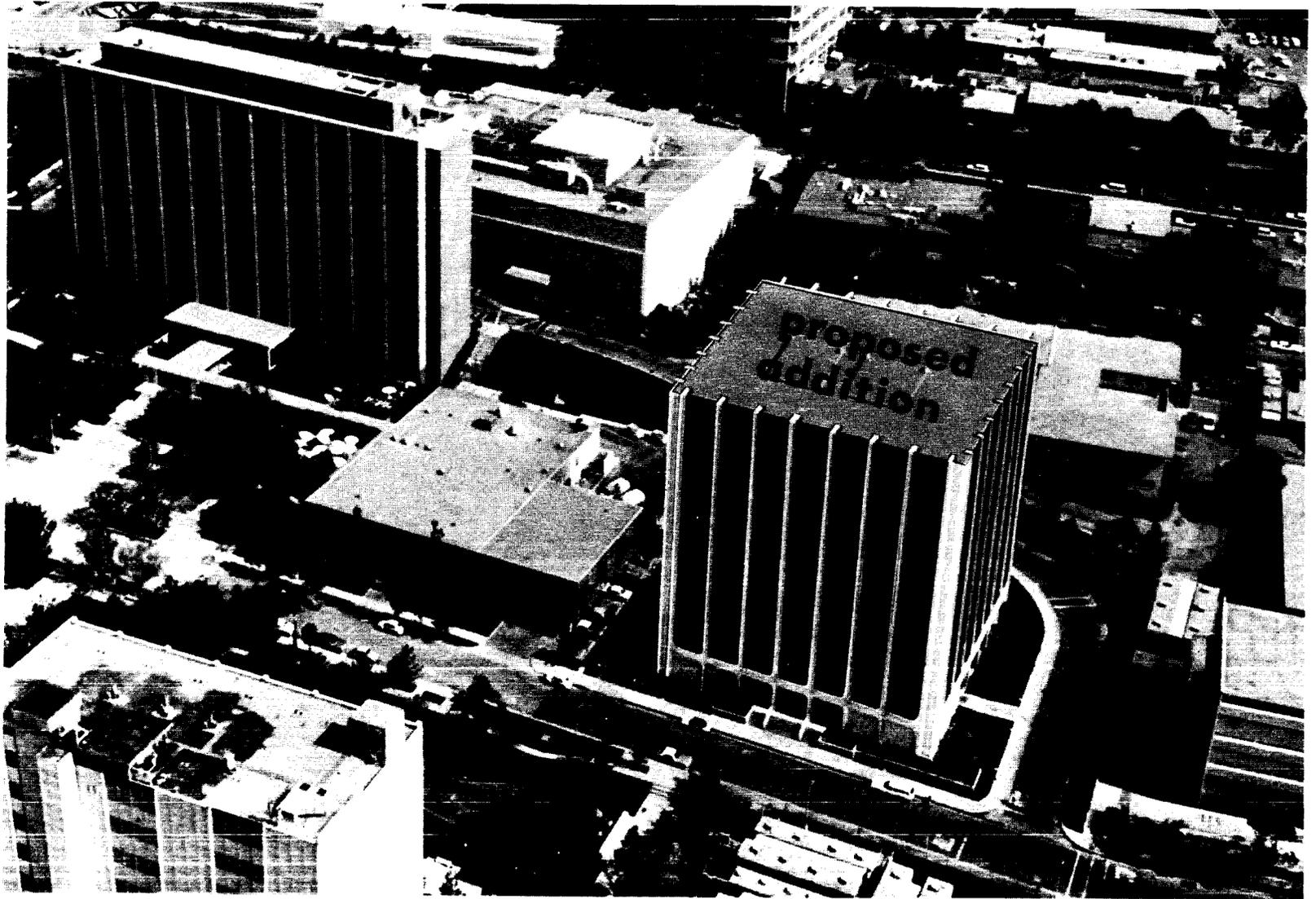
FUTURE CoF FUNDING REQUIRED TO COMPLETE PROJECT:

For presently planned usage, there are no further funding requirements to complete this project. However, additional institutional and other office/laboratory space deficiencies may be reflected in future years estimates.

JET PROPULSION LABORATORY
FISCAL YEAR 1975 ESTIMATES
ADDITION TO SYSTEMS DEVELOPMENT LABORATORY (SDL)



JET PROPULSION LABORATORY
FISCAL YEAR 1975 ESTIMATES
ADDITION TO SYSTEMS DEVELOPMENT LABORATORY (SDL)



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Addition for Integrated Systems Testing Facility</u>
LOCATION	<u>Jet Propulsion Laboratory</u>
	FY 1975 CoF ESTIMATE <u>\$3,790,000</u>

COGNIZANT INSTALLATION: Jet Propulsion Laboratory

LOCATION OF PROJECT: Pasadena, Los Angeles County, California

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$304,000
Construction	<u>1,004,758</u>
Total FY 1974 and Prior Years	<u>\$1,308,758</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for an addition to the existing Spacecraft Assembly Facility, Building 179, for a new spacecraft assembly and checkout and integrated test facility. The capabilities provided by this addition would be compatible with current and projected spacecraft cleanliness and containment requirements. Essential features include an air lock; a clean, shielded, contamination free operations area; personnel change facilities; and areas for storage of flight ready parts and equipment. This addition will initially support the Mariner Jupiter Saturn (MJS) 1977 test program but will be an essential facility for "all up" systems testing on all future flight missions using the multi-hundred watt Radioisotope Fueled Thermo-electric Generators (RTG's) as on-board power sources. The addition will provide the critically clean environment required for spacecraft committed to these long duration missions.

PROJECT JUSTIFICATION:

This addition is primarily for "all up" integrated testing and will be attached to and supported through the existing SAF. It will provide an important new capability to perform assembly and systems test operations of

CF 3-10

spacecraft in a clean environment which fulfills the requirements for the testing of complete spacecraft powered by RTG's. This project will provide a radiologically shielded test chamber, environmentally controlled for pressure, temperature, humidity, particulate matter, and nuclear containment. This will insure adequate spacecraft assembly and test conditions while simultaneously protecting personnel and surrounding areas from incidental or accidental nuclear exposure.

Deep space missions will require substantial amounts of electrical power for spacecraft operation including thermal control and science instruments. In outer planetary spacecraft, the practice of obtaining power from the sun will no longer be effective or practical. RTG's, which have an almost indefinite life with respect to flight projects, will be used to satisfy these power requirements. MJS-77 will use three multi-hundred watt RTG units. The test and calibration accuracy desired for MJS flight experiments cannot be approached in any known facility since none of any reasonable size exists.

The proposed addition will directly support the MJS-77 spacecraft assembly test and related RTG compatibility tests. Spacecraft tests with RTG's installed are required to provide verifications of compatibility of the engineering and science subsystems with the radiation environment and the RTG power characteristics. These tests must be conducted with the spacecraft as close to flight conditions as possible to simulate mission conditions. Radiation mapping is also required to provide a detail comparison of spacecraft variations and to permit accurate assessment of long term radiation effects. Construction of this facility will also provide a prime spacecraft assembly facility that will have a long and useful life. This facility, which will satisfy all Atomic Energy Commission requirements for RTG integration, handling and test operations, is a basic resource for all future planetary missions.

PROJECT DESCRIPTION:

The proposed facility will provide the operationally required spacecraft assembly, system test, and checkout capability that is consistent with all current project and mission requirements, as well as applicable regulations and codes.

It includes a large (approximately 70 foot - 21 meter) cubical test volume with vertically downward clean air flow, a 20 foot x 70 foot (6 meter x 21 meter) airlock, personnel dressing and cleanup areas, a bonded inspection and storage area for flight-ready equipment, general flight project storage, and a personnel control lobby. Construction of the main test volume is standard reinforced concrete, the thickness of which is controlled by the greater of structural or radiological shielding requirements.

The present SAF will continue in use to support less critical spacecraft assembly operations such as weight and balance tests and certain preparatory operations. The SAF will also act as the staging area for bulky equipment such as propulsion subsystem transporters, spacecraft transporters and assembly, handling and shipping equipment which must be kept clean but for which no space is available at present.

Authorization of this project will provide for future spacecraft cleanliness, and in addition will provide the capability for "all up" radioisotope thermoelectric mapping and testing with the experiments on board the spacecraft. The lack of this testing capability would generate an "unknown" which cannot be evaluated.

PROJECT COST ESTIMATE:

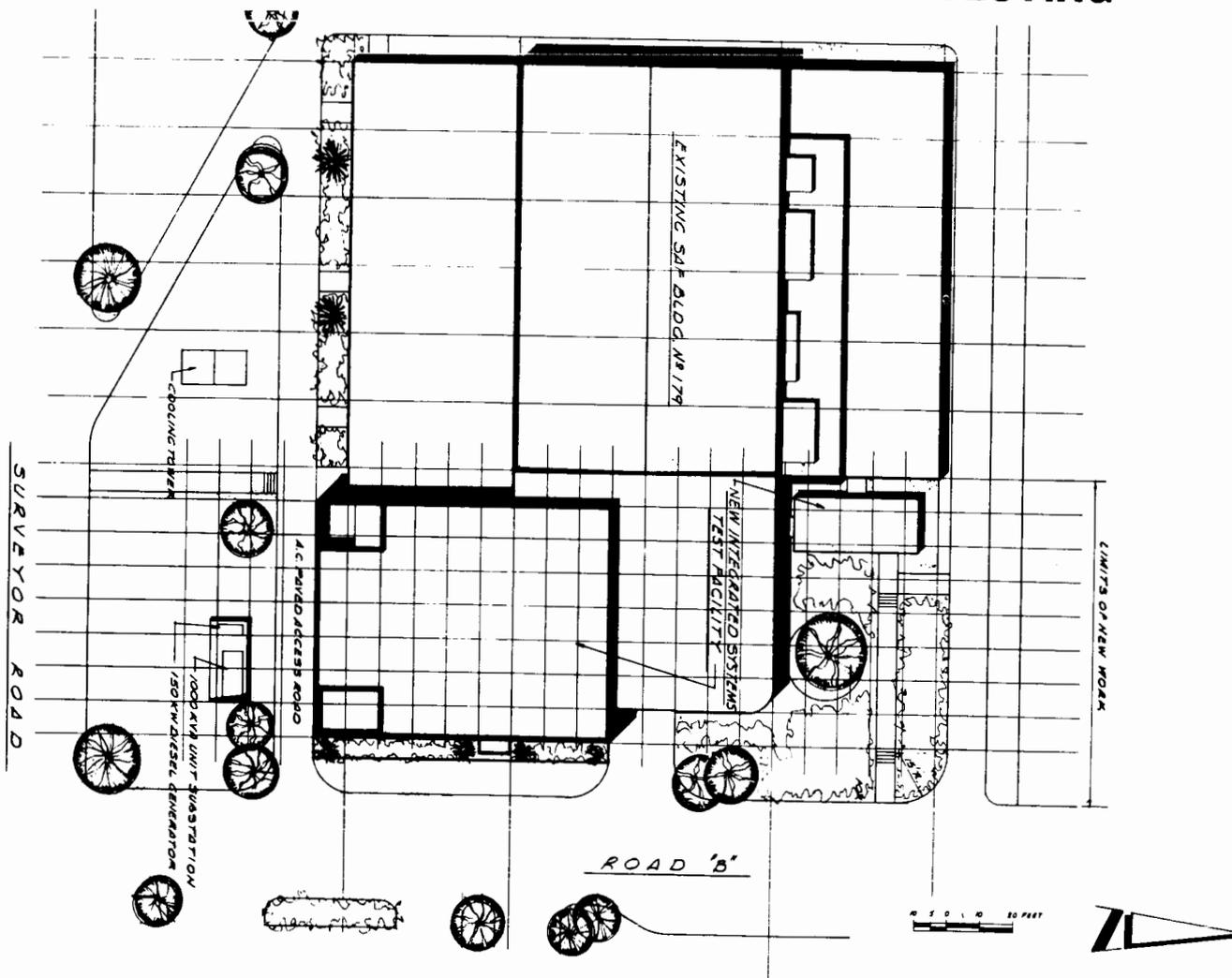
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$3,570,000</u>
Demolition	LS	---	---	190,000
Architectural/structural	CF	530,000	\$3.56	1,890,000
Mechanical	LS	---	---	915,000
Electrical	LS	---	---	575,000
<u>Equipment</u>				<u>220,000</u>
Cranes and conveyor system	LS	---	---	220,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	---
			TOTAL	<u>\$3,790,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

All currently foreseen requirements are included in the project scope. A subsequent need for future funding is not now anticipated.

JET PROPULSION LABORATORY
FISCAL YEAR 1975 ESTIMATES

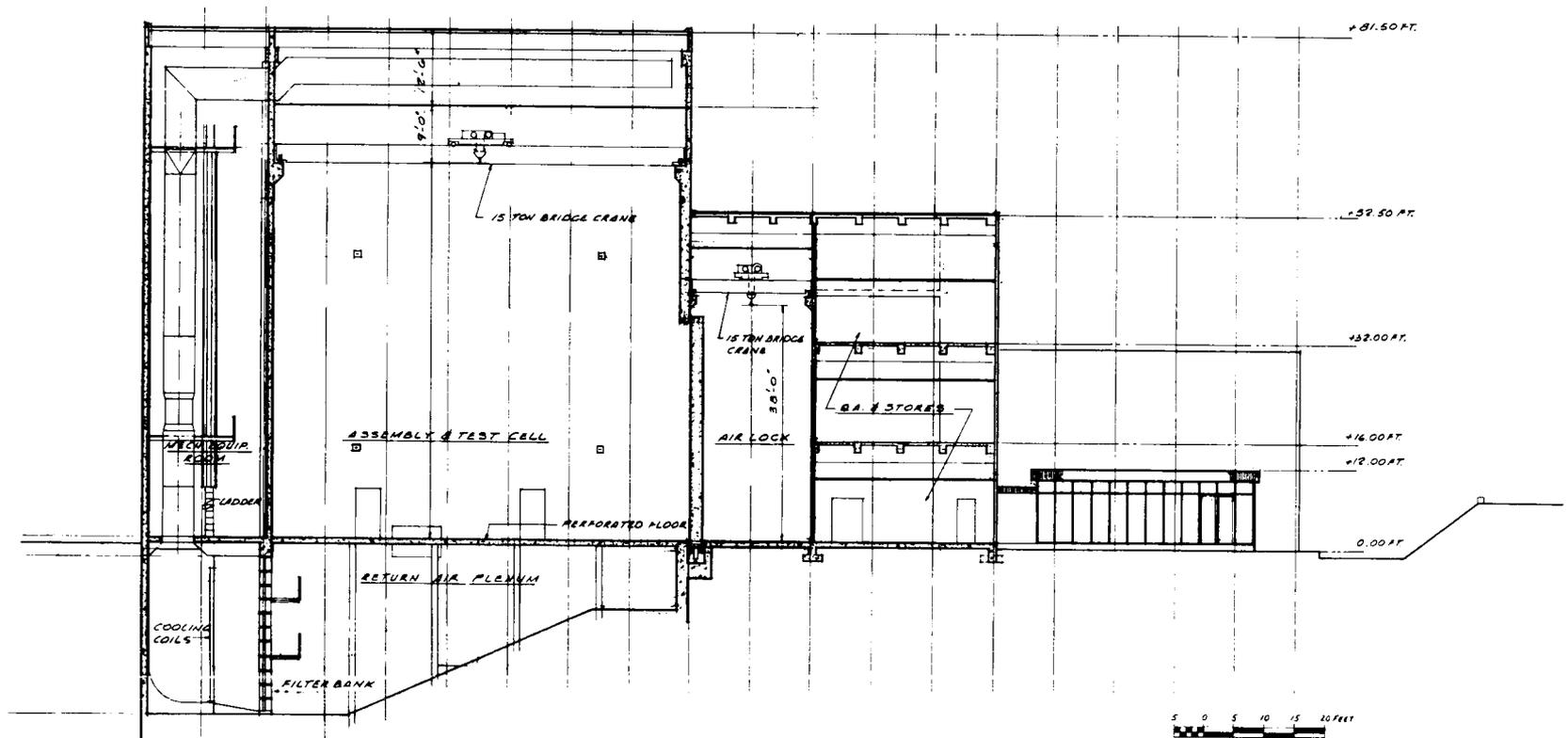
ADDITION FOR INTEGRATED SYSTEMS TESTING



SITE PLAN

JET PROPULSION LABORATORY
FISCAL YEAR 1975 ESTIMATES

ADDITION FOR INTEGRATED SYSTEMS TESTING



CROSS SECTION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

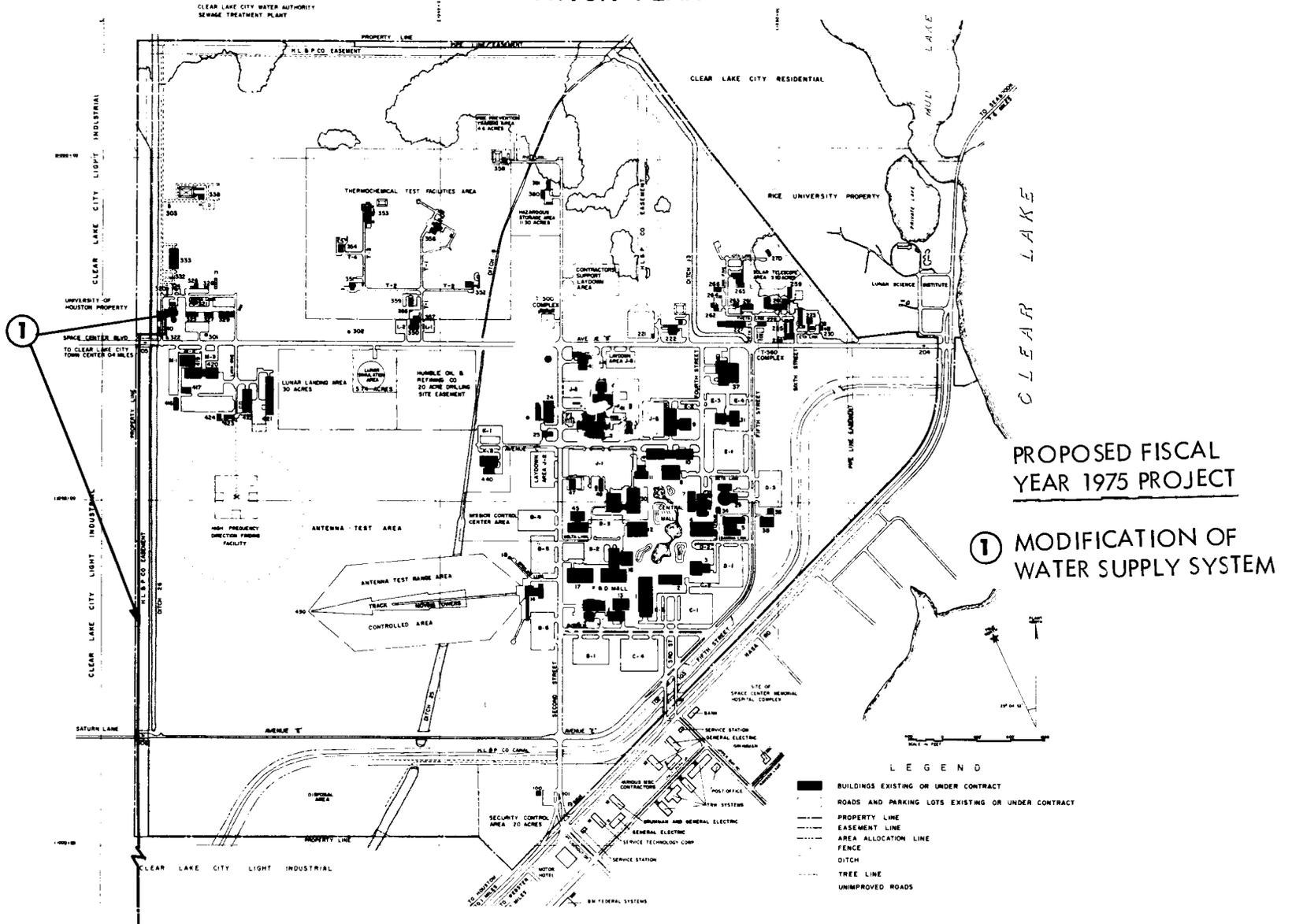
SUMMARY

Johnson Space Center

	<u>Amount</u>	<u>Page No.</u>
Location plan.....		CF 4-1
<u>Office of Manned Space Flight:</u>		
Modification of water supply system.....	<u>\$935,000</u>	CF 4-2

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1975 ESTIMATES

LOCATION PLAN



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modification of Water Supply System</u>
LOCATION	<u>Lyndon B. Johnson Space Center</u>
	FY 1975 CoF ESTIMATE <u>\$935,000</u>

COGNIZANT INSTALLATION: Lyndon B. Johnson Space Center

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$75,320
Construction	---
Total FY 1974 and Prior Years	<u>\$75,320</u>

SUMMARY PURPOSE AND SCOPE:

This project will provide a new and more reliable prime source of potable water for the Lyndon B. Johnson Space Center (JSC). The present water supply is derived from ground water sources via on-site wells. Withdrawal of ground water from such deep wells in the Houston-Galveston region is believed to be the prime cause of problems of land subsidence, intrusion of salt water into aquifers due to lowered present levels of fresh water tables, and surface faulting. This project will permit JSC to change from a ground water to a surface water supply by obtaining treated surface water from a new City of Houston supply main. The project includes both off-site and on-site water conveyance facilities and appurtenances.

PROJECT JUSTIFICATION:

This project is required to enable the JSC to change from a ground water to a treated surface water supply source for the total current and projected water needs of the Center. The use of ground water to supply the domestic and industrial water needs for the entire Houston-Galveston region is believed to have resulted in severe land subsidence. This subsidence in the region of JSC has exceeded three feet (91.4 centimeters) in some areas during the period between 1942 and 1964, and more than a foot (30.5 centimeters) during the period from 1964 to 1971. Problems related to subsidence, the intrusion of salt water into the fresh water aquifers and faulting of

of the land surface, have generated such serious concern as to require a regional effort to change from ground water to surface water for domestic and industrial use. It is essential that JSC work effectively with the surrounding municipalities, industries and the State of Texas in utilizing the available surface water supply.

This use of treated surface water, in lieu of ground water, has been encouraged by engineers, environmentalists and pollution control authorities for a number of years, and the City of Houston has been working toward the development of reservoirs to impound sufficient surface water and the construction of treatment facilities and distribution mains to serve future demands. Treated surface water has recently been made available in the JSC area by the City of Houston through the construction of a 42-inch (106.7 centimeter) underground supply main along Texas Highway 3. This line will provide a supply point approximately 13,000 feet (3,962.4 meters) from the Center property. The cost of this treated surface water is expected to approximate the cost of producing the distributing ground water on-site. The long-term plans and contractual arrangements of the City of Houston in obtaining surface water will assure this source of water for the foreseeable future.

Although JSC plans to place its existing water wells on a "standby" status for emergencies, the possibility of legal limitations on ground water withdrawal in this area diminishes the future reliance which can be placed on such wells for regular water supply.

The City of Houston will treat the water prior to distribution through the supply main. Post-chlorination only is planned by JSC. Laboratory surveillance to assure potability of the water supply throughout JSC will be continued.

PROJECT DESCRIPTION:

Since the original development of this Center, JSC has obtained water entirely from on-site wells. Three wells are now in use which draw from an aquifer approximately 600 feet (182.9 meters) deep. These wells have combined rated capacities of 2,750 gallons per minute (10,409.6 liters per minute). Average use by JSC in 1972 was 1,132,239 gallons (4,285,864.3 liters) of water per day; peak 1972 production was 1,737,375 (6,576,485.6 liters). This project provides for obtaining treated surface water in lieu of continued use of ground water by connecting to a City of Houston surface water supply main. The planned connection to this off-site underground main is approximately 13,000 feet (3,962.4 meters) from the Center's ground storage tank and booster pump facilities. It is anticipated that a portion of the off-site conveyance facilities 6,800 feet (2,072.6 meters) of 24-inch (61.0 centimeters) pipe will be shared by the Center and a neighboring water supply agency, Clear Lake City Water Authority (CLCWA). An additional 6,400 feet (1,950.7 meters) of 18-inch (45.7 centimeters) pipe will be constructed off-site from the CLCWA water plant to the JSC water plant site.

CF 4-3

The cost of off-site holding reservoir, booster pump station and other appurtenances will also be shared by CLCWA and JSC. Plans anticipate that CLCWA will construct the off-site conveyance facilities, both those shared by the agencies and those serving JSC alone, with a one-time reimbursement provided by JSC to CLCWA for its share of construction costs of these facilities to serve the Center. The water conveyance lines will be constructed along a right-of-way dedicated for public use. It is also anticipated that CLCWA will purchase treated surface water from the City of Houston for resale to JSC at the Center's storage tank.

On-site facilities contained in this project include a conveyance line to the existing ground storage tank, a new 600,000 gallon (2,271,180 liter) ground storage tank to assure adequate water storage for industrial and fire demands, valves and other appurtenances. Facilities for chlorination of the previously treated water will be included to insure potability.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	<u>\$15,000</u>
Right-of-way	LS	---	---	15,000
<u>Construction</u>				<u>920,000</u>
18-inch water main	LF	6,400	\$44.00	282,000
24-inch steel RCP main	LF	6,800	53.00	360,000
Connection and meters (8,400 gpm) 24-inch	Each	1	17,800	17,800
Connection and meters (3,800 gpm) 18-inch	Each	1	9,000	9,000
Clear well	Each	1	21,000	21,000
Booster pumps and electric power	Each	2	8,250	16,500
600,000 gal. ground storage tank	Each	1	82,800	82,800
24-inch sectional valves with concrete box and cover	Each	4	2,500	10,000
18-inch sectional valves with concrete box and cover	Each	7	3,500	24,500

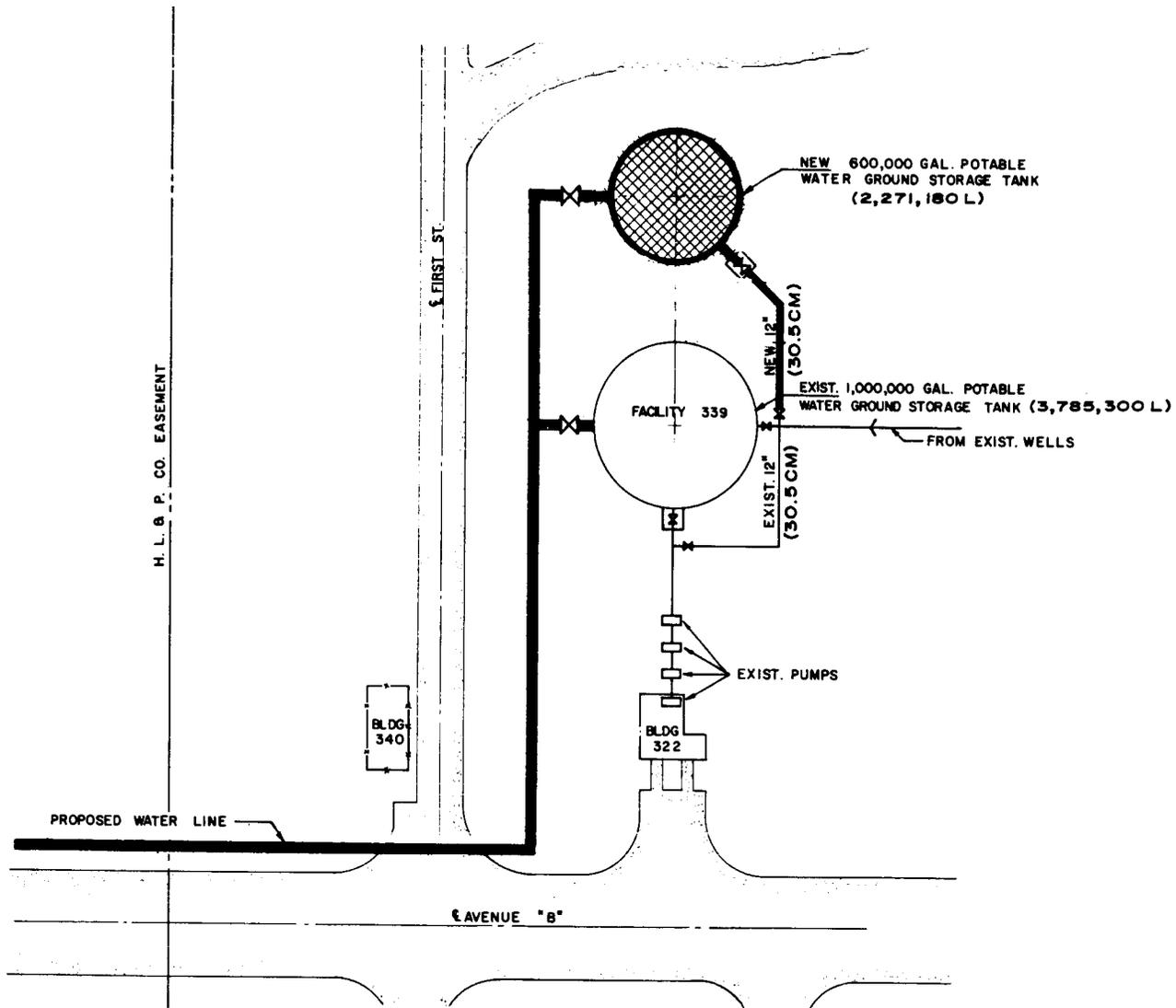
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Bridging ditch for 24-inch main	LF	100	\$50	5,000
Road and railroad crossing 36-inch sleeve	LF	214	100	21,400
Modifications to piping, meters and pumps	LOT	---	70,000	70,000
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	---
			TOTAL	<u>\$935,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

For presently planned usage, there are no currently foreseen future funding requirements necessary to complete this project.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1975 ESTIMATES

MODIFICATION OF WATER SUPPLY SYSTEM



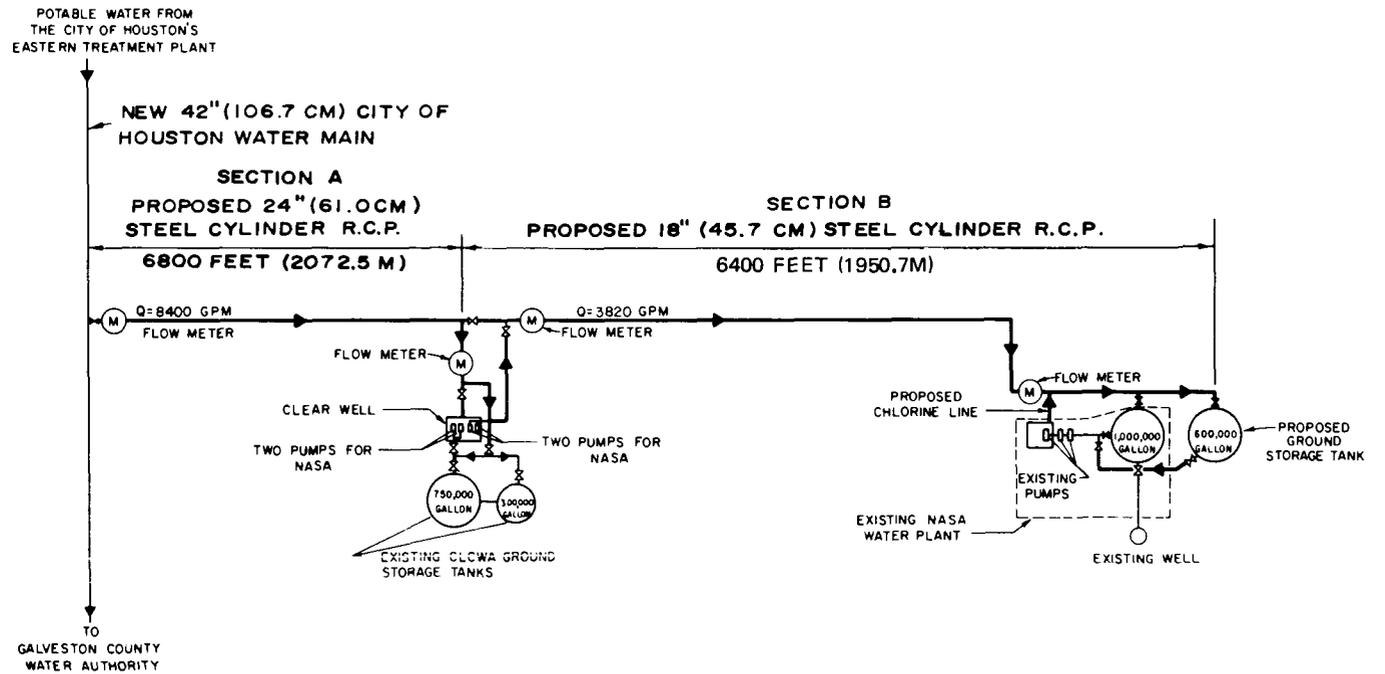
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SCALE IN FEET

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SCALE IN METERS

CP 4-7

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1975 ESTIMATES

MODIFICATION OF WATER SUPPLY SYSTEM



SCHEMATIC OF PROPOSED TREATED SURFACE
WATER CONVEYANCE SYSTEM FOR
CLCWA AND JSC

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

SUMMARY

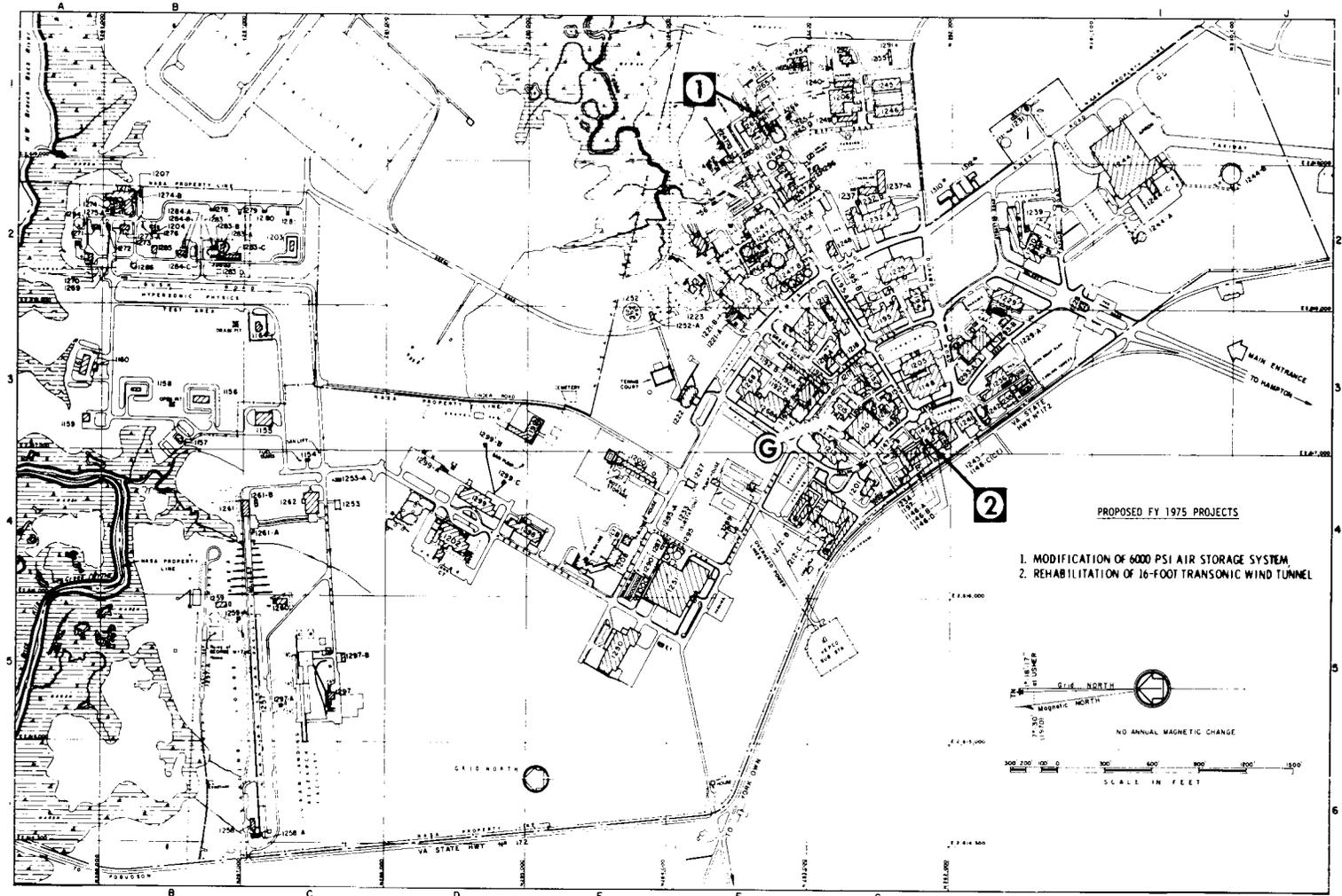
Langley Research Center

	<u>Amount</u>	<u>Page No.</u>
Location plan.....		CF 5-1
<u>Office of Aeronautics and Space Technology:</u>		
Modification of 6,000 p.s.i. air storage system.....	\$515,000	CF 5-2
Rehabilitation of 16-foot transonic wind tunnel.....	<u>2,990,000</u>	CF 5-7
Total.....	<u>\$3,505,000</u>	

LANGLEY RESEARCH CENTER

FISCAL YEAR 1975 ESTIMATES

LOCATION PLAN



PROPOSED FY 1975 PROJECTS

1. MODIFICATION OF 6000 PSI AIR STORAGE SYSTEM
2. REHABILITATION OF 16-FOOT TRANSONIC WIND TUNNEL

WEST AREA

CF 5-1

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modification of 6,000 psi Air Storage System</u>
LOCATION	<u>Langley Research Center</u>
	FY 1975 CoF ESTIMATE <u>\$515,000</u>

COGNIZANT INSTALLATION: Langley Research Center

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT PROGRAM OFFICE: Office of Aeronautics and Space Technology

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$2,500
Construction	<u>12,404,935</u>
Total FY 1974 and Prior Years	<u>\$12,407,435</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for the modification of the 6,000 psi air storage system of the 8-Foot High Temperature Structures Tunnel by the provision of a "thermal control enclosure". This will permit the operation of this facility and the new Thermal Protection System Test Facility at a full continuous operating pressure of 6,000 psi to ambient temperatures as low as 5° F.

PROJECT JUSTIFICATION:

Following the report of the Accident Investigating Board on the 9' x 6' Tunnel, 600 psi Air Supply System failure in late 1971, Langley facilities involving the most critical personnel safety aspects were reviewed for compliance with current codes. The 8-Foot High Temperature Structures Tunnel, one of those reviewed, has been in research test operation for over ten years. The review of this facility, which included visual, preliminary stress analysis, nondestructive examination techniques, and current code plus personnel safety compliance concluded that only temporary operation, of not more than 50 additional equivalent cycles (approximately one year of normal operations), should be allowed. These additional facility cycles are further limited to an operating pressure of 5,400 psi at temperatures above 60° F. with a straight line decrease in operating pressure to 4,200 psi at 30° F.

CF 5-2

Upon completion of a rehabilitation and modification program now underway, the air storage system will be subject only to temperature constraints. With the further improvement proposed under this project, the continuous operating pressure of the system will be restored to 6,000 psi when ambient temperature is as low as 5° F.

The 6,000 psi air and fuel storage systems are the energy sources required for the operation of the 8-Foot High Temperature Structures Tunnel and the Thermal Protection System Test Facility. The 8-Foot Tunnel is a "blowdown" tunnel which operates at stagnation pressures up to 4,000 psi with temperatures between 2,500° R and 4,000° R to simulate M = 7.0 flight environment. Temperatures are achieved by burning methane (CH₄) air under pressure and the resulting gas is used as the test medium. The facility is required to research the response of full scale structures designed for hypersonic flight.

The High Temperature Structures Tunnel is one of the Center's major research facilities heavily involved in such high priority national programs as: shuttle thermal protection system technology development, development of hypersonic vehicle structures and thermal control systems applicable to future shuttle vehicles, hypersonic aircraft and missiles. Current test programs of this tunnel are focused on the development of technology for space shuttle vehicle surface structures and thermal control systems. Such tests require subjecting an array of full scale panels (up to 3.5 ft., 1.07m x 5.0 ft., 1.52m) including joints, seals, and support structure to a realistic aerodynamic environment. The 8-Foot Tunnel is the only national facility having the size and environment to permit such tests. The facility is also suitable for future research programs for the development of hypersonic structures and hypersonic air-breathing propulsion systems applicable to future civil, military, and space vehicles.

The Thermal Protection System Test Facility is also a "blowdown" tunnel. However, it simulates local flow conditions on vehicles. It will be used to expose a full scale structural panel, mounted in the tunnel wall, to a simulated entry environment. Additional important features of this facility include its ability to simulate the environment schedules for reentry missions or for sustained hypersonic flight. A rapid frequency of operation makes the tunnel a ready means of accumulating data on cyclic performance. Thus, the facility will provide essential cyclic life and qualification tests of surface structures for the space shuttle and other future vehicles.

The operation of the High Temperature Structures Tunnel and the Thermal Protection System Test Facility is dependent upon the integrity of the 6,000 psi air and fuel storage systems. Maintenance of these 6,000 psi systems in a safe and efficient state are, therefore, essential to the current and future programs aimed at developing required thermal structures.

PROJECT DESCRIPTION:

This project will provide a total thermal enclosure (44 ft., 13.41m x 40 ft., 12.19m x 80 ft., 24.38m) for the bottle field for protection against adverse weather conditions. The enclosure will maintain a minimum air storage vessel environment temperature of 60° F. The structure will also have the necessary platforms and work areas to support periodic vessel inspections and monitoring procedures. The project also includes work area for the evaluation of materials used in the fabrication of the existing air storage system for structural life properties.

Without this modification work, the 8-Foot High Temperature Structures Tunnel and the Thermal Protection System Test Facility will have to continue to operate at a reduced capacity (50%) during the winter months by temperature constraints.

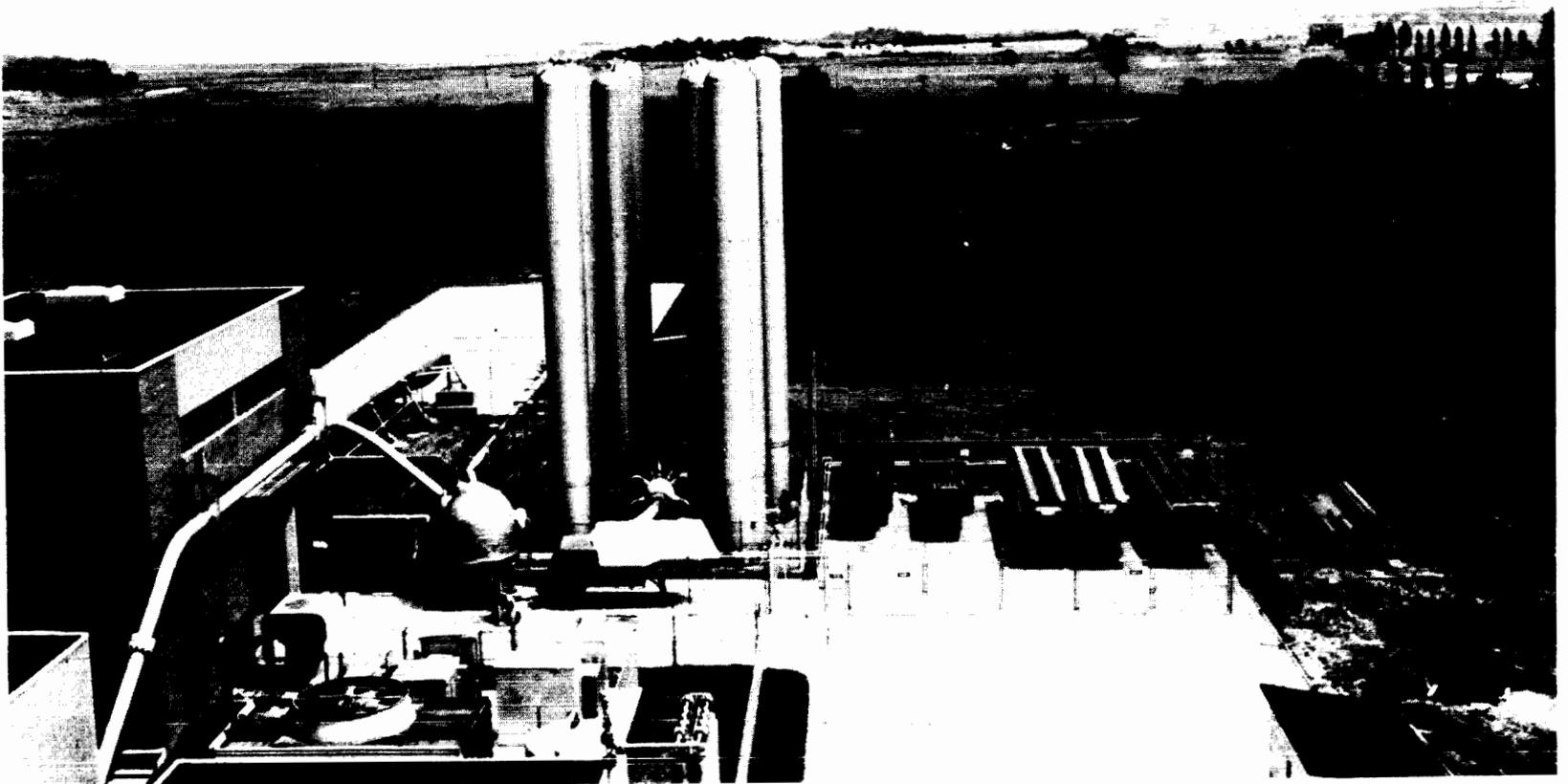
PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$465,000</u>
Thermal control enclosure	CF	140,800	\$2.70	380,000
Acoustical emission system	LS	---	---	85,000
<u>Testing</u>				<u>50,000</u>
Material testing	LS	---	---	50,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	---
		TOTAL		<u>\$515,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

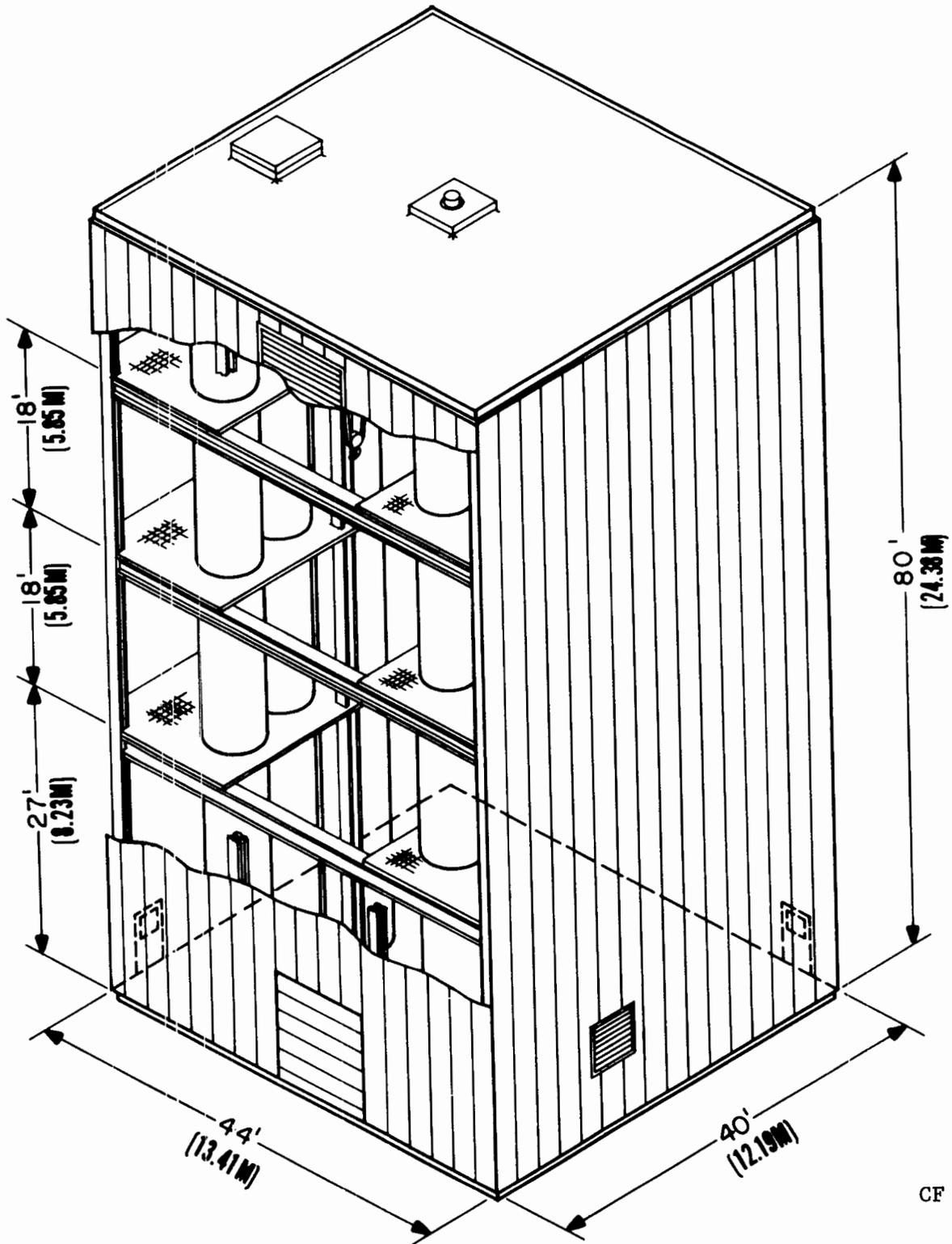
At this time, no other requirements have been identified as being needed to meet the objectives of this modification project.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATION OF 6000 PSI AIR STORAGE SYSTEM



CIT 5-5

LANGLEY RESEARCH CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATION OF 6,000 PSI AIR STORAGE SYSTEM



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Rehabilitation of 16-Foot Transonic Wind Tunnel</u>
LOCATION	<u>Langley Research Center</u>
	FY 1975 CoF ESTIMATE <u>\$2,990,000</u>

COGNIZANT INSTALLATION: Langley Research Center

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT PROGRAM OFFICE: Office of Aeronautics and Space Technology

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$213,800
Construction	<u>14,337,034</u>
Total FY 1974 and Prior Years	<u>\$14,550,834</u>

SUMMARY PURPOSE AND SCOPE:

This rehabilitation of the 16-Foot Transonic Wind Tunnel will provide for the continued and improved use of this unique national resource. The rehabilitation of this equipment, which has been in continuous operation for 23 years, will permit NASA to maintain a capability for large-scale model research investigations at transonic speeds in the fields of aeronautics, propulsion aerodynamics and space support. The project will include the necessary replacements in the wind tunnel main drive fan system and other critical ancillary components required for continued safe operation of this facility.

PROJECT JUSTIFICATION:

The Langley 16-Foot Transonic Wind Tunnel is the largest transonic tunnel operated by NASA and one of two existing research facilities in the "free world" with transonic speed capability for testing large-scale models for determination of aircraft and spacecraft aerodynamics and load characteristics of propulsion effects on aerodynamics in the transonic range. This testing requires a ratio of model to test section area in the order of one percent. Its large size makes this facility uniquely adapted to investigations of these complex propulsion models. A continuing need for transonic

research exists since transonic cruise speed is being gradually approached by advanced commercial transport aircraft and both military and space vehicles must traverse this speed region in going to supersonic flight.

Many problems in aerodynamics, stability, control, loads and propulsion system interactions can only be answered through the use of ground test facilities that have transonic speed capability. The Langley 16-Foot Transonic Tunnel has produced a large share of the specialized NACA-NASA research in the transonic aerodynamics and propulsion system integration fields over the years. With consideration of the recent emphasis on the importance of propulsion integration research, it is necessary to maintain this facility as the primary research tool in this field.

For this facility to continue to contribute significantly to the national effort, in both civilian and defense related aeronautical progress, it must be kept in an effective operating condition. This tunnel was originally constructed in 1941, and converted into a "slotted throat" transonic tunnel in 1950, and the main drive power system has been in operation for the last 23 years. This factor of age and the limitations on fatigue life of the machinery require that these items now be rehabilitated to insure safe and continued effective operation. It is estimated that the replacement of the Langley 16-Foot Transonic Tunnel complex would cost about \$35 million and therefore it represents a considerable investment, the full use of which must be presumed.

PROJECT DESCRIPTION:

In the main drive system the fan blades, shanks, interblade fairings, and other related parts will be replaced. The angle of attack, Mach number, and model propulsion control systems will be modified for automatic operation. The hoist mechanism for the 180 ton top will be rebuilt, and the hoist supporting structure will be stiffened.

The air exchange tower oil-bath filters will be replaced with dry-type, thereby eliminating the oil film coating that builds up on tunnel walls and models. The electrolytic heat exchanger will be rehabilitated. The interior tunnel walls will be painted. The project also includes building maintenance of exterior walls, roof, windows, and rehabilitation of office and shop spaces to current standards.

The need for this project at this time stems from a need to minimize the effects of unforeseen hazards and resulting research losses through a planned program of major rehabilitation and modification. The alternative is to wait for failures or accidents to occur and to accept lower resultant effectiveness. This, of course, is not conducive to safety or to the necessary levels of operations and could result in delay to research programs and probably more costly later "emergency repairs".

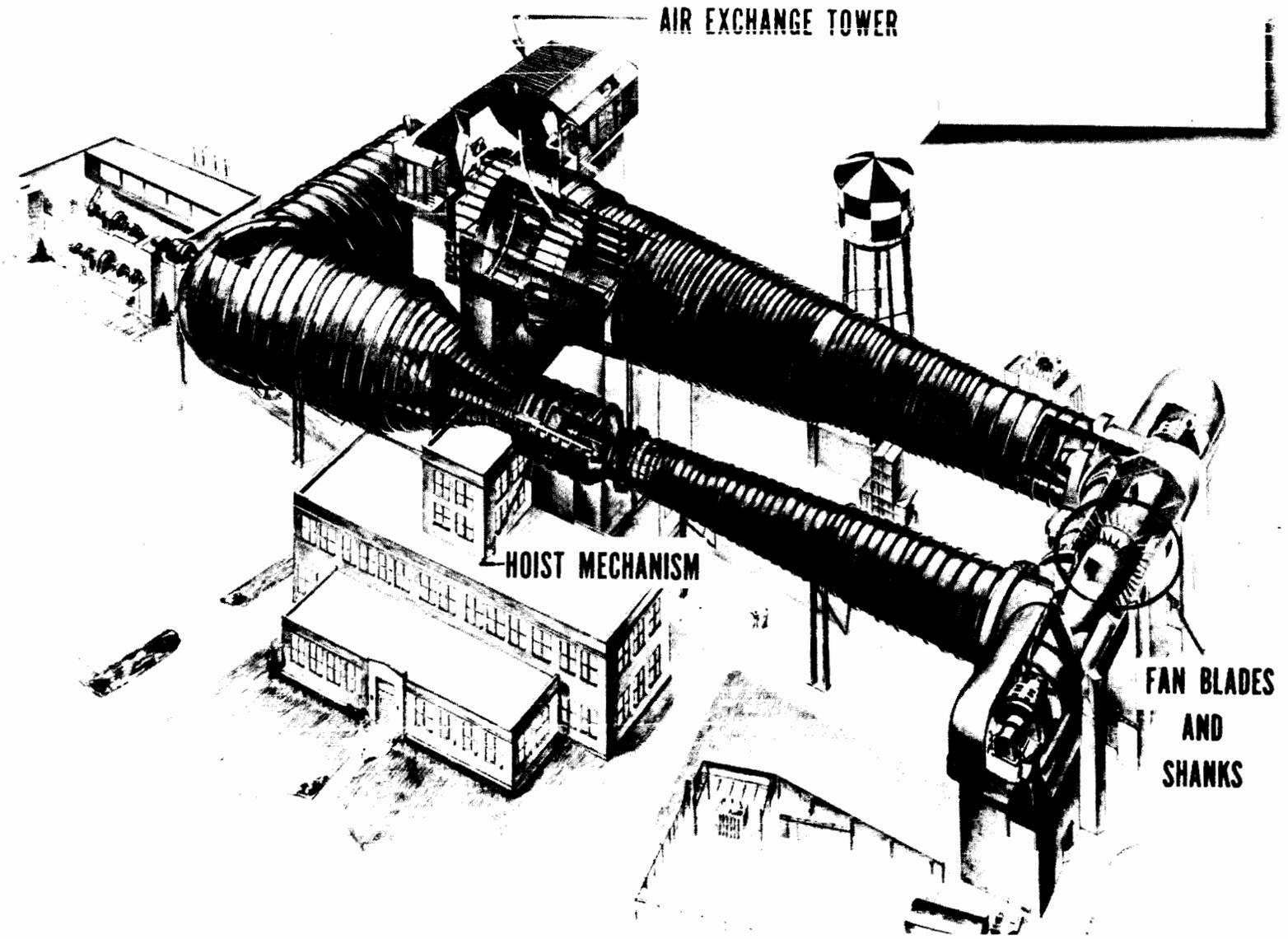
PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$580,000</u>
Office and shop rehabilitation	SF	29,000	\$20.00	580,000
<u>Equipment</u>				<u>2,410,000</u>
Bolts and sleeves	Sets	459	150.00	68,850
Fan blade shanks	Each	51	14,200.00	724,200
Interior blade fairings	LS	---	---	40,000
Fan blades (wooden)	Each	61	6,800.00	414,800
Improvements to lift section	LS	---	---	680,000
Update tunnel controls	LS	---	---	275,000
Miscellaneous tunnel support equipment repair/replacement	LS	---	---	207,150
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	---
			<u>TOTAL</u>	<u>\$2,990,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

This rehabilitation project is a consolidation of currently identified tasks which must be accomplished to insure safe, reliable and efficient continued operation of this tunnel. Further minor requirements may subsequently be required but are not now adequately defined for inclusion in this project.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1975 ESTIMATES
REHABILITATION OF 16-FOOT TRANSONIC WIND TUNNEL



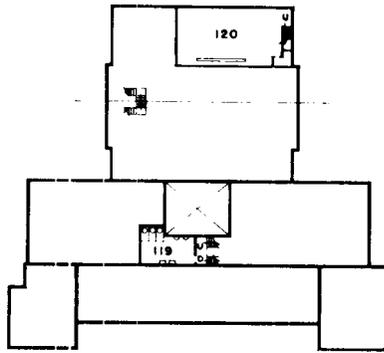
CP 5-10

CP 5-10

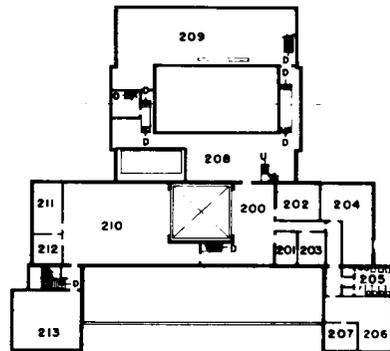
LANGLEY RESEARCH CENTER

FISCAL YEAR 1975 ESTIMATES

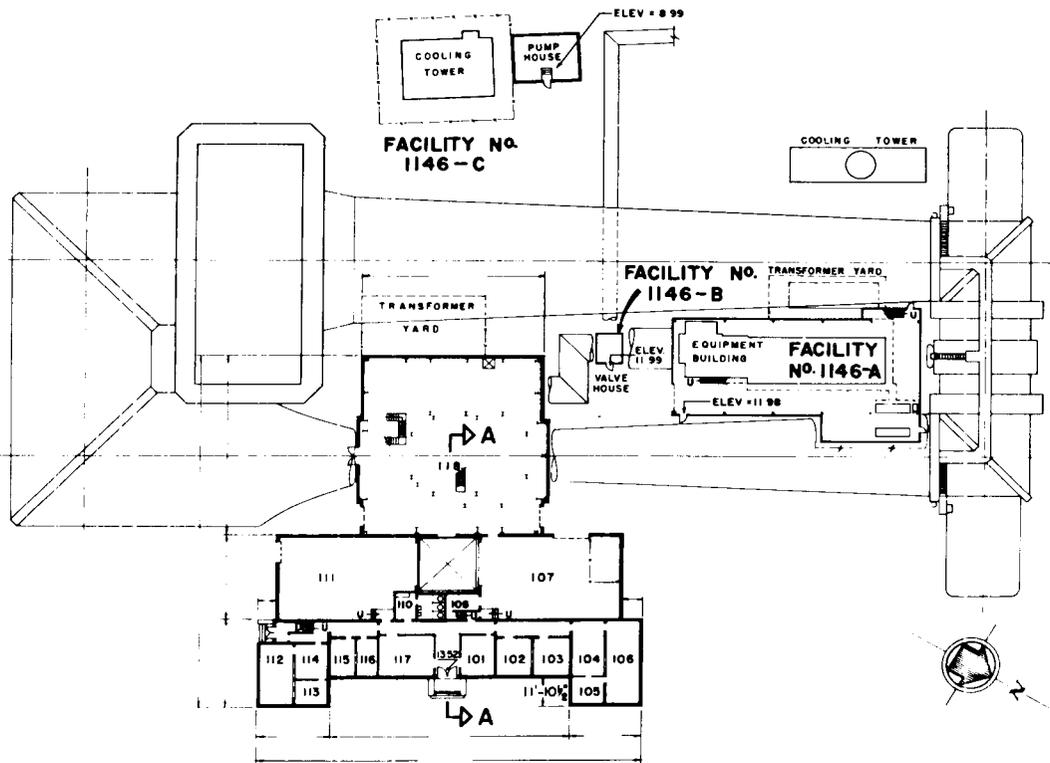
REHABILITATION OF 16-FOOT TRANSONIC WIND TUNNEL



INTERMEDIATE FLOOR PLAN



SECOND FLOOR PLAN



FIRST FLOOR PLAN

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

SUMMARY

Lewis Research Center

	<u>Amount</u>	<u>Page No.</u>
Location plan.....		CF 6-1
<u>Office of Aeronautics and Space Technology:</u>		
Modification of propulsion systems laboratory.....	\$2,580,000	CF 6-2
Modification of rocket engine test facility.....	<u>660,000</u>	CF 6-11
Total.....	<u>\$3,240,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modification of Propulsion Systems Laboratory</u>
LOCATION	<u>Lewis Research Center</u>
	FY 1975 CoF ESTIMATE <u>\$2,580,000</u>

COGNIZANT INSTALLATION: Lewis Research Center

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT PROGRAM OFFICE: Office of Aeronautics and Space Technology

FY 1974 AND PRIOR YEARS FUNDING:

Planning and Design	\$910,000
Construction	<u>33,608,253</u>
Total FY 1974 and Prior Years	<u>\$34,518,253</u>

SUMMARY PURPOSE AND SCOPE:

For many years, the Propulsion Systems Laboratory (PSL), with its ability to simulate high altitude flight environment, has played an important role in propulsion research. In the planned development of this facility, two additional altitude test chambers, PSL 3 and PSL 4, having large exhaust gas cooling capacity were authorized in FY 1967 and recently became operational. Additional air refrigeration capability is now required in order to provide correct simulation of inlet air temperatures for critical portions of the flight envelopes of advanced engines for both commercial and military aircraft.

The proposed project will increase the air refrigeration capability of the Propulsion Systems Laboratory from its present capacity of 110 pounds of air per second at -70° F. to 400 pounds per second at -100° F. plus drying its remaining 55 pounds per square inch absolute combustion air (60 pounds per second). Thus, this project will permit refrigerating the available combustion air supply at Lewis Research Center to a controlled temperature between minus 55° F. and minus 100° F. by mixing dry unrefrigerated air with refrigerated air.

PROJECT JUSTIFICATION:

Since the initial use of the facility with its original two test chambers in 1952, significant increases in combustion air and exhaust were made in 1955 and again in 1959 to provide for anticipated growth in engine size. It is now very important to provide the PSL with the capability to refrigerate all of its 165 pounds per square inch absolute combustion air (400 pounds per second) to -100° F. plus drying its remaining 55 pounds per square inch absolute combustion air (60 pounds per second). The present capacity is 110 pounds of air per second at -70° F. The ability to obtain actual flight performance data on experimental or prototype aircraft engines is an extremely important capability to the aircraft industry in the expeditious and economical development of advanced military and commercial aircraft propulsion systems.

This facility modification increasing the refrigeration capacity of PSL will improve the operating capability of the PSL to cover the more critical portions of the flight envelope at high altitude and low Reynolds numbers. Investigations of compressor stall margin, compressor inlet distortion, combustor blowout, pollution emissions, and afterburner ignition are typical of the engine characteristics that must now be more thoroughly evaluated.

The limitations to the present system and the advantages of an expanded refrigeration capacity are shown in figures 1 and 2 for two engines of interest. Figure 1 shows flight envelopes with both present and proposed refrigeration for the JT8D REFAN engine. With the present system, this engine cannot be tested at the standard day cruise condition (Mach 0.85, 35,000 feet, 10,668 meters). The figure indicates that correct simulation is possible above 45,000 feet (13,716 meters); however, this is not an area of interest for this engine. Although some engine operation is possible at lower altitudes, proper corrected speeds cannot be obtained. Testing at these high corrected speeds is necessary because many engines have had serious compressor instability and performance problems at these conditions. In addition, combustor inlet conditions are also not correctly simulated when the inlet air temperature is high, and proper performance evaluation and pollution measurements are not possible.

The proposed refrigeration will provide a balanced air system which will permit correct test simulation for the JT8D REFAN engine over the entire flight envelope.

Figure 2 depicts the flight envelope for a potential advanced civil transport engine being considered for introduction into service by 1980. The left hand side shows that with the present system no standard-day simulation is possible throughout the entire envelope. With the proposed refrigeration (shown on the right hand side) the cruise condition as well as many other operating conditions can be correctly simulated over a significant portion of the flight envelope.

The addition of the two new test chambers and the growth in air capacity in PSL in past years now permits installation and testing of these larger turbofan engines. The requested addition of refrigeration capability will provide a well balanced total air system that will permit more realistic investigations of engine characteristics associated with current operational problems of noise, pollution, flow distortion, and stall margin.

PROJECT DESCRIPTION:

In order to meet the requirements for refrigerated air (400 pounds per second at -100° F.), it will be necessary to dehydrate, dry, and refrigerate the presently available supply of compressed air. The proposed facility to achieve this will be composed of three major types of equipment: an air dehydrator, a desiccant air dryer, and brake loaded expansion turbines to refrigerate the air supply. A schematic flow diagram indicating the relation of the new equipment to the existing equipment is also attached.

The dehydrator, which will decrease the moisture content of 115 pounds of air per second from 100 to 10 grains per pound by refrigerant cooling, will be housed in the existing PSL equipment building. This equipment will operate in parallel with existing similar equipment.

The desiccant dryer will be installed out-of-doors in an available space to the west of the PSL equipment building. It will operate in parallel with an identical dryer and use the same regeneration equipment. The unit will dry 230 pounds per second of air from 10 grains per pound to dew points of minus 100° to minus 60° F. for periods up to eight hours.

The expansion turbines, four in number, will be housed in the basement of the existing heater building. This location allows entry of the cold turbine discharge air into the supply line to the PSL test chambers immediately upstream of the existing internally insulated length. Utilizing this piping will minimize temperature lag between the turbine outlet and the test chamber. Each turbine will be loaded by a power absorbing brake. Cooling for the brakes will be supplied from an existing cooling water system. With a design pressure ratio of approximately 6, the four expansion turbines will be able to provide 400 pounds per second of air at minus 100° F. and 25 pounds per square inch absolute from turbine inlet conditions of 100° F. and 165 pounds per square inch absolute.

Other major elements of the facility are the Power Control and Instrumentation System, Safety Systems, Cooling Water System, and building modifications.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$80,000</u>
Modification to PSL equipment Building 64	LS	---	---	18,000
Modification to PSL heater Building 124	LS	---	---	62,000
<u>Equipment</u>				<u>2,500,000</u>
Refrigeration turbines	LS	---	---	1,260,000
Cooling water system	LS	---	---	75,000
Safety systems	LS	---	---	25,000
Electrical power, control, and instrumentation	LS	---	---	275,000
Dryer and dehydrator equipment	LS	---	---	865,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	<u>---</u>
			TOTAL	<u>\$2,580,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

No future funding requirements are currently foreseen to complete the work envisioned in this project; however, it is anticipated that about \$40.0 million will be required in future years to provide an increased supply of combustion air as well as additional exhaustor capability.

LEWIS RESEARCH CENTER FISCAL YEAR 1975 ESTIMATES MODIFICATION OF PROPULSION SYSTEMS LABORATORY

PLS FACILITY LIMITS, JT8D REFAN ENGINE

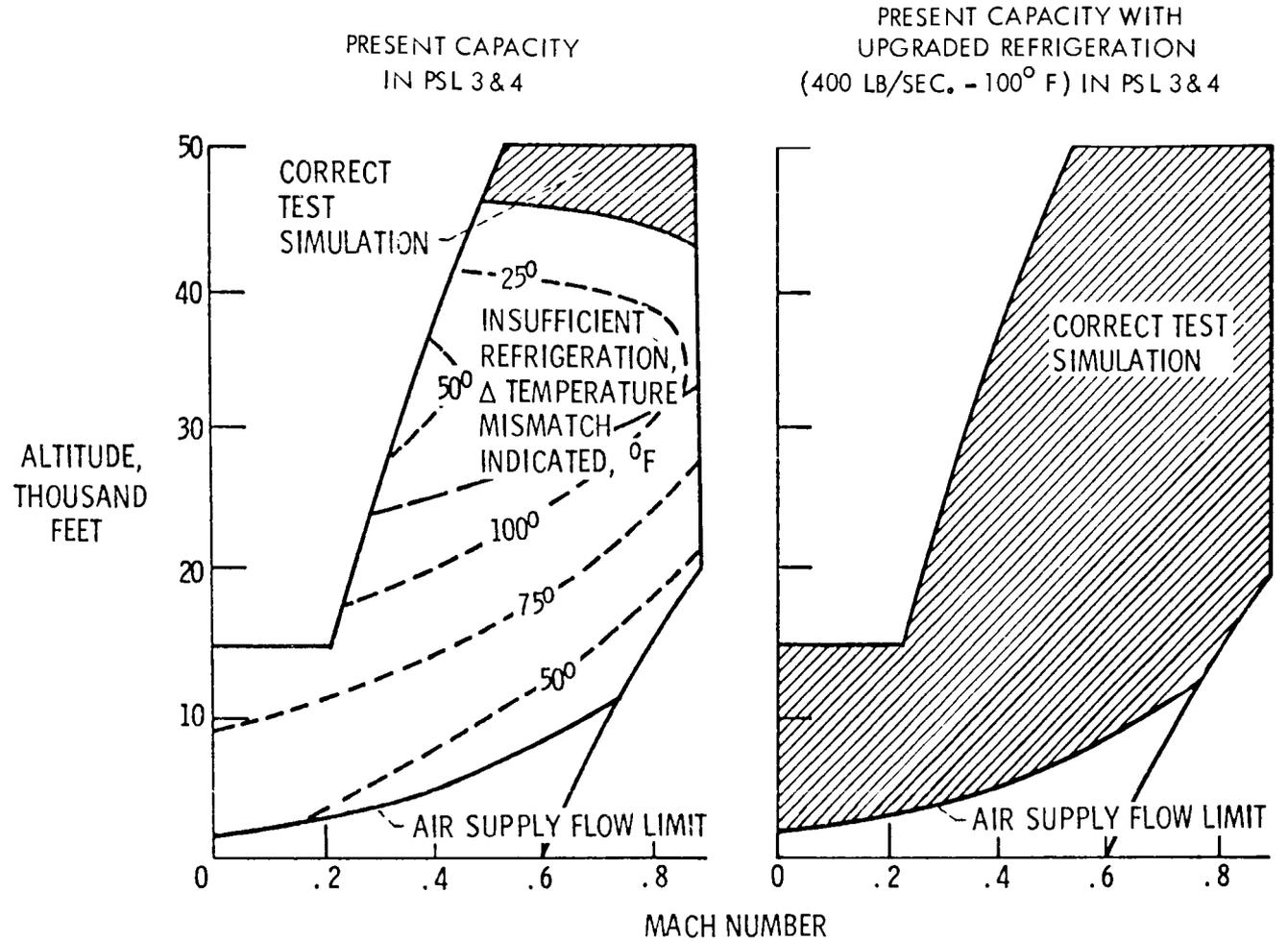


FIGURE 1

LEWIS RESEARCH CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATION OF PROPULSION SYSTEMS LABORATORY

PSL FACILITY LIMITS
CIVIL TRANSPORT ENGINE - 27000 LB. THRUST (960 LB/SEC)

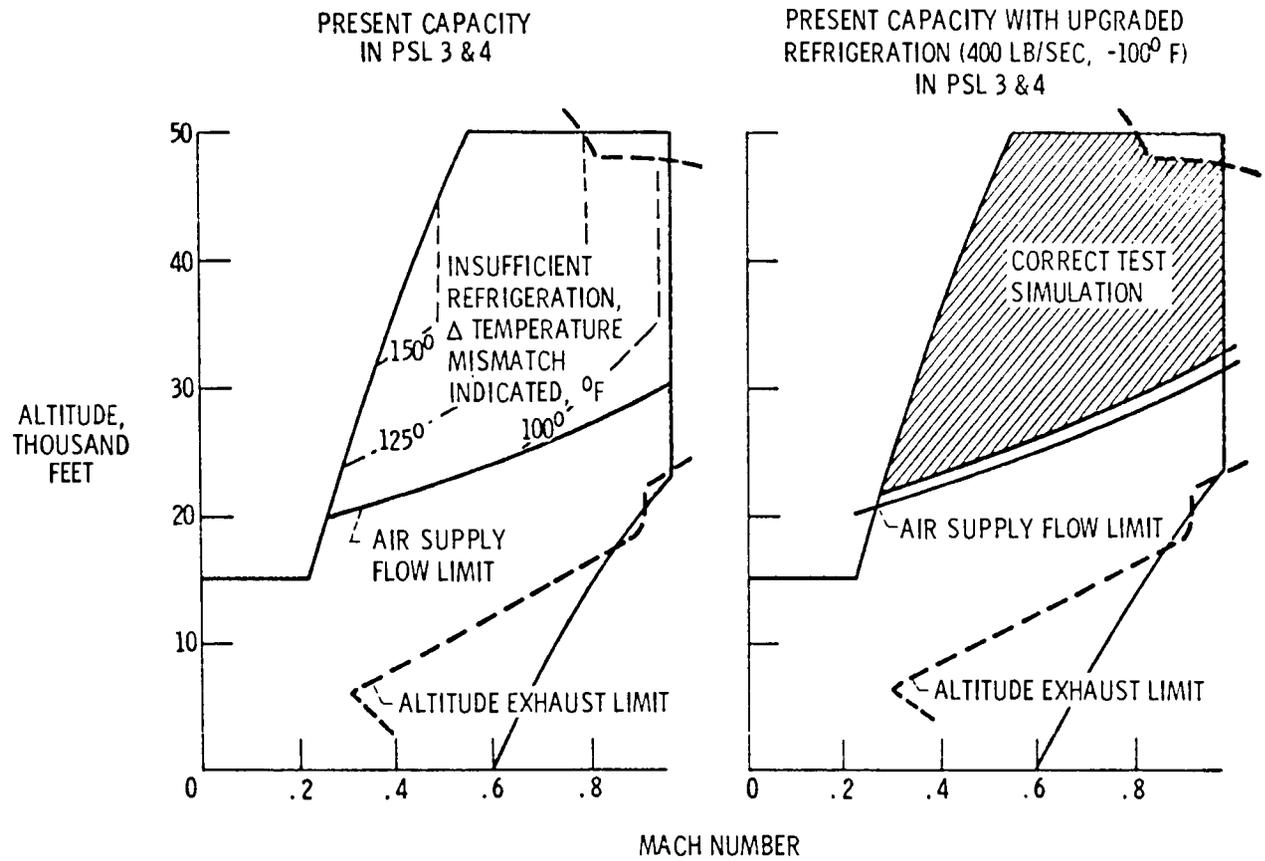
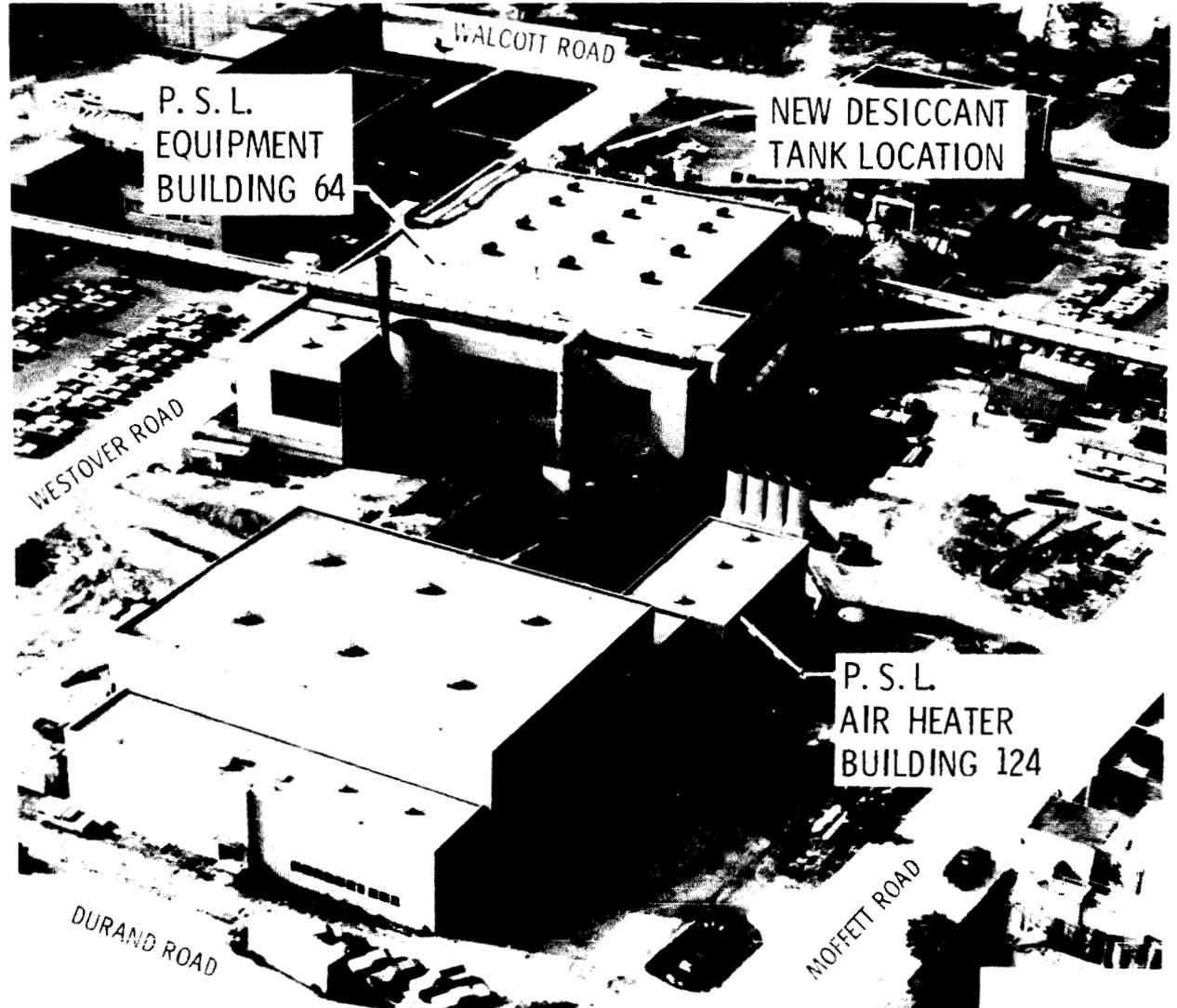


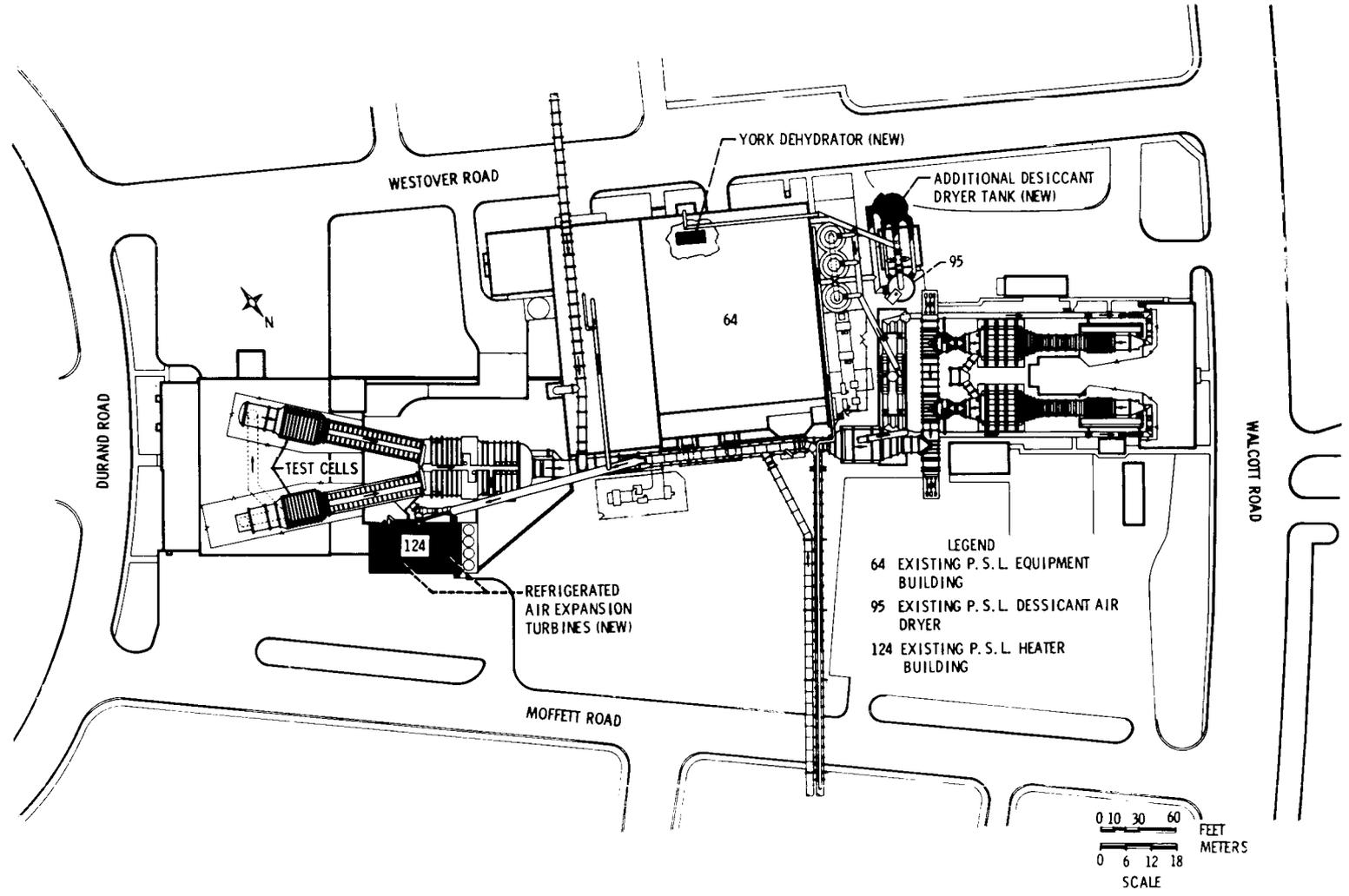
FIGURE 2

LEWIS RESEARCH CENTER
FISCAL YEAR 1975 ESTIMATES

MODIFICATION OF PROPULSION SYSTEMS LABORATORY

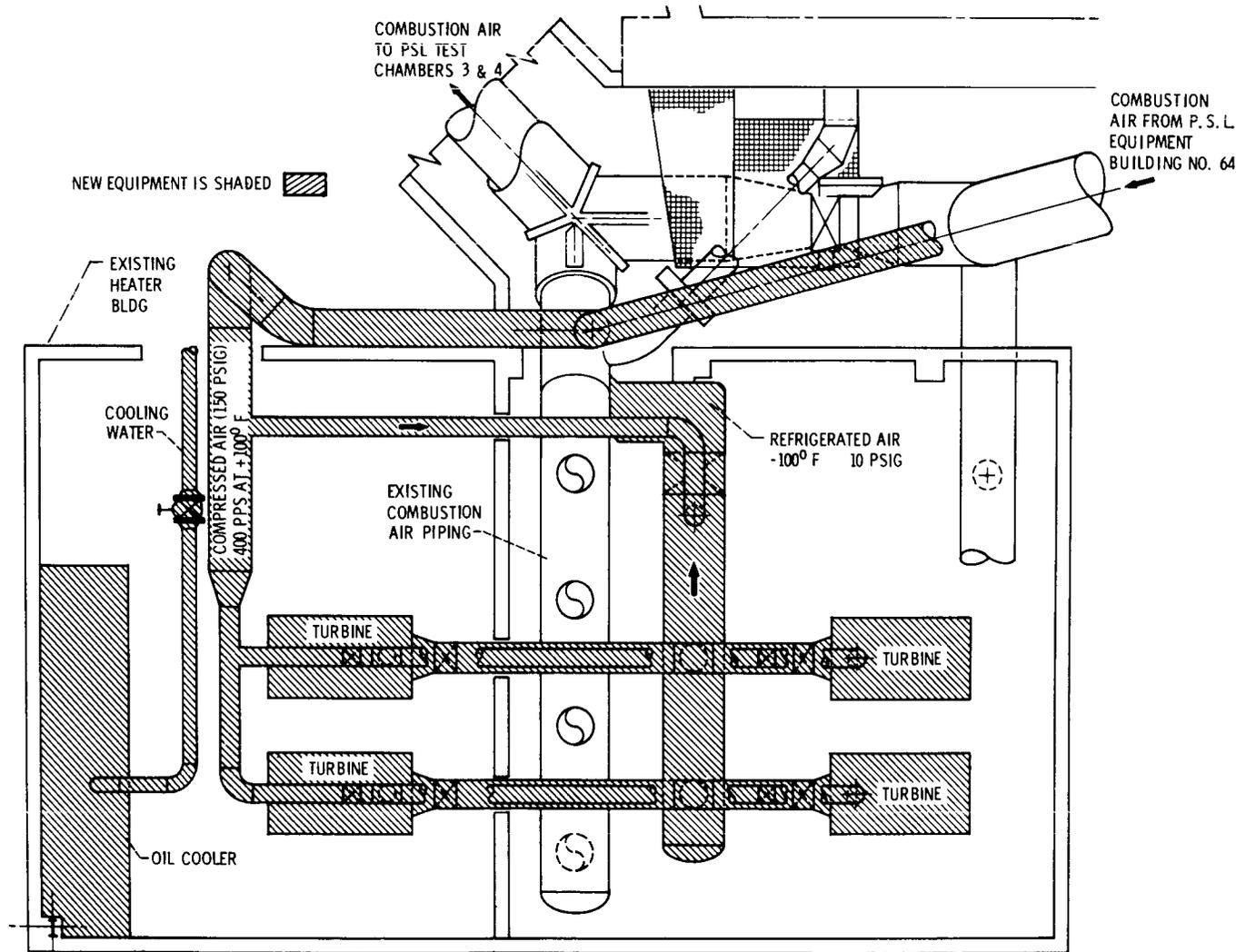


LEWIS RESEARCH CENTER
 FISCAL YEAR 1975 ESTIMATES
 MODIFICATION OF PROPULSION SYSTEMS LABORATORY



SITE PLAN

LEWIS RESEARCH CENTER
 FISCAL YEAR 1975 ESTIMATES
 MODIFICATION OF PROPULSION SYSTEMS LABORATORY



BASEMENT PLAN FOR HEATER BUILDING NO. 124

CF 6-10

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	Modification of Rocket Engine Test Facility
LOCATION	Lewis Research Center
	FY 1975 CoF ESTIMATE \$660,000

COGNIZANT INSTALLATION: Lewis Research Center

LOCATION OF PROJECT: Cleveland, Cuyahoga County, Ohio

COGNIZANT PROGRAM OFFICE: Office of Aeronautics and Space Technology

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$7,350
Construction	<u>2,721,000</u>
Total FY 1974 and Prior Years	<u>\$2,728,350</u>

SUMMARY PURPOSE AND SCOPE:

This project will provide for modifications to the existing Rocket Engine Test Facility, Building 202, to permit research operation and testing of high pressure (5,000 psi) rocket engines fueled with liquid oxygen and liquid hydrogen. The present facility has the required capability to achieve this objective with the exception of the high pressure cryogenic propellant storage and delivery systems. The scope of this project is to provide LH₂ and LOX dewars and the necessary piping, controls and instrumentation to deliver the LH₂ and LOX to the research rocket engine at the flow rates and pressures required.

PROJECT JUSTIFICATION:

The Office of Aeronautics and Space Technology and the Lewis Research Center have undertaken a broad research program on the technology required for near-earth space vehicle stages such as Tug, Orbit-to-Orbit Shuttle or Versatile Upper Stage. Mission analyses indicate that engine chamber pressures on the order of 2,000 psi with preburners at 3,300 psi and hydrogen propellant entering the jacket at 4,300 psi are needed.

Severe problems are apparent in the areas of thrust chamber cooling, combustion performance, low cycle thermal fatigue and combustion stability. To accomplish the technology advances required in these areas, an experimental program is necessary, in turn requiring a major increase in the pressure capability of the Rocket Engine Test Facility propellant feed systems. Facilities with which to conduct this program can be provided at a minimum of cost and time by utilizing the existing Rocket Engine Test Facility complex and merely adding high pressure cryogenic systems. The test stand, scrubber, safety systems, instrumentation, facility control, data acquisition, and support systems can readily accommodate the high pressure rocket engine research operation program with very minor modification.

PROJECT DESCRIPTION:

This project consists of acquisition and installation of two cryogenic high pressure dewars and the cryogenic piping systems to transport separately LH₂ and LOX to interfaces on the research rocket engine, to be mounted in the existing Rocket Engine Test Facility. Provisions for purging, filling, pressurizing with existing gas storage, venting and inerting each system will be incorporated in the installation. Necessary valves, flow meters, pressure regulators and associated sensors, controllers and safety devices will also be included.

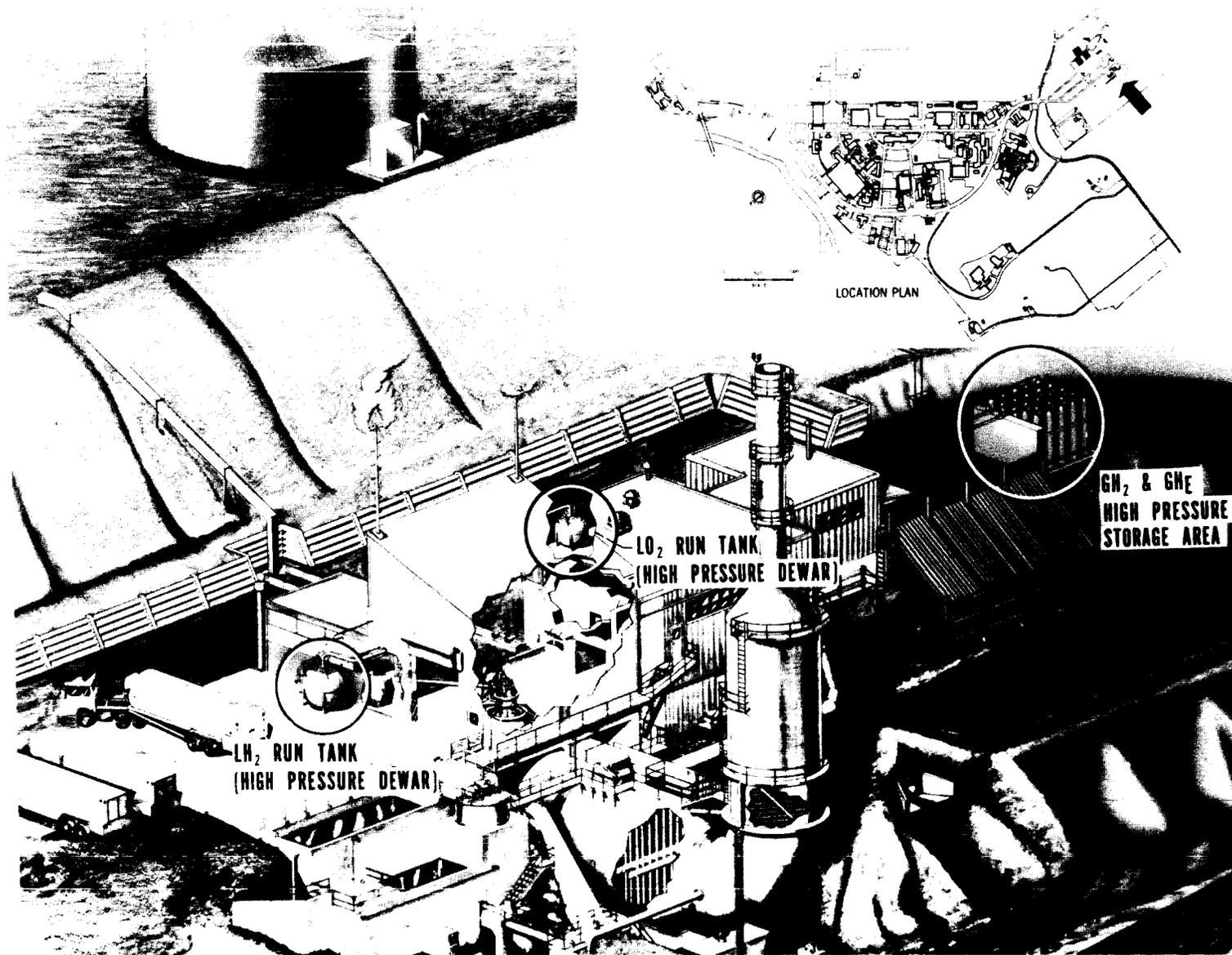
PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$67,000</u>
Electrical power and controls	LS	---	---	67,000
<u>Equipment</u>				<u>593,000</u>
LOX dewar	CF	67	\$1,537	103,000
LH ₂ dewar	CF	135	1,311	177,000
Piping systems	LS	---		313,000
<u>Fallout Shelter (Not Feasible)</u>				<u>---</u>
			<u>TOTAL</u>	<u>\$660,000</u>

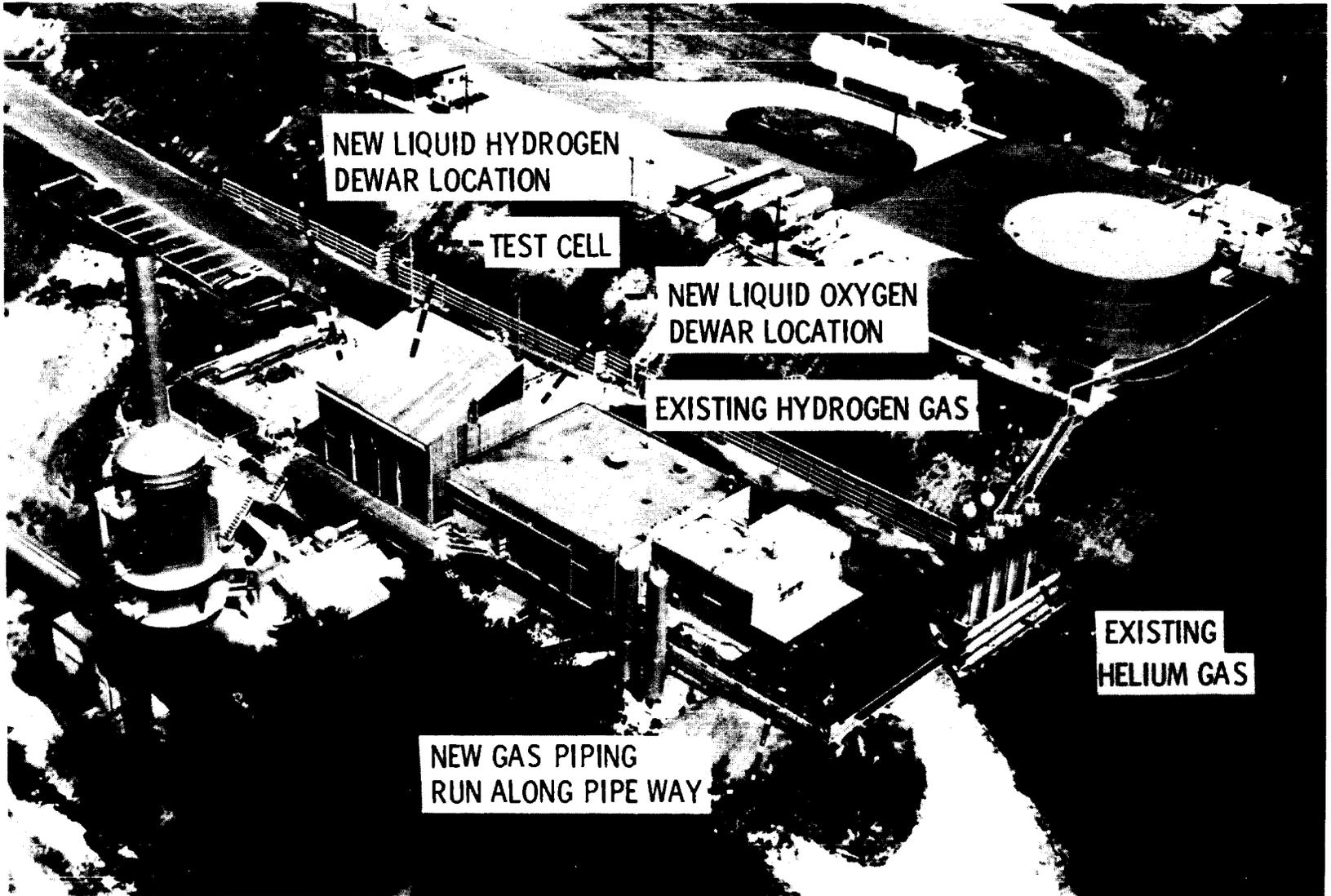
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Additional future funding is not required to complete this project within the presently defined objective and scope.

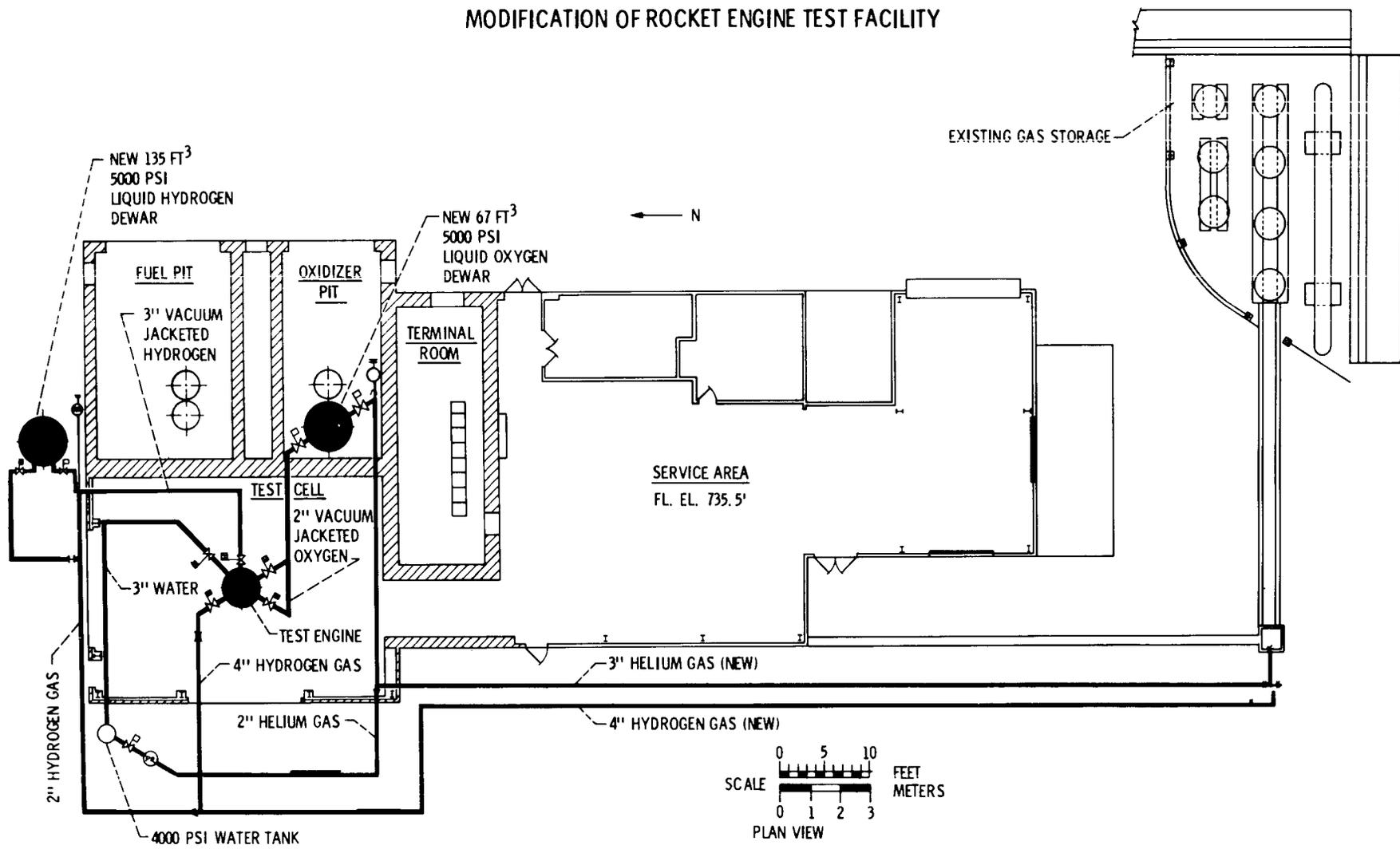
LEWIS RESEARCH CENTER FISCAL YEAR 1975 ESTIMATES MODIFICATION OF ROCKET ENGINE TEST FACILITY



LEWIS RESEARCH CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATION OF ROCKET ENGINE TEST FACILITY



**LEWIS RESEARCH CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATION OF ROCKET ENGINE TEST FACILITY**



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
CONSTRUCTION OF FACILITIES
FISCAL YEAR 1975 ESTIMATES
SUMMARY

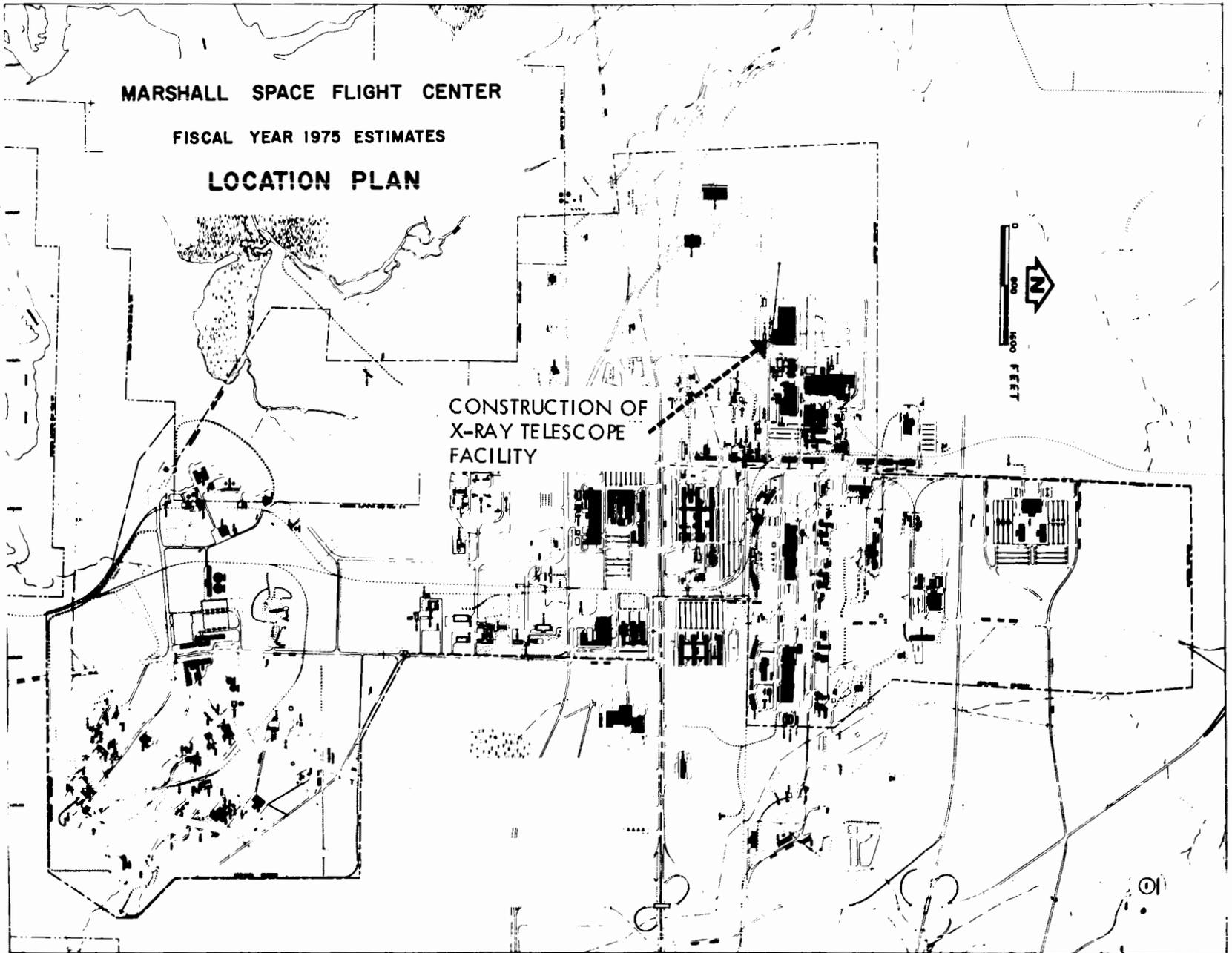
Marshall Space Flight Center

	<u>Amount</u>	<u>Page No.</u>
Location plan.....		CF 7-1
<u>Office of Space Science:</u>		
Construction of X-ray telescope facility...	<u>\$4,060,000</u>	CF 7-2

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1975 ESTIMATES

LOCATION PLAN



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	Construction of X-Ray Telescope Facility
LOCATION	Marshall Space Flight Center
	FY 1975 CoF ESTIMATE \$4,060,000

COGNIZANT INSTALLATION: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$420,000
Construction	<u>9,142,330</u>
Total FY 1974 and Prior Years	<u>\$9,562,330</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide for the construction of a facility to calibrate and test large diameter X-ray focusing mirrors and X-ray detectors.

The facility, which is to be located adjacent to an existing building at the Marshall Space Flight Center, will consist of an X-ray source chamber, a 1,000 foot long guide tube (305 meters) and an instrument chamber with associated vacuum pumping equipment.

The justification for this facility is based on the test requirements for the HEAO-B mission which is to be launched in 1978. To meet the launch schedule, testing of the X-ray mirrors and detectors must begin in early CY 1976. Accordingly, the facility must be completed and checked out by the end of CY 1975.

No existing ground facility is capable of calibrating and testing the HEAO-B telescope system because of its size. Furthermore, adjustments to the mirror and detectors on the spacecraft after it is launched into orbit are not possible.

It is planned to test and calibrate future astronomy payloads such as the Large Space Telescope (LST), X-Ray Sounding Rocket experiment, and optical sensors, such as star trackers, in this facility.

PROJECT JUSTIFICATION:

The Astronomy Missions Board and the Physical Sciences Committee, advisory boards to NASA, as well as the Space Science Board of the National Academy of Science, have given the HEAO program the highest priority in astronomy for the next decade.

The first three (3) HEAO's are now currently scheduled for launch in 1977, 1978, and 1979.

The second HEAO mission, HEAO-B, will carry four X-ray mirrors nested inside each other and aligned to focus a beam of radiation to a common point. A set of detectors will be located at this focal point to measure the properties of the beam, and thus provide information about the X-ray source.

The mirrors and detectors must be aligned, calibrated, and tested on the ground in order to establish the system performance and assure wavelength response. Minimal adjustment of the detectors into the beam while the system is in orbit is planned; repolishing, if necessary; and large adjustments to the system must be accomplished on the ground.

The facility is designed to provide a simulation of a stellar X-ray source. In space, X-rays travel from distant stars through vacuum over essentially infinite distances. These beams of radiation will strike the telescope in parallel paths.

On earth, infinite distances are not possible nor is the hard vacuum of space. These can only be approximated.

In the planned facility, the radiation must be brought to a reasonable focus to evaluate the performance of the X-ray optics. Since the test radiation is not truly parallel, a multiple focus effect will occur. The path must be such that a "circle of confusion" or "blur circle" will exist that is 2 arc seconds to evaluate the desired telescope performance. This resolution requirement necessitates provision of a path 1,000 feet (305 meters) long. Furthermore, since the radiation in these wavelengths is heavily attenuated in air, the path length of the radiation must be subjected to a significant vacuum.

PROJECT DESCRIPTION:

This project provides for construction of an X-ray telescope calibration and test facility. The principal components of this facility are an X-ray source chamber and telescope or instrument chamber which are interconnected by a guide tube, and an oil free vacuum pumping system of 10^{-6} torr range for the chambers and 10^{-4} torr for the guide tube.

The source chamber is a 4 foot diameter by 4 foot long (1.22 x 1.22 meters) stainless steel cylinder for containing an X-ray source with an alignment and control system. It will have a vacuum pumping system and access ports. The source chamber is housed in a 300 square foot (28.17 square meters) pre-engineered structure which provides a shelter for the chamber. A liquid nitrogen supply is required for the chambers and guide tube.

The source chamber will connect to the instrument chamber by a steel guide tube. The guide tube is 3 feet in diameter by 1,000 feet (.914 x 305 meters) long with isolating valves and inserts which will permit maintenance of a vacuum in the guide tube while either the source or target chambers are opened for access. The guide tube will have baffles to prevent scattering by absorbing off-axis X-rays. The guide tube will require vacuum pumping, structural supports and access ports for maintenance along its length. An aluminum cover is required to control thermally-induced gradients across the guide tube.

The instrument chamber will be a stainless steel cylindrical structure 20 feet in diameter by 25 feet long (6.1 x 7.62 meters).

The chamber will have a vacuum pumping system, removable dished head at one end to permit installation and removal of the X-ray telescope alignment table, and the test article.

There will be an environmentally controlled building addition to house the instrument chamber and auxiliary equipment. This addition will have approximately 2,400 square feet (223 square meters) of floor area, and height from floor to roof trusses of about 24 feet (7.3 meters). It is located so as to enable the use of an existing cleanroom for test article set up. An instrumentation and control system for operational control of the facility and equipment for data acquisition will be provided. An excess instrument vacuum chamber, source chamber, and LN₂ storage tanks have been identified and committed to the project.

The development and qualification testing will require use of related equipment and fixtures for special measurements, filming and developing, data analysis, and laboratory instrumentation. These items will be funded out of R&D sources and are estimated to cost \$500,000 at this time.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$560,000</u>
Site development				200,000
Cleaning and grading	Job	---	---	(75,000)
Paving	SY	3,000	\$3.33	(10,000)
Utilities	Job	---	---	(115,000)
Building/structures				360,000
Building	SF	4,425	74.58	(330,000)
Source buildings	LS	---	---	(30,000)
<u>Equipment</u>				<u>3,500,000</u>
Guide tube	LF	1,000	695.00	695,000
Instrument chamber	Each	1	---	310,000
Source chamber	Each	1	---	40,000
Vacuum systems	Job	---	---	750,000
Cryogenic systems	Job	---	---	390,000
Optical Bench	Each	1	---	390,000
Chamber environmental control system	Each	1	---	310,000
X-ray source	Each	1	---	25,000
Electrical	Job	---	---	365,000
Data system	Job	---	---	130,000
Mass spectrometer leak check	Job	---	---	95,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	<u>---</u>
			TOTAL	<u><u>\$4,060,000</u></u>

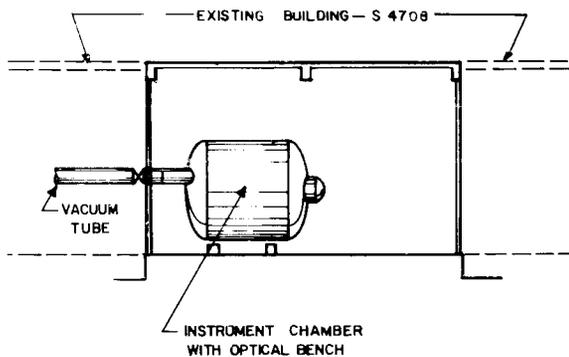
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

For presently planned usage there are no currently foreseen future funding requirements necessary to complete this project.

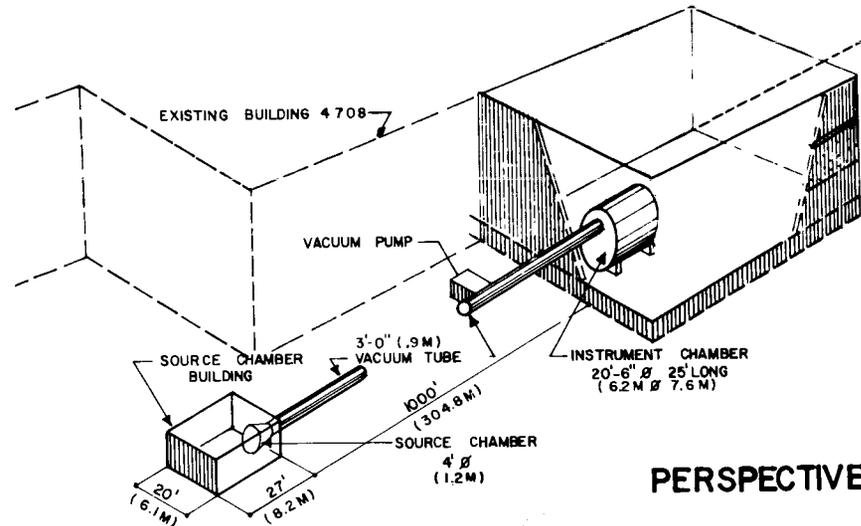
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1975 ESTIMATES

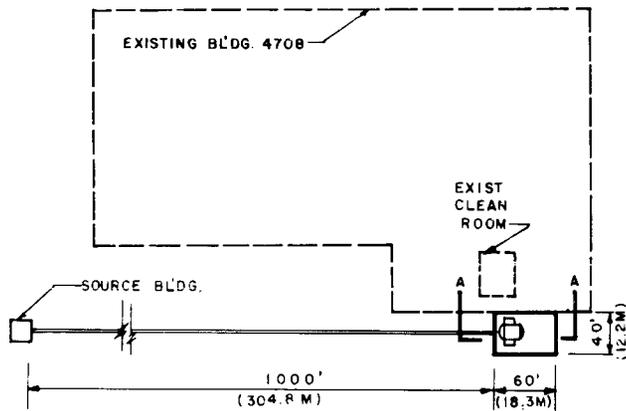
CONSTRUCTION OF X-RAY TELESCOPE FACILITY



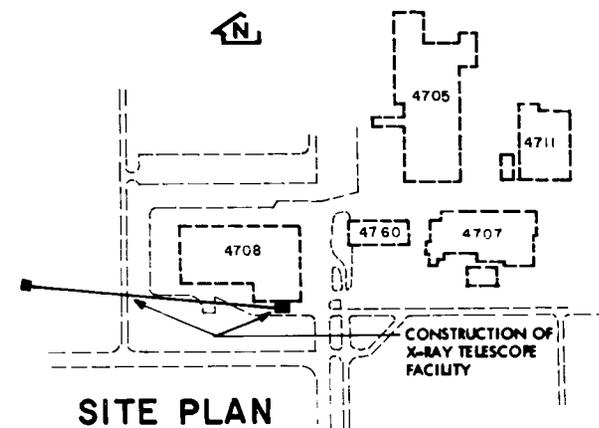
SECTION A-A



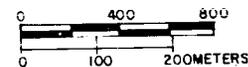
PERSPECTIVE



PLAN



SITE PLAN



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

SUMMARY

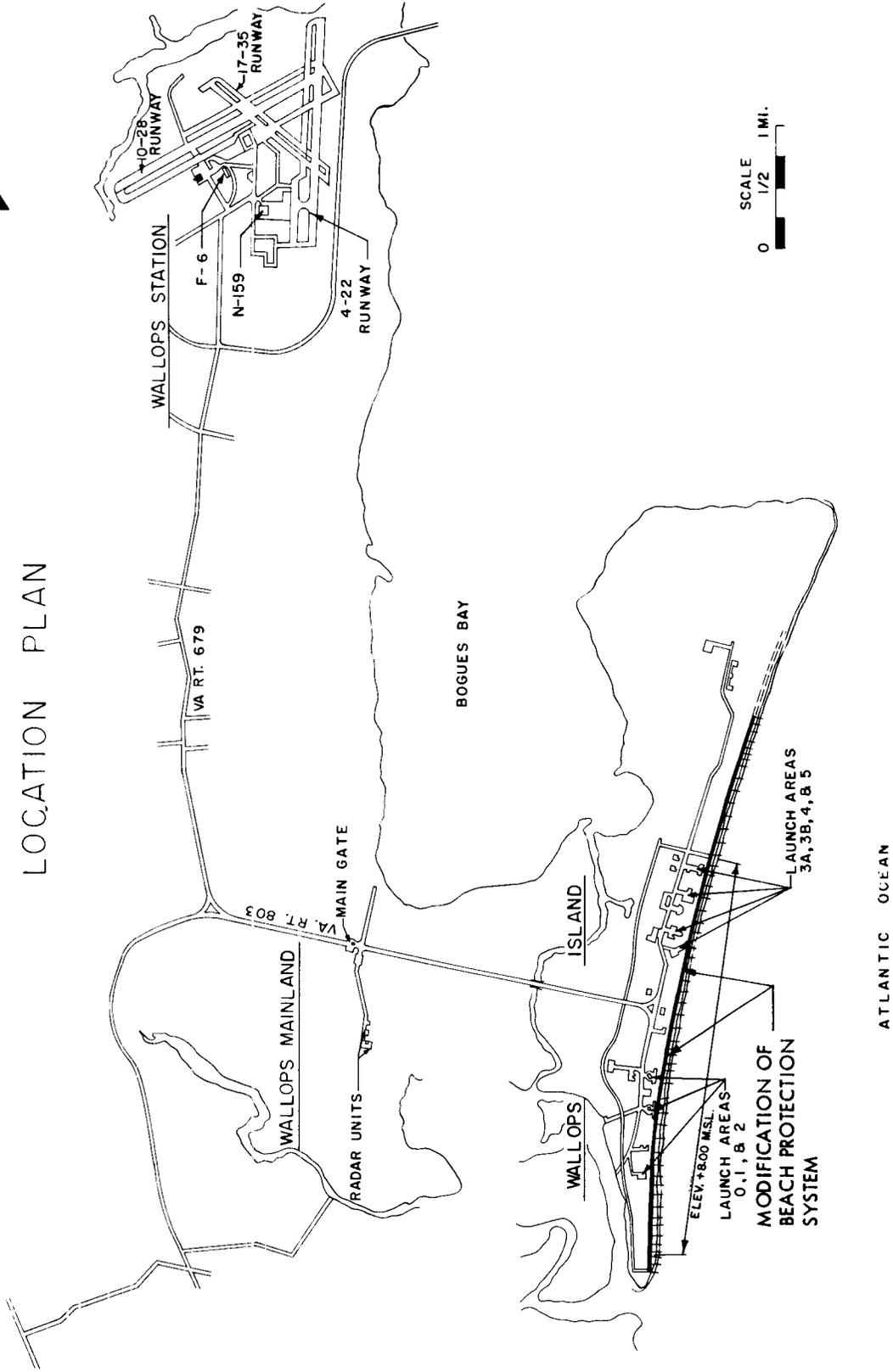
Wallops Station

	<u>Amount</u>	<u>Page No.</u>
Location plan.....		CF 8-1
<u>Office of Space Science:</u>		
Modification of beach protection system....	<u>\$1,370,000</u>	CF 8-2

WALLOPS STATION

FISCAL YEAR 1975 ESTIMATES

LOCATION PLAN



ATLANTIC OCEAN

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modification of Beach Protection System</u>
LOCATION	<u>Wallops Station</u>
	FY 1975 CoF ESTIMATE <u>\$1,370,000</u>

COGNIZANT INSTALLATION: Wallops Station

LOCATION OF PROJECT: Wallops Island, Accomack County, Virginia

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$75,000
Construction	<u>3,573,021</u>
Total FY 1974 and Prior Years	<u>\$3,648,021</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to strengthen and raise the existing seawall and groin system to +12 feet mean sea level (m.s.l.) to provide minimum protection from storm impacts for the launch facilities on Wallops Island.

PROJECT JUSTIFICATION:

The Wallops Station launch facilities, located on Wallops Island, are protected from wave action and high seas by a seawall and groin system. The original wall was constructed in 1943 and has been extended at three separate later times. The elevation of the original 10,200 linear feet (3,108 meters) of seawall and groin system constructed in 1943 and the 4,800 linear feet (1,463 meters) added in 1958 is +8 feet (2.4 meters) m.s.l. A 4,100 linear foot (1,250 meters) addition was constructed in 1969 at an elevation of +10 feet (3.0 meters) m.s.l. then envisioned as potentially adequate. Both of the sections, however, have suffered damage in the following years and continue to erode due to wave and sea action. The latest 3,600 linear foot (1,097.2 meters) addition on the north end was installed at +12 feet (3.6 meters) m.s.l. in 1971 and this last higher section has given very satisfactory protection.

The +8 and +10 foot m.s.l. sections were badly damaged by the high tides and wave actions in the numerous storms off the coast of Wallops Island during 1972-73. Earth fill over and behind the seawall has been washed away, and continuing storms could well cause the launch areas to become inundated. It is necessary to raise the effective elevation of the beach protection system to protect the valuable launching and tracking facilities on Wallops Island. Approximately 1,000 linear feet of seawall at the south end of the Island is very seriously deteriorated and will be abandoned as it is not now required to protect any existing long term facilities.

PROJECT DESCRIPTION:

The existing bulkhead will be repaired and strengthened as necessary by installing additional piles in front of and behind the existing seawall. Approximately 14,000 linear feet (4,267.2 meters) of +8 (2.4 meters) m.s.l. will be raised to +12 (3.6 meters) m.s.l. and the 4,100 feet (1,250 meters) of seawall at +10 (3.0 meters) m.s.l. will be raised to +12 (3.6 meters) m.s.l. by installing precast interlocking concrete blocks. The blocks will be installed on a slope to form a revetment on the seaward face of the existing earth fill to the rear. Additional fill will be provided where necessary.

PROJECT COST ESTIMATE:

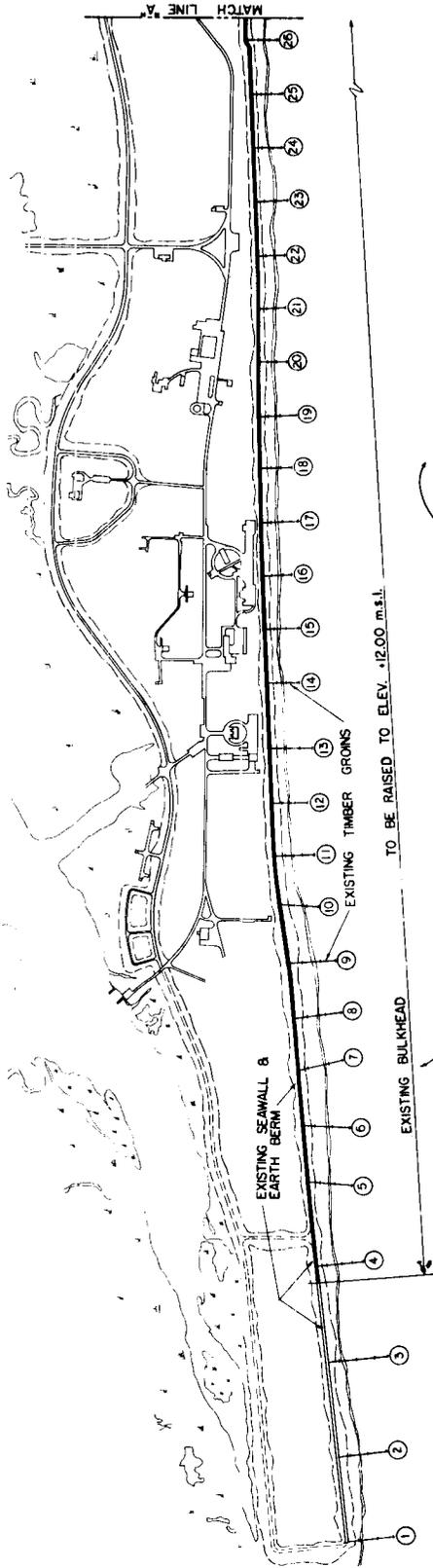
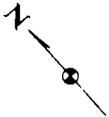
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$1,370,000</u>
Repair groins	LS	---	---	300,000
Excavation and piles	LS	---	---	415,000
Concrete	LS	---	---	655,000
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	---
			TOTAL	<u><u>\$1,370,000</u></u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

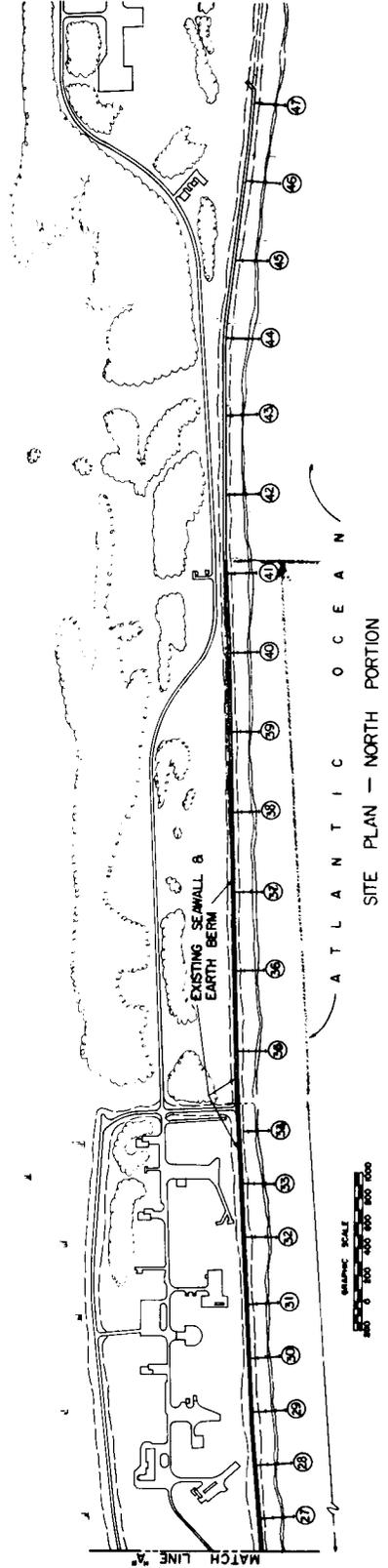
For presently planned usage, there are no current foreseen future funding requirements necessary to complete this project. However, for continuing maintenance of the beach erosion protection, funds in the amount of \$200,000 may be needed each year dependent on the extent of extreme storm actions as well as routine wear and tear.

WALLOPS STATION
FISCAL YEAR 1975 ESTIMATES

MODIFICATION OF BEACH PROTECTION SYSTEM



ATLANTIC OCEAN
SITE PLAN - SOUTH PORTION



ATLANTIC OCEAN
SITE PLAN - NORTH PORTION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

SUMMARY

Various

	<u>Amount</u>	<u>Page No.</u>
<u>Office of Space Science:</u>		
Construction of infrared telescope facility.....	\$6,040,000	CF 9-1
<u>Office of Tracking and Data Acquisition:</u>		
Modifications for fire protection and safety at various tracking stations.....	<u>1,430,000</u>	CF 9-5
Total Various.....	<u>\$7,470,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Construction of Infrared Telescope Facility</u>
LOCATION	<u>Location to be Designated</u>
	FY 1975 CoF ESTIMATE <u>\$6,040,000</u>

COGNIZANT INSTALLATION: NASA Headquarters

LOCATION OF PROJECT: Location to be Designated

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$200,000
Construction	<u>---</u>
Total FY 1974 and Prior Years	<u>\$200,000</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to construct a large aperture (3-meter diameter primary mirror) ground-based infrared telescope for the observation of the planets, their satellites, and other objects in the solar system. Such observations will be in that portion of the infrared wavelength range from one micrometer to one millimeter which can be covered from the ground. Major emphasis will be placed on observations of the outer planets and their satellites. The telescope will also be available for observations of other astronomical objects in this wavelength range. The telescope facility will consist of the telescope, including optics and mounting, auxiliary instrumentation, and the appropriate building and supporting utilities.

Five locations are under consideration as the site for this research facility: (1) Mauna Kea, Hawaii; (2) Baja California, Mexico; (3) White Mountain, California; (4) Mount Lemmon, Hawaii; and (5) Kitt Peak, Arizona. The choice of location will be based on the quality of the site for infrared observations and on the logistics required for the operation of the facility. The Hawaiian site has been used as a "baseline" for the project cost estimate as it is considered representative of the sites presently under review.

PROJECT JUSTIFICATION:

This new ground-based planetary research facility is required to provide supporting and complementary data to planetary exploration flight programs. With the spectacular success of Pioneer 10, NASA is planning to embark upon a detailed exploration of the outer solar system where 99% of the total mass of the planetary system lies. The next mission, after Pioneer 11 which will encounter Jupiter in December 1974, is Mariner Jupiter/Saturn scheduled to be launched in August 1977. The infrared telescope will play a major role in optimizing the scientific return from this mission. All outer planets and their satellites are cold bodies and, therefore, emit radiation largely in the far infrared which when studied from earth-based telescopes can begin to provide basic data on the temperatures and surface characteristics of these planets and their satellites. This data can then be used to determine which of the satellites of Jupiter and Saturn are of the greatest scientific interest. This information is required in early 1977 prior to launch of the Mariner Jupiter/Saturn mission in order to permit the maximum improvements in the planning for the Jupiter encounter in 1979.

In recognition of the fact that no existing telescopes provide the necessary capability to make such ground-based studies of the planets and other astronomical objects in the middle and far infrared portion of the spectrum, the recently completed National Academy of Sciences' report "Astronomy and Astrophysics for the 1970's" included as third among their recommendations of the four programs of highest priority, "A significant increase in support and development of the new field of infrared astronomy, including construction of a large ground-based infrared telescope..."

PROJECT DESCRIPTION:

This project will consist of the large aperture infrared telescope and the associated 17,000 square foot (1,600 meters) observatory building.

The infrared telescope will be designed specifically for use in the middle and far infrared. A 3-mirror optical system will be used with a 3-meter diameter primary mirror optimately designed to produce a diffraction limited image at a wavelength of 5 micrometers. The telescope mounting will have a usable focus at the cassegrain or telescope fixed position to permit using heavy auxiliary equipment. A specially mounted secondary mirror will give a cassegrain focal ratio of 20 or greater. The secondary mirror can be oscillated, a feature required for infrared observations. The third mirror, an optical flat, will direct the light beam to the fixed focus. A computer operated drive and control system will permit absolute pointing of the telescope with sufficient accuracy to observe nonvisible infrared sources.

The building will have two levels with the upper level including the observing floor containing the telescope. The control room will be on the

upper level and one or more focus rooms, electronics room and telescope drive room on the first level. The telescope will be mounted on concrete piers independent of the building and anchored to the subsurface material. The piers will be extended to provide support for auxiliary instrumentation. The 90-foot (27.4 meters) observing floor will be covered with a rotating dome.

PROJECT COST ESTIMATE:

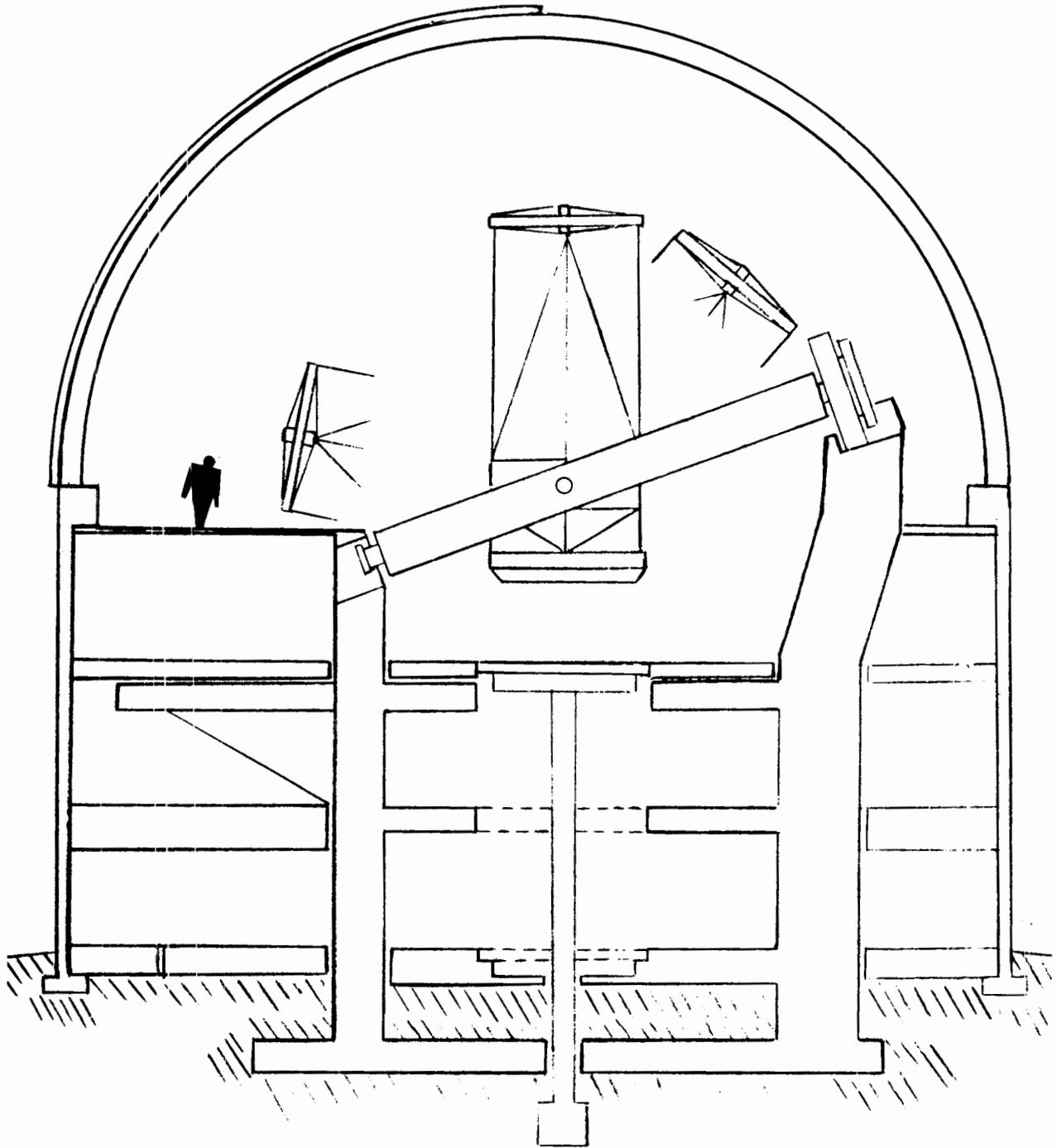
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$2,440,000</u>
Site work/utilities	LS	---	---	435,000
Observatory building	SF	17,000	\$47.94	815,000
Telescope piers and substructure	LS	---	-	290,000
Rotating dome	LS	---	---	900,000
<u>Equipment</u>				<u>\$3,600,000</u>
Optical system	LS	---	---	800,000
Telescope mount and controls	LS	---	---	2,400,000
Auxiliary instrumentation	LS	---	---	400,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	---
			TOTAL	<u>\$6,040,000</u>

Approximately \$200,000 of miscellaneous existing equipment, primarily auxiliary instrumentation, will be utilized in this facility.

FUTURE CoF FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There are no presently known additional requirements needed to meet the outlined objectives of this project.

**VARIOUS LOCATIONS
FISCAL YEAR 1975 ESTIMATES
CONSTRUCTION OF INFRARED TELESCOPE FACILITY**



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modifications for Fire Protection and Safety</u>
LOCATION	<u>Various Spaceflight Tracking and Data Network Stations and Deep Space Network Stations</u>
FY 1975 CoF ESTIMATE <u>\$1,430,000</u>	

COGNIZANT INSTALLATION: Goddard Space Flight Center and Jet Propulsion Laboratory

LOCATION OF PROJECT: Spaceflight Tracking and Data Network Stations and Deep Space Network Stations

COGNIZANT PROGRAM OFFICE: Office of Tracking and Data Acquisition

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$340,000
Construction	<u>5,499,000*</u>
Total FY 1974 and Prior Years	<u>\$5,839,000</u>

SUMMARY PURPOSE AND SCOPE:

This is the fifth increment of this specific program to provide improved fire protection for the tracking and data acquisition network stations. This program, which was instituted in 1970, corrects the more serious deficiencies identified by a thorough survey of each station conducted by fire protection engineers and consultants. It provides those measures of fire protection prudently and realistically required by these stations to reduce the most critical risks.

PROJECT JUSTIFICATION:

At these stations, generally fire protection for facilities and technical equipment has lagged behind the introduction of newly recognized and more

* This construction cost relates only to the modifications for fire protection funded in prior years CoF for both networks.

stringent fire protection standards especially for the technical (electronic) equipment. For example, recent revised fire protection standards for electronic equipment have introduced the requirement for water sprinkler systems for electronic equipment (including computers) operating area.

Very few deficiencies were discovered by the survey made by fire protection engineers and consultants that would significantly contribute to loss of life by fire. In addition, there were no problems peculiar to tracking and data acquisition stations which could not be corrected by standard methods. Considerations, however, had to be given to the fact that due to the isolation of tracking stations from established communities, station operations personnel alone must provide an adequate level of fire protection. Therefore, this program was instituted and designed to provide the electronic engineer, the electronic technician, the power plant operator, etc., with the necessary capability to protect tracking station equipment and facilities.

PROJECT DESCRIPTION:

Using the fire protection survey for a basis, this program provides for the following: increase in water supply, storage and distribution systems, sprinkler systems, detection systems, relocation of day tanks external to buildings, installation of remote shutdown switches for electronic systems and utility systems, pressure pumps, hose houses, and essential fire protection/safety building modifications. This project will complete the storage, distribution, sprinkler, and detection systems for the Deep Space Network (DSN).

(Thousands of Dollars)

Station	Storage	Distribution	Sprinkler	Detection	Other*	Total
<u>DSN</u>						<u>\$733</u>
Goldstone, Calif.	-	\$ 22	\$ 64	\$78	\$144	308
Canberra, Aust.	34	104	103	37	21	299
Madrid, Spain	-	-	47	33	46	126
<u>STDN</u>						<u>627</u>
Canberra, Aust.	-	58	190	10	45	303
Madrid, Spain	-	-	-	50	40	90
Transportable	-	-	-	40	-	40
Goldstone, Calif.	-	-	-	33	78	111
Rosman, No. Carolina	-	-	-	20	82	102
Mila, Florida	-	-	-	19	32	51
TOTAL	<u>\$34</u>	<u>\$184</u>	<u>\$404</u>	<u>\$320</u>	<u>\$438</u>	<u>\$1,430</u>

* Described on following page.

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(Thousands of Dollars)

<u>Station</u>	<u>Storage</u>	<u>Distribution</u>	<u>Sprinkler</u>	<u>Detection</u>	<u>Other*</u>	<u>Total</u>
<u>DSN</u>						<u>\$733</u>
Goldstone, Calif.						
Pioneer	-	-	\$10	\$20	\$25	55
Echo	-	-	10	15	55	80
Venus	-	-	-	18	20	38
Mars	-	\$22	34	15	44	115
Microwave/Airport	-	-	10	10	-	20
Tidbinbilla, Aust.	-	18	46	18	10	92
Honeysuckle, Aust.	\$34	86	57	19	11	207
Robeldo, Spain	-	-	22	18	28	68
Cebreros, Spain	-	-	25	15	18	58
<u>STDN</u>						<u>697</u>
Orroral Valley, Aust.	-	58	190	10	45	303
Madrid, Spain	-	-	-	50	40	90
Transportable	-	-	-	40	-	40
Mojave, Calif.	-	-	-	15	28	43
Goldstone, Calif.	-	-	-	18	50	68
Rosman, No. Carolina	-	-	-	20	82	102
Mila, Florida	-	-	-	19	32	51
<u>TOTAL</u>	<u>\$34</u>	<u>\$184</u>	<u>\$404</u>	<u>\$320</u>	<u>\$488</u>	<u>\$1,430</u>

*Described on following page.

* Other - Provides fire protection/safety building modifications such as fire doors, replace combustible ceilings, fireproof structural members and emergency lighting.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$1,410,000</u>
Architectural	LS	---	---	315,000
Mechanical	LS	---	---	575,000
Electrical	LS	---	---	520,000
<u>Equipment</u>	LS	---	---	<u>20,000</u>
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	<u>---</u>
			TOTAL	<u>\$1,430,000</u>

At this time, no other equipment items, either collateral or noncollateral, have been identified as being required for the initial operation or use of this project.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROGRAM:

Approximately \$1.7 million may be required to complete the fire protection modifications to the Spaceflight Tracking and Data Network (STDN). This requirement will be considered in future years on a priority basis.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

SPACE SHUTTLE FACILITIES

	<u>Amount</u>	<u>Page No.</u>
<u>Office of Manned Space Flight:</u>		
Summary.....		CF 10-1
<u>Launch and Landing Facilities.....</u>	<u>\$71,950,000</u>	
Construction of Orbiter Landing Facilities, Kennedy Space Center, Florida.....	15,880,000	CF 10-4
Construction of Orbiter Processing Facility, Kennedy Space Center, Florida.....	13,380,000	CF 10-12
Modifications to Launch Complex 39, Kennedy Space Center, Florida.....	42,690,000	CF 10-18
<u>Ground Test Facilities.....</u>	<u>7,480,000</u>	
Modifications for Dynamic Test Facilities, Marshall Space Flight Center, Alabama and NASA Industrial Plant, Downey, California.....	3,920,000	CF 10-30
Construction of Orbiter Horizontal Flight Test Facilities, Flight Research Center, California..	1,940,000	CF 10-37
Modifications for Crew Training Facilities, Johnson Space Center, Houston, Texas.....	420,000	CF 10-46
Modification of the Vibration and Acoustic Test Facility, Johnson Space Center, Houston, Texas..	410,000	CF 10-51
Construction of Materials Test Facility, White Sands Test Facility, New Mexico.....	790,000	CF 10-55
<u>Solid Rocket Booster Production and Test Facilities.</u>	<u>6,590,000</u>	
Modifications for Solid Rocket Booster Structural Test Facilities, Marshall Space Flight Center, Alabama.....	2,590,000	CF 10-61
Construction/Modification of Solid Rocket Motor Production and Test Facilities (Location to be designated).....	<u>4,000,000</u>	CF 10-67
TOTAL.....	<u>\$86,020,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Space Shuttle Facilities</u>
	FY 1975 CoF ESTIMATE <u>\$86,020,000</u>

COGNIZANT INSTALLATION: Various Locations

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

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$17,925,000
Construction	<u>105,625,000</u>
Total FY 1974 and Prior Years	<u>\$123,550,000*</u>

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 necessary to meet unique requirements in support of the space shuttle program. In FY 1975, these facilities are primarily for the launch and landing requirements at John F. Kennedy Space Center. The work includes completing the construction of the landing facilities that were initiated with FY 1974 resources, the construction of an orbiter processing facility for maintenance and checkout of the orbiter and modifications to the Launch Complex 39 to support the launch of the space shuttle. FY 1975 requirements at other locations include modifications and additions to existing facilities to provide major ground test capability for dynamic testing of the shuttle vehicle, horizontal flight testing of the orbiter vehicle, crew training, vibro-acoustic testing and material testing. In addition, facility requirements to support the production and tests of the solid rocket motors during the design, development, test and evaluation phase of the program have also been included.

.....
*For unique space shuttle facilities provided under the CoF program only.

PROJECT JUSTIFICATION:

To meet present space shuttle program requirements, FY 1974 and prior Construction of Facilities projects provided for the technology facilities, engine test facilities, manufacturing facilities for the orbiter and external tanks and a portion of the ground test facilities. Construction of these facilities is currently in progress to meet the shuttle development needs. Of major significance is the first phase of the orbiter landing facilities which was included in the FY 1974 program. Final design of these facilities has now been completed and construction is scheduled to begin early in 1974.

The FY 1975 request is primarily planned to provide the second phase of the orbiter landing facilities and the first and major phase of the launch facilities at the Kennedy Space Center. These launch and landing facilities at KSC comprise more than 80% of the FY 1975 shuttle facilities request. The work involved is needed to provide operable facilities for the shuttle launch and landing and will require long construction and activation time in view of the magnitude and complexity of these requirements. Furthermore, these facilities must be operable at least one year before the first manned orbital flight to support receipt of the shuttle major elements and the extensive checkout activities required before the first launch. For these reasons, programming of these facilities in FY 1975 is necessary.

The remaining projects, in this FY 1975 request, are vital for providing and continuing the major ground test capabilities necessary for the shuttle development. These include facility modifications to conduct dynamic tests of the shuttle mated elements; construction of support facilities for horizontal flight testing of the orbiter; modification to crew training facilities for training of ground and flight personnel in shuttle operations; upgrading the amplifier system to support the orbiter vibro-acoustic test program; and to provide adequate capability for hazardous material testing. In addition, this project provides modification to those facilities deemed to be most probably needed in support of the solid rocket production and test during the design, development, test and evaluation phase (DDT&E) of this program.

Current space shuttle planning is based on achieving a first horizontal flight test in the second quarter of CY 1977, and a first manned orbital flight in the second quarter of CY 1979. The FY 1975 request for space shuttle facilities is necessary to support these major milestones. Each project is required to meet a specific target or intermediate milestone directly relatable to either the first horizontal flight or first vertical flight. The individual project writeups specifically designate the intermediate milestone involved.

CF 10-2

SUMMARY PROJECT COST ESTIMATE:

Launch and Landing Facilities.....	\$71,950,000
Ground Test Facilities.....	7,480,000
Solid Rocket Booster Production and Test Facilities.....	<u>6,590,000</u>
TOTAL	<u>\$86,020,000</u>

PROJECT COST ESTIMATE:

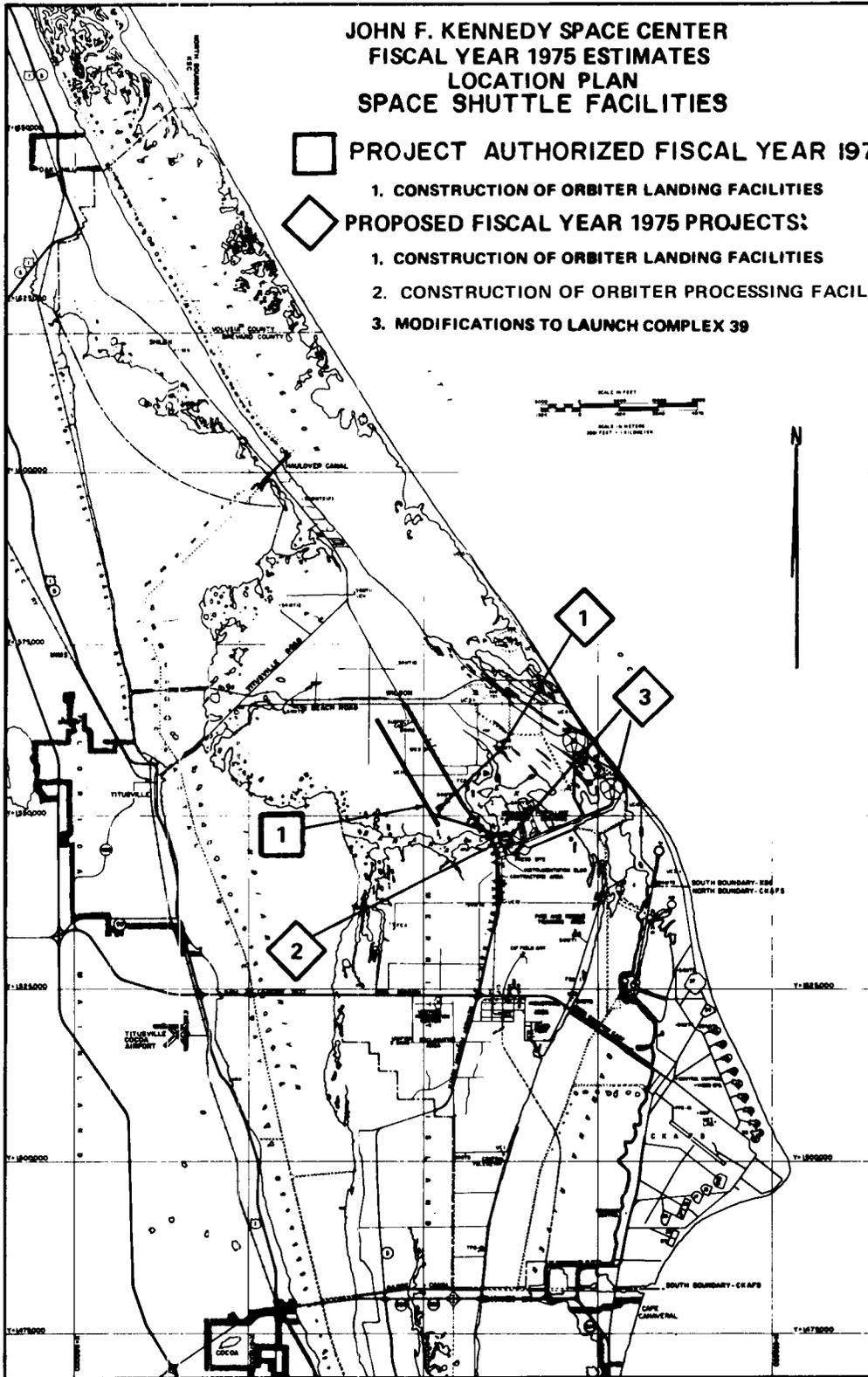
<u>Launch and Landing Facilities.....</u>	<u>\$71,950,000</u>
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Construction of Materials Test Facility, White Sands Test Facility, New Mexico.....	790,000
<u>Solid Rocket Booster Production and Test Facilities.....</u>	<u>6,590,000</u>
Modifications for Solid Rocket Booster Structural Test Facilities, Marshall Space Flight Center, Alabama.....	2,590,000
Construction/Modification of Solid Rocket Motor Production and Test Facilities (Location to be designated).....	<u>4,000,000</u>
TOTAL	<u>\$86,020,000</u>

PROJECT DOCUMENTATION:

There follows, in the order of the above listing, a detailed justification, description, and cost estimate for each subproject.

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
LOCATION PLAN
SPACE SHUTTLE FACILITIES**

- PROJECT AUTHORIZED FISCAL YEAR 1974
- 1. CONSTRUCTION OF ORBITER LANDING FACILITIES
- PROPOSED FISCAL YEAR 1975 PROJECTS:
- 1. CONSTRUCTION OF ORBITER LANDING FACILITIES
- 2. CONSTRUCTION OF ORBITER PROCESSING FACILITY
- 3. MODIFICATIONS TO LAUNCH COMPLEX 39



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Construction of Orbiter Landing Facilities</u>
LOCATION	<u>John F. Kennedy Space Center</u>
	FY 1975 CoF ESTIMATE <u>\$15,880,000</u>

COGNIZANT INSTALLATION: John F. Kennedy Space Center

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$1,428,000
Construction	<u>17,300,000*</u>
Total FY 1974 and Prior Years	<u>\$18,728,000</u>

SUMMARY PURPOSE AND SCOPE:

This project is a continuation and extension of the construction work provided for in FY 1974 for the orbiter landing facilities at Kennedy Space Center (KSC). The FY 1974 project included the runway, parking apron, "tow-way" to the Vehicle Assembly Building and related utilities. This FY 1975 project provides for a landing aids control building, supporting structures for the landing instrumentation system and associated utilities. It also provides for the necessary added resources to complete the total work included in the FY 1974 project.

PROJECT JUSTIFICATION:

The orbiter, after completing its space mission, will return to the launch site and land in a manner similar to an unpowered aircraft. To accomplish this, construction of the landing facilities at the Kennedy Space Center is required. These same facilities will be used for landing the orbiter after a ferry flight from the final assembly plant or the horizontal flight test site on the west coast.

.....
*Budget authority approved against the FY 1974 request of \$28.2 million for this project.

The FY 1974 program provided for the basic but major portion of the required landing facilities. These included a 15,000 foot x 300 foot (4,572.0 meter x 91.4 meter) runway, a parking apron, a 10,600 foot x 50 foot (3,230.9 meter x 15.2 meter) "tow-way" and associated airfield lighting and utilities. The FY 1975 additional request provides for the navigation and instrumentation facilities that are essential to guide the orbiter to a safe landing, the associated site work and utilities, and for the completion of the FY 1974 work.

After re-entering from space, the orbiter must be guided to a safe landing, rollout and stop under all weather conditions. To accomplish this, navigational aids and an instrument landing system must be provided. Since the orbiter will normally land unpowered, these systems are even more critical for a safe landing than comparable facilities for conventional aircraft operations. The orbiter maneuvers in the landing area must be precise, timely and closely monitored. This will require an automatic instrument landing system, radio and radar approach system, meteorological system, a television system for position monitoring, airfield lighting control system and communication equipment. The additional authorization requested provides the facilities to house and accommodate the total navigational and instrumentation system.

To meet the first manned orbital flight approved schedule, the first orbiter must be delivered in early CY 1978 for its integration into the launch and landing complex and for extended, essential prelaunch activities. These include verification of horizontal flight tests, installation and checkout of rocket engines, mating and integration of the orbiter to the external tank and the solid rocket booster, integrated checkout of the mated shuttle vehicle and flight readiness firing of the orbiter main engines. Therefore, the landing facilities must be operationally ready in early CY 1978 to receive the flight orbiter for the manned mission. Based on this schedule, construction of the first increment, including the earth-work runway paving and utilities, will start in early CY 1974. The second increment must be phased into the total project in sufficient time and in the proper sequence to preclude conflicts in construction schedules, to permit timely activation and checkout and to insure operable landing facilities by early CY 1978. This necessitates that the added construction reflected by this increment begin in early CY 1975, thus requiring FY 1975 resources.

PROJECT DESCRIPTION:

The FY 1974 increment of this project included extensive site preparation and earthwork, a 15,000 foot (4,572.0 meter) runway with overruns and a small apron, "tow-way", airfield lighting, power and water system, and access roads. In addition to providing for the completion of this work, as reflected in the project cost estimate data, the proposed FY 1975 increment includes the following:

Site Preparation

Instrumentation and building sites must be cleared, grubbed and graded; and the necessary drainage structures must be installed.

Orbiter Landing Instrumentation Facilities

Six instrument landing system shelters, one weather surveillance radar shelter and a radio navigation system shelter of approximately 350 square feet (32.5 square meters) each will be constructed to house the electrical/electronic equipment. The shelters will be of masonry construction and will have environmentally controlled space to insure required equipment operating conditions.

Two operational television towers, approximately 70 feet (21.3 meters) high, will be constructed to provide an unobstructed view of orbiter landings and take-offs.

Landing Aids Control Building

This building, located near the parking apron, will be of metal construction and have a gross area of approximately 4,500 square feet (418.1 square meters). The building will house monitoring, control and termination equipment for: the instrument landing system, airfield lighting, navigational aids, radar, timing, communications, meteorological system and airfield emergency systems. The building will be air conditioned and will have raised floors where necessary for cooling and routing of cables to the electrical/electronic equipment to be housed in this facility.

Utilities

An electrical power distribution system and supervisory control system will be installed to provide power to the various landing facilities.

Communications and instrumentation cabling will be extended from the existing Vehicle Assembly Building Repeater Station to the Landing Aids Control Building and from there to the various instrumentation and building sites.

A new water distribution system will be installed to provide water for fire, domestic, and industrial uses. A 2,500 gallon (9,463.3 liter) per day capacity sewage treatment plant will be constructed near the Landing Aids Control Building and be connected to the building by a gravity sewer line.

Fire Protection and Safety

Fire detection and alarm systems will be provided in the various facilities and will be interconnected to existing systems at Launch Complex 39. A sprinkler system will be installed in the Landing Aids Control Building and a Halon 1301 system will be installed in all electrical and electronic areas.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$33,020,000</u>
Site preparation				3,540,000
Clear & grub	Acres	1,300	\$1,100	(1,430,000)
Other (fencing, seeding, & drainage)	LS	---	---	(1,760,000)
Building site preparation	LS	---	---	(350,000)
Earthwork				3,990,000
Excavation & borrow	CY	2,185,000	1.20	(2,620,000)
Grade, roll and other stabilization operations	LS	---	---	(1,370,000)
Paving - runway, tow-way, apron (15" and 16" PCC and 6" soil cement base coarse)	SY	627,000	23.45	14,700,000
Airfield lighting	LS	---	---	2,800,000
Landing instrumentation facilities	LS	---	---	340,000
Landing aids control building				540,000
Structure	SF	4,500	36.00	(162,000)
Electrical system	LS	---	---	(115,000)
Mechanical system	LS	---	---	(100,000)
Special communications and instrumentation cabling systems	LS	---	---	(163,000)
Utilities				7,050,000
Power system for airfield lighting	LS	---	---	(2,860,000)
Power system augmentation (navigation aids & communication systems)	LS	---	---	(3,190,000)
Basic airfield primary water system	LS	---	---	(360,000)

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Water distribution system	LS	---	---	(\$300,000)
Basic roads and parking	LS	---	---	(300,000)
Roads and parking augmentation	LS	---	---	(40,000)
Fire protection & safety	LS	---	---	60,000
<u>Equipment</u>				<u>160,000</u>
100 KVA emergency power unit	Each	1	\$160,000	160,000
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	<u>---</u>
		TOTAL		<u>\$33,180,000</u>
FY 1974 Budget Authority Approved				<u>17,300,000</u>
FY 1975 Budget Authority Requested				<u>\$15,880,000</u>

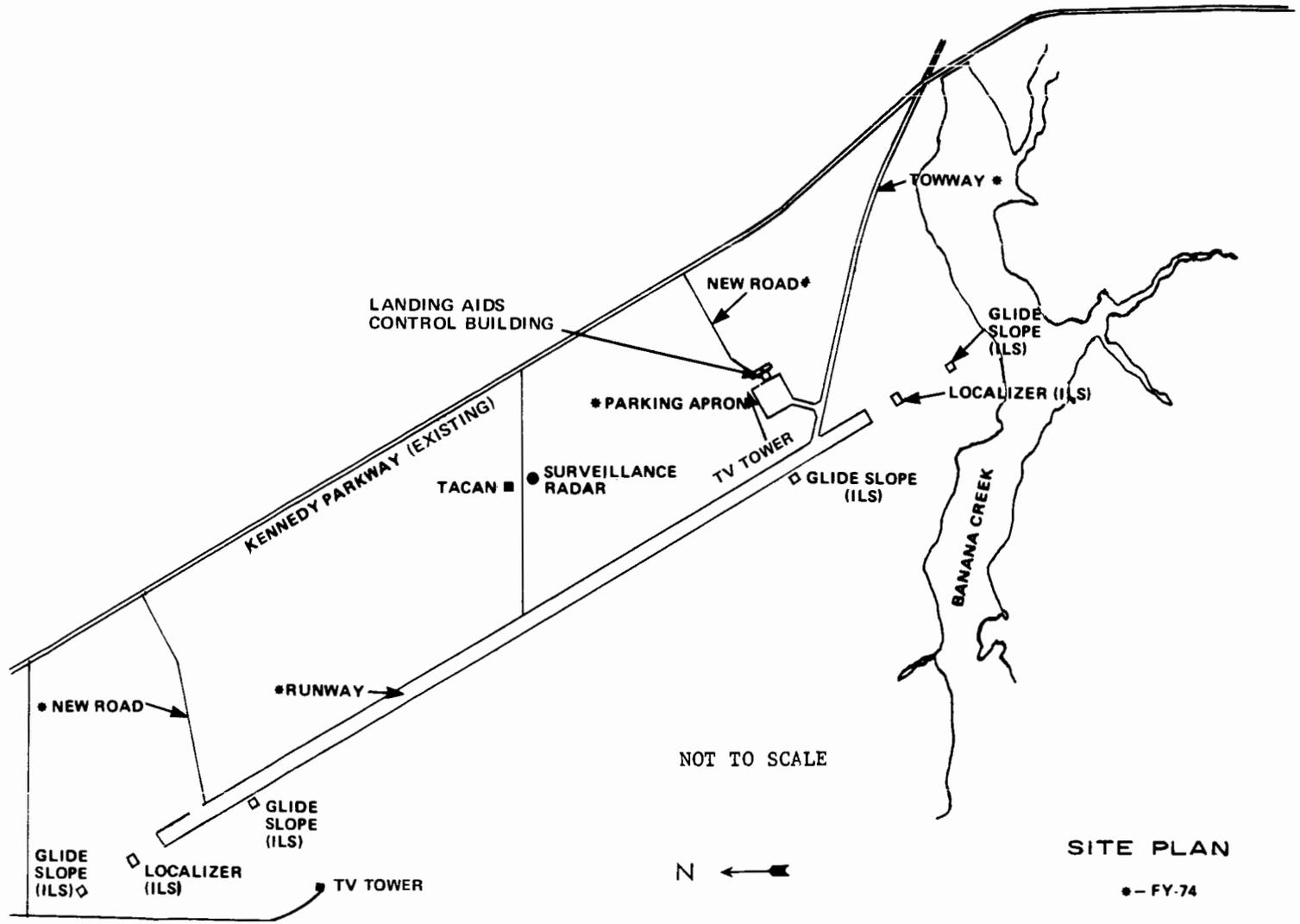
For initial operations it is anticipated that approximately \$7 million of R&D resources will be required to provide noncollateral equipment such as the landing instrumentation system, navigation and communications systems, and for the integration of these into the landing facilities and their checkout.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

The \$33,180,000 identified in the project cost estimate data for this project will essentially complete the facility requirements for the orbiter landing facilities with the exception of an emergency arresting system. This requirement is under review, and, if and when validated, will be requested in a future program at an estimated cost of \$1 - 1.5 million.

JOHN F. KENNEDY SPACE CENTER
 FISCAL YEAR 1975 ESTIMATES
 CONSTRUCTION OF ORBITER LANDING FACILITIES

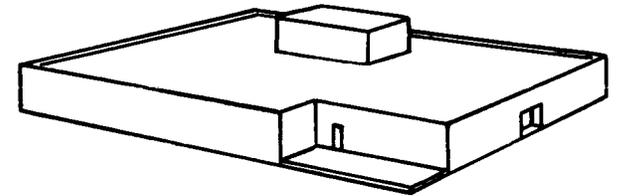
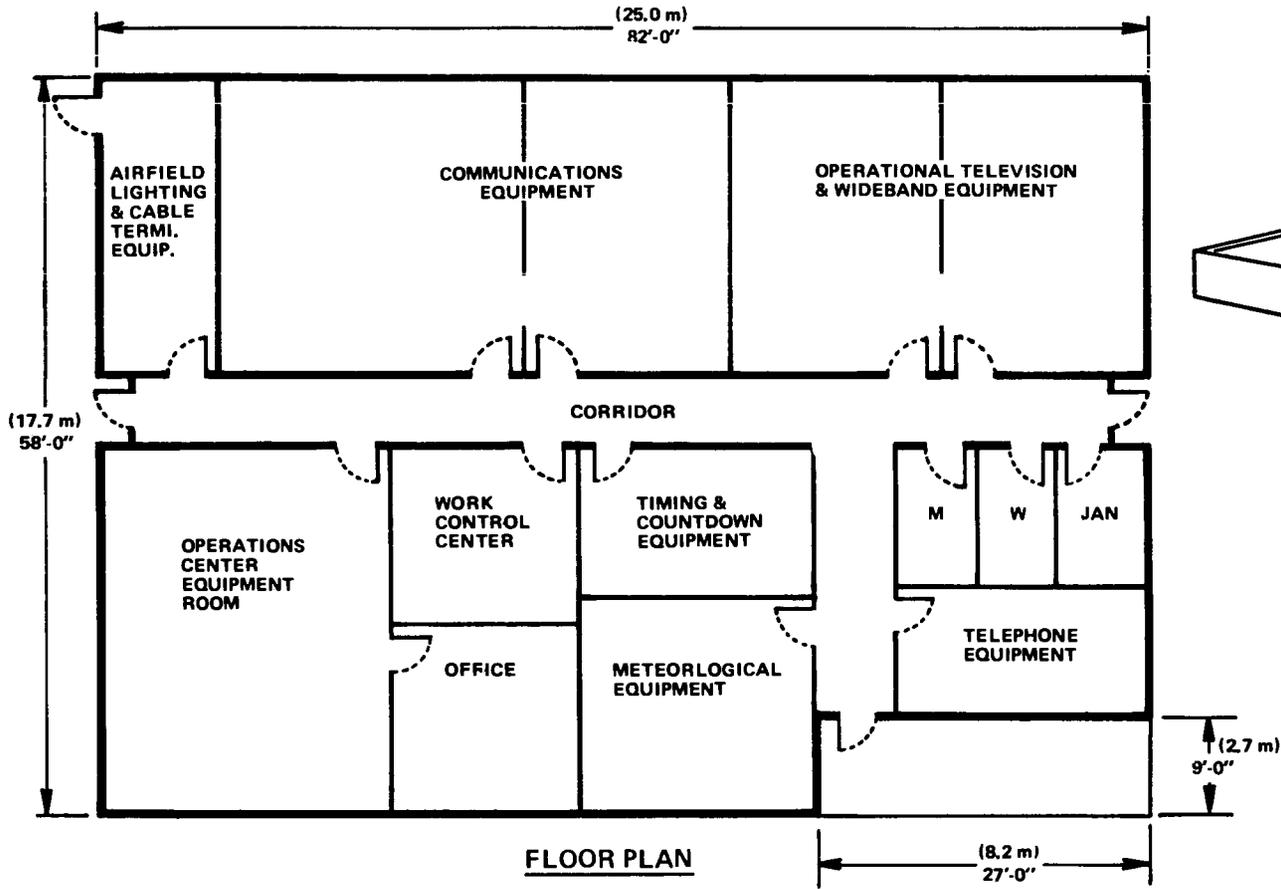
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SITE PLAN
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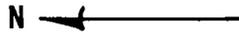
JOHN F. KENNEDY SPACE CENTER
 FISCAL YEAR 1975 ESTIMATES
 CONSTRUCTION OF ORBITER LANDING FACILITIES



PERSPECTIVE

TOTAL AREA APPROXIMATELY
 4,500 SF (418 Sq M)

FLOOR PLAN



LANDING AIDS CONTROL BUILDING

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Construction of Orbiter Processing Facility</u>
LOCATION	<u>John F. Kennedy Space Center</u>
	FY 1975 CoF ESTIMATE <u>\$13,380,000</u>

COGNIZANT INSTALLATION: John F. Kennedy Space Center

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$1,050,000*
Construction	<u>---</u>
Total FY 1974 and Prior Years	<u>\$1,050,000</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide a facility for safing, maintenance and checkout of the space shuttle orbiter, for payload integration and removal, and for thermal protection system refurbishment. The facility, to be located west of the Vehicle Assembly Building, will consist of a large "high bay" area for orbiter operations and a "low bay" area for support functions.

PROJECT JUSTIFICATION:

Upon returning from a space mission, the orbiter must undergo "safing", maintenance and checkout operations before it can be made ready for reuse. The major operations include draining and purging all fuel systems, removal of ordnance, removal of payloads brought back from space, inspection of the payload bay and crew cabin, repair and replacement of damaged components and refurbishment of the thermal protection system. These are vital functions that take approximately two-thirds of the total orbiter processing time between missions. To effectively carry out these operations, this processing facility is required.

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*Reflects design of total (dual high bay) facility.

After the orbiter lands, the vehicle must undergo "safing" operations before the payloads are removed and maintenance and refurbishment can begin. This is necessary because hazardous residual fuels as well as explosive ordnance items will remain on board subsequent to the space mission. The "safing" operations include: the draining and purging of the propellant feed lines; removal of explosive actuators, hypergolic pods, forward reaction control system and auxiliary power fuel tanks; and related activities necessary to eliminate any hazardous condition. These hazardous "safing" operations will be accomplished in the processing facility.

Another vital activity to be carried out in this facility relates to the shuttle payloads. Here the payloads are removed after a space mission and other payloads inserted before the next flight. The payload bay equipment, including the manipulator, must be inspected and serviced after each flight. To preclude payload contamination and to increase reliability of the flight mission, these important operations must be carried out in a clean and controlled environment.

During reentry, the orbiter will be subjected to extremely high temperatures which may cause the protective surfaces (thermal protective system) to crack, erode or ablate. To prepare each orbiter for reuse, the thermal protection system will require careful inspection as well as the repair or replacement of damaged sections. This facility will also be used to inspect, test and refurbish the landing gear system, main and auxiliary propulsion systems, power units, flight instrumentation and communication systems. This project provides the capability to carry out these functions.

The facility is sized to accommodate the orbiter, the payload transporters, work and access stands, hypergolic pod handling equipment and the various special equipment for use in the maintenance and checkout operations.

To meet the first manned orbital flight as currently scheduled, the first orbiter must be delivered to Kennedy Space Center (KSC) in early CY 1978 for its integration into the launch and landing complex and for extended and essential prelaunch activities. This processing facility must be ready to service the orbiter upon arrival at KSC to: (1) maintain and modify the orbiter as necessary during the horizontal flight test verification period; (2) install the main rocket engines; and (3) perform checkout operations prior to the orbiter's first integration with the external tank and solid rocket boosters. Therefore, this processing facility must be operationally ready in early CY 1978 to accept the first orbiter and provide the maintenance and checkout support necessary for these pre-launch activities. To achieve this critical goal, facility construction must begin in early CY 1975, thus requiring FY 1975 resources.

PROJECT DESCRIPTION:

This project provides for construction of an Orbiter Processing Facility consisting of one 29,100 square foot (2,703.4 square meter) "high bay" and

one 25,000 square foot (2,322.5 square meter) "low bay" to include site preparation and foundation work for a second "high bay" to be provided in a future program. The building is to be constructed of structural steel framing with insulated metal panel and masonry exterior walls, and will be located west of the Vehicle Assembly Building. This site was selected in order to minimize orbiter towing distance and cost of site preparation and utilities.

The "high bay" will be equipped with two 40-ton (36.3 metric ton) capacity bridge cranes with a hook height of approximately 70 feet (21.3 meters) and ultra-smooth hoist controls for equipment and payload handling. An under-floor trench system will be provided for electrical, electronic, communications, instrumentation and control cabling; hydraulic supply and return, gaseous nitrogen, oxygen and helium piping; and compressed air distribution piping. These systems will be routed through the trenches to orbiter work stations. Vent systems for nitrogen, helium, oxygen and hydrogen will also be provided and routed through the trenches. In addition, the safing operations require the installation of fuel drainage and purge systems as well as the provision of safety systems. The gaseous nitrogen, helium and compressed air will be supplied from the existing systems at the Vehicle Assembly Building.

The "low bay" area, approximately 25,000 square feet (2,322.5 square meters), will house a mezzanine floor and areas for electronic equipment, mechanical and electrical equipment, shops, thermal protection system repair, self-contained atmospheric pressure ensemble (SCAPE) suit storage and suiting, locker room and toilet facility. Four 5-ton (4.5 metric ton) monorail cranes will be provided for equipment handling in the shop and storage areas. The mezzanine floor of approximately 2,500 square feet (232.3 square meters) will include provisions for a communications room of approximately 700 square feet (65.0 square meters), office and supervisory control rooms with windows overlooking the "high bay" area.

The required electrical, communications, instrumentation, control and sewage systems will be connected to the existing Launch Complex 39 systems. The facility will be provided with air conditioning, heating and ventilating systems. The "high bay" area will be provided with a large air handling capacity and high efficiency particulate filters to maintain the required level of air cleanliness. The chilled water for the air conditioning system will be supplied from the existing Vehicle Assembly Building system. The "high bay" area will also be provided with emergency exhaust systems for use in case of a hypergolic fuel spill. A fire sprinkler system, including a manual foam/water system, will be provided in the "high bay" area for fire protection. The "low bay" area will be equipped with an automatic sprinkler system. A new pump house will be provided to house pumps required to supply water for the sprinkler systems.

PROJECT COST ESTIMATE:

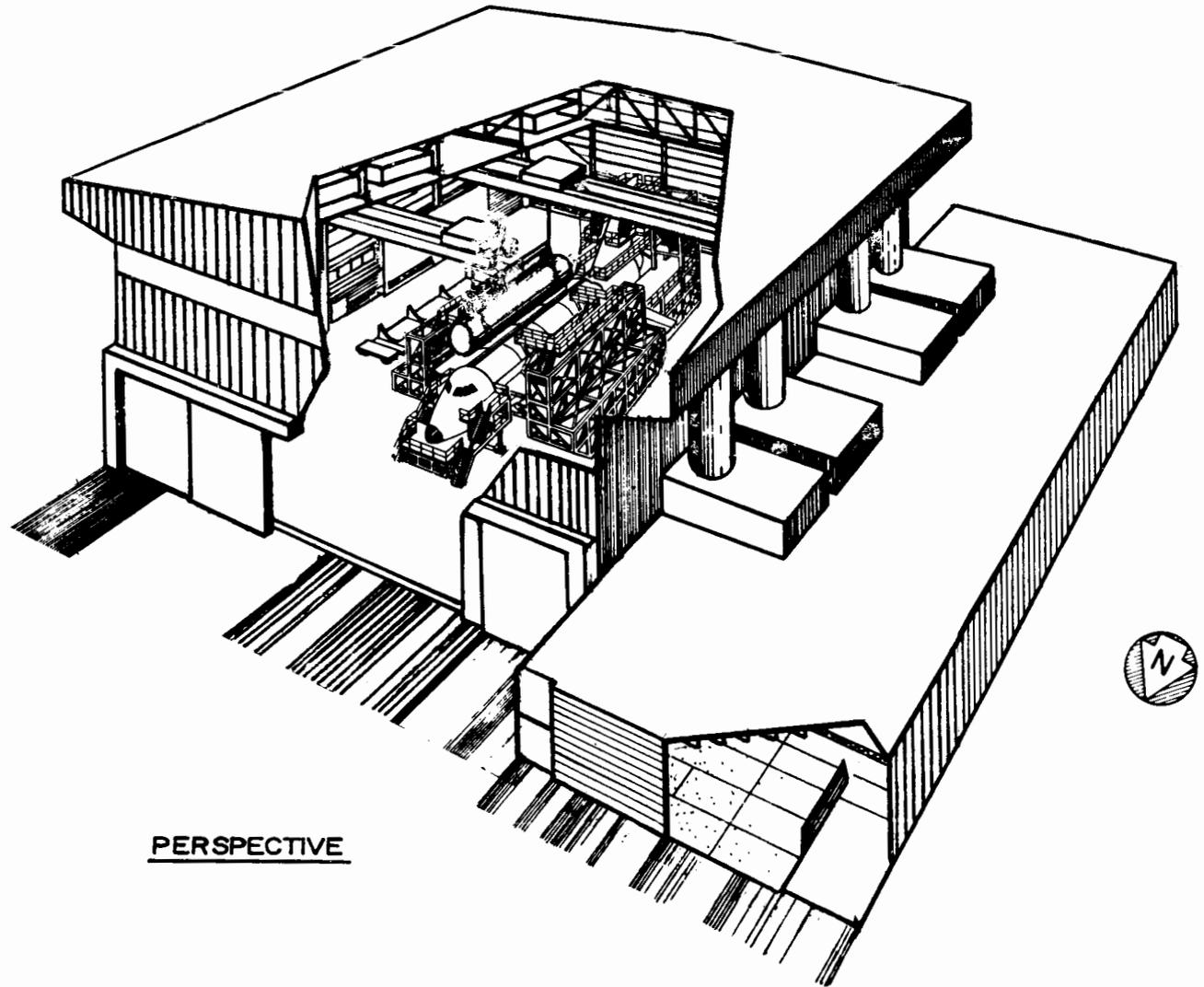
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$12,500,000</u>
Site preparation	LS	---	---	988,000
Building				5,512,000
"High bay" area	CF	2,706,300	\$1.70	(4,600,000)
"Low bay" area	SF	25,000	36.50	(912,000)
High pressure gas system	LS	---	---	363,000
Fuel drainage and purge system	LS	---	---	1,055,000
Environmental control system for "high bay" area	LS	---	---	2,437,000
Utilities (outside 5 foot line)	LS	---	---	1,832,000
Fire protection and safety	LS	---	---	313,000
<u>Equipment</u>				<u>880,000</u>
40-ton bridge crane	Each	2	400,000	800,000
5-ton monorail crane	Each	4	20,000	80,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	<u>---</u>
			TOTAL	<u>\$13,380,000</u>

For initial operations it is anticipated that approximately \$18-20 million of R&D resources will be required, beginning in FY 1976, to provide non-collateral equipment for this facility. As currently defined, this equipment includes such items as special test sets and units, special handling equipment, access platforms, tool sets, service masts, thermal protection system maintenance equipment and other ground support equipment.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

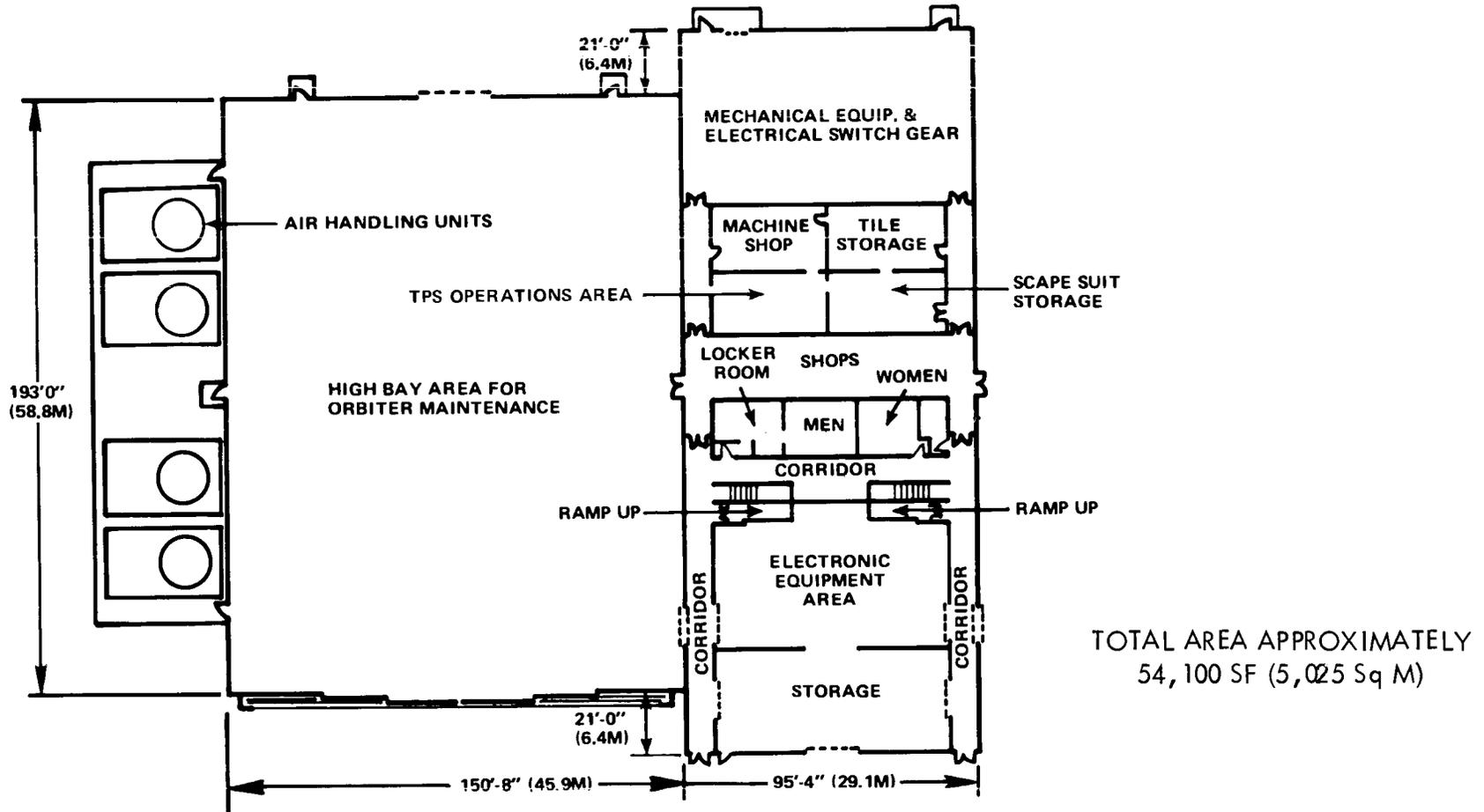
It is estimated that \$8-10 million will be required in the future CoF programs to provide an additional "high bay" area to support the later scheduled higher flight rates.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
CONSTRUCTION OF ORBITER PROCESSING FACILITY



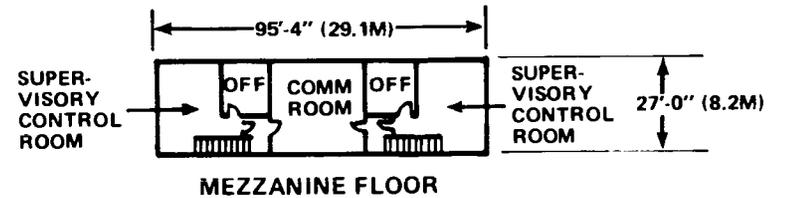
PERSPECTIVE

**JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
CONSTRUCTION OF ORBITER PROCESSING FACILITY**



TOTAL AREA APPROXIMATELY
54,100 SF (5,025 Sq M)

FLOOR PLAN



MEZZANINE FLOOR

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modifications to Launch Complex 39</u>
LOCATION	<u>John F. Kennedy Space Center</u>
	FY 1975 CoF ESTIMATE <u>\$42,690,000</u>

COGNIZANT INSTALLATION: John F. Kennedy Space Center

LOCATION OF PROJECT: Merritt Island, Brevard County, Florida

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 and PRIOR YEARS CoF FUNDING:

Planning and Design	\$2,539,000
Construction	<u>501,538,000</u>
Total FY 1974 and Prior Years	<u>\$504,077,000</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to modify Launch Complex 39 to provide the capability to launch the space shuttle vehicle. The project includes modifications to the Vehicle Assembly Building (VAB), one mobile launcher and one launch pad. The work is necessary to: (1) receive, process and store the external tanks; (2) mate and integrate the orbiter, external tank and solid rocket boosters; (3) accomplish final system checkout; and (4) launch the space shuttle.

PROJECT JUSTIFICATION:

Launch Complex 39 was constructed to provide the necessary facilities to launch the Saturn V/Apollo spacecraft vehicle. An in depth evaluation has determined that these same facilities, with major modifications, can be used effectively to launch the space shuttle vehicle. This project is required to provide the essential modifications to parts of the Vehicle Assembly Building (VAB), a mobile launcher and Launch Pad 39A for shuttle launch operations.

Based on the requirement to launch 40 flights per year from the Kennedy Space Center, it has been decided that the four high bays of the VAB (two for external tank operations and two for mating integration and checkout),

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two launch pads and a minimum of two mobile launchers will be required. This project will provide the initial requirements of the total launch capability. The remaining requirement for a second pad, at least a second mobile launcher and high bays will be programmed, as required, in future years.

After the external tanks arrive by barge from the Michoud Assembly Facility, Louisiana, they have to be moved into the VAB and placed in High Bay 4 for processing and storage prior to mating with the other shuttle elements. Because of the large size of the tank (approximately 27 feet diameter x 155 feet (8.2 meters x 47.2 meters)) major structural modification to provide access and work platforms will be required to service and check out the tank in High Bay 4. The checkout operations include tests of the electrical, mechanical and instrumentation subsystems; a full system test, including leak checks at all joints; and inspection of the tank and its thermal protection system to include any required repairs.

The solid rocket booster segments, after receipt, inspection and processing, are to be moved to High Bay 3 in the VAB for stacking and erection on the modified mobile launcher. Following that activity, the external tank is to be moved from High Bay 4 to be mated to the solid rocket boosters. Subsequently, the orbiter will be moved from the Orbiter Processing Facility into High Bay 3 and will then be mated to the external tank. To support these matings, integration and total checkout of the shuttle vehicle in the launch configuration, major modifications to High Bay 3 will be required.

The mobile launcher, originally designed to accommodate the Apollo hardware, must be modified to meet the space shuttle configuration and weight requirements. The shuttle vehicle will require three major exhaust openings: two for the solid rocket boosters and one for the orbiter main engines. The mobile launcher platform, currently built with a single exhaust opening, must be extensively modified to accommodate the shuttle exhaust configuration. The launch umbilical tower with associated systems will be removed from the mobile launcher. This is necessary to preclude overloading the crawler transporter that must transport the shuttle vehicle, mounted on the mobile launcher, to the pad. The weight of the shuttle vehicle exceeds the unfueled Saturn V/Apollo spacecraft by approximately 1.9 million pounds (861,840 kilograms). This project provides the necessary mobile launcher modifications to adapt this sophisticated facility for the shuttle.

The space shuttle vehicle undergoes vital operations preceding final countdown and launch. These prelaunch activities include: final systems checkout, propellant loading of the external tank, loading of hypergolic pods for the auxiliary propulsion and power systems, and crew ingress. In addition, shuttle requirements necessitate providing capability for payload loading, servicing or changeout at the launch pad. This project provides the necessary modifications and additions required to carry out these vital prelaunch operations as well as the final countdown activities and launch of the shuttle.

To achieve the first manned orbital flight milestone as currently approved, the launch facilities must be operationally ready in early CY 1978. This is necessary to allow for the extensive prelaunch activities including receipt and checkout of the orbiter, external tank and solid rocket boosters; mating and integration; and flight readiness firing of the orbiter engines now scheduled 3-4 months before the first manned orbital flight. To achieve this, facility modifications must start in early calendar year 1975. This schedule makes FY 1975 programming necessary in order to accommodate the extensive effort required. The launch facilities are large and complex with critical interfaces requiring an extensive construction period as well as a 16-18 month period of activation and checkout. For these reasons, this project must be undertaken as scheduled.

PROJECT DESCRIPTION:

This project includes:

Modifications to the Vehicle Assembly Building

High Bay 4 will be modified to provide facilities for external tank operations. The existing jib crane and support framing will be removed and two vertical checkout/storage structures will be constructed. These structures are required to support the external tanks in the vertical position and provide access for the necessary checkout operations. Areas in Tower B will be modified to provide laboratory and shop space required in support of the external tank checkout activities. The existing pneumatic, environmental control and water systems in Tower B will be extended to High Bay 4. Related electrical and mechanical systems will also be modified.

High Bay 3 will be modified to provide facilities and systems necessary for mating, integration and checkout of the two segmented solid rocket boosters, the external tank and the orbiter. Structural modifications include removing large extensible platforms and modifying and reinstalling these platforms to meet the space shuttle configuration. In addition, structural framing in High Bay 3 will be modified to accommodate the orbiter wing span. Towers E and F will be modified to provide the required laboratory and shop space in support of the integration functions. Related mechanical systems piping, power, lighting, equipment and instrumentation grounding, fire alarm and communications systems will also be modified to support the operations.

The existing 55 foot (16.8 meters) north transfer aisle door opening will be widened to 93 feet 4 inches (28.4 meters) to accommodate the orbiter. New aircraft grounding connectors will be installed in the transfer aisle and existing electrical systems will be modified to provide for transfer aisle shuttle operations. The existing automatic fire protection and safety systems will be rearranged and extended within the Vehicle Assembly Building to provide protection for the shuttle operations.

For external tank, solid rocket booster and orbiter access to the Vehicle Assembly Building, a 48 foot (14.6 meters) wide accessway system will be provided. This system will require approximately 2,600 feet (792.5 meters) of new tow-way and modification of approximately 1,400 feet (426.7 meters) of existing roadway to provide the necessary width.

Modifications to a Mobile Launcher

The modifications to an existing mobile launcher consist of: removing the umbilical tower, relocating vehicle support and holddown points, reconfiguring engine exhaust openings, and modifying and installing mechanical, electrical, communications and special systems. The umbilical tower and its extensive systems will be reused to construct the fixed service tower required at the pad.

The mobile launcher platform will be modified to provide for new support and holddown points and three exhaust openings, one approximately 32 feet x 35 feet (9.8 meters x 10.7 meters) for the orbiter engines and two approximately 21 feet x 54 feet (6.4 meters x 16.5 meters) each for the two solid rocket boosters. The existing pneumatic, propellant, water, environmental and electrical systems, affected by the structural change, will be modified and reconfigured to meet shuttle requirements. A new fire alarm system and hazardous gas detection system will be provided.

Modification to Launch Pad 39A

The launch pad work includes construction of a fixed service tower, a shuttle service and access structure, an orbiter flame deflector and modifications to existing mechanical and electrical systems.

The fixed service tower will be built from salvaged sections of the umbilical tower removed from the mobile launcher. This structure that provides the basic services to the vehicle before launch will be located on the west side of the pad. The structure will be approximately 230 feet (70.1 meters) tall with a base of 40 feet x 40 feet (12.2 meters x 12.2 meters). Two high speed elevators, also salvaged, will be modified and installed in the tower. A 50 ton (45.4 metric ton) stiffleg derrick for handling payloads and hypergolic pods will be provided.

A shuttle service and access structure will be installed on the fixed service tower to provide the capability for inserting or changing out a space shuttle payload at the launch pad, and for servicing and changeout of the hypergolic pods, auxiliary power unit and reaction control system. The structure will be capable of rotating from a mated position against the orbiter to a fully retracted position where the structure will rest on a new 70 foot (21.3 meters) tall support tower.

The shuttle service and access structure will include the payload changeout room 70 feet (21.3 meters) tall with a triangular base, each side being approximately 50 feet (15.2 meters), and a room 25 feet (7.6 meters) tall and 25 feet (7.6 meters) square constructed on top of the payload changeout room to provide access to the forward reaction control system. Platforms for hypergolic pod changeout will be provided underneath the payload changeout room.

The existing Saturn V flame deflector will be modified for the solid rocket boosters exhaust. The existing deflector rail system will be utilized. A new fixed flame deflector will be constructed in the existing flame trench for the orbiter main engines exhaust. The existing propellant, high pressure gas, water, environmental control, pneumatic, fuel, electrical, communications and instrumentation systems will be modified to adapt to the new pad configuration and to meet shuttle operational requirements.

The existing fire alarm, hazardous gas detection, lightning protection and area warning systems will be extended and modified. The existing emergency egress system will also be modified to provide for safe egress from the shuttle in case of an emergency during checkout and launch count-down operations.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$42,690,000</u>
Modifications to Vehicle Assembly Building	LS	---	---	9,450,000
Site preparation and accessways	LS	---	---	(1,150,000)
Modifications to High Bay 4	LS	---	---	(3,480,000)
Modifications to High Bay 3	LS	---	---	(3,280,000)
Modifications to transfer aisle and north door	LS	---	---	(760,000)
Fire protection and safety	LS	---	---	(780,000)
Modifications to a mobile launcher	LS	---	---	13,840,000
Remove umbilical tower	LS	---	---	(1,200,000)
Modify mobile launcher platform	LS	---	---	(7,650,000)
Modify electrical systems	LS	---	---	(900,000)
Modify environmental control systems	LS	---	---	(570,000)
Modify propellant systems	LS	---	---	(800,000)
Modify pneumatic systems	LS	---	---	(1,700,000)

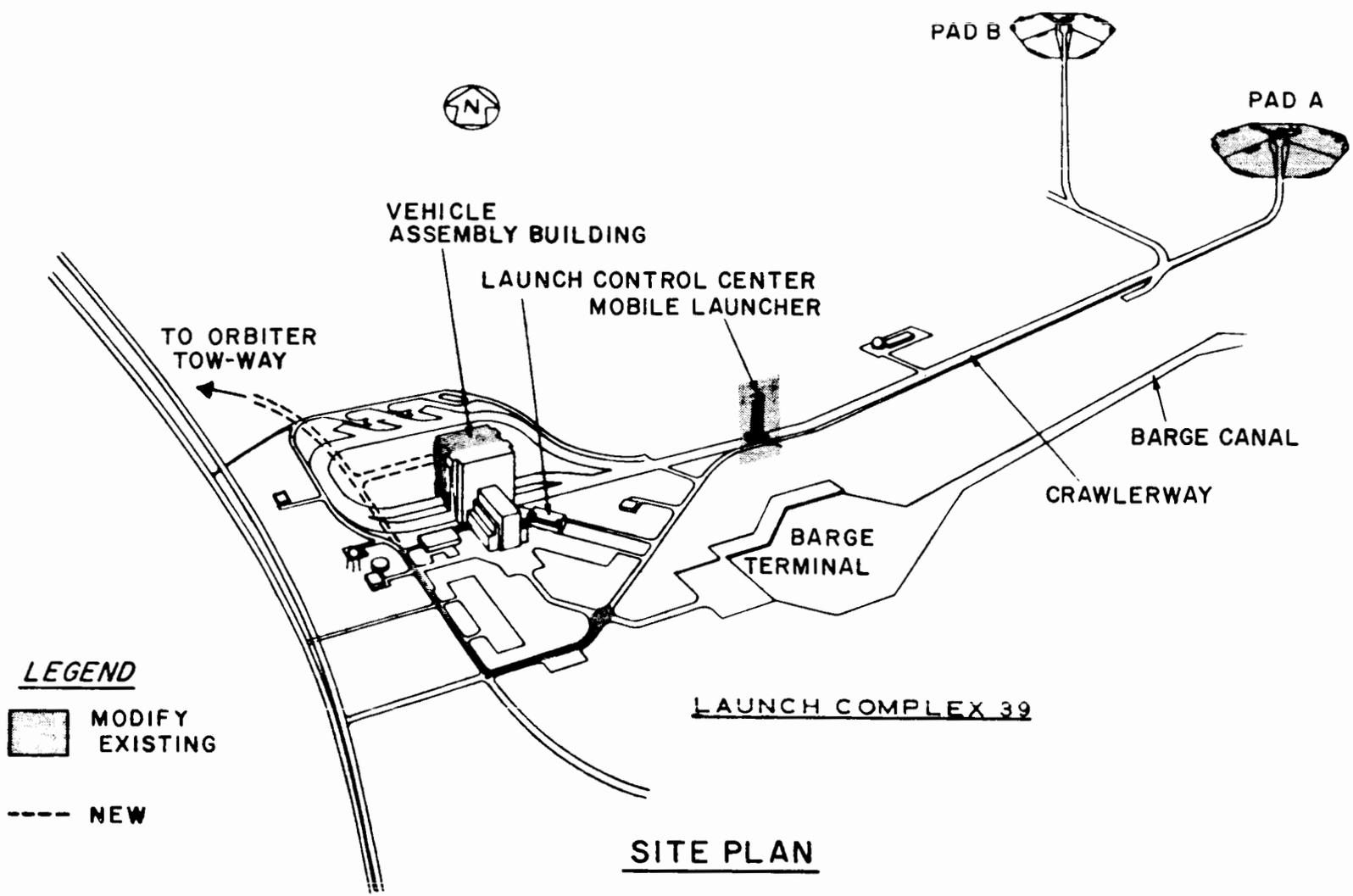
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Modify water systems	LS	---	---	(720,000)
Fire protection and safety	LS	---	---	(300,000)
Modifications to Launch Pad A				19,400,000
Site preparation	LS	---	---	(980,000)
Construct fixed service tower	LS	---	---	(2,900,000)
Install pad elevators	LS	---	---	(340,000)
Stiffleg derrick and handling equipment	LS	---	---	(900,000)
Construct shuttle service and access structure	LS	---	---	(3,800,000)
Modify Saturn V flame deflector	LS	---	---	(400,000)
Construct new flame deflector	LS	---	---	(1,320,000)
Modify propellant systems	LS	---	---	(350,000)
Modify high pressure gas system	LS	---	---	(950,000)
Modify water systems	LS	---	---	(420,000)
Modify environmental control system	LS	---	---	(1,200,000)
Modify pneumatic systems	LS	---	---	(840,000)
Modify fuel systems	LS	---	---	(2,300,000)
Modify electrical, communications and instrumentation systems	LS	---	---	(1,600,000)
Fire protection and safety	LS	---	---	(1,100,000)
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	---
				<u>\$42,690,000</u>

It is anticipated that approximately \$20 to 25 million of R&D resources will be required to provide the noncollateral equipment for initial operations of the launch facilities. As currently defined, this equipment includes such items as handling and access equipment, ground support equipment, simulators, special communications and launch systems that are closely related and sensitive to the flight hardware.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

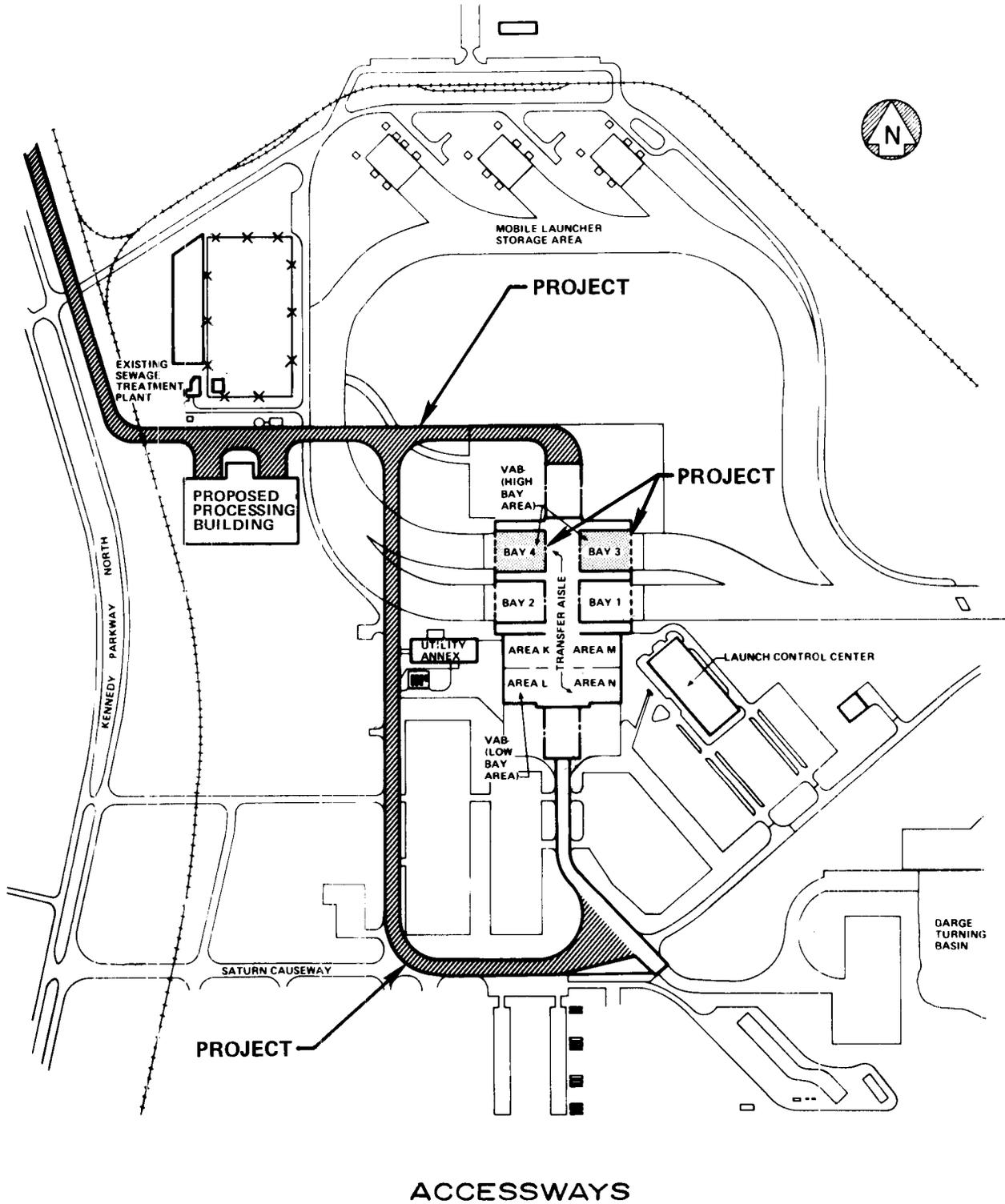
It is estimated that \$50 to 52 million will be required in future CoF programs to complete this project and provide additional launch facilities necessary to support the higher flight rates anticipated. These CoF resources would be used to provide modifications to the Launch Control Center, a second launch pad, at least a second mobile launcher and two more high bays in the VAB. These additional facilities would be required to achieve the 40 flights/year operational level.

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX 39

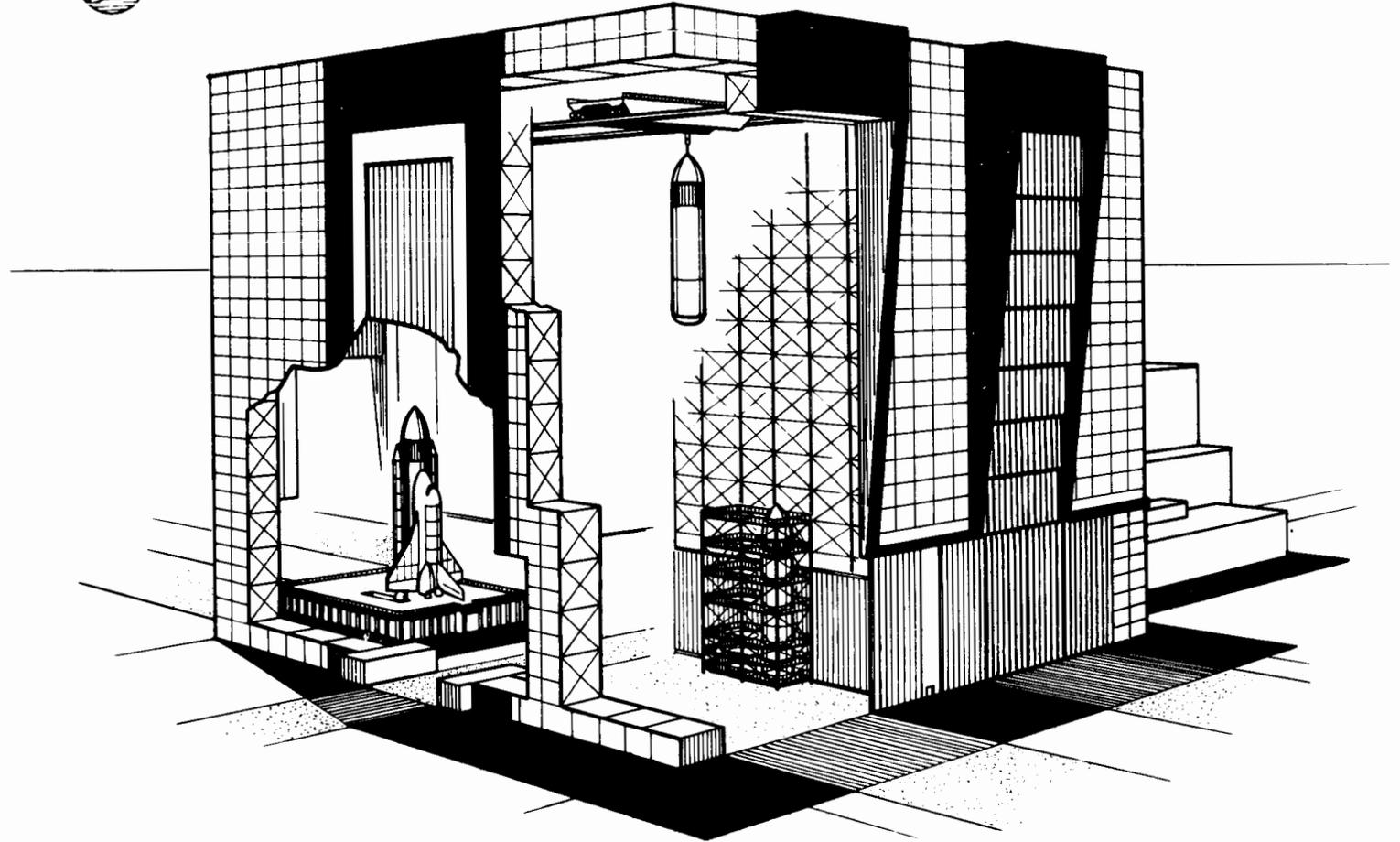


CF 10-24

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX 39



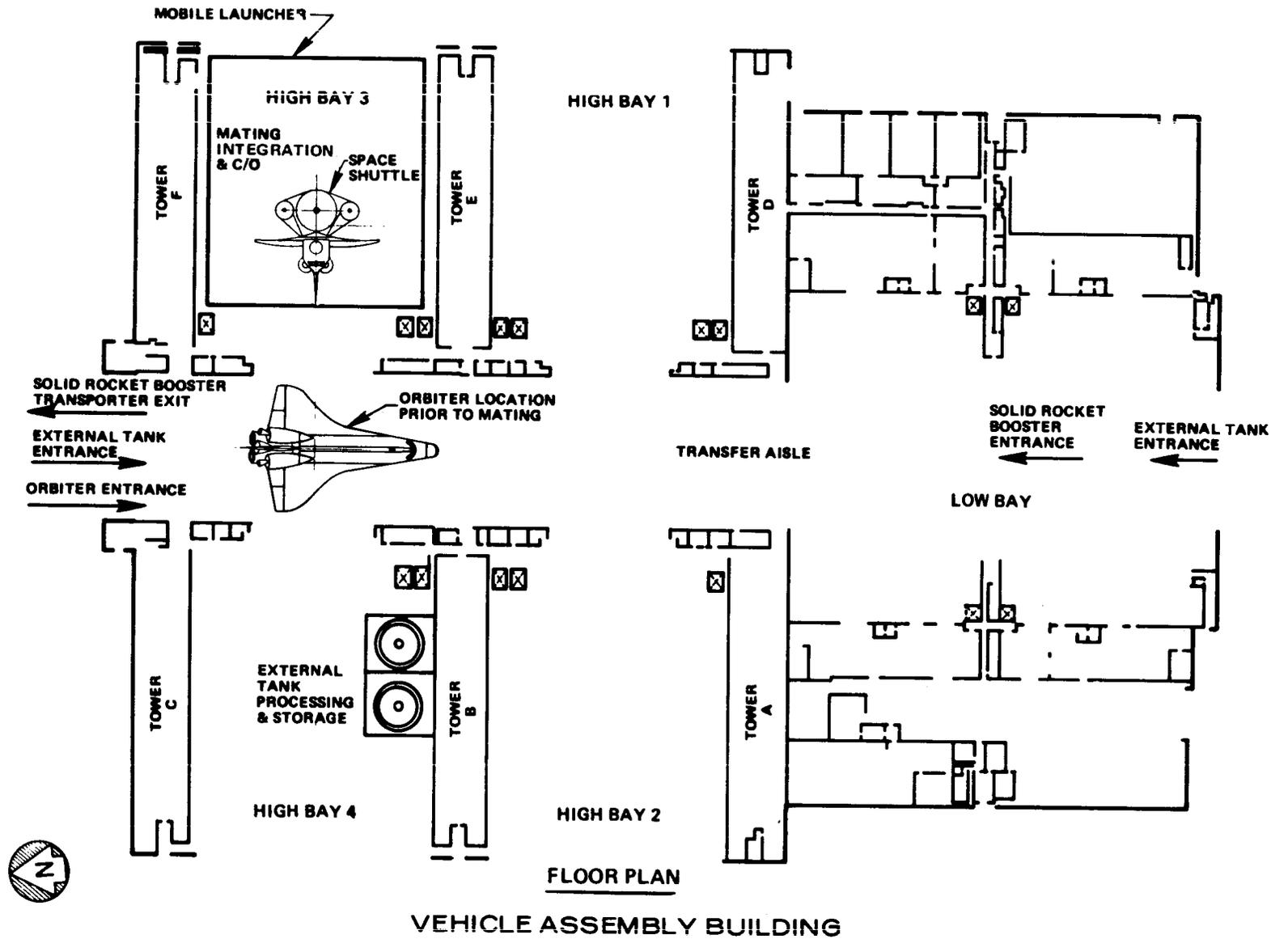
JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX 39



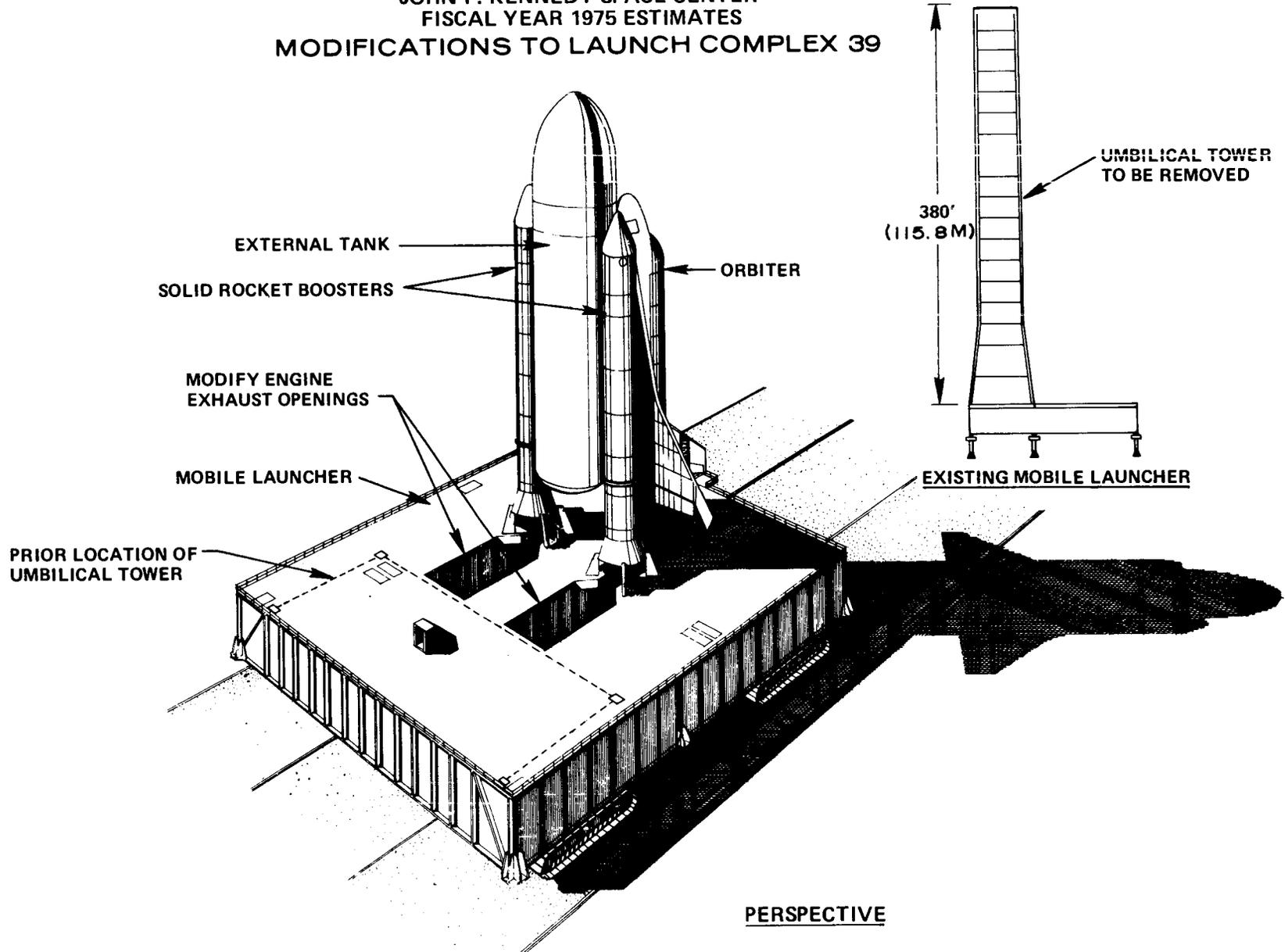
PERSPECTIVE

VEHICLE ASSEMBLY BUILDING

JOHN F. KENNEDY SPACE CENTER
 FISCAL YEAR 1975 ESTIMATES
 MODIFICATIONS TO LAUNCH COMPLEX 39



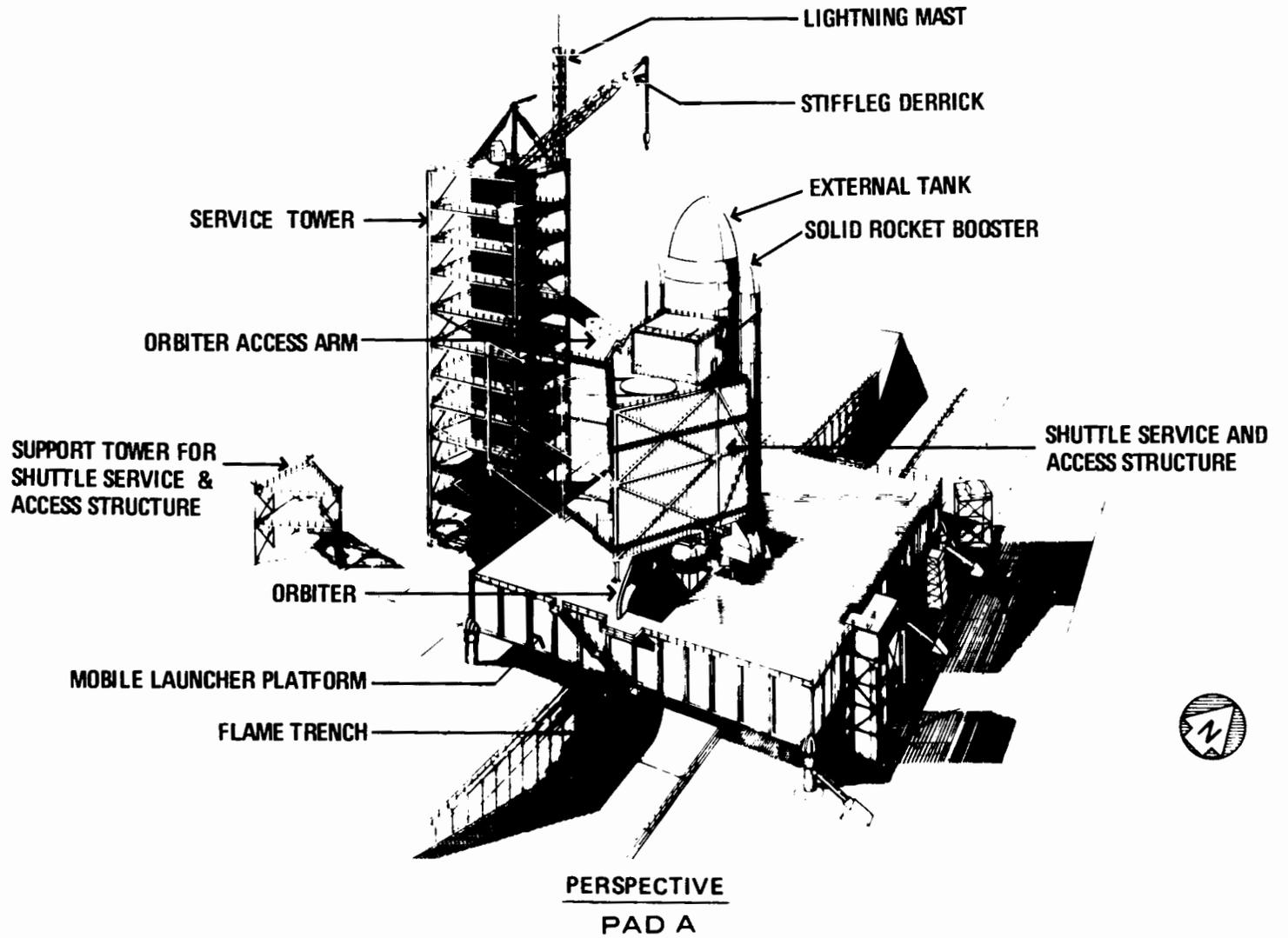
JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX 39



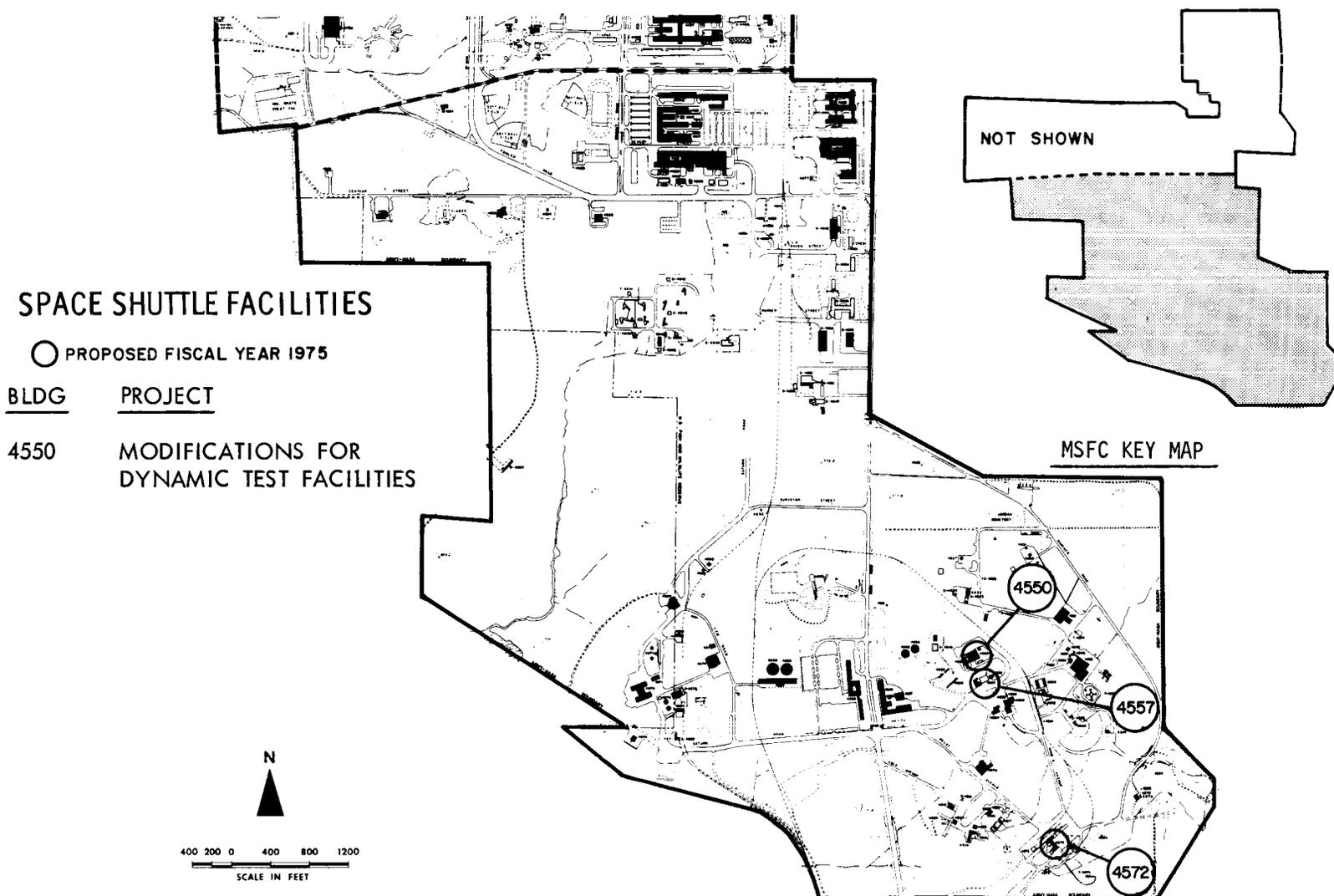
MOBILE LAUNCHER

PERSPECTIVE

JOHN F. KENNEDY SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATIONS TO LAUNCH COMPLEX 39



**MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1975 ESTIMATES
LOCATION PLAN**



SPACE SHUTTLE FACILITIES

○ PROPOSED FISCAL YEAR 1975

<u>BLDG</u>	<u>PROJECT</u>
4550	MODIFICATIONS FOR DYNAMIC TEST FACILITIES

MSFC KEY MAP

N

400 200 0 400 800 1200
SCALE IN FEET

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	Modifications for Dynamic Test Facilities
LOCATION	Marshall Space Flight Center and NASA Industrial Plant Downey, California
FY 1975 CoF ESTIMATE \$3,920,000	

COGNIZANT INSTALLATION: Marshall Space Flight Center and
Johnson Space Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama
Downey, Los Angeles County, California

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$305,000
Construction	<u>6,731,000</u>
Total FY 1974 and Prior Years	<u>\$7,036,000</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide capability to conduct ground vibration tests on the three mated elements of the shuttle vehicle. This test program includes early vibration model tests of 1/4th scale structural replica of the space shuttle vehicle at the NASA Industrial Plant, Downey, CA, followed by full-scale model surveys of the mated orbiter, external tank and two solid rocket boosters in the Dynamic Test Facility, Building 4550, at the Marshall Space Flight Center. This capability is essential for verifying the mathematical models developed to analyze the dynamic forces acting on the space shuttle and to substantiate the vehicle's ability to withstand the rigorous dynamic loads encountered in flight.

PROJECT JUSTIFICATION:

The space shuttle vehicle will be subjected to great static and dynamic loadings during the launch, ascent, separation and re-entry phases of the mission. To insure the ability of the vehicle to withstand the static forces, the orbiter, external tank and the solid rocket boosters will be separately subjected to similar loadings on the ground. Prior years

resources provided for the facility requirements related to the structural static testing of the orbiter and external tanks. A separate FY 1975 request provides the necessary facilities for structural testing of the solid rocket booster. These static tests of major elements of the total system are distinct requirements from those represented by this project.

During lift-off and throughout the launch profile the mated vehicle will be subjected to great dynamic forces resulting from firings of the boosters and the orbiter, the aerodynamic effects on the individual structures, and the interreaction coupling forces imposed by each shuttle element on the other two. To evaluate these forces and the ability of the vehicle to withstand them, mathematical models are developed and analyzed. A consensus of national experience in developing conventional aircraft as well as ballistic missiles has established that experimental ground test verification of the mathematical models is necessary. This project provides the capability to achieve that objective.

The test program is designed to evaluate and analyze dynamic loads on the vehicle throughout its launch profile. Consequently, the mated orbiter/external tank/solid rocket boosters will be excited and vibrated (using shakers) as in the lift-off configuration. Additionally, the mated orbiter with the external tank only will be similarly subjected to the vibration loads to be encountered in flight after the solids have separated. In addition to verifying the mathematical model, the ground test program will provide more accurate data necessary to evaluate and analyze pogo effects, surface flutter, and aerostability as well as essential complex coupling data at the interfaces and joints where mathematical modeling techniques are somewhat limited. The acquired data is essential in substantiating, verifying and assuring successful development of the shuttle and increasing the reliability and safety for the flight missions. This project provides the facility modifications necessary to achieve these objectives.

To achieve the program objective two test programs will be conducted. The first test program, using a 1/4th scale structural replica of the shuttle, will be conducted in Building 288, a government-owned facility, at Downey, CA. This test program is required for early validation of the vehicle design. The test location was selected because of its proximity to the engineering and manufacturing capabilities of the contractor. The second test program will use full-scale flight type hardware as it becomes available and will be conducted in the existing Dynamic Test Facility at the Marshall Space Flight Center (MSFC). This facility was selected because of its proximity to the structural static test sites of the external tank and the solid booster and because of its existing and proven capability for similar dynamic testing on the Saturn V vehicle.

To achieve the first manned orbital flight as presently scheduled, the 1/4th scale dynamic test program must start by end of CY 1975 and the full-scale tests by early CY 1977. The modification and activation of facilities at the two separate sites are estimated at one year and two years respec-

tively. Correspondingly, the facility work must start in late CY 1974 at the 1/4th scale site and in early CY 1975 at the full-scale site to meet program objectives. Therefore, FY 1975 construction funds are necessary.

PROJECT DESCRIPTION:

The existing Dynamic Test Facility, Building 4550, at MSFC will be modified to conduct the full-scale ground vibration test program. The major modifications include: expanding the test bay from 50 feet x 50 feet x 360 feet (15.2 meters x 15.2 meters x 109.7 meters) to 74 feet x 74 feet x 360 feet (22.6 meters x 22.6 meters x 109.7 meters) in order to accommodate the size of the test vehicle; strengthening the foundation under the test vehicle to provide support for the combined weight of the shuttle elements and to withstand the dynamic loads to be applied; providing overhead framing and suspension system at the top of the test bay to enable simulation of vehicle weight in the boost configuration; and modifying the existing sliding door framing to accommodate the orbiter. The remaining work consists of modifying existing platforms and constructing additional platforms to support equipment and cables, as well as to provide safe working areas for test personnel; refurbishing existing derricks; and rerouting utilities. Limited modifications to the Redstone Army Airfield and access roads will also be required to permit landing of the orbiter and subsequent towing to the test site.

Building 288 at Downey will be modified to support the 1/4th scale test program. The work includes erection of a heavy support frame approximately 8 feet x 22 feet x 55 feet (2.4 meters x 6.7 meters x 16.8 meters) on the existing support block; installing an airspring system to freely suspend the test article; and constructing platforms for access to the test article and for housing test equipment. Deionized water storage and related transfer piping will also be provided. The water will be used to simulate the liquid oxygen in the external tank replica.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$3,920,000</u>
Modifications to Dynamic Test Facility, MSFC				3,700,000
Expansion of test bay	CF	1,071,360	\$1.24	(1,330,000)
Launch configuration supports	LS	---	---	(420,000)
Boost configuration suspension	LS	---	---	(275,000)
Sliding door framing modifications	LS	---	---	(375,000)

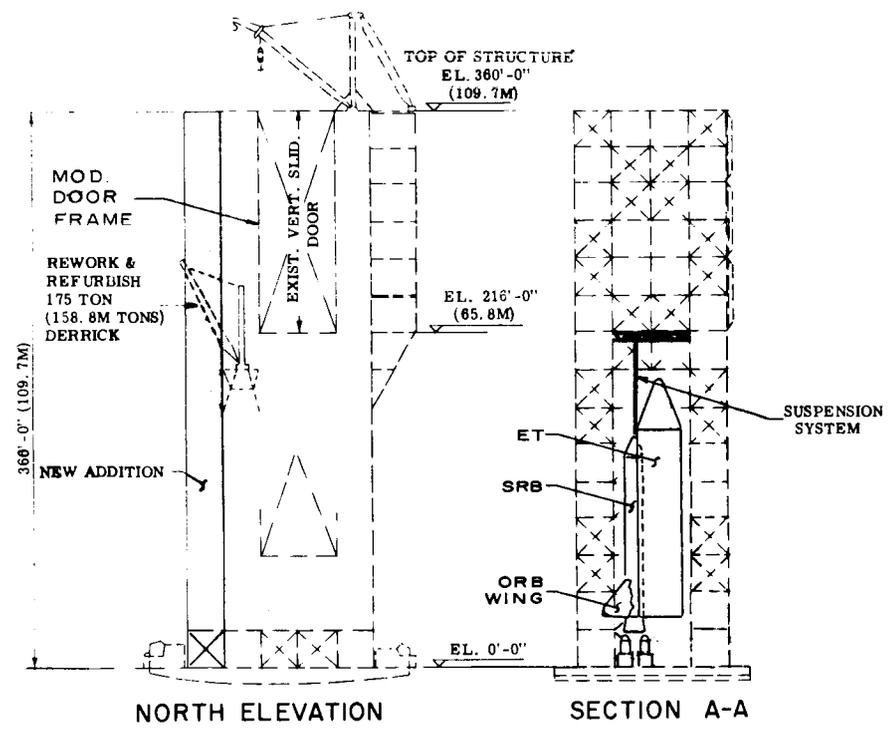
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Access and work platform modifications	LS	---	---	(360,000)
Refurbish derricks	LS	---	---	(65,000)
Airfield and road modifications	LS	---	---	(600,000)
Utility extension and modifications	LS	---	---	(275,000)
Modifications for 1/4th scale Dynamic Test Facility, Downey, CA	LS	---	---	220,000
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	---
			TOTAL	<u>\$3,920,000</u>

To support this test program, special test equipment will be required. This equipment, considered sensitive to the hardware, will be housed in two mobile vans and will be initially used at the 1/4th scale test site, Downey, California, and subsequently moved to MSFC. The estimated cost of the equipment is approximately \$4.0 million. However, approximately half of this equipment exists and the other half will be purchased from the R&D account.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

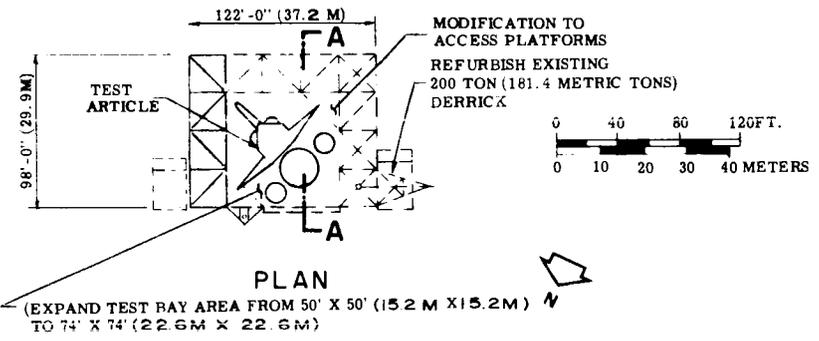
For presently planned usage, there are no currently foreseen future funding requirements necessary to complete this project.

MARSHALL SPACE FLIGHT CENTER FISCAL YEAR 1975 ESTIMATES MODIFICATIONS FOR DYNAMIC TEST FACILITIES



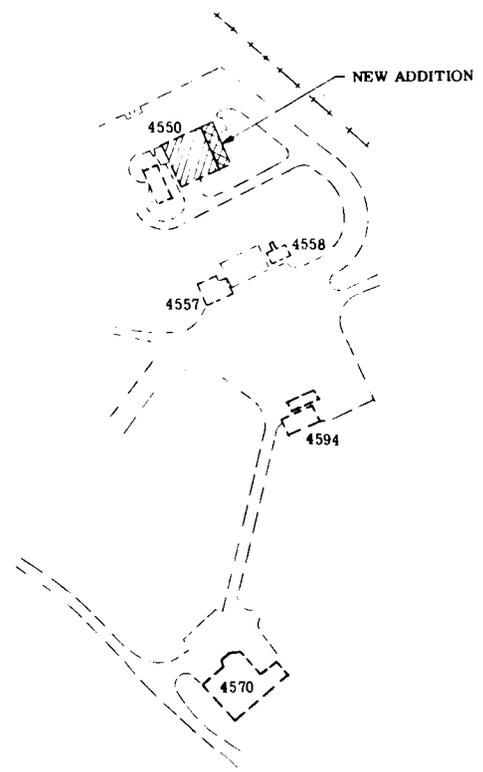
NORTH ELEVATION

SECTION A-A

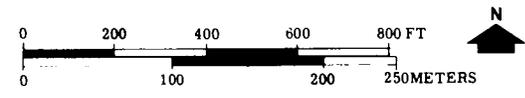


PLAN

(EXPAND TEST BAY AREA FROM 50' X 50' (15.2 M X 15.2 M) TO 74' X 74' (22.6 M X 22.6 M))

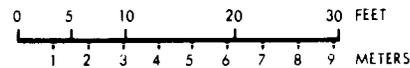
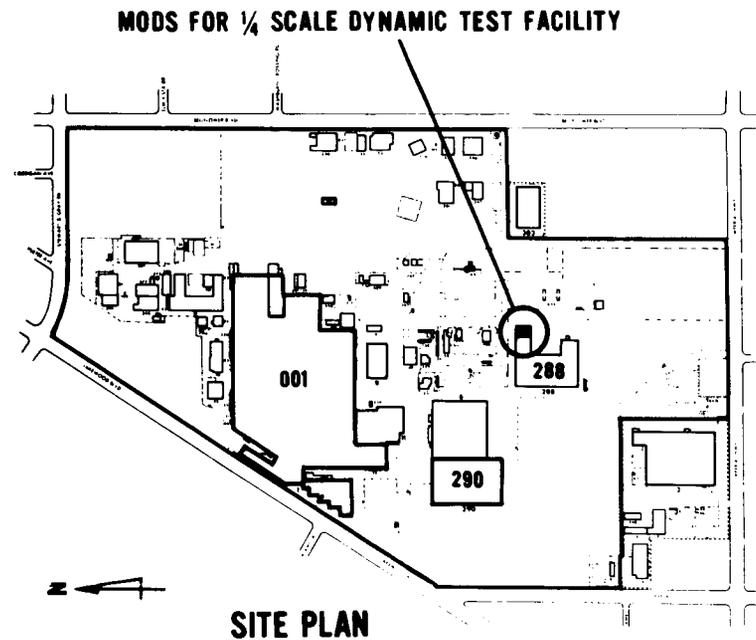
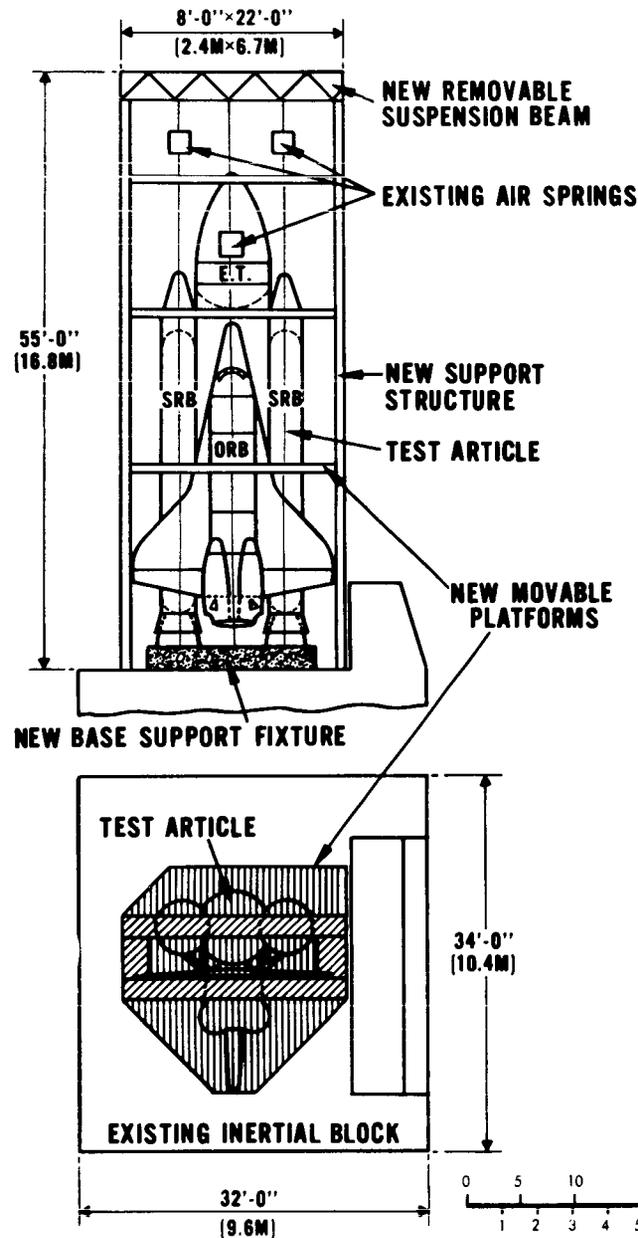


SITE PLAN



CF 10-35

LYNDON B. JOHNSON SPACE CENTER
 FISCAL YEAR 1975 ESTIMATES
 MODIFICATIONS FOR DYNAMIC TEST FACILITIES
 (1/4 SCALE ORBITER)
 NASA INDUSTRIAL PLANT, DOWNEY, CAL.

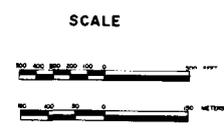


FLIGHT RESEARCH CENTER FISCAL YEAR 1975 ESTIMATE LOCATION PLAN



- 1 LABORATORY BUILDING (4800)
 - 2 AIRCRAFT CONSTRUCTION AND MODIFICATION HANGAR (4801)
 - 3 MAIN HANGAR (4802)
 - 4 AIRCRAFT TIRE REPAIR SHOP (4803)
 - 5 TRAILER PARK AND MODULAR BUILDINGS
 - 6 BOILER HOUSE (4805)
 - 7 SHOPS (AGE, MODEL, BATTERY, GARAGE)(4806)
 - 8 STORAGE BUILDING (4807A)
 - 9 PHYSIOLOGY STRESS LAB (4807B)
 - 10 WAREHOUSE N^o 2 (4808)
 - 11 WAREHOUSE N^o 3 (4809)
 - 12 WAREHOUSE N^o 4 (4810)
 - 13 HIGH TEMPERATURE LOADS CALIBRATION FACILITY (4820)
 - 14 PAINT SPRAY BUILDING (4821)
 - 15 PAINT STORAGE BUILDING (4822)
 - 16 COMMUNICATIONS BUILDING (4824)
 - 17 MAINTENANCE DOCK (4826)
 - 18 FIBERGLASS SPRAY BOOTH (4830)
 - 19 WAREHOUSE N^o 5 (4831)
 - 20 RADAR BUILDING (4870)
 - 21 100 FT. TOWER, BORESIGHT TARGET ASSEMBLY AND EQUIPMENT (4887)
 - 22 CENTRAL STANDBY ELECTRICAL POWER FACILITY (4889)
 - 23 STORAGE BUILDING (4804)
 - 24 AIRCRAFT SERVICING DOCK (4823)
 - 25 FPS-16 RADAR FACILITY (4982)
- PROPOSED FACILITIES**

- SPACE SHUTTLE FACILITIES**
- PROPOSED FISCAL YEAR 1975 CONSTRUCTION OF ORBITER HORIZONTAL FLIGHT TEST FACILITIES.



LEGEND

- PROPERTY LINE
- - - CHAIN LINK FENCE
- EXISTING FACILITIES
- PROPOSED FACILITIES

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Construction of Orbiter Horizontal Flight Test Facilities</u>
LOCATION	<u>Flight Research Center</u>
	FY 1975 CoF ESTIMATE <u>\$1,940,000</u>

COGNIZANT INSTALLATION: Lyndon B. Johnson Space Center

LOCATION OF PROJECT: Edwards, Kern County, California

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$119,000
Construction	---
Total FY 1974 and Prior Years	<u>\$119,000</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide facilities to support the horizontal flight testing of the space shuttle orbiter. The facilities will include a new flight test hangar, shop space and office space, as well as associated sitework and utilities.

PROJECT JUSTIFICATION:

The first flight orbiter, equipped with "air breathing" engines, must undergo horizontal flight testing to verify its performance and overall operational characteristics. The orbiter is a "first of a kind" vehicle that will fly both as an airplane and as a spacecraft. The horizontal flight test program is intended to verify and qualify the performance of the orbiter in the airborne mode environment. The test objectives include verification of stability and control, basic aerodynamics, automatic landing capability, ferry and subsonic performance and development of procedures for maintenance and checkout of the vehicle. This project provides the facilities necessary to achieve these objectives.

Flight Research Center, Edwards Air Force Base (AFB), was selected as the optimum site for the test program because of its proximity to the program management, engineering and manufacturing operations of the prime

contractor at Downey, California, and its proximity to the final assembly and checkout facilities at Palmdale, California. In addition, the Flight Research Center/Air Force Flight Test Center Complex at Edwards AFB, California, has the dedicated facilities, special equipment and personnel necessary to conduct this test program. The existing runway, dry lakes, and flight instrumentation and control system at this site, which have been used successfully in the flight testing of other new or experimental aircraft, make this the ideal location for the orbiter horizontal flight test program.

The flight test hangar is required to install test instrumentation, conduct critical inspections, perform necessary maintenance and perform "weight and balance" operations prior to each flight. These activities must be conducted in a hangar to protect the precision tools and instrumentation, insure validity of critical inspections and to preclude interruptions of critical operations due to inclement weather.

Shop space is required to provide areas for engine and structures repair, electronics and instrumentation, ground support equipment maintenance and related horizontal flight test support. Office space must be provided for approximately 200 personnel that will be required on-site in support of the flight test program. These personnel are required for ground operations, flight operations and site management. However, due to the limited duration of this program (1-2 years), it is planned to provide office space for these personnel in trailers. This project provides these necessary shop facilities as well as the sitework and utilities necessary to accommodate the office, shop and supply trailers which will be made available by lease or from available existing assets.

A review of existing Air Force and NASA facilities at this site has established that the hangar and support space required for these shuttle activities cannot be provided because of previous testing commitments and closely controlled schedules for the use of any suitable facilities. Therefore, the facilities requested in this project must be provided to support the orbiter horizontal flight test program.

To achieve the first horizontal flight milestone as currently approved, the horizontal flight test facilities must be completed in the second half of CY 1976 to allow sufficient time for installation and checkout of ground support equipment required in the test program. Therefore, construction must begin in the first half of CY 1975, thus making FY 1975 programming necessary.

PROJECT DESCRIPTION:

The new hangar will be a pre-engineered metal building 140 feet x 175 feet (42.7 meters x 53.3 meters) long with a clear height door opening of 60 feet (18.3 meters). For access, the taxiway and apron will be extended to the new hangar location. This hangar is the minimal size facility capable of housing the orbiter and providing the necessary working space.

The shop space will be an attached lean-to type building, 175 feet x 37 feet (53.3 meters x 11.3 meters), with a 15 foot (4.6 meters) eave height. The facility will provide space for a general shop, maintenance, electronics and instrumentation, structure repair, and ground support equipment repair.

The office, supply and additional shop areas will be composed of leased trailers or existing assets to the extent available. The trailers will accommodate approximately 200 persons and provide approximately 24,000 square feet (2,229.6 square meters) for administration and engineering support. Additional trailer space will provide 1,440 square feet (133.8 square meters) for supply and 2,160 square feet (200.7 square meters) for shop areas adjacent to the hangar shop lean-to. This project provides for site preparation, utilities and trailer connections.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$1,940,000</u>
Site preparation and utilities	LS	---	---	181,000
Flight test hangar/shop				1,530,000
Foundation	LS	---	---	(96,000)
Architectural/structural				
Hangar area	SF	24,500	\$32.60	(799,000)
Shop area	SF	6,500	21.40	(139,000)
Mechanical	LS	---	---	(194,000)
Electrical	LS	---	---	(302,000)
Taxiway and apron pavements	SY	10,880	18.75	204,000
Site preparation and transportation for trailers	LS	---	---	25,000
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	---
			TOTAL	<u><u>\$1,940,000</u></u>

For initial operations, it is anticipated that approximately \$2.5 to \$3.0 million of R&D resources will be required for modifications to existing equipment installed in the instrumented test range to meet specific orbiter requirements and for a microwave automatic landing system. Ground support equipment (GSE) and special test equipment required to support horizontal flight testing will be largely procured with the orbiter itself and will be initially used to support manufacturing, final assembly and checkout of the hardware. This equipment will be moved to the horizontal flight test site as required.

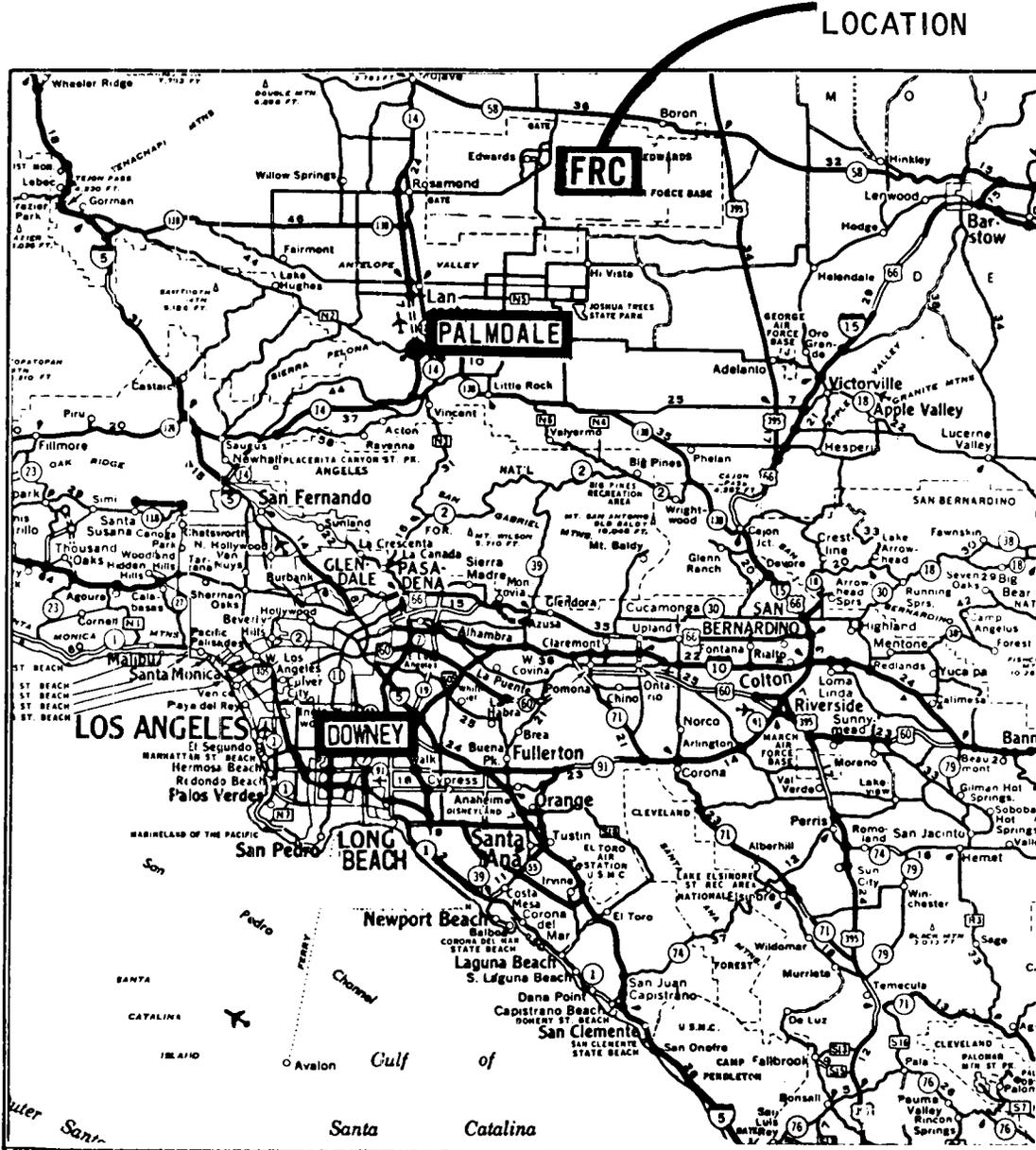
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

For presently planned usage, there are no currently foreseen future funding requirements necessary to complete this project. Certain rehabilitation/modification type work may follow to support the automatic landing system tests or for other presently undefined requirements, but these potential requirements cannot be fully identified at this time.

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1975 ESTIMATES

CONSTRUCTION OF ORBITER HORIZONTAL FLIGHT TEST FACILITIES
FLIGHT RESEARCH CENTER

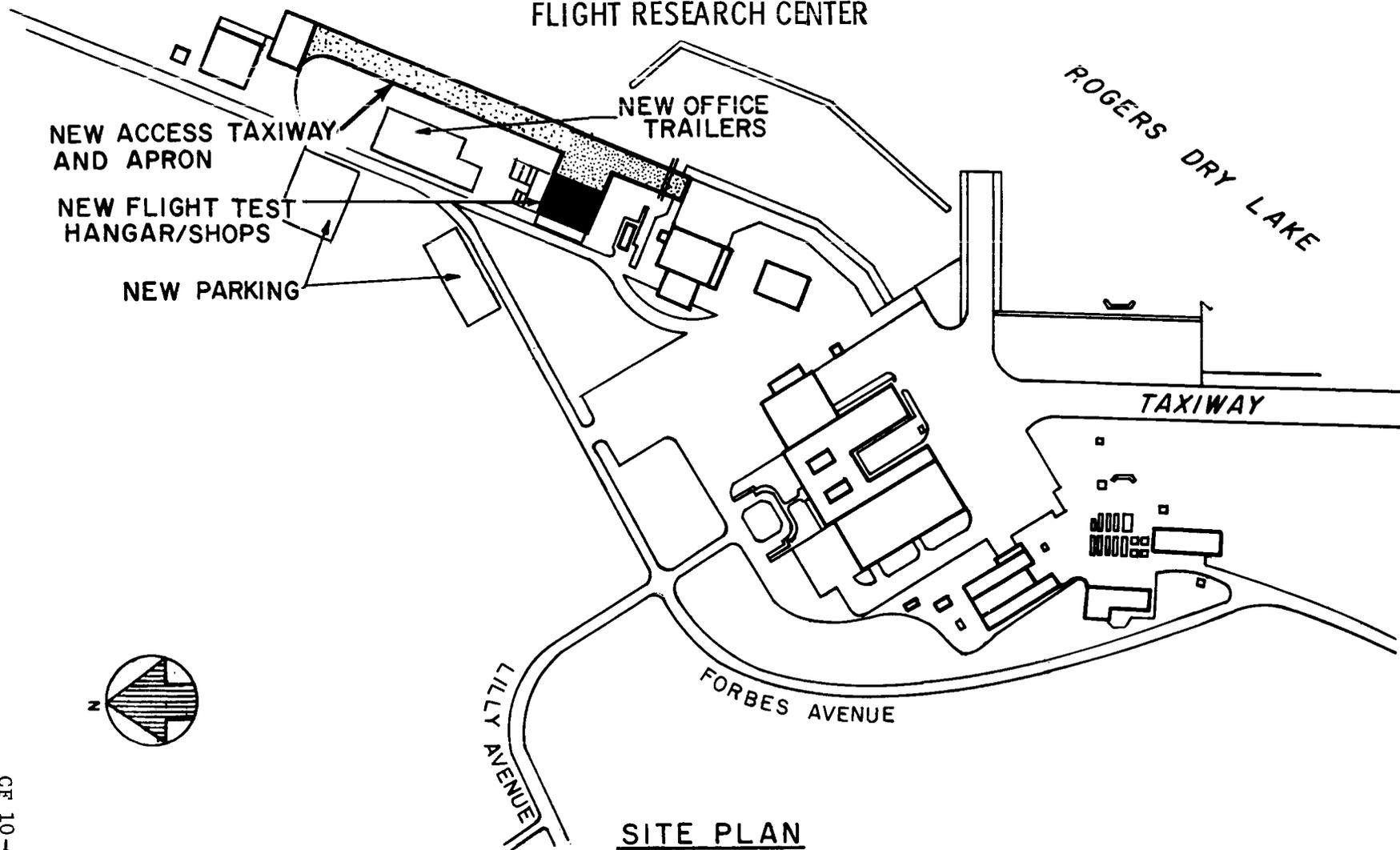
PROJECT
LOCATION



VICINITY MAP

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1975 ESTIMATES

CONSTRUCTION OF ORBITER HORIZONTAL FLIGHT TEST FACILITIES FLIGHT RESEARCH CENTER

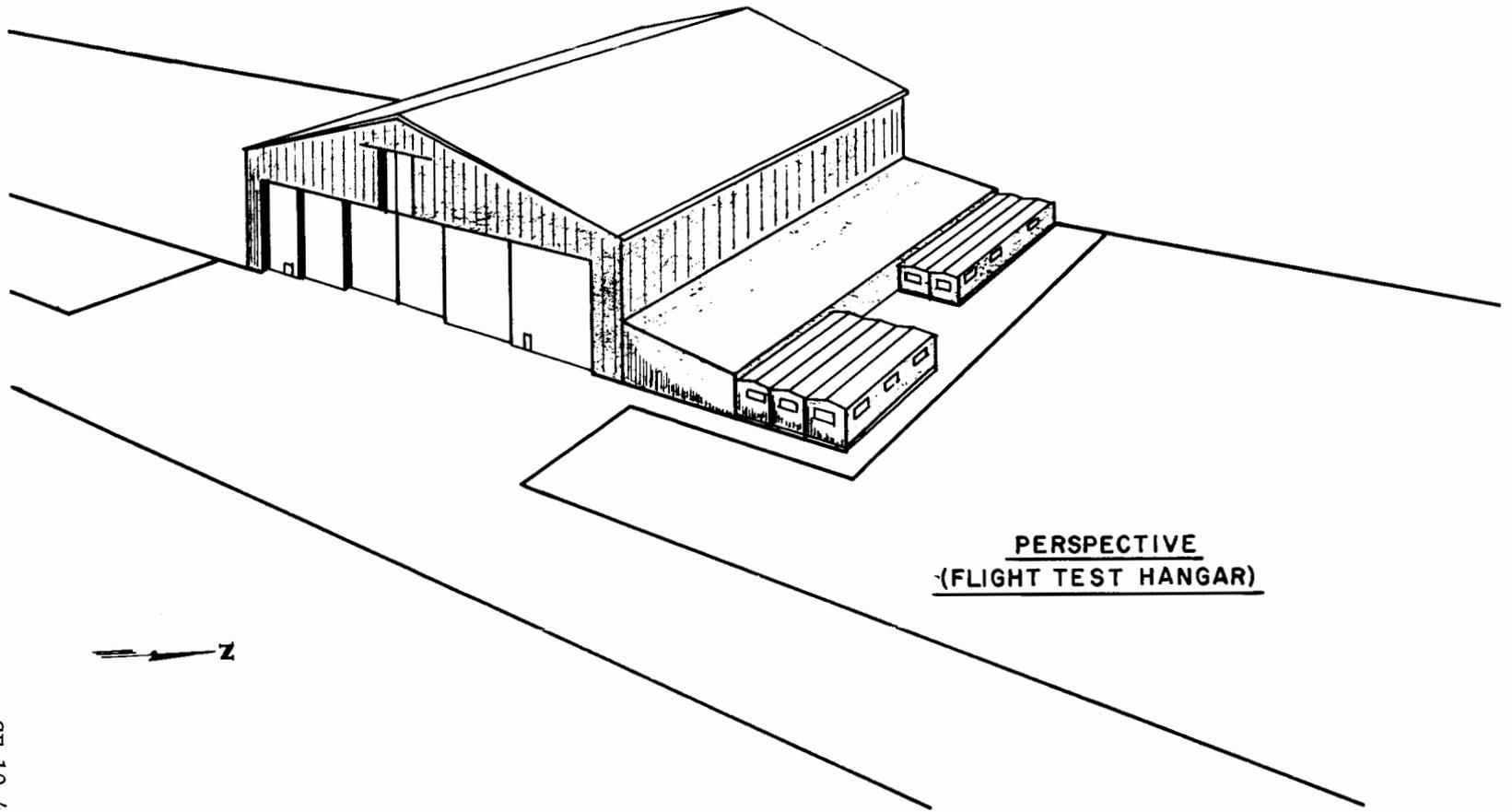


CF 10-43

SITE PLAN

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1975 ESTIMATES

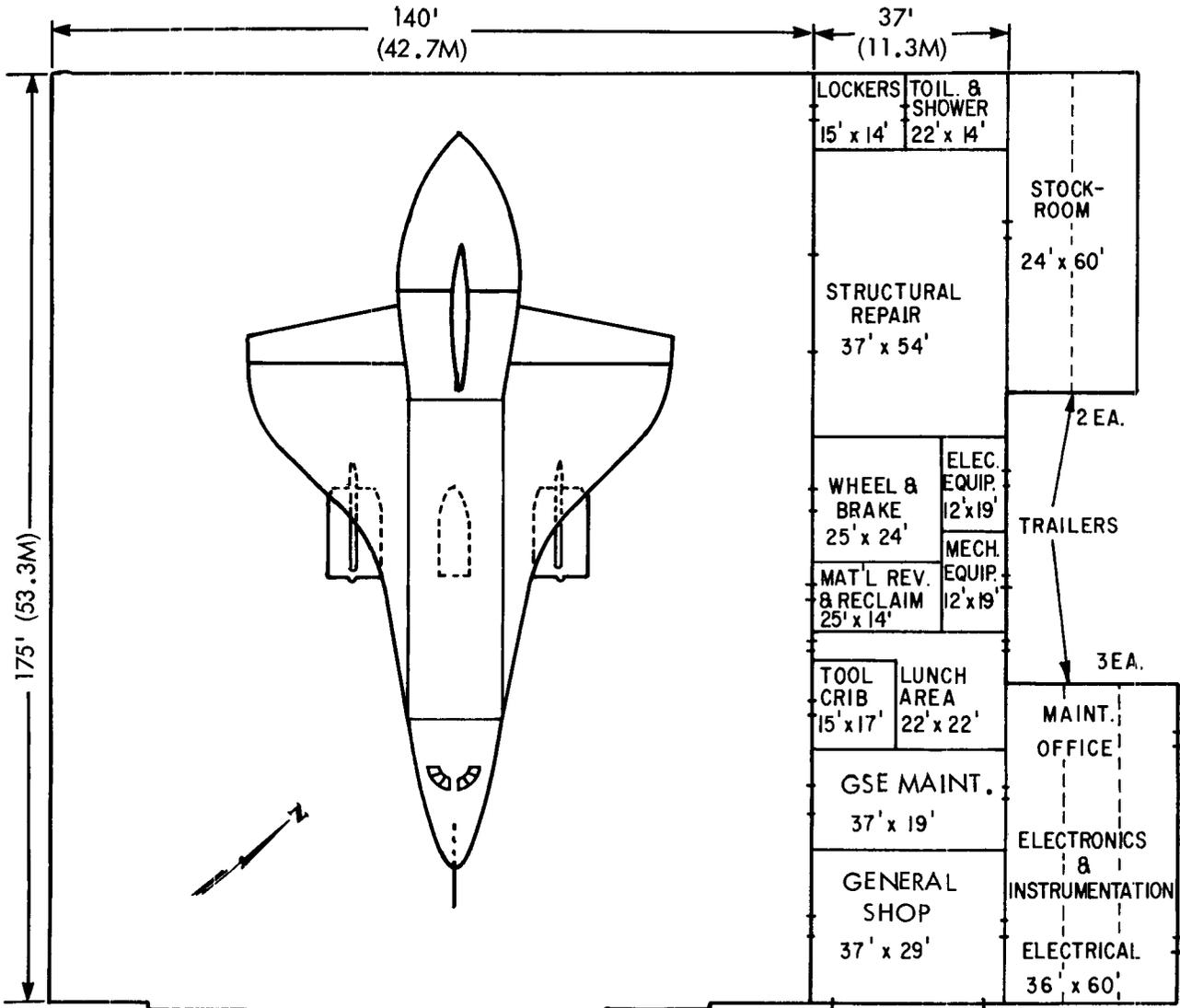
CONSTRUCTION OF ORBITER HORIZONTAL FLIGHT TEST FACILITIES
FLIGHT RESEARCH CENTER

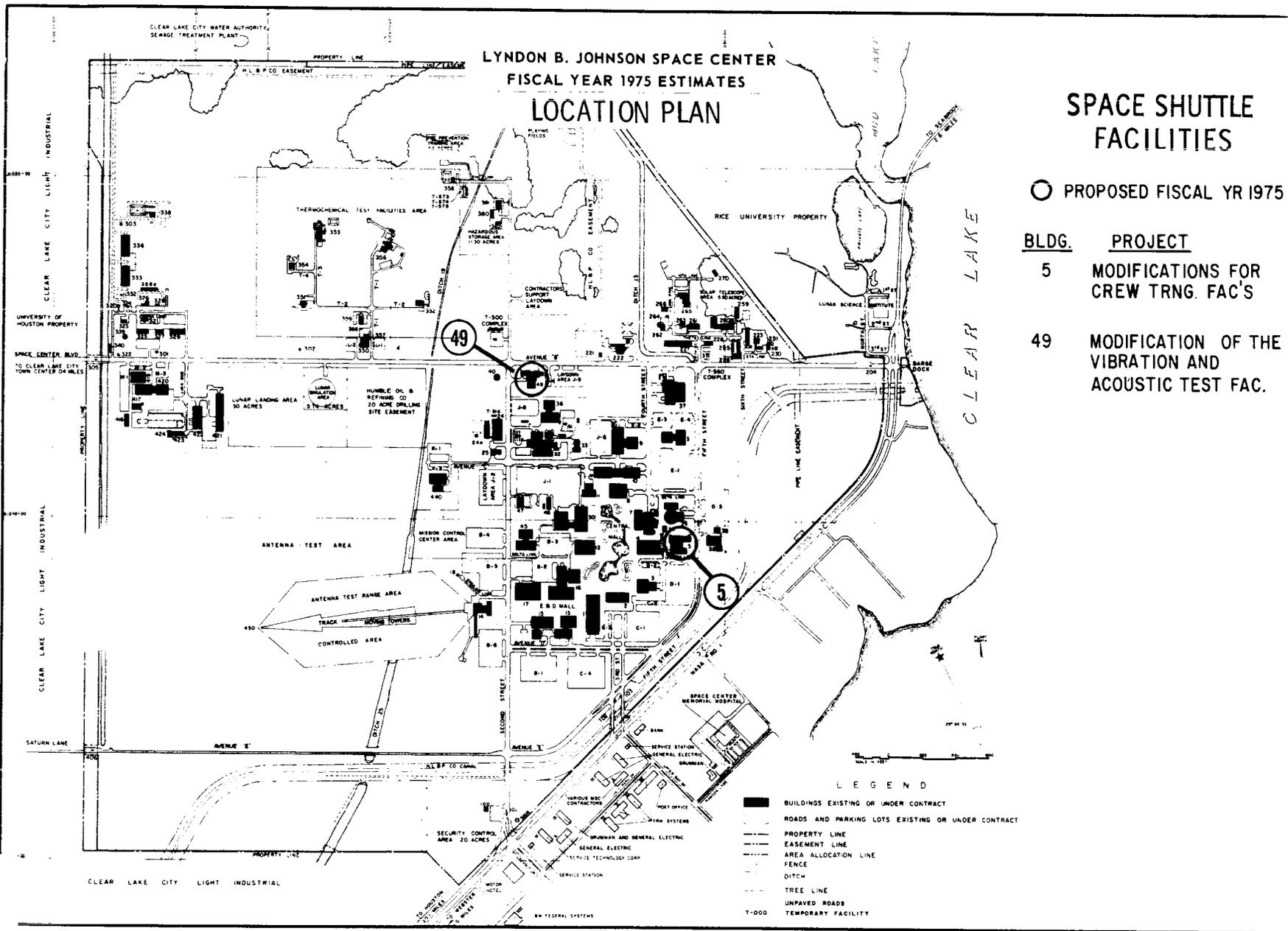


PERSPECTIVE
(FLIGHT TEST HANGAR)

CF 10-44

LYNDON B. JOHNSON SPACE CENTER
 FISCAL YEAR 1975 ESTIMATES
CONSTRUCTION OF ORBITER HORIZONTAL FLIGHT TEST FACILITIES
 FLIGHT RESEARCH CENTER





CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modifications for Crew Training Facilities</u>
LOCATION	<u>Lyndon B. Johnson Space Center</u>
	FY 1975 CoF ESTIMATE <u>\$420,000</u>

COGNIZANT INSTALLATION: Lyndon B. Johnson Space Center

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$30,000
Construction	<u>2,610,000</u>
Total FY 1974 and Prior Years	<u>\$2,640,000</u>

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications of the Mission Simulation and Training Facility, Building 5, to accommodate the Shuttle Horizontal Flight Simulator and Shuttle Mission Simulator computer. The work is required to provide capability for training the flight crews and ground controllers, and developing procedures for operating the shuttle in the atmosphere and outer space.

PROJECT JUSTIFICATION:

A principal factor for the success of manned space flight programs to date can be attributed to an intensive flight crew training program carried out by using mission simulators. The Mission Simulation and Training Facility was specifically designed and constructed as a training base for the flight crew using unique simulation equipment. To date, this facility has successfully supported the essential crew training activities for the Gemini, Apollo and Skylab programs. This project provides the initial and necessary modifications to adapt the facility for the shuttle crew training requirements.

To support space shuttle program requirements it is necessary, at this time, to procure and install a shuttle Horizontal Flight Simulator and a Shuttle Mission Simulator computer. The first is required to train the crew in flying the orbiter in the airborne mode, while the latter is required to initiate the software development and better define the total shuttle mission simulation needs. The Horizontal Flight Simulator consists of a crew station and an instructor station with the associated displays, controls and animated window scenes. Using this equipment, the crew is able to train, develop and use the procedures and techniques for normal and emergency flight situations while incurring no personal risk. This project provides the facility modifications necessary to support these activities.

The Horizontal Flight Simulator must be "on line" one year before the first horizontal flight test. The Shuttle Mission Simulator computer must also be available about the same time to meet the crew training requirements. To achieve these milestones, it is necessary to start facility modification in the FY 1975 time frame.

PROJECT DESCRIPTION:

This project provides for modifications to the Mission Simulation and Training Facility, Building 5, to house the shuttle Horizontal Flight Simulator and the Shuttle Mission Simulator computer. For the Horizontal Flight Simulator, the work includes the installation of a 3,000 psi (211 Kg/square centimeter) hydraulic pump, and 2-inch (5.1 centimeter) distributor lines to and from the simulator, procurement and installation of 225 KVA transformer to provide the required power to the hydraulic equipment, strengthening the existing floor foundation for the simulator moving base, rearranging partitions and rerouting related utilities.

For the Shuttle Mission Simulator computer, the modifications include changes to the existing raised floor system, rerouting electrical cabling and air conditioning ducts and rearranging room partitions. In addition, the existing Skylab dynamic crew procedures simulator will be disassembled and removed to provide storage space in support of crew training activities.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$420,000</u>
Horizontal flight simulator area modifications	LS	---	---	90,000

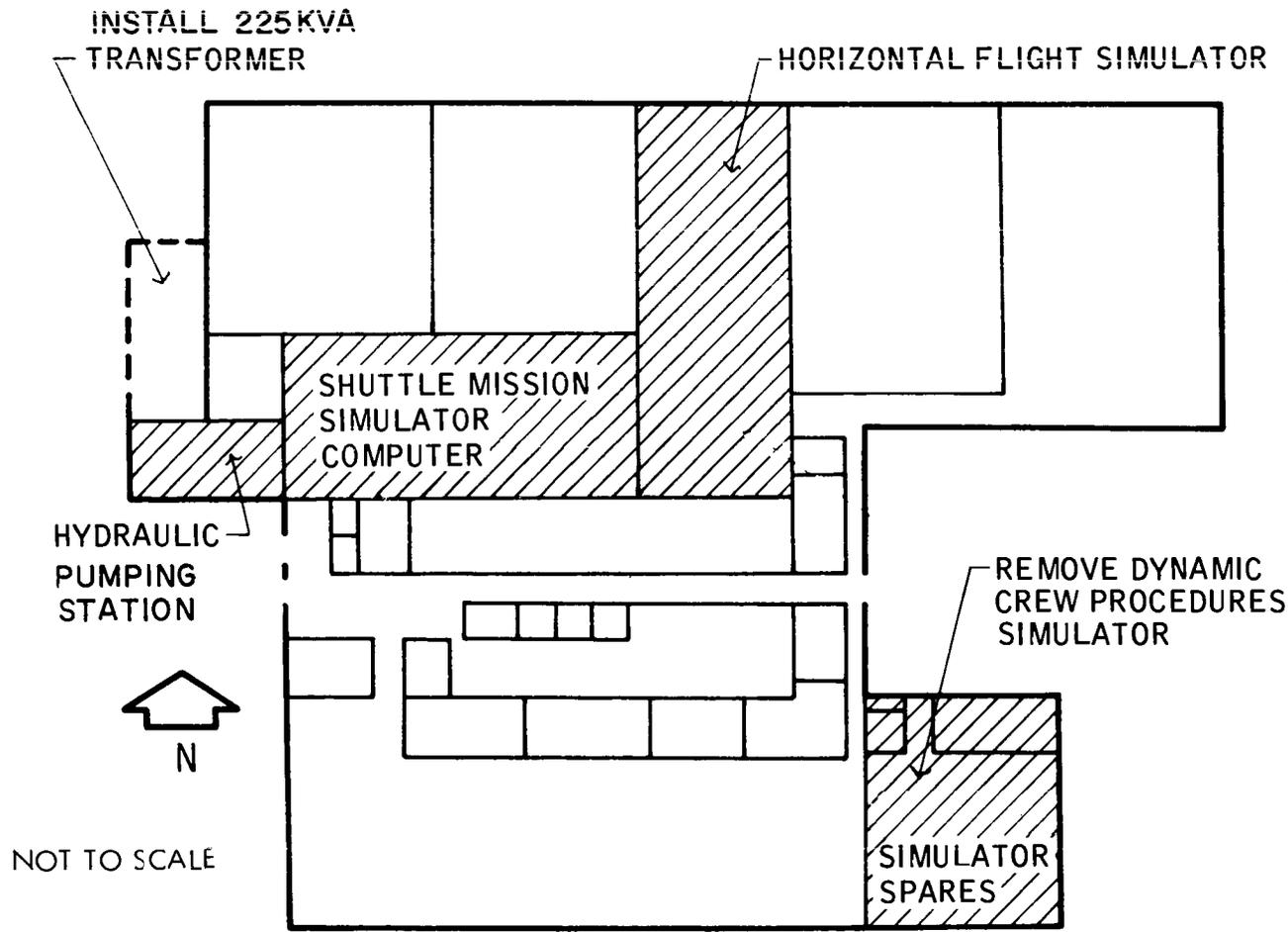
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
Shuttle mission simulator computer modifications	LS	---	---	\$44,000
Hydraulic power and transformer stations	LS	---	---	126,000
Rehabilitation and equipment removal	LS	---	---	160,000
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	---
			TOTAL	<u>\$420,000</u>

This project provides for the facility modifications required for housing the Horizontal Flight Simulator and associated equipment, and the Shuttle Mission Simulator computer complex. The Horizontal Flight Simulator and the Shuttle Mission Simulator computer and associated equipment will be developed and procured from the R&D appropriation. Existing simulation equipment, valued at about \$4.3 million, will also be used in conjunction with the Horizontal Flight Simulator.

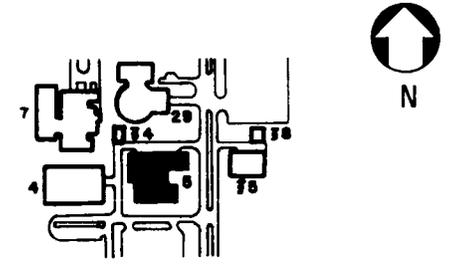
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that approximately \$500,000-1,000,000 will be required in future years for housing the Shuttle Mission Simulator, and other facility modifications in support of crew training.

MODIFICATIONS FOR CREW TRAINING FACILITIES



MODIFIED AREA
APPROX. 10,500 SQ. FT.
(975 SQ M)



FIRST FLOOR PLAN
MISSION SIMULATION AND TRAINING FACILITY

SITE PLAN

580-957 O-74-20

CF 10-50

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modification of the Vibration and Acoustic Test Facility</u>
LOCATION	<u>Lyndon B. Johnson Space Center</u>
	FY 1975 CoF ESTIMATE <u>\$410,000</u>

COGNIZANT INSTALLATION: Lyndon B. Johnson Space Center

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$249,000
Construction	<u>6,610,000</u>
Total FY 1974 and Prior Years	<u>\$6,859,000</u>

SUMMARY PURPOSE AND SCOPE:

This project rehabilitates and upgrades the amplifier capability in the Vibration and Acoustic Test Facility, Building 49, at the Johnson Space Center. This upgrading is necessary to improve the reliability and efficiency of the amplifier system in support of space shuttle vibro-acoustic testing. This testing will be performed on components and fuselage sections of the orbiter vehicle. The upgrading is to be accomplished by replacing the existing obsolete amplifiers with a current and more reliable amplifier system.

PROJECT JUSTIFICATION:

The orbiter will be subjected to severe noise impingement during lift-off, boost and re-entry. This will significantly affect the structural design of the overall shuttle vehicle. For this reason, a vibro-acoustic test program that will subject components and large segments of the orbiter vehicle to the noise environment to be encountered throughout the mission profile has been determined essential for shuttle development. To provide this basic capability, the FY 1973 Construction of Facilities program included a project for modifying the existing Vibration and Acoustic Test Facility at the Johnson Space Center. That project provided for modifying

the existing reverberant acoustic chamber, increasing the compressor and the noise generation capabilities and adding a sonic fatigue test cell for testing orbiter segments with the thermal protection system. This construction work is in progress toward meeting the program test requirements. This FY 1975 request is required to rehabilitate the high power amplifier system used in driving the noise generators and shakers. This work is needed to increase the reliability and efficiency of the vibro-acoustic test program.

To subject the orbiter hardware to the appropriate acoustic and aerodynamic flight environment, varying sizes of horns, noise generators and shakers are installed at proper locations inside the walls of the test chambers. These noise generators and electro-mechanical shakers are activated by varying power levels, the magnitude of which depend on the noise and vibratory forces to be simulated. The amplifiers are used to amplify the control and pre-programmed electric current which activates the noise generators and shakers to the proper power level. Some of the existing amplifiers, specifically those concerned with the high power levels, that were used for Apollo and Skylab testing have deteriorated and become seriously unreliable. This project provides for replacement of those obsolete units with a more recently developed and more reliable amplifier system.

The existing high power amplifiers are 8-10 years old and because of their age incur frequent "down-time" with resultant reduced reliability and more difficult maintenance and operation. All of these adverse factors have become more severe and more critical during the past two years, subsequent to the FY 1973 budget estimates. In addition, replacement parts have become increasingly more difficult to acquire. For these reasons replacement of this amplifier equipment, while not included in the cited FY 1973 project, is now urgent and necessary. The amplifier system requested in this project will greatly increase the efficiency and reliability of the testing, and at the same time reduce the "down-time" and the related inefficiencies of maintenance and operation. This work is required in FY 1975 to support the major vibro-acoustic testing that is scheduled to start in early CY 1976.

PROJECT DESCRIPTION:

This project involves work in the Vibration and Acoustic Test Facility, Building 49, providing for the replacement of the high power amplifiers. This will be accomplished through the replacement of the deteriorated existing amplifiers with a unified power amplifier system, made up of 40 improved, presently available type amplifier modules, and peripheral equipment.

Small automatic checkout and performance monitoring equipment will also be included to improve efficiency and productivity of the vibro-acoustic testing. The subsystem will have the flexibility to work simultaneously or independently with any single or all vibro-acoustic excitation systems supporting the acoustic and vibration laboratories and sonic fatigue test cell.

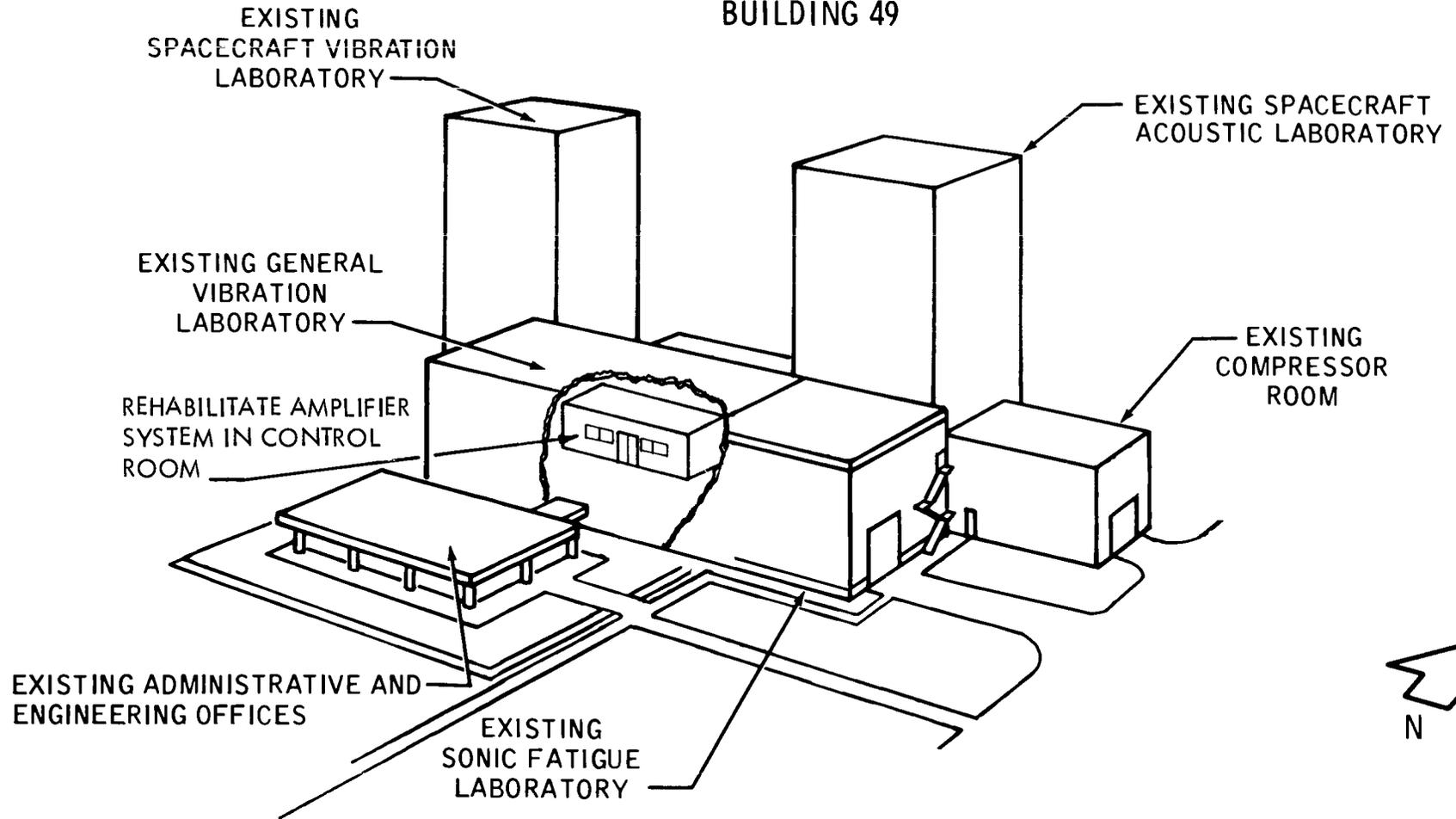
PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$46,000</u>
Facility modifications	LS	---	---	46,000
<u>Equipment</u>				<u>364,000</u>
Amplifier system	LS	---	---	355,000
Checkout equipment	LS	---	---	9,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	<u>---</u>
		TOTAL		<u>\$410,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

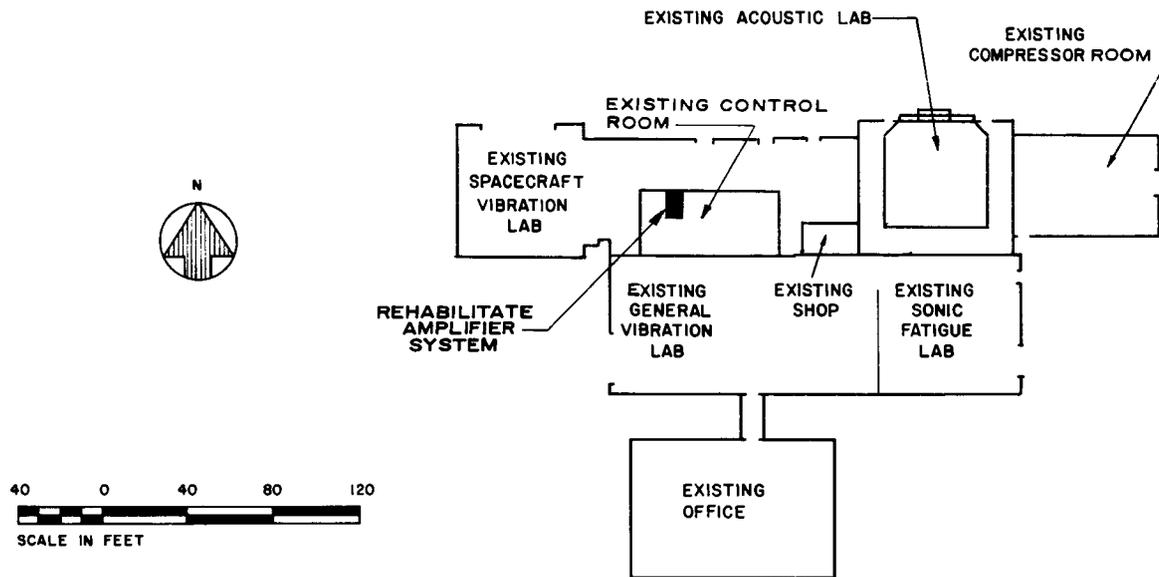
A potential requirement amounting to approximately \$1.5 million may be required to increase the noise level testing capability of this facility. The validity of this requirement will be determined in the next year and, if validated, it will be considered for possible inclusion in the FY 1976 estimates.

MODIFICATION OF THE VIBRATION AND ACOUSTIC TEST FACILITY BUILDING 49

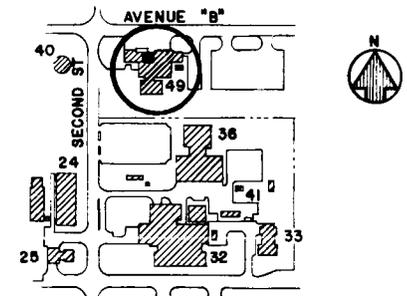


LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1975 ESTIMATES

MODIFICATION OF THE VIBRATION AND ACOUSTIC TEST FACILITY



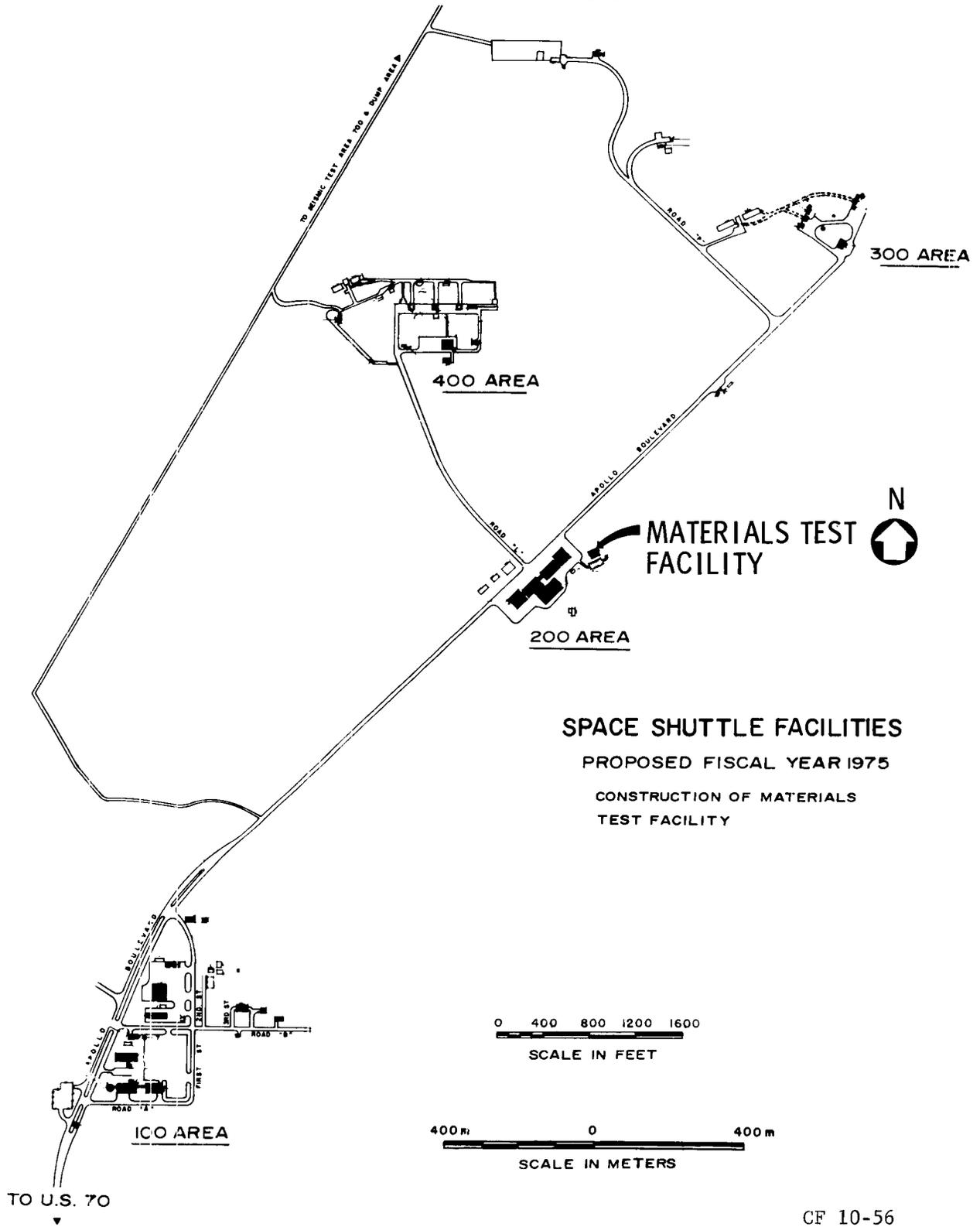
**BUILDING 49
FLOOR PLAN**



SITE PLAN

CF 10-55

LYNDON B. JOHNSON SPACE CENTER
FISCAL YEAR 1975 ESTIMATES
**LOCATION PLAN
WHITE SANDS TEST FACILITY**



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Construction of Materials Test Facility</u>
LOCATION	<u>White Sands Test Facility</u>
	FY 1975 CoF ESTIMATE <u>\$790,000</u>

COGNIZANT INSTALLATION: Lyndon B. Johnson Space Center

LOCATION OF PROJECT: Las Cruces, Dona Ana County, New Mexico

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$61,000
Construction	<u>---</u>
Total FY 1974 and Prior Years	<u>\$61,000</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide capability for hazardous materials testing and certification in a safe and reliable environment. This project includes construction of a concrete structure housing nine test cells and a test control center that will replace existing substandard, inadequate and potentially unsafe facilities.

PROJECT JUSTIFICATION:

The White Sands Test Facility has performed the majority of materials testing, qualification and certification in support of the Apollo and Skylab programs. It has the qualified personnel, the equipment and test apparatus, and the engineering laboratories to effectively carry out the materials testing functions. For these reasons, the White Sands Test Facility has been determined to be the optimum site for materials qualification and certification in support of the orbiter development. Work in these areas has been started.

Certain of the materials testing is considered hazardous in that the material samples are tested for compatibility with liquid oxygen, air, and hypergolic fuels at both low and high pressures. For Apollo, these hazardous activities were carried out in temporary, skid mounted and prefabricated

metal structures using sand bag barricades. Controls were manual and, because the facilities were remote and scattered, adequate fire protection could not be effectively or economically provided. This project is required to provide an adequate facility that can carry out these hazardous functions in a reliable, efficient and safe manner.

In June 1972, an accident, involving personal injury, occurred at White Sands while carrying out certain material testing. This accident was directly attributable to a lack of adequate facilities. As a result, it was determined that the hazardous testing activities would be greatly curtailed until more adequate facilities were provided. For that reason, via minor construction, there will be provided twelve concrete test cells; and, a trailer will be modified for use as a control center. This work is currently in progress. This FY 1975 request provides nine additional concrete cells and support space as well as a permanent test control center. The test control center will replace the trailer and serve as the central control facility for all hazardous test cells. This project therefore is needed to satisfy the total requirement for hazardous materials testing at White Sands in support of the shuttle orbiter program.

Materials testing, qualification and certification is an essential and a "heavy-load" activity in support of developmental space programs. For Apollo, some 3,600 different material samples were subjected to a total of approximately 21,000 tests at the White Sands Test Facility. It is estimated that materials testing for the shuttle will be comparable in terms of workload. In view of the amount of testing and in light of the accident, it is essential that safer and more adequate facilities be provided.

Materials are tested to determine flash and fire points at different pressures, compatibility with different gaseous and liquid propellants, flame propagation rates, off-gassing characteristics, mechanical and pneumatic impact effects, material odor in certain flight environments and effects of aging on materials exposed to oxygen and air. With this project, the existing facilities at White Sands will be capable of accomplishing these materials test objectives. This project is required now to meet the heavy materials testing workload that is expected to peak in the late CY 1975 and early CY 1976 time frame.

PROJECT DESCRIPTION:

This project will provide for the construction of a concrete facility in support of hazardous materials testing. The facility will be approximately 8,000 square feet (743.2 square meters) and will consist of a test cell area connected to a two-story building. The test cell area will include nine cells for hazardous materials testing in the simulated flight environments. The fluid media includes liquid oxygen, gaseous oxygen, gaseous nitrogen and/or air environment. The two-story building will house a nonhazardous testing laboratory and test preparation area on the first floor and the test control center on the second floor.

CF 10-58

Related utilities extensions, fire protection, instrumentation and control systems, site work, a 250 foot x 20 foot (76.2 meters x 6.1 meters) access road and parking will be provided. The work also includes relocating and installing existing equipment, including gaseous and liquid storage vessels, and test equipment and fixtures at this site.

PROJECT COST ESTIMATE:

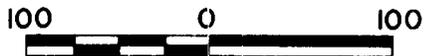
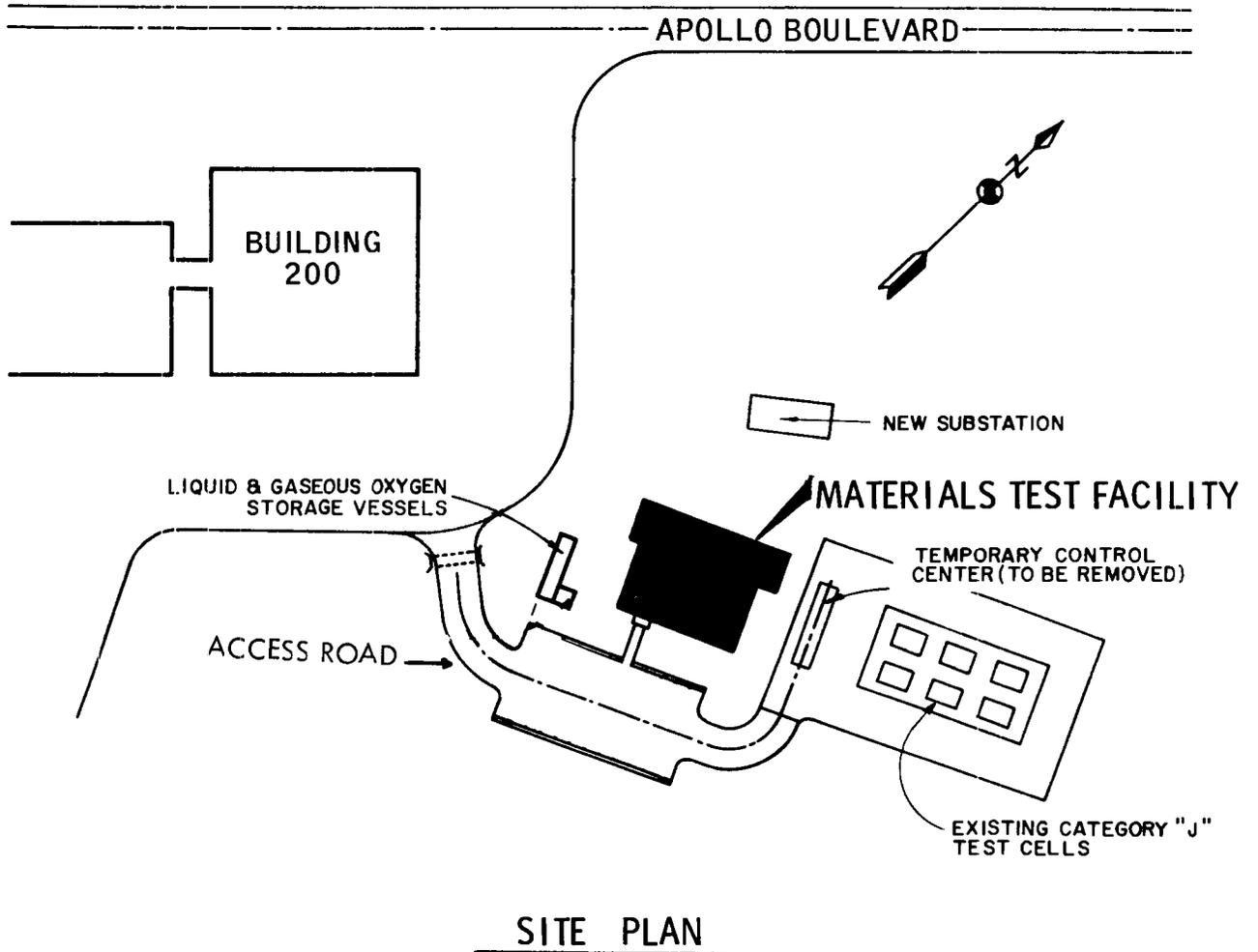
	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$444,000</u>
Concrete building	SF	8,000	\$38.00	304,000
Outside utilities (water, electrical and mechanical)	LS	---	---	80,000
Site work and paving	LS	---	---	60,000
<u>Equipment</u>				<u>346,000</u>
Instrumentation and control system	LS	---	---	170,000
Relocation and installation of existing equipment	LS	---	---	176,000
Fallout Shelter (Not Feasible)	---	---	---	---
			TOTAL	<u>\$790,000</u>

This project includes the installation of existing test equipment, fixtures, and gaseous and liquid storage vessels valued at approximately \$600,000.

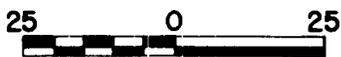
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

For presently planned usage, there are no currently foreseen future funding requirements necessary to complete this project.

CONSTRUCTION OF MATERIALS TEST FACILITY WHITE SANDS TEST FACILITY

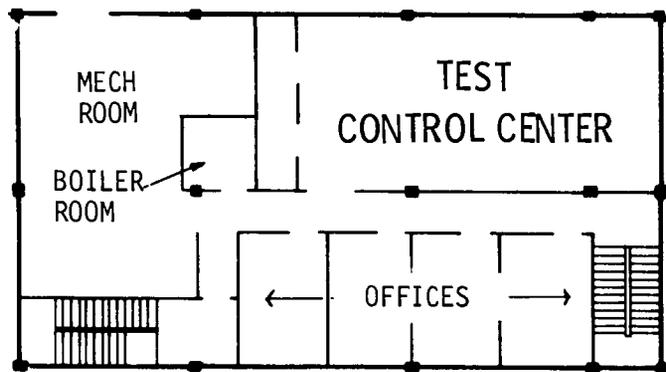


SCALE IN FEET

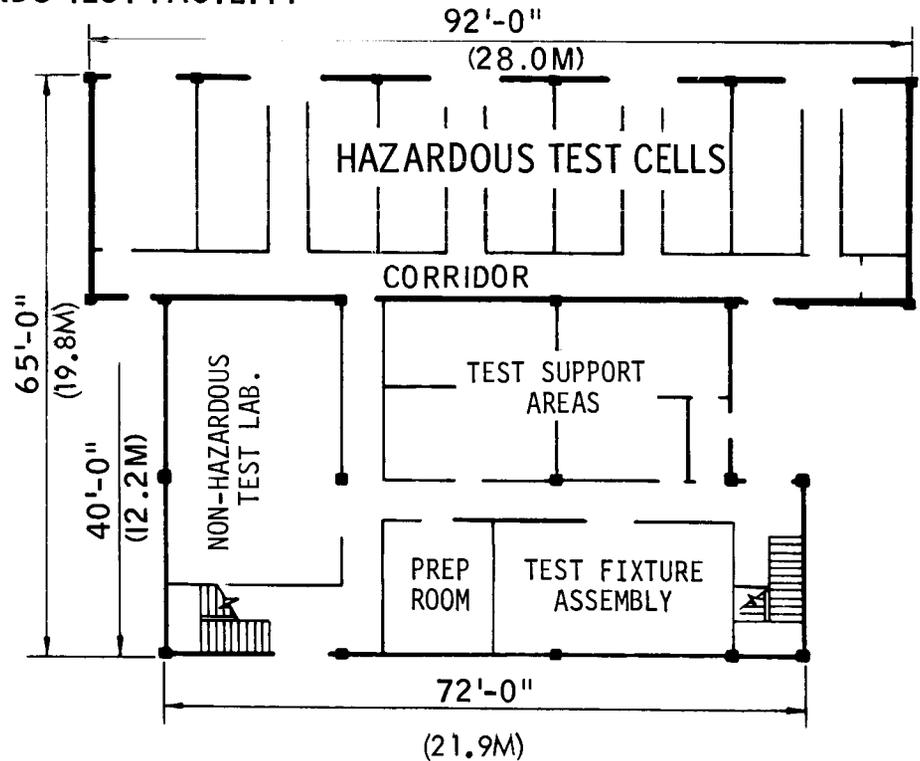


SCALE IN METERS

LYNDON B. JOHNSON SPACE CENTER
 FISCAL YEAR 1975 ESTIMATES
CONSTRUCTION OF MATERIALS TEST FACILITY
WHITE SANDS TEST FACILITY



SECOND FLOOR PLAN

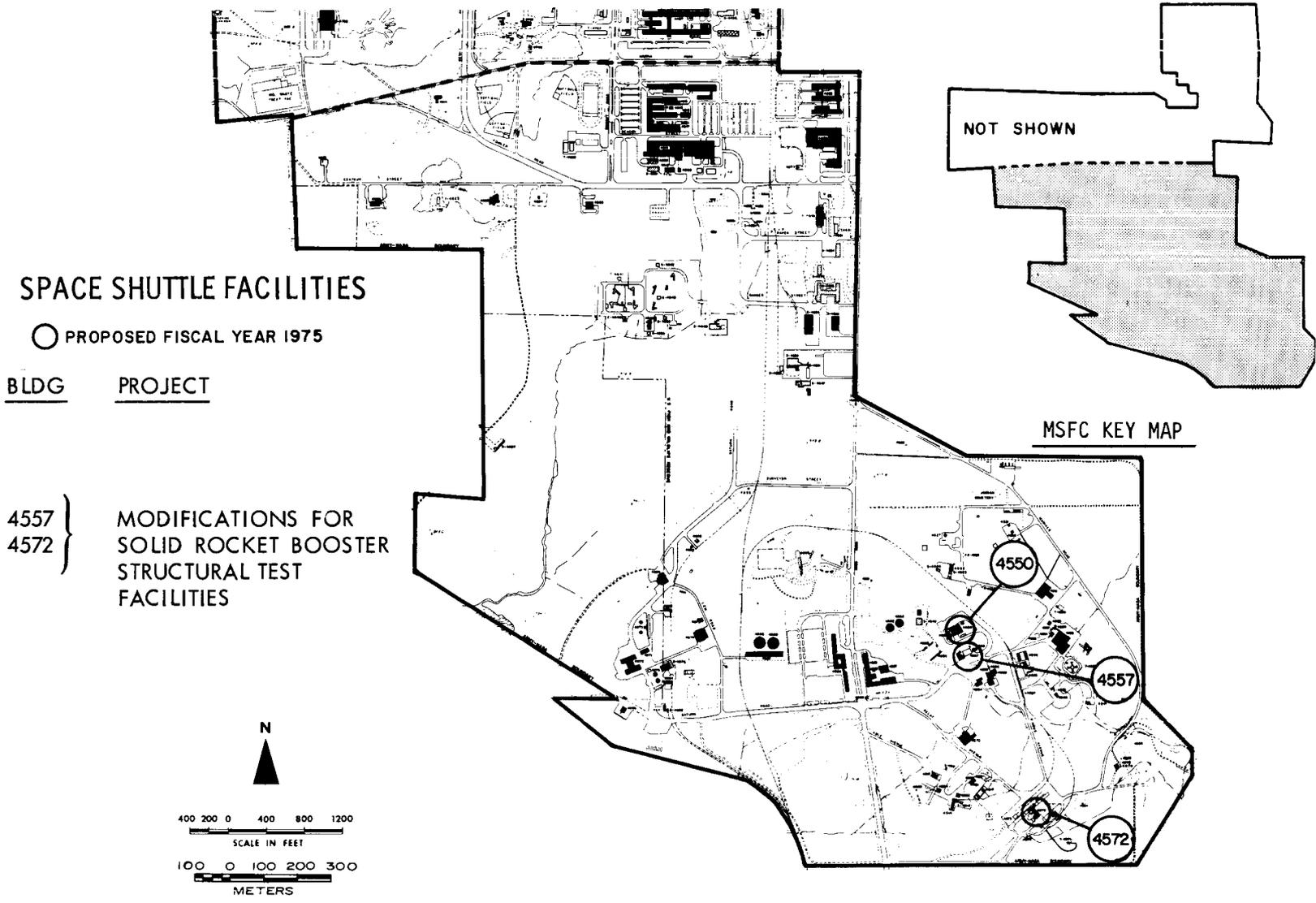


FIRST FLOOR PLAN

NOT TO SCALE

TOTAL AREA APPROX. 8,000 SF
 (743 SQ. M)
 NET SQUARE FOOTAGE 5,682 SF
 (528 SQ. M)

**MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1975 ESTIMATES
LOCATION PLAN**



CF 10-62

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Modifications for Solid Rocket Booster Structural Test Facilities</u>
LOCATION	<u>Marshall Space Flight Center</u>
	FY 1975 CoF ESTIMATE <u>\$2,590,000</u>

COGNIZANT INSTALLATION: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$194,000
Construction	<u>4,308,000</u>
Total FY 1974 and Prior Years	<u>\$4,502,000</u>

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to modify the existing Static Test Tower West, Building 4572, and the S-IB Dynamic Test Stand, Building 4557, at the Marshall Space Flight Center (MSFC) to provide capability for structural testing of the solid rocket booster (SRB) case. This capability is essential to support the design, development, and verification of the structural integrity and reusability of the solid rocket booster.

PROJECT JUSTIFICATION:

The space shuttle vehicle is comprised of an orbiter, external tank, and two solid rocket boosters. The solid rocket boosters, which provide the major portion of the thrust (approximately 1.25 million pounds each), are attached to the external tank in the launch configuration. The major structural components of the solid rocket booster include the solid rocket motor, forward and aft skirt, external tank attached structures, and a nose cone. These components will be subjected to extensive stress loadings from the time the three shuttle elements are mated through the launch, separation, and recovery phases of each mission. The ability of the solid rocket booster to withstand these great forces, coupled with the stringent require-

ments of minimum weight and reusability dictate the need for a ground structural test program. This test program will verify the structural integrity of the solid rocket booster assemblies during launch, flight, and recovery operations. To verify the structural ability of the SRB to withstand the water pressure during the recovery phase, the case must also be tested while submerged in water. This project is necessary to provide the capability to carry out this structural test program.

Because of the large size of the booster, approximately 12 feet in diameter x 145 feet long (3.7 meters x 44.2 meters), and the hazardous nature of the testing, large test facilities with a suitable location for the hazardous activities will be required. These selected facilities, with modifications, will satisfy these requirements. The data acquisition and instrumentation system required to support this program is available in the Structures and Mechanics Laboratory, Building 4619, at MSFC. This system is being rehabilitated and modified with FY 1973 Construction of Facilities funds specifically to support the structural test program for the solid rocket booster as well as the external tanks.

To achieve the first manned orbital flight as currently scheduled, the SRB structural test program must start in the second half of CY 1976. The modification and activation work, to achieve operable facilities for this testing, is estimated to require approximately 18-22 months. Correspondingly, this facility work must be initiated in late CY 1974 to meet program requirements. This requires that FY 1975 Construction of Facilities resources be available for that purpose.

PROJECT DESCRIPTION:

This project will provide for modifications to the existing Static Test Tower West, Building 4572, the test stand annex and area systems, and the S-IB Dynamic Test Stand, Building 4557, at Marshall Space Flight Center.

The work at the Static Test Tower West includes: extension of flame trench by 40 feet (12.2 meters), widening of flame trench by 6 feet (1.8 meters) and providing a new reinforced concrete foundation, a new structural load frame and enclosure, and a platform for stacking SRB segments. Refurbishment of the test stand annex, including the installation of a new control system, conversion of the existing RP-1 fuel storage system to a pressurization system, and extension of utility systems, will also be accomplished.

The work at the S-IB Dynamic Test Stand, Building 4557, includes: refurbishment of the existing 75 ton (68.0 metric tons) derrick, construction of a new water loading tank approximately 15 feet in diameter x 93 feet high (4.6 meters x 28.3 meters), related loading rods, fixtures and modification to six access platforms.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$1,956,000</u>
Static Test Tower West modifications				1,416,000
Extension of flame trench area	LS	---	---	(105,000)
New reinforced concrete foundation	CY	1,800	\$160.00	(288,000)
New load frames and enclosures	LS	---	---	(982,000)
New stacking platform	LS	---	---	(41,000)
Refurbishment of test stand annex	LS	---	---	15,000
Pressurization system and utilities extension	LS	---	---	79,000
S-IB Dynamic Test Stand modifications	---	---	---	446,000
<u>Equipment</u>				<u>634,000</u>
Control system	LS	---	---	634,000
<u>Fallout Shelter (Not Feasible)</u>	---	---	---	---
		TOTAL		<u>\$2,590,000</u>

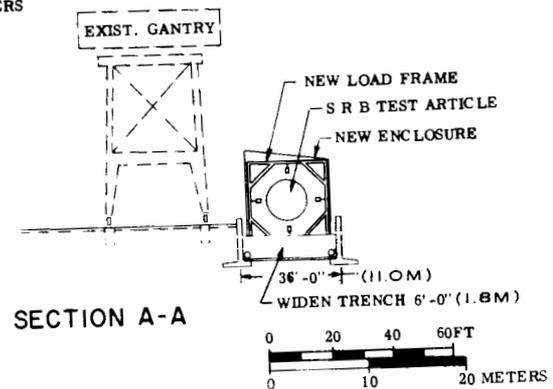
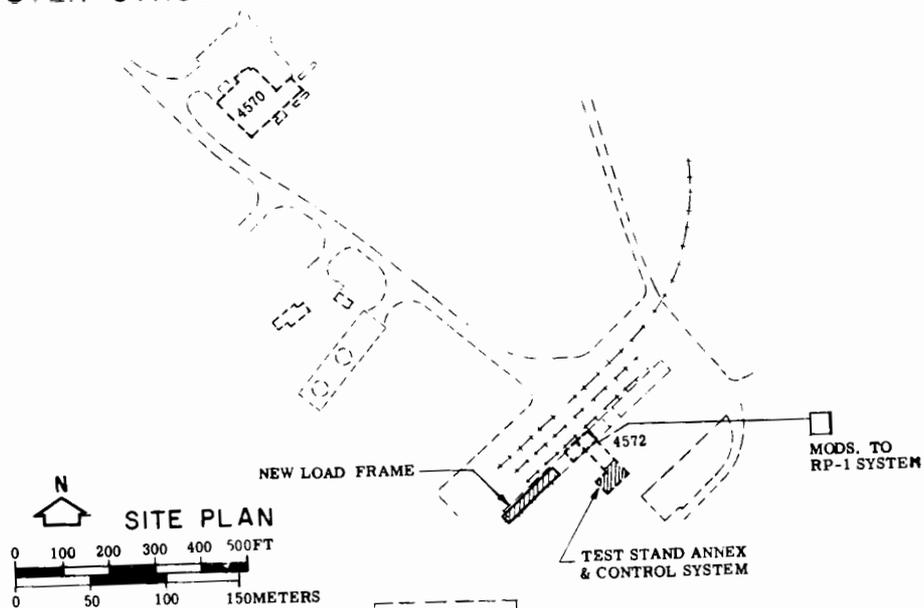
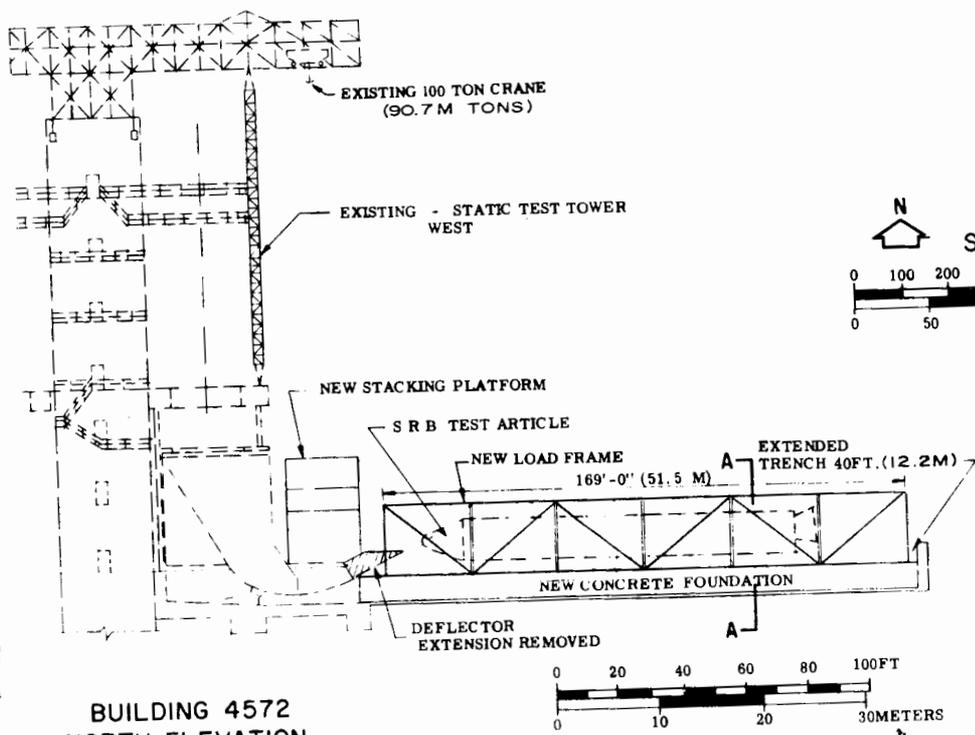
Additional noncollateral test equipment such as strain gauges, sensors, load application hardware, and related equipment that is sensitive to the SRB test article will be funded from the Research and Development appropriation. The cost of this equipment is estimated to be approximately \$2 million.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

For presently planned usage, there are no currently foreseen future funding requirements necessary to complete this project.

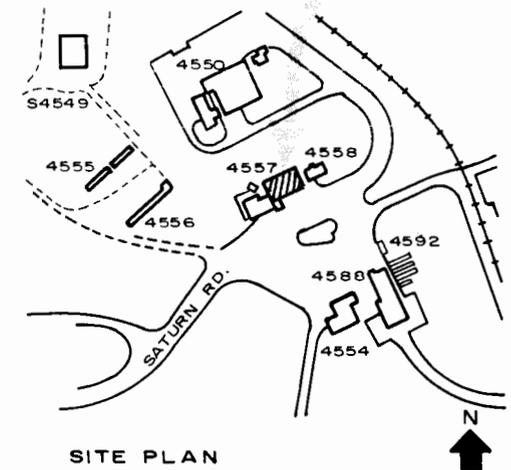
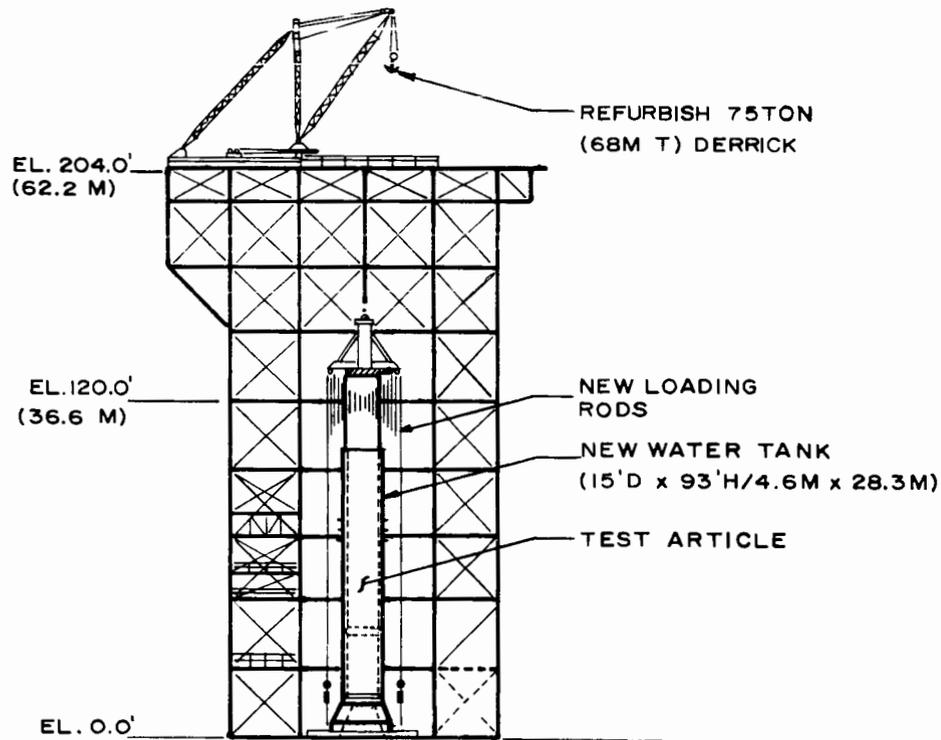
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MARSHALL SPACE FLIGHT CENTER FISCAL YEAR 1975 ESTIMATES MODIFICATIONS FOR SOLID ROCKET BOOSTER STRUCTURAL TEST FACILITIES

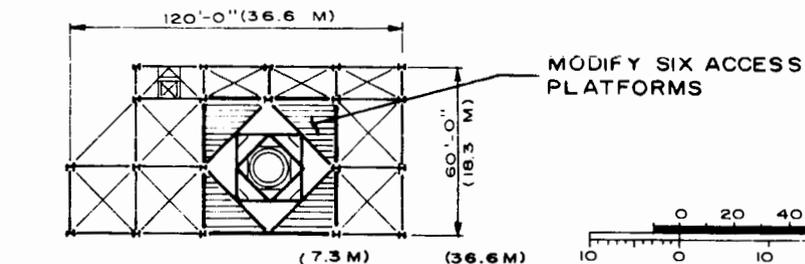


CF 10-66

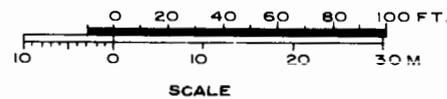
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1975 ESTIMATES
MODIFICATIONS FOR SOLID ROCKET BOOSTER STRUCTURAL TEST FACILITIES



SOUTH ELEVATION



PLAN AT ELEVATION 24'-0" TO 120'-0"



CF 10-67

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Construction/Modification of Solid Rocket Motor Production and Test Facilities</u>
LOCATION	<u>Various Locations</u>
FY 1975 CoF ESTIMATE <u>\$4,000,000</u>	

COGNIZANT INSTALLATION: Marshall Space Flight Center

LOCATION OF PROJECT: To be designated

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$320,000
Construction	<u>---</u>
Total FY 1974 and Prior Years	<u>\$320,000</u>

SUMMARY PURPOSE AND SCOPE:

This project, at a location to be designated, provides for the modifications of existing facilities and/or construction of new facilities which are necessary to support production and tests of the solid rocket motors during the Design, Development, Test and Evaluation (DDT&E) phase of the program. The facility requirements for these functions are sensitive to the detailed plans of the solid rocket motor (SRM) contractor selected in November 1973. Award of this contract is being withheld pending resolution of a protest made to the General Accounting Office. Only subsequent to award can definitive SRM facility needs be delineated. This project is based on the most probable requirements of the selected contractor using earlier analysis and appraisals.

PROJECT JUSTIFICATION:

A contractor has been selected for the production and testing of solid rocket motors (SRM's) for the space shuttle. Based on discussions and facility requirement reviews with this contractor before the formal proposals were submitted, facilities needs in terms of site locations, scope of facilities required, phasing of needs and the use and modification of existing facilities versus construction of new ones were fairly well identified. However, in light of the contract award being withheld, precise

facility requirements cannot be determined. This project is based on modifying and using existing facilities for solid rocket motor production and test requirements; and is estimated to include the most probable requirements of the selected contractor for the DDT&E phase of the program.

If a contract is awarded to the selected contractor, NASA will proceed at that time to confirm and more fully delineate the facility needs of the contractor. The sequence of events will consist of; negotiations to describe the government and contractor responsibilities; identification, justification and scoping of each SRM project element; agreement on facility acquisition schedules to satisfy DDT&E SRM requirements and program milestones; and cost validation of SRM facility project estimates.

To achieve the first manned orbital flight milestone as currently approved, the first SRM test article must be produced and tested in the first half of CY 1976. To support this goal, the SRM facility requirements must be initiated in the FY 1975 time frame.

PROJECT DESCRIPTION:

A solid rocket motor will include a steel casing approximately 142 inches (360.7 centimeters) in diameter and 100-120 feet long (30.5 - 36.6 meters). The casing could be made in three or more segments. The casing segments will be processed and filled with the solid propellant fuel at the production plant before shipping to the launch site for stacking. Facilities required to support SRM development will include capabilities to manufacture the casing, produce the propellants, cast them in the case, finish the segments and prepare them for shipment. The basic solid propellant ingredients include aluminum, polymer, and the ammonium perchlorate oxidizer. These ingredients must be received, inspected, conditioned and mixed in certain determined quantities, cast into the casing and cured under a controlled environment. To support these function, the SRM production plant must have the capabilities to carry out these activities.

Typical capabilities will include: a casing preparation facility; fuel storage and preparation facilities; oxidizer storage, conditioning and grinding facilities; mixing, casting and curing facilities; finishing and inspection facilities, and supporting laboratories. In addition, a test stand for test firing of the SRM will also be required.

Early preliminary data evolved with the selected contractor indicated considerable existing capability which required some modification or "tailoring" to manufacture and test the space shuttle solid rocket motor. Included were modifications to such facilities as those required for case preparation, casting and curing, nozzle preparation and the test bay. These facility modifications will be required in order to meet the first SRM development firing now scheduled for the first half of CY 1976.

PROJECT COST ESTIMATE:

	<u>Unit of Measure</u>	<u>Quantity</u>	<u>Unit Cost</u>	<u>Total Cost</u>
<u>Land Acquisition</u>	---	---	---	---
<u>Construction</u>				<u>\$4,000,000</u>
Modification of facilities				
Case preparation	LS	---	---	1,300,000
Cast and cure	LS	---	---	1,400,000
Nozzle preparation	LS	---	---	500,000
Test bay	LS	---	---	800,000
<u>Equipment</u>	---	---	---	---
<u>Fallout Shelter</u> (Not Feasible)	---	---	---	---
			TOTAL	<u>\$4,000,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

To complete facility modification to satisfy the DDT&E requirement, some additional resources may be necessary but, the details and extent of this possible need cannot now be estimated.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

Rehabilitation and Modification

	<u>Amount</u>	<u>Page No.</u>
<u>Summary of Project Amounts by Location and Cognizant Office</u>		
<u>Office of Manned Space Flight:</u>	<u>\$3,385,000</u>	
Johnson Space Center.....	1,163,000	CF 11-4
Kennedy Space Center.....	967,000	CF 11-7
Marshall Space Flight Center.....	955,000	CF 11-11
Various Locations.....	300,000	CF 11-12
 <u>Office of Space Science:</u>	 <u>4,845,000</u>	
Goddard Space Flight Center.....	1,040,000	CF 11-13
Jet Propulsion Laboratory.....	1,650,000	CF 11-15
Kennedy Space Center.....	785,000	CF 11-17
Wallops Station.....	1,370,000	CF 11-18
 <u>Office of Aeronautics and Space Technology:</u>	 <u>4,488,000</u>	
Ames Research Center.....	1,155,000	CF 11-20
Flight Research Center.....	560,000	CF 11-23
Langley Research Center.....	1,593,000	CF 11-24
Lewis Research Center.....	1,180,000	CF 11-27
 <u>Office of Tracking and Data Acquisition:</u>	 <u>682,000</u>	CF 11-29
 <u>Miscellaneous Projects Less Than \$50,000 Each:</u>	 <u>1,500,000</u>	CF 11-31
 Total.....	 <u>\$14,900,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Rehabilitation and Modification of Facilities not in Excess of \$500,000</u>
LOCATION	<u>Various Locations</u>
	FY 1975 CoF ESTIMATE <u>\$14,900,000</u>

COGNIZANT INSTALLATION: Various Locations

LOCATION OF PROJECT: Various Locations

COGNIZANT PROGRAM OFFICE: Office of the NASA Comptroller

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$6,135,000
Construction	<u>59,790,000</u>
Total FY 1974 and Prior Years	<u>\$65,925,000</u>

SUMMARY PURPOSE AND SCOPE:

This program is intended 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 1975 which can be foreseen at the time of the submission of these estimates, and which are estimated to cost not in excess of \$500,000. The purpose of this program is to protect, preserve, and enhance the capabilities and usefulness of existing NASA facilities, and to insure the continued safe, economical, and efficient use of this physical plant. While, in earlier years, this particular program was specifically directed toward the general nonprogrammatic segment of NASA facilities, this is the third year in which additional attention has been given to these types of facility requirements generated by specific programs or projects.

PROJECT JUSTIFICATION:

At its initial cost, the existing NASA physical plant totals about \$5.7 billion (June 30, 1973). A continuing program of rehabilitation and modification of these facilities is required to:

- a. Protect the capital value represented by those facilities and to overcome the cumulative effects of wear and deterioration.
- b. Insure 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 to overcome the aggregate effects of obsolescence.
- d. Provide a better and safer working environment for all personnel.
- e. Assist in achieving the goal of more efficient energy utilization by updating utility systems and other building elements with greater orientation toward reducing energy demand.

This project includes only facility rehabilitation and modification type work having an estimated cost of 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, by minor repair activities, or by related routine facility work efforts which 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 of facilities (new and addition type) items required in FY 1975. This latter requirement is provided for by a separate project included in these CoF estimates and entitled "Minor Construction".

PROJECT DESCRIPTION:

Items of rehabilitation and modification type work proposed to be accomplished within this program for FY 1975 are outlined under "PROJECT COST ESTIMATE" and total \$14,900,000. Of this total, \$13,400,000 is represented by discrete work packages at designated NASA installations. The remaining \$1,500,000 relates to smaller rehabilitation and modification type work estimated to cost less than \$50,000, the nature and purpose of which are the same as for that work specifically delineated but which, because of their individual smaller size, are not listed by item.

At this time these items, as presented, are considered to be of the highest priority. They have been carefully selected from lists totaling about \$37 million. This \$13,400,000 listing represents a most modest increment in relation to the existing total "backlog" of this type of work, which must be provided for over the next several years. For example, the FY 1975 estimate includes \$4,488,000 for the Aeronautics and Space Technology installations.

The initial survey conducted at these field installations indicated that at least \$60,000,000 (1971 dollars) of rehabilitation and modification type work should be undertaken as a phased program over the next several years to place these installations on a more economical and efficient operating basis. The concept of this survey has been expanded to other NASA installations in order to provide an improved NASA-wide base for this specific program. As a consequence, it is now estimated that at least \$150,000,000 (1971 dollars) of rehabilitation and modification work may be required at all installations. 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 re-arrangement of priorities may be necessary and 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 requirement for facilities rehabilitation and modification, a tentative listing of projects is set forth under "PROJECT COST ESTIMATE". This list totals \$13,400,000 for discrete projects which relate to the following broad categories of facilities:

a. Utility Systems	\$2,802,000
b. Fire Detection/Protection Systems	156,000
c. General Purpose Buildings	1,288,000
d. Technical Buildings/Structures	8,108,000
e. Pavements and Drainage	671,000
f. Building Exteriors and Roofs	375,000

In addition there are the "Lump Sum" estimates of \$1,500,000 for smaller project work, thus making a total of this list \$14,900,000.

The FY 1975 request for facility rehabilitation and modification work, therefore, is directed toward the most urgent current needs for work of this type in the continuation of this essential program at NASA installations.

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REHABILITATION AND MODIFICATION:

SUMMARY:

a. Office of Manned Space Flight	\$3,385,000
b. Office of Space Science	4,845,000
c. Office of Aeronautics and Space Technology	4,488,000
d. Office of Tracking and Data Acquisition	682,000
e. Smaller "Lump Sum" Projects	<u>1,500,000</u>
Total	<u>\$14,900,000</u>

PROJECT COST ESTIMATE:

1. <u>OFFICE OF MANNED SPACE FLIGHT</u>	<u>\$3,385,000</u>
A. <u>Johnson Space Center</u>	<u>\$1,163,000</u>
(1) Rehabilitation of Anechoic Chamber Doors, Building 14	74,000

This project provides for the repair of Anechoic Chamber doors to Building 14. The doors were installed in 1964 and at present require installation of new "fingerstock" (an interlocking radio frequency shield) on the large chamber door and cleaning the contact surface of the minor fingerstock, install new weatherseals and refurbishment of the interlock switches and air cylinders. A study was made to determine the amount of damage and deterioration of the doors, and it concluded that the continued rate of deterioration, if not corrected, may seriously impact the shuttle and other testing to be performed in the chamber. Penetration of moisture and dirt through improperly closed and weather-sealed doors will cause deterioration of the radio frequency (RF) absorber material, which would be extremely costly to repair. This project is required in order to maintain integrity in the results of electromagnetic interference (EMI) tests.

(2) Rehabilitate Chilled Water Valves, Utility Tunnel	74,000
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This project will provide for rehabilitation or replacement of worn or inoperative valves in the utility tunnel chilled water distribution system. More than 75 percent of the chilled water valves in the distribution system failed to close completely during a recent systems check. The valves are 8 to 10 years old and are in need of refurbishment or replacement. At present, inoperative valves involve a shutdown of building and zones on a more excessive basis than would ordinarily be necessary to repair inoperative elements. Such shutdowns could create unnecessary delays in essential test programs due to a lack of a chilled water supply. The rubber seating material presently used has a normal operating temperature range higher than the 40°F required for use in this system. At present, emergency repairs are performed on an "as needed" basis; however, a planned rehabilitation program is required to prevent major Center-wide outages beyond normal routine maintenance or repair. Should the valves continue without a planned rehabilitation program their operational integrity and reliability will be seriously degraded. This project is a continuation of the FY 1973 and 1974 funding of a 5 year phased effort to replace or rehabilitate worn and/or inoperative valves in the chilled water distribution system in the utility tunnel.

(3) Rehabilitate Steam System in Utility Tunnel and Building 24

\$275,000

This project consists of rehabilitation of the steam system in the Central Heating and Cooling Plant, Building 24 and its Utility Tunnel. Boiler control valves and tunnel steam and condensate control valves will be rehabilitated or replaced. An orderly program to rehabilitate/replace is necessary to maintain overall reliability and safety in the central steam system. The boilers have been in operation since 1963 and are approaching major rehabilitation requirements. There are approximately 175 expansion joints and 200 steam and condensate valves located in the Utility Tunnel. One function of the valves is to serve as shutdown devices in case of emergency. Presently, several of the valves will not close adequately. There have been 24 to 36 system failures per year in the equipment to be replaced or rehabilitated by this project. A major failure would create a safety hazard to personnel and equipment. Failures of major proportions could delay a mission-essential test which could result in an increase in the expenditure of funds required. The Building 24 steam system supports both institutional and research/development related facilities by supplying the necessary steam utilities. This is Phase II of a 5 year program started in FY 1974 to rehabilitate each boiler in the Central Heating and Cooling Plant in order to provide efficiency, safety and reliability in the steam generation system.

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(4) Rehabilitation of Heating and Cooling System in Technical Services Shop Building 10 and Space Environment Simulation Laboratory, Building 32

\$250,000

This project plans the replacement of heating and cooling valves, flexible hoses, actuator valves and pressure reducing stations in Buildings 10 and 32. This project is required to maintain overall reliability and permit more efficient operation of the utility distribution system within each of the respective buildings. These buildings were built in the 1964 to 1965 time frame. This specific effort is phase two of a four phase program started in FY 1974 which is planned to be accomplished within successive future years and the buildings selected represent the most urgent and pressing needs. All the valves, expansion joints, pressure reducing stations are approaching the end of a useful life based on like equipment failure and normal life expectancy. This replacement program must be started now to maintain the reliability required of these systems.

(5) Modifications for Life Sciences Facility, Building 37

490,000

This project provides for the modification of the Lunar Receiving Laboratory (LRL), Building 37, to permit its effective use as a Life Sciences Facility. Presently, one-half of the usable space in the LRL is occupied by life sciences activities. The reconfiguration of the LRL facility to a full life sciences facility will provide the necessary capability to further develop bio-medical research and support the life sciences payloads for the shuttle orbital flight and other programs. Presently the medical and bio-medical operations are scattered in several locations at JSC and Ellington AFB. This FY 1975 Phase I modification consists of completely modifying the existing biological barrier type air-conditioning systems to conventional systems typical of other laboratories at JSC, modifying the air conditioning system in the administrative area, providing required emergency accessways through existing biological barrier areas, and modifying plumbing and electrical systems and special purpose walls in such areas as quarantine airlocks and change rooms. The conditions generated by the existing dispersed locations of the life science

activities can be improved greatly by the consolidation of these activities. At the same time this work will permit some capability for expansion of these activities to meet new needs. This proposed facility work, when completed, will provide space needed to coordinate operations, configure payloads, and to integrate and simulate functions in support of payloads development and actual flight. The FY 1976 Phase II and FY 1977 Phase III modifications will maximize the beneficial utilization of the LRL for life sciences payload and other activities.

B. Kennedy Space Center

\$967,000

(1) Rehabilitate Roofs and Roof Mounted Air Handling Units at Missile Assembly Building "M" (1731)

95,000

This project provides for replacing the roof mounted 15.2 ton air handling unit on Missile Assembly Building "M" (1731) in the Cape Kennedy Air Force Station Industrial Area; replacing approximately 30,000 square feet (2,790 m²) of built-up roofing and insulation, flashing, gravel stops, pitch pockets and penetrations on the high bay portion of the building; removing the splash blocks on the low bays; and extending the high bay down spout lines across the low bays. This building was constructed in 1956 and has received routine maintenance, however, deterioration has occurred due to the building's age and the semitropical environment. The air handling unit and roof must be replaced because they have deteriorated to where maintenance cannot restore them to a satisfactory condition. Leaks in the high bay roof have occurred at various locations attesting to its general deteriorated condition. The air handling unit is beyond economical repair because of extensive corrosion. The building is used for assembly, modification, and checkout operations on the first and second stages of the unmanned satellite programs' Delta launch vehicle. Plans are to continue utilizing this building for Delta vehicle and space shuttle operation. This rehabilitation work then must be done on a timely basis to avoid further damage to the building interior and to space hardware and equipment in the building.

(2) Rehabilitate Hangars "AM" and "AO" (60503 and 60550) CKAFS

208,000

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This project will replace the existing 150 ton cooling tower with a new tower in Hangar "AM". In Hangar "AO" the work includes replacement of an existing 400 ton single cell cooling tower with a new 420 ton two cell cooling tower; rehabilitation of the air conditioning system for the west equipment room by the installation of a 1,350 MBH (thousands of BTU's per hour) heat exchanger and the replacement of existing old mercury vapor lights in the high bay with high intensity metal halide lamps. Cooling tower replacement is required because the existing towers have deteriorated to a point where normal maintenance is not effective. The heat exchanger is required to ensure proper temperature and humidity control in the clean room. The lamps in the lighting system must be replaced because of the high failure rate of the existing system resulting primarily from age and type of luminaire.

(3) Modify Buildings 840, 1622, 1623A and 1623B for Fire Protection/Detection, Western Test Range

\$82,000

Western Test Range Operations
Division Headquarters, Building 840 - Install heat activated detectors (HADS) throughout the 24,000 square foot (2,230 m²) area. Smoke detectors will also be used in critical areas. In addition, six hose cabinets will be installed and sensors will be connected to base monitoring system.

Blockhouse and Ready Room, Building 1622 - Install eleven HADS, seven smoke detectors and three fire doors and connect sensors to base monitoring system. The building contains approximately 5,200 square feet (483 m²).

PAD Support, Fuel Operations, Building 1623A - Install three HADS, two smoke detectors, two manual pull stations with connections to base monitoring system. The building contains approximately 700 square feet (65 m²).

PAD Support, General, Building 1623B - Install two HADS and two manual pull stations with connections to base monitoring system. This building contains approximately 480 square feet (45 m²).

Building 840 is the NASA/Western Test Range Operations Division Headquarters facility. It contains printing and communications equipment, records, and offices. The Mission Director Center area is used as the control point for all NASA launch operations, coordinating inputs from the spacecraft, launch vehicle, Range, weather, tracking stations, etc. This facility is considered vital in conducting NASA launches at WTR.

Building 1622 is the blockhouse, from which launch operations are conducted. Building 1623 (two structures) is located at the SLC-2W launch pad. Both facilities contain "launch critical equipment."

(4) Rehabilitate Explosive Safe Assembly Area CKAFS (54445 and 54446)

\$80,000

This project provides for rehabilitation of the Explosive Safe Assembly Facilities as follows: Replace one 127 ton cooling tower and rebalance the air conditioning system in the Sterilization and Assembly Building No. 54445. Modify the existing high bay lighting systems in Building 54445 and the Propellant Loading Building No. 54446 by installing remote ballasts and replacing lense gaskets and lense fasteners on the fluorescent light fixtures. A total of 140 fixtures require modification. The cooling tower to be replaced was installed in 1963 and is reaching the point where increased maintenance can no longer maintain the tower in an efficient operation condition. The present lighting system is a high intensity system employing fluorescent lamps in nitrogen pressurized fixtures. The existing ballast installation is conducive to overheating which significantly shortens the life of the ballasts. Remotely installed ballasts will eliminate the overheating problem. The existing lense seals are not dependable and when a pressurization failure occurs these lighting systems cannot be operated because of pressure differential switches installed in the nitrogen feed lines.

(5) Rehabilitate Outside Air Dampers in Buildings K6-900, K6-848, M6-342 and M7-355

192,000

This project will replace air dampers and provide sensors and controllers on these new dampers in Launch Control Center, Building K6-900, Vehicle Assembly Building, Building K6-848, Central Instrumentation Facility - Industrial Area, Building M6-342 and the Operations and Checkout Building - Industrial Area, Building M7-355. Existing dampers are corroded and are rapidly becoming inoperative. The sensorized damper controllers will allow use of recirculated air only during uninhabited periods and should result in savings on utilities cost. The sensors and controls will ultimately be connected to, and controlled from the proposed Utilities Control System.

(6) Utilities Control System Modification

\$310,000

This project provides for the modification of facilities in the KSC Industrial Area to extend the Utilities Control System (UCS) capabilities. As such, this is the second transitional increment required to complete the work in this area for air conditioning, water supply, high temperature hot water, waste treatment and fire alarm systems. The total objective of this UCS effort is to improve utilities operation and monitoring and permit operational control and diagnostic fault analysis. Savings in energy, manpower and costs are anticipated from the full implementation of this concept. Completion of this work in the Industrial Area will provide the total needs of the systems, as covered above, and permit more efficient and more energy-oriented operation of these systems. Additional follow-on requirements are envisioned as discrete line item projects in subsequent years in order to provide the total UCS needed at KSC.

C. Marshall Space Flight Center

\$955,000

(1) Modification to Guidance and Control,
Building 4487 (Inertial and Celestial Sensors
Laboratory)

490,000

This project provides for modification of approximately 3,600 square feet (1,090 m²) of interior space of Building 4487 and additional air conditioning capacity. The interior work involves replacement of walls, ceilings, flooring, doors and hardware, and air conditioning to upgrade the area to clean room status for testing and evaluating inertial and celestial sensors such as: stabilized platforms, precision gyroscopes and accelerometers, gimballed and strap-down inertial navigation systems, sun sensors, star sensors and trackers, control moment gyroscopes, and the computer and peripheral devices necessary to automate portions of the testing. The environment needs to be updated to permit testing in an environment similar to that which the listed devices will encounter in space. This laboratory is located in Rooms A-118, A-124, A-126 and A-130. Room A-124 requires updating to a "Class 50,000" clean room. Rooms A-118, A-126 and A-130 require updating to "Class 100,000" clean rooms. Inadequacy of the existing test environment severely inhibits continuation of effective support of programs such as space shuttle and other programs involving this type of testing and evaluation.

(2) Rehabilitation of Guidance and Control,
Building 4487 ("A" Wing East)

465,000

This project provides for rehabilitation of 45,000 square feet, first and second floor, "A" Wing East, Building 4487. The work includes removal of various obsolete and overloaded air conditioning units, air handlers, chillers, and the installation

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of a centralized air conditioning system connected to an existing new central chiller. Power systems will be replaced to provide required breakers and controls for special loads such as computers. Lighting systems will be modified to meet required illumination levels. In addition, repair or replacement and painting of partitions, doors, windows, and ceilings will also be required. This building was built in 1956 as a Guidance and Control Laboratory for the Army, using austere standards of construction, and has since become inadequate to meet demands and loads of current aerospace research. Wear and tear of the building and its poor utility systems have increased maintenance and has been the cause of having to make piecemeal additions to the systems to meet even the minimal operational requirements of the research activities in the building. Future funding to rehabilitate other wings of the building will be required in the future.

D. Various Locations

\$300,000

(1) Rehabilitation and Modification of Industrial Plants

300,000

This project provides for rehabilitation of the facilities, utilities and support systems as required at NASA industrial plants in order to maintain the facilities in a serviceable condition to meet basic functional needs. This work which is not directly program related involves necessary repair of water, sewage, heating and power lines, storm drains, parking lots, air conditioning and building equipment associated with the NASA industrial plants. There is significant investment in the facilities at the industrial plants which must be protected by a comprehensive program of repairs and replacement. The majority of these facilities were constructed 20 to 30 years ago and many are now in need of rehabilitation. This project is to provide for the priority features of work of this nature which will arise but can not be specifically identified at this time and will include the type of work required to protect the Government investment, prevent deterioration and maintain the facilities in a serviceable condition.

2. OFFICE OF SPACE SCIENCE

\$4,845,000

A. Goddard Space Flight Center

1,040,000

(1) Rehabilitation of Underground
Pipe Lines

295,000

This project provides for replacement of 2,350 linear feet (741.4 meters) of steam condensate and high pressure drip lines and provision of cathodic protection for all replacement piping as well as existing pipe in this area. Examination of these lines has indicated that corrosion of the outer steel conduits is taking place, and replacement is required to avoid failure of the services to facilities supporting or directly related to various center programs. This is a continuation of work of this nature begun in FY 1974. This represents the most pressing and critical needs. Future requirements of this nature are anticipated.

(2) Rehabilitation of Roofs and Siding of
Twelve Laboratory Buildings

280,000

This project provides for rehabilitation of roofs and siding of Buildings 3, 4, 5, 7, 8, 9, 10, 14, 15, 17, 19 and 20. This project includes fascia repair, roof drain rehabilitation, reroofing approximately 70,000 square feet (6,503 m²) of deteriorated roof, replacing approximately 21,000 square feet (1,970 m²) of external panels and resurfacing approximately 230,000 square feet (21,400 m²) of interior and exterior siding and concrete walls. The rehabilitation is required to minimize further deterioration of these buildings which has now reached a critical point.

(3) Rehabilitation and Modification of
Utility Distribution Systems

60,000

This project provides for rehabilitation of the septic sewage system facilities at the Magnetic

Test Site, which is a remote site. It also provides an overflow drain from the existing 300,000 gallon (1,135,000 liters) water storage tank to handle the periodic maintenance overflow of the tank, and provides an additional 50,000 gallon (182,250 liters) fuel oil storage capacity (providing a total six day supply) for the central power plant. These items are required to meet ecology constraints and provide for more efficient operation.

(4) Rehabilitation of Roadway Drainage System \$50,000

This project provides for installing shoulders and swales, and regrading and rehabilitating as necessary existing roads at various remote site locations. This is necessary to correct existing undermined swales, serious erosion of shoulders, and flooding of existing roads.

(5) Modification of Tape Library, Building 3 70,000

This project provides for the consolidation of several tape libraries located in Building 3. This will free laboratory space and provide for a safer, more effective operation.

(6) Rehabilitation and Modification of the Heating, Ventilating and Air Conditioning System in Nine Laboratory Buildings 285,000

This project provides for the rehabilitation and upgrading of the heating, ventilating and air conditioning system in Buildings 1, 4, 11, 14, 18, 19, 20, 21 and 25. It includes: upgrading the air conditioning on the south side of Building 1 to relieve solar heat gain and to provide zone and cycle control, upgrading the air conditioning system of the laboratory in Building 4; providing a ventilation system and insulated wall in the steam station, Building 11; installing a ten ton air conditioning unit for the first floor of Building 14; rehabilitating the entire system in Buildings 18, 19 and 20; upgrading the system on the south side of Building 21; and increasing the air quantities and provide additional humidification in the computer areas of Building 25. These modifications are necessary to meet the changed occupant requirements of the buildings as well as the rehabilitation of deteriorated equipment involved.

B. Jet Propulsion Laboratory

\$1,650,000

(1) Rehabilitation and Modification of the
Instrumentation Cable System

375,000

This project provides for the extensive rehabilitation and modification of the Instrumentation Cable System (ICS) and all other TV and program hard-lines. The ICS ties together all program offices, control rooms, remote monitoring stations and instrumentation/data handling systems. Much of the system has been in existence for many years and has become seriously degraded, been patched and changed so extensively that its condition is now of questionable reliability and is urgently in need of overall rehabilitation. This will complete the work for the entire system.

(2) Seismic Modifications to Four Laboratory
Buildings

284,000

This project provides for the appropriate structural modifications to eliminate potential earthquake hazards to occupants of the Engineering and Mechanics Building 157; Space Sciences Instrument Systems Laboratory, Building 168; Engineering Office Building 169; and Materials Services Building 171. Jet Propulsion Laboratory is near traceable earthquake faults, and recent seismic evaluations made of these buildings indicate that certain structural conditions should be corrected. This project is a continuation of the FY 1974 program.

(3) Modifications to Mission Support Area,
Space Flight Operations Facility, Building 230

300,000

This project will modify the computer area of the Space Flight Operations Facility (SFOF), rehabilitate the cabling and ground system, and separate the mission control and computing center communications functions from those of the Deep Space Network. This project provides for extensive modifications to the SFOF to satisfy project requirements. It is also necessary to upgrade the ground system to reduce noise levels, and improve equipment operations and communications between

SFOF and the Systems Development Laboratory, and to rearrange the communication equipment. Work of this nature is a continuing requirement in light of mission operations utilization of this facility.

(4) Modification to Two Laboratory Facilities \$136,000

This project provides for the installation of two screen rooms: one a 400 square foot (37.2 m²) room in the Spacecraft Assembly Facility Building 179 to be used for system testing and be large enough to accept complete spacecraft assemblies; the other, a 140 square foot (13 m²) room in the Telecommunications Laboratory, Building 161 for research and development in low noise, microminature, multimission transponders to be used in flight missions. Both of these screen rooms are needed to carry on the testing programs associated with development of more sensitive components which require stricter shielding requirements from radio frequency and magnetic interference.

(5) Rehabilitation of Mechanical Equipment in Central Engineering Building 180 115,000

This project provides for replacement of a (1) deteriorated, roof mounted, cooling tower which is leaking and (2) an adjacent fire tube boiler which is beyond economical repair. The cooling tower's leakage has contributed to a roof problem that cannot be adequately corrected until the leakage is eliminated.

(6) Modification to the Mission Control and Communication Facility (MCCF), Development Laboratory, Building 230 175,000

This project provides the necessary power and air conditioning modifications to reconfigure the MCCF Development Laboratory to support the development of data systems for the Mariner Jupiter Saturn (MJS) '77 and other post-Viking missions. The system must be brought to operational status during the full MCCF flight support of Viking in the FY 1976 time frame.

(7) Modification of Space Operations Facility, Building 230 for Computer Operations 265,000

This project provides for the modification of the second and third floors of the Space Flight Operation Facility (SFOF) to provide increased space for additional leased computing machinery. The work includes modification to the raised flooring, electrical and air conditioning systems. The laboratory's computer loading data base forecast indicates that the total general and scientific computing requirement exceeds that available during the Viking mission period. Also, the Viking project requires an additional computer to process its imaging data during orbital operations.

C. <u>Kennedy Space Center</u>	<u>\$785,000</u>
(1) Rehabilitation and Modification of Launch Complex 17, Eastern Test Range	180,000
<p>This project provides for a series of rehabilitation efforts to portions of the Delta Vehicle Launch Complex 17 that has been in use since 1956, and provides a 1,200 square foot (111.5 m²) addition at the complex to meet storage needs for auxiliary ground equipment. This includes rehabilitation of the overhead hoist control system on both mobile service towers, and rework of the whiteroom on pad 17B.</p>	
(2) Rehabilitation and Modification of Launch Complex 36, Eastern Test Range	200,000
<p>This provides for rehabilitation and modification to the Atlas Centaur Vehicle Launch Complex 36 at the Eastern Test Range. The Complex is fifteen years old and major rehabilitation is necessary to the water, pneumatic, hydraulic, and electrical systems. It also provides for sealing the launch stand building, and installing a dust control system in the blockhouse.</p>	
(3) Rehabilitation and Modification of Launch Complex 41, Eastern Test Range	405,000
<p>This project provides for modification of the Mobile Service Tower at Titan Centaur Launch Complex 41, Eastern Test Range to strengthen the structural members to meet the weight loads due to the Centaur equipment. It includes refurbishment of the dry gas</p>	

purge system and rehabilitation of the three elevators on the pad to meet safety requirements. Additional known rehabilitation work amounting to approximately \$200,000 will be required in future years.

D. Wallops Station

\$1,370,000

(1) Rehabilitation of Twenty Buildings

425,000

This project provides for the general rehabilitation of 20 buildings at Wallops main base and Wallops Island (F-1, 2; U-60; W-20, 25, 40, 50, 55; X- 55, 70, 115; Y-15, 30, 38; Z-15, 20, 25, 35, 44, and 50). The buildings on Wallops Island are directly exposed to the corrosive seaside atmosphere and require urgent rehabilitation to stop the accelerated rate of deterioration. The two buildings (F-1/F-2) on the main base were built by the Navy in the early 1940's and are in serious need of rehabilitation. This project will include roof rehabilitation, corrosion protection, replacement of windows and doors, rehabilitation of utility services, toilet refurbishment, floor tile and acoustical surface replacement, and environmental control system modification.

(2) Rehabilitation and Modification of Electrical Services

180,000

This project provides modification of the Station's primary distribution system including a protected switching station and feeders. The Station's peak load is at the maximum for the system, and due to the age of the system, there is a growing rate of major outages. This rehabilitation is urgently required to modernize the service and to reduce the possibility of a disruption of services to facilities supporting or directly related to the Station's programs.

(3) Rehabilitation of Air Systems, Wallops Island

220,000

This project provides for complete rehabilitation of the central air system on Wallops Island. It includes replacement of all deteriorated air lines, and provision of cathodic protection, replacement of the after-cooling and cooling tower pumps, replacement of the wooden cooling tower,

and installation of a refrigerated dryer. This rehabilitation is urgently required due to deteriorated conditions of the system which has been in continuous use since its installation in 1950.

(4) Rehabilitation of Lighting and Ventilating Systems, Machine Shop, Building F-10 \$85,000

This project provides additional ventilation in the 1,600 square foot (149 m²) welding area, replacement of inadequate lighting in the precision machine shop area, and upgrading of the communication system between the office areas of the building. These rehabilitations are essential to provide suitable working conditions in Building F-10 which is a converted Navy hangar built in the 1940's.

(5) Rehabilitation and Modification of Two Support Buildings, F-7 and F-8 200,000

This project provides for the major rehabilitation of two general purpose buildings, Shipping and Receiving Building F-7, and Plating Shop and Supply Shipping Building F-8, located in the main areas of the Station. The buildings, constructed in the early 1940's, are deteriorated and need to be rehabilitated to prevent accelerated deterioration. The rehabilitation includes repair to the structure; rehabilitation of toilets, utility systems, air conditioning and heating, and lighting; replacement of existing wood block floor and tank vent stacks in the plating shop; provision for rinse water disposals to prevent water pollution; and renovation of the penetrate room to provide for precision metal electroplating. This work is urgently required to prevent further deterioration and to provide a suitable working environment.

(6) Rehabilitation of Steam and Fuel Systems 260,000

This project provides for the rehabilitation of the existing steam and condensate lines, pumps and housings which are in a seriously deteriorated condition. The project includes replacement of underground lines, provisions of cathodic protection, replacement of fuel pumps, filters and loaders and related equipment.

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3. OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY \$4,488,000

A. Ames Research Center 1,155,000

(1) Rehabilitation and Modification of Gas Fuel Distribution, Storage and Boiler Facilities 180,000

This work provides for the rehabilitation and modification of the existing liquid gas system (low pressure L.P.) to include the addition of a new packaged vaporizer mixer to double the capacity to 60,000 cubic feet (1,699,200 liters) per hour. A new blower, liquid pump, and a 40,000 gallon (151,400 liters) storage tank will be provided. The existing L.P. gas plant was installed in 1964 and is incapable of adequately meeting today's standby fuel requirements. This project will also provide for the replacement of approximately 1,200 feet (365.8 meters) of 3 inch (7.62 cm) pipe with a 4 inch (10.2 cm) steel pipe gas main, coated and wrapped. This gas main was installed in 1944, leakage is now a serious problem, and it is inadequate in size to serve the Administration Building, 40 x 80-Foot Wind Tunnel and five other major facilities connected to it. This work also includes the replacement of three existing boilers in Buildings N-221, one boiler each in Building N-212, N-238 and N-235 with new boilers. The boilers to be replaced have deteriorated, are obsolete, and some do not now meet boiler safety codes.

(2) Rehabilitation of Wind Tunnels, Buildings N-215, N-218 and N-226 95,000

This work provides for the preparation of surfaces and application of protective coatings to the exterior surfaces of large research facilities, Wind Tunnels N-215, N-218 and N-226. This work is required to preclude further rusting and deterioration of the facility surfaces. Protective coating of Building N-215 was previously accomplished in 1950, N-218 in 1953 and N-226 in 1947 with 25% "touch up" performed in 1958.

(3) Rehabilitation of Unitary Plan Wind Tunnel, Building N-227, Aftercooler No. 2 150,000

This project provides for the rehabilitation of the Unitary Plan Wind Tunnel, Building N-227, Aftercooler

No. 2 by the replacement of approximately twenty-four coils. The original forty-four coils were installed in this cooler in 1955. The remaining twenty original coils were replaced in 1964 during the last major refurbishing of the cooler. In the past year leakage in this aftercooler has developed to a unacceptable level requiring considerable additional purging and drying time to obtain proper test conditions. This has resulted in long operational delays making it necessary to temporarily repair the coils in place. This project is required to eliminate unnecessary operational delays and excessive purge cycles. Aftercooler No. 2 is the main cooler for the 9 x 7 foot and 8 x 7 foot circuits of the Unitary Plan Wind Tunnel, which is a heavily used facility.

(4) Rehabilitation and Modification of Payload Integration and Test Facility, Building N-224

\$400,000

This project provides for the rehabilitation and modification of 4,750 square feet (441.3 m²) of the Payload Test Facility, Building N-224, for use in the thermal and physical testing of polymers. This work consists of dismantling of obsolete equipment and removal of interior partitions to clear areas for the installation of new physical test laboratories. Existing second floor area will be increased approximately 600 square feet (55.7 m²) to provide for a mechanical room and storage room. The building will be heated and air conditioned to support individual space temperature and humidity control which includes the replacement of an existing boiler. Exhaust fans and fume scrubbers will be installed in the roof structure. The project also includes plumbing for the laboratory equipment and additional toilet facilities. The work includes the procurement and installation of a fire test chamber 20 feet (6.1 m) in diameter and 40 feet (12.2 m) in length with appropriate smoke and fume scrubbing equipment. This equipment is required to support research programs in the areas of engineering evaluation of fire-retardant and high temperature materials

which will be used for improving aircraft safety. The present facility is inadequate for performing thermo-physical characterization of fire-retardant materials and does not offer the capability of performing fire tests. This is the second of a two phased program and will complete this requirement for polymer and chemical research.

(5) Modification to Arc Heater and Test Bay of the Mach 50 Helium Tunnel Building N-238

\$330,000

An existing electric arc air heater will be modified and reinstalled in the test bay of Building N-238. New water manifolds, four inch gas line, electric controls, switch gear, and cables will be provided by this project.

This modification work will provide a capability to perform tests to determine the effects of massive boundary layer transition and turbulent heating rates at high stagnation pressures. The information obtained from these tests will be used in the design of thermal protection systems (TPS) for ballistic missiles and for planetary probes. The unique capability of this arc will be the proper scaling of model and gap size in relation to boundary layer thickness. A large arc heater such as the one proposed will permit precise determination of heat shield performance under turbulent boundary layers. This will result in a significant increase in the payload of entry vehicles. The power supply (60 megawatts) provided for the Interaction Heating Shuttle Test Facility under a FY 1972 CoF project will also be used to power this arc heater. The resultant combustor will greatly enhance the capabilities indicated.

Although this modification work will provide a completely operational facility in itself, it may be necessary to undertake additional modification work at a later time in this facility to achieve greater capabilities. This proposed new requirement is being fully evaluated and would cost approximately \$450,000. This proposed future work will be a separate and distinct project from that described above and, if later approved, will be funded as a separate project.

B. Flight Research Center

\$560,000

(1) Rehabilitate 400 Hertz Power Supplies,
Building 4800, 4801 and 4802

185,000

This project provides for the replacement of the 400 Hertz Power Distribution System for Buildings 4800, 4801 and 4802. The existing four small motor-generator sets will be replaced by two motor generator sets each having an output of 125 KW, 575 volts, 400 hertz. From these motor generators a new distribution system between the buildings will be installed utilizing non-magnetic raceways. Four new load center panelboards will be installed to handle the distribution. Power step down transformers will be provided from one motor-generator set to the other capable of carrying the full output of one generator. The project also provides for a small prefabricated metal type shelter approximately 400 square feet (37.2 m²) with a concrete floor slab to be constructed from the east wall of Building 4801 to house one new motor generator set. The existing motor generators are old units obtained from military surplus sources and are insufficient to provide precise power requirements necessary for the modern aircraft presently involved in testing and research programs. The existing distribution systems are inadequate with unacceptable voltage transients. This project will increase the 400 hertz system reliability that is necessary with modern aircraft operation.

(2) Rehabilitate Administrative Building,
Building 4800, Cafeteria

375,000

This project provides for the rehabilitation and modification of the Administration Building, Building 4800 by expanding the existing Cafeteria from 3,675 square feet (341.4 m²) to approximately 7,200 square feet (668.9 m²). This includes enclosing the courtyard with a roof. The dining area will provide seats for about 200 persons. Existing kitchen and serving equipment will be removed and replaced. Dishwashing facilities will be enlarged to accommodate new equipment. Heating, cooling, lighting and appropriate rehabilitation

of existing walls and other architectural features will be modified accordingly. The existing cafeteria and kitchen was installed in 1953 as a part of the original Building 4800 construction and was sized to accommodate 85 persons in one seating. The original functional design was marginal, with an undersized kitchen area, insufficient food storage space and little capability for handling trash and garbage. The Center has grown to approximately 700 NASA and contractor personnel plus a significant number of visitors. The result of the inadequate cafeteria facilities has meant a long standing, grossly inadequate and substandard level of service for the general maintenance and employee health, welfare and morale.

C. Langley Research Center

\$1,593,000

(1) Rehabilitation of Aircraft Parking Apron

250,000

This project provides for the rehabilitation of the existing aircraft parking apron with construction of a 3,800 square yards (3,177.7 m²) concrete extension. This extension will be located on the south side of Building 1244, near the end of the main taxiway going to the Air Force main runway. The new apron extension will improve flight operations at Langley by providing a better flow of traffic from the taxiway and improve operations in parking and maneuvering aircraft and equipment. For some time, operations have been impeded by restricted ramp space. Traffic includes such large aircraft as the C-310, C-54, G-159 and CH-54 (Flying Crane Helicopter) in addition to numerous smaller jet, reciprocating engine, and rotary wind aircraft. Other large transient aircraft (C-141) often utilize the NASA ramp. Twenty aircraft are now assigned to this Center including the Boeing 737. Inefficiency in ground handling operations involves not just loss of time, but also unnecessary manpower. This project will also involve removal of the existing fueling system which will be replaced by truck fueling. The replacement of the fueling system is necessary since the existing one is obsolete and does not have sufficient pressure or volume to accommodate present and future aircraft requirements.

(2) Rehabilitation of Dynamic Loads
Division Building, Building B-1229

\$465,000

This project provides for the rehabilitation of approximately 26,000 square feet (2,415.4 m²) of the Dynamic Loads Division Building B-1229 which was constructed in 1945. The interior modifications will include doors, partitions, mechanical, electrical equipment, floor covering, lighting, acoustical treatment, painting and air conditioning. The exterior modifications include tuck pointing and waterproofing of masonry, and the replacement of doors and windows. Normal wear and tear over the past 25 years require that a general refurbishment be undertaken. Further, replacement of rotted wooden doors and windows and masonry repairs are required to prevent entry of moisture and to arrest accelerated deterioration. This rehabilitation will reduce the maintenance cost, provide space for 25 additional people by improving space utilization, and eliminate safety deficiencies in the building.

(3) Rehabilitation of the Gas Dynamics
Complex, Building 1247B

250,000

This project provides for the replacement of two compressors associated within the 22 inch Helium Tunnel and the procurement and installation of a single compressor. The compressor will be skid mounted and rated at 150 SCFM (4.25 m³M) at 5,200 psi (365.6 KG per CM²). The existing compressors have been in service approximately 12 years, operating up to 5,000 psi (351.6 KG per CM²) over the years. They have had numerous major repairs, are obsolete, and replacement parts are not available. These compressors are associated with research systems providing direct support of space shuttle, advanced vehicle technology programs, and basic hypersonic fluid mechanics research.

CF 11-25

(4) Rehabilitation and Modification of Space
Technology Facility, Building 1232

\$458,000

This project provides for the rehabilitation and modification of approximately 27,000 square feet (2,508 m²) of the office space of the Space Technology Facility, Building 1232. This work includes some masonry repairs and the replacement of windows, air conditioning and lighting systems. The refurbishment of the interior parts will include new ceilings, floor covering, acoustical treatment, painting and a new stairway. Building 1232 was constructed in 1946 as a laboratory-shop type building. Since that time many areas have been converted into office space. This rehabilitation is necessary due to normal wear and tear and to reduce maintenance costs, improve access and safety and provide space for 17 people.

(5) Rehabilitation of the Horn Chamber,
Building 1299

170,000

This project provides for the rehabilitation of the Horn Chamber, Building 1299 by replacing the anechoic foam absorber material. The old deteriorated material will be replaced with a new foam material which has a fire retardant treatment permeating the entire foam cell. The thickness of the new material will be varied in accordance with a new design concept which will allow for minor throat reshaping which is expected to improve the Chamber's performance. The present anechoic foam absorber material has deteriorated and is a fire hazard. Rehabilitation of the Chamber is required to support the continuing effort of the Flight Instrumentation Division research programs such as space shuttle antenna and materials design, aerostat antenna development, calibration and measurement of radiometer antenna for the advanced applications flight experiments program in addition to providing antenna measurement support for other programs.

D. Lewis Research Center

\$1,180,000

(1) Rehabilitation and Modification of
Streets, Parking, Sidewalks and Storm Sewers

250,000

This project provides for the rehabilitation of the curbs, gutters, sidewalks and the wearing surfaces of Walcott, Westover, Moffet, Durand and Ames Roads. Approximately 21,900 square yards (18,310 m²) of road pavement and associated sidewalks and curbs will be rehabilitated. This road work includes surface treatment, removal and reconstruction of deteriorated concrete curbs and drain tile, replacement of deteriorated sidewalks, and realigning manholes and catchbasins. These roads and sidewalks were constructed in 1943 and except for periodic seal coating, no major repairs have been undertaken. This project also provides for the extension of the 60 inch (152.4 cm) storm sewer approximately 300 feet (91.4 m) through a deep ravine into Abrams Creek, to include the construction of a downstream headwall and the placement of embankment fill to prevent further erosion.

(2) Rehabilitation of Air Drying
Equipment, Engine Research Building No. 5

490,000

This project provides for the rehabilitation of the combustion air system in the Engine Research Building (ERB) by replacement of the air drying equipment in No. 5 Combustion Air Cooler. The air drying equipment to be provided will include a 500 ton mechanical refrigeration unit, pressure vessels, heat exchangers and an absorptive desiccant dryer. This new equipment will have the capability of providing dry cold compressed air to the combustion air system. This will also include the installation of two adsorptive dryer tanks 11 foot (3.4 m) in diameter and 14 foot (4.3 m) high. This new equipment will be located in the basement of the

CF 11-27

ERB and will replace the existing 25 year old ammonia refrigeration system which is obsolete, costly to operate and maintain, and involves some safety problems.

(3) Rehabilitate Intercooler Tube Nets and Expansion Joints at the PSL Equipment Building No. 64

\$240,000

This project provides for the rehabilitation of 10 exhaust intercooler tube nests, and three intercooler tanks in the altitude exhaust system in the PSL Equipment Building. Also it provides for the replacement of five expansion joints in the altitude exhaust system in the PSL Equipment Building. The tube nests will be removed and replaced or rehabilitated as warranted to restore them to their original performance capability. The expansion joints will be replaced.

The exhaust intercoolers in PSL were put in service in 1952. Because of accumulated service cooling corrosive and erosive exhaust gases from engine research installations the coolers have become increasingly ineffective. As water leaks develop, the tubes are blocked and thus reduce the effective heat transfer surfaces. This rehabilitation project is a continuation of a similar project begun in FY 1972. It is necessary to the continuance of Center's capability to provide altitude exhaust for engine and component research programs.

Replacement of expansion joints is also necessary as the expected fatigue life of these components has been reached or exceeded and their timely replacement is necessary on a schedule basis that will create minimum interference with research operations.

(4) Rehabilitate Electrical Power
Distribution System

\$200,000

This project provides for the re-habilitation of several components of the electrical power distribution system. The undersized 2,400 volt tie cable between transformers "B2" and "G4" is inadequate to handle essential loads in the event "B2" is required to be removed from service. Transformer "B2" provides electrical power for critical loads throughout the Center. This project also provides for the replacement of the high voltage 34.5 KV "potheads" at Substations "A" and "B". These original dry-type high voltage pot-heads were installed 30 years ago, some have failed and all need replacement. The adjacent potheads when dismantled have indicated evidence of imminent failure. This project also includes the replacement of the control cables from the Electrical Distribution Center to Substation "B", the Sewage Pumping Station No. 1, Building No. 26, to the switching apparatus at Substation "C", and from Manhole 38 to Manhole 7. All of these cables indicate considerable sign of deterioration also, resulting in a condition of imminent failure. Additional rehabilitation of the Center's electrical power distribution system will be required in future program years.

4. OFFICE OF TRACKING AND DATA ACQUISITION

\$682,000

A. Various Locations

682,000

(1) Modification of Solid and Liquid Waste Disposal Systems at Deep Space Network (DSN) and Spaceflight Tracking and Data Network (STDN) Locations

At the DSN locations this project provides for modifications of disposal of solid waste material using sanitary landfill methods, and/or waste compactor; and a portion of the project includes fencing of oxidation ponds, repair of sewerage lines and manholes/clean-outs, new waste oil tanks, new protector-interceptor

ditches, provisions for flush washing of sewerage system, and increase capacity of septic tanks. At the STDN location this project will provide for installation of an extended aeration, activated sludge type mechanical sewage plant with chlorinated effluent. The increasing stringent requirements for clean air and water eliminate most of the existing practices employed at these stations. This project will provide the first increment of modifications to facilities necessary to conform with new local requirements and regulations. Prior work in this area dealt mainly with sewage treatment at stations located in the United States.

The above work is applicable to the following locations:

Canberra (DSN)	\$69,000
Madrid (DSN and STDN)	154,000
Goldstone (DSN)	150,000

(2) Modifications of Facilities for Safety and Health Protection at the Goldstone Complex

This project is the first increment of a program that provides for facility modifications required to comply with the new occupational safety and health regulations. These deficiencies were determined by an in-house safety survey and by the Division of Industrial Safety, State of California. Facility modifications at the Goldstone Deep Space stations will deal with the more serious safety and health deficiencies such as: Safety railings on antennas and roofs, storage areas for flammables, ladder cages on antennas, covers on exposed gears (antennas), replacing all temporary wiring, eye wash areas (battery rooms), replacing old flooring, and providing guards on machinery.

Goldstone	188,000
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(3) Rehabilitation of Roads at the Goldstone Complex

This project provides for rehabilitation of the existing 24.3 miles (39.1 kilometers) of roads to correct or eliminate hazardous conditions by improving curves, removing of dips, improving drainage, eliminating flash flood areas, installing additional guard rails and replacing sections of road where the subgrade has failed.

Goldstone	\$121,000
5. <u>MISCELLANEOUS PROJECTS LESS THAN \$50,000 EACH</u>	<u>1,500,000</u>
TOTAL	<u>\$14,900,000</u>

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that between \$15 and \$20 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 1975 ESTIMATES

Minor Construction

	<u>Amount</u>	<u>Page No.</u>
<u>Summary of Project Amounts by Location and Cognizant Office</u>		
<u>Office of Manned Space Flight:</u>	<u>\$466,000</u>	
Johnson Space Center.....	225,000	CF 12-2
Marshall Space Flight Center.....	241,000	CF 12-3
<u>Office of Space Science:</u>	<u>709,000</u>	
Goddard Space Flight Center.....	50,000	CF 12-4
Jet Propulsion Laboratory.....	159,000	CF 12-4
Kennedy Space Center.....	460,000	CF 12-4
Wallops Station.....	40,000	CF 12-5
<u>Office of Aeronautics and Space Technology:</u>	<u>1,020,000</u>	
Ames Research Center.....	440,000	CF 12-5
Flight Research Center.....	110,000	CF 12-7
Langley Research Center.....	245,000	CF 12-7
Lewis Research Center.....	225,000	CF 12-8
<u>Office of Tracking and Data Acquisition:</u>	<u>1,805,000</u>	CF 12-9
<u>Miscellaneous Projects Less Than \$25,000 Each:</u>	<u>500,000</u>	CF 12-11
Total.....	<u>\$4,500,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Minor Construction of New Facilities and Additions to Existing Facilities</u>
LOCATION	<u>Various Locations</u>
	FY 1975 CoF ESTIMATE <u>\$4,500,000</u>

COGNIZANT INSTALLATION: Various Locations

LOCATION OF PROJECT: Various Locations

COGNIZANT PROGRAM OFFICE: Office of the NASA Comptroller

FY 1974 AND PRIOR YEARS CoF FUNDING:

Planning and Design	\$689,000
Construction	<u>6,320,000*</u>

Total FY 1974 and Prior Years \$7,009,000

SUMMARY PURPOSE AND SCOPE:

To provide for minor facility construction at NASA field installations and at Government-owned industrial plants engaged in NASA activities. This provides for minor facility projects involving the construction of minor new facilities or additions to existing facilities, each project of which is estimated to cost not in excess of \$250,000. Such minor construction is necessary in FY 1975 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.

PROJECT JUSTIFICATION:

The existing NASA physical plant is necessarily 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 like activities. Items included in this project reflect those projects which must be accomplished in FY 1975 to meet

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* Prior to FY 1973, this activity was included in the R&PM and R&D appropriations.

general NASA installation requirements or general technical facility needs which are not solely or primarily required to support specific research or development programs or projects. Also included are those items which are required in FY 1975 to meet the peculiar needs of one or more specific research or development programs or projects, and 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 1975 have been carefully selected from a list totalling about \$9 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:

Tentative candidate subprojects of work to be considered for accomplishment under this estimate are outlined under "PROJECT COST ESTIMATE" and total \$4,500,000. Of this amount, \$4,000,000 represents specific, discrete items of work, and \$500,000 is indicated as a "lump sum" amount to provide for facilities work of these types (new construction and additions) estimated to cost less than \$25,000.

SUMMARY:

a. Office of Manned Space Flight	\$466,000
b. Office of Space Science	709,000
c. Office of Aeronautics and Space Technology	1,020,000
d. Office of Tracking and Data Acquisition	1,805,000
e. Smaller "Lump Sum" Projects	<u>500,000</u>
TOTAL	<u>\$4,500,000</u>

PROJECT COST ESTIMATE:

1. <u>OFFICE OF MANNED SPACE FLIGHT</u>	<u>466,000</u>
A. <u>Johnson Space Center</u>	<u>\$225,000</u>
(1) Construction of Test Article Preparation Facility	225,000

This project will provide for construction of a pre-engineered building 60 feet (18.29 meters) wide by 100

feet (30.48 meters) long with 30 by 30-foot (9.14 x 9.14 meters) access doors on each end. The facility will be located north of Avenue B in close proximity to Vibration and Acoustic Test Facility, Building 49. The facility will contain a 10-ton (9,072 kg) bridge crane with a minimum hook clearance height of 35 feet (10.66 meters). The facility will not require air temperature and humidity control; however, sanitary facilities, fire detection, and fire suppression capabilities will be required. The sanitary facilities and a 20 foot by 20 foot (6.09 x 6.09 meters) office area will require heating and air conditioning. Exterior lighting will be provided for all doors and the outdoor security area. A 60 foot (18.29 meters) wide by 80 foot (24.38 meters) long hard surfaced apron will be located adjacent to the building and enclosed with a security fence. A hard surfaced road 30 feet (9.14 meters) wide will provide access to the facility doors. The facility will also be used for preparation of spacecraft modules, transporters, slings, and servicing test equipment for special testing. The Vibration and Acoustic Test Facility, Building 49, will primarily be used to house movable platforms, fixtures, shakers, suspension systems, acoustic horns, ducts, terminators, and other equipment and materials used in performing vibration and acoustic tests. Sheltered areas are required to maintain structural integrity of test articles and associated lifting devices during use. Presently 95 Vibration and Acoustic Test Facility items are in open laydown areas allowing deterioration as a result of adverse climatic conditions. As a result, extensive refurbishment is required to avoid hazards to the test articles and personnel working with them. Construction of this facility is needed in FY 1975 to effectively support vibration and acoustic testing of the space shuttle test articles, and to provide an adequate enclosed preparation area to refurbish and recertify the Apollo equipment which will be used for shuttle activities prior to initial test article delivery. Failure to provide the facility will necessitate perpetuating current uneconomical storage and refurbishment costs and will adversely impact operation timeliness for shuttle and other test articles.

B. Marshall Space Flight Center

241,000

(1) Installation of Boiler Fuel System

241,000

This project will provide for the installation of combination gas-oil burners in existing boilers in

CF 12-3

Building 4567 (Boiler Plant for East Test Area), Building 4596 (Boiler Plant for Steam Ejectors), Building 4660 (Boiler Plant for North Test Area and Nitrogen Vaporization), and Building 4675 (Boiler Plant for West Test Area). It will also include the installation of approximately 10,000 feet (3,048 meters) of 4-inch underground gas line which will connect these boilers to an existing gas main. These existing boilers serve the MSFC test area and are presently utilizing fuel oil as the sole energy source. Due to the current shortage of fuel oil, it is essential to provide an alternate source of fuel to insure reasonable continuous boiler plant operations. These boilers support the important developmental test operations carried out in the MSFC test divisions area for such programs as shuttle external tank and the solid rocket booster.

2. OFFICE OF SPACE SCIENCE \$709,000

A. Goddard Space Flight Center 50,000

(1) Extension of Roadway System 50,000

This project provides a new service access drive from Road No. 8 near the east gate, to the rear of the test and evaluation complex, Buildings 7, 10, and 15. The truck deliveries in this area cause heavy traffic congestion through the service and parking area which will be eliminated by the construction of this roadway.

B. Jet Propulsion Laboratory 159,000

(1) Construction of Mezzanine, Machine Shop, Building 170 159,000

This project modifies the central machine shop by constructing a 1,530 square foot (142.1 square meters) enclosed mezzanine to permit the expanded use of numerically controlled precision machine tools and alleviate the present crowded conditions in the grinding room which requires a controlled environment.

C. Kennedy Space Center 460,000

(1) Addition to Blockhouse, Launch Complex 36 215,000

This project provides a 5,100 square foot (474 square meters) addition to the blockhouse annex of the Atlas Centaur Vehicle Launch Complex 36, Eastern Test Range. This addition will permit consolidation of

engineering personnel in the blockhouse annex and enable the release of 14 trailers presently utilized by the personnel at the blockhouse.

- (2) Construction of Maintenance Support Building Launch Complex 2 West, Western Test Range \$245,000

This project provides an approximately 6,400 square foot (594.6 square meters) maintenance support building at the Delta Vehicle Launch Complex 2 West, for spare parts, tools, launch support equipment, and work space. The provision of this prefab metal building will consolidate storage and enable release of the presently used but deteriorated Building 836.

D. Wallops Station 40,000

- (1) Construction of Storage Enclosure 40,000

This project provides a 40' x 50' (12.1 meters x 15.2 meters) prefabricated building on an existing concrete pad. This structure will provide protection from corrosive elements to various high value steels and alloys. This work is necessary due to the corrosive effect of the salt air environment of the area. This structure will also provide a consolidated location for storage of this material.

3. OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY 1,020,000

A. Ames Research Center 440,000

- (1) Addition to Central Computing Facility, Building N-233 245,000

This project provides for the construction of a one-story building addition to the south wing of the Central Computing Facility (CCF), Building N-233. This addition will be similar to the existing structure and approximately 6,300 square feet (585.3 square meters), 180 feet (54.9 meters) long by 35 feet (10.7 meters) wide and 15 feet (4.6 meters) high, with a connecting wing to the southwest entrance of the existing building. This addition will relieve congestion in the existing building and eliminate three trailers presently in use to house computer personnel. Increased speed of computers requires graphic display devices to make the most effective

CF 12-5

use of the computer system. Additional space is needed for these graphic display devices. This equipment must be located in the existing CCF due to communication channel length restrictions. The construction of this addition will free areas now occupied by personnel for the graphic equipment. Programs supported include advanced technology transports, space shuttle, highly maneuverable aircraft, turbulent flow studies, and remotely piloted vehicle research.

(2) Addition to Fence and Roads for Security
and Flood Protection

\$135,000

This project provides for the addition of approximately 6,000 feet (1,829 meters) of 6-foot (1.8 meters) high security fence around the west and north perimeters of the Ames property. The new perimeter fence will stop current problems of vandalism and trash dumping on the ARC property. The project also includes raising the elevation of the low segments of the road to the Magnetic Test Facilities, Building N-217 and N-217A by 3-feet (.9 meters), and adding an oil surface treatment to approximately 2,000 feet (609.6 meters) of the existing road. This road elevation and improvements will reduce the maintenance of the roads and keep the area from flooding during storms. Also included is a dike around Building N-217 with a drainage system and lift station to pump collected water outside the diked area. The dike and pumps for the Magnetic Standards Laboratory, Building N-217, will protect this facility and its equipment and space hardware from water damage. The Magnetic Standards Laboratory and the Magnetic Test Facility are important to the success of the Pioneer spacecraft, its experiments and follow-on programs such as Pioneer Venus.

(3) Addition to 3.5-Foot Wind Tunnel,
Building N-229

60,000

This project provides for the construction of a pre-engineered steel building addition of approximately 4,800 square feet (446 square meters), 40 feet (12.2 meters) wide by 120 feet (35.6 meters) long, between the office and wind tunnel test section portions of Building N-229. Many of the recent and projected experiments in the 3.5-Foot Wind Tunnel of the Experimental Fluid Dynamics Branch require the use of large models and special support equipment that must be stored between experiments in the facility. The proposed building will provide the needed

storage area for the large models and special support equipment. Providing this storage area will improve facility operation by making equipment more readily available and reduce the manpower required in refurbishing work.

B. Flight Research Center

\$110,000

- (1) Addition to Remotely Piloted Research Vehicle (RPRV) Ground Station, Building 4801

110,000

This project provides for the modification of 1,095 square feet (101.7 square meters) of interior space in Building 4801 and an exterior addition to this building of 1,420 square feet (131.9 square meters). The interior work consists of removal and relocation of welding shop equipment to the new addition, the removal of metal partitions, and subsequent expansion of the existing Remotely Piloted Research Vehicle (RPRV) ground station. The work involved in the expansion process consists of extending the raised floor, constructing soundproof walls and ceilings, increasing air conditioning size, providing lighting, and extending the fire protection system. This expansion will provide space to house cockpit systems, telemetry and computer equipment required to support the Center's growing remotely piloted research vehicle program.

The remotely piloted research vehicle program includes aircraft of the 1/3 scale F-15 and Firebee types which will be flown by a pilot from the ground station. Considerable equipment of the telemetry and computer type, along with cockpits, are required for a successful program of this type. As the program is expanded in numbers and scope, additional space is a primary necessity. The aircraft used in this program will be tested in manners not available through manned flight because of physical limitations of the pilot, such as spins, and remote testing is paramount for obtaining data.

The external addition of Building 4801 will provide the space necessary for the relocation of the displaced welding shop. The addition will consist of all necessary hardware and equipment required for welding shop operations.

C. Langley Research Center

245,000

- (1) Construction of an Outdoor Anechoic Test Apparatus

245,000

CF 12-7

This project provides for the construction of an outdoor anechoic apparatus for a facility capable of obtaining jet noise research data. This work will include the construction of an 80-foot (24.4 meters) diameter semicircle of acoustical wedges of open-cell polyurethane foam geometrically designed to absorb noise. The acoustically treated area on the ground permits measurements of the noise generated by jet engines to be obtained over relatively large distances without the complicating effects from ground reflections and refractions. In order to describe the jet engine noise field produced by a supersonic jet, much larger distances are required than are available from existing jet noise facilities. Supersonic jet engine noise is radiated from sources distributed many diameters downstream of the jet engine in comparison to the noise produced by subsonic jets.

D. Lewis Research Center

225,000

(1) Additional 3,000 psi Compressed Air Capability

190,000

This project provides for the construction of a building and the installation of an existing 3,000 psi air compressor to increase this capability. This includes the construction of a pre-engineered steel structure of approximately 1,250 square feet (116.13 square meters) with a concrete slab. An existing 3,000 psi air compressor and auxiliary equipment, valued at about \$125,000 and excess to the needs of the Atomic Energy Commission, Jackass Flats, Nevada, will be dismantled, crated, moved, and reinstalled in the new steel structure. The output of this air compressor will be piped into the existing 3,000 psi compressed air system to double its capacity. This project will also permit the continuance of research activities when the existing 3,000 psi air compressor is down for maintenance. No further expansion of this 3,000 psi air supply is contemplated at this time.

(2) Addition of the Helium Distribution System
Helium Gas Holder, Building 121

35,000

This project will provide for the construction of 1,500 linear feet of underground 4-inch line for transporting

helium gas (resulting from boil-off of liquid helium used in Engine Research Building (ERB) research facilities) directly to helium purification, storage, and reliquification equipment located adjacent to helium gas storage container holders, Buildings 121 and 122.

The existing helium gas holder, Building 120, adjacent to the Engine Research Building 5, has deteriorated and is in need of replacement unless other helium recovery measures are instituted. The proposed line will not only replace the holder, Building 120, but will also eliminate the costly and time consuming present procedure of collecting the helium in the holder, pumping it into a tube trailer, and then transporting it to Buildings 121 and 122 for temporary storage. Further, the present method of handling the helium results in contamination which would be eliminated by use of the direct pipeline proposed.

4. <u>OFFICE OF TRACKING AND DATA ACQUISITION</u>	<u>\$1,805,000</u>
A. <u>Various Locations</u>	<u>1,805,000</u>
(1) Construction of Support Facilities for Mobile Lasers at Various Locations	1,338,000

This project will provide facilities for the periodic location of mobile, precise laser tracking stations to support the San Andreas Fault Experiment (SAFE), and the Laser Geodynamic Satellite (LAGEOS). This project is designed to define the global tectonic plates, plate motion (earthquakes), plate stress, and information about fault structures. The construction will consist of site clearing/grading, road construction, erection of temporary shelters, trailer hardstands, boresight towers, wind holddowns, connection of commercial power, grounding and sanitary facilities. Higher costs are estimated at the remote sites due to their distances from supporting centers and area locations. All costs have been tailored to the proposed site.

SAFE - Support facilities will be constructed for the mobile laser facilities at three various locations including Utah, and range in estimated cost from \$78,000 to \$140,000.

LAGEOS - Support facilities will be constructed for the mobile laser facilities at eight various locations including Alaska and Hawaii, and range in estimated cost from \$64,000 to \$215,000.

Each of the eleven sites will be managed as a separate project because of the different locations involved. This is the first increment of IAGEOS projects. The second increment will be approximately equal to the first.

- (2) Construction of Transmitter Buildings at Rosman and Tananarive STDN Locations \$157,000

This project provides for the construction of a transmitter building at the locations indicated below. The work will consist of the construction of a 650 square foot (60.4 square meters) concrete and masonry building at each location with air conditioning, electrical service, and grounding. Site work and extension of the fire detection system will also be provided. The existing S-band range and range rate systems are being updated with new high power transmitters which support the near earth satellite programs. These transmitters require a separate building near the antenna for proper equipment operation. This isolation also provides for required personnel safety. Similar small humidity control buildings are located at other high power transmitting antennas throughout the tracking and data acquisition network. The high power transmitter will be used with the High Energy Astrophysical Observatory and the Atmospheric Explorer series (beginning with AE-E).

Rosman	(84,000)
Tananarive	(73,000)

- (3) Construction of Emergency Center at Alaska Spaceflight Tracking and Data Network (STDN) Station 121,000

This project provides for the construction of an emergency center at Fairbanks, Alaska. The work will include a 1,300 square foot (167 square meters) addition to the minitrack building to house emergency vehicle and first aid and safety equipment with associated electrical fire protection and air conditioning systems. Due to weather conditions, and the distance from major support cities (Fairbanks - 15 miles, 24.1 kilometers), this station depends solely on station personnel to fight fires and administer first aid when required. This site is also operated around-the-clock in support of the near earth satellite programs and are part of the long range network requirement.

Alaska	(121,000)
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- (4) Construction of Cafeteria Facility at the
 Rosman Spaceflight Tracking and Data
 Network (STDN) Station \$189,000

This project provides for the construction of a cafeteria facility at the Rosman STDN location. The work will include construction of a 2,500 square foot (232 square meters) building with associated electrical, fire protection, and air conditioning. No cafeteria facility exists at the Rosman station and only a small room in the operation building serves as an eating facility. The station population has grown to exceed 200 with over 100 employees working on day shift. Due to the distance of 15 miles (24.1 kilometers) to the nearest commercial establishments, personnel are forced to carry meals to work and the food is consumed in working areas. In addition to providing the necessary food preparation, serving and eating areas, the facility will serve as a central conference and training area. This is one of the main STDN stations operating 24 hours a day to support the near earth satellite programs and is part of the long range network requirement.

Rosman (189,000)

5. MISCELLANEOUS PROJECTS LESS THAN \$25,000 EACH 500,000

TOTAL \$4,500,000

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that between \$4 and \$6 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 1975 ESTIMATES

SUMMARY

Facility Planning Design

	<u>Amount</u>	<u>Page No.</u>
<u>Regular Requirements:</u>	<u>\$3,900,000</u>	
Master planning and facility studies.....	900,000	CF 13-2
Preliminary engineering reports.....	450,000	CF 13-2
Final design.....	2,550,000	CF 13-3
<u>Other Requirements:</u>	<u>7,000,000</u>	
Shuttle facilities planning and design.....	4,400,000	CF 13-3
Large aeronautical facilities planning and design.....	<u>2,600,000</u>	CF 13-5
Total.....	<u>\$10,900,000</u>	

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1975 ESTIMATES

PROJECT TITLE	<u>Facility Planning and Design</u>
	FY 1975 CoF ESTIMATE <u>\$10,900,000</u>

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 updating of "as-built" drawings and the provision of engineering services.

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

c. The preparation of final construction contract 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 as the accomplishment of special facilities studies and reports.

The \$10.9 million requested for facility planning and design for FY 1975 is composed of two major segments:

a. Regular requirements - \$3,900,000

b. Other requirements - \$7,000,000

These 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. For these larger projects significantly more planning work than is normally involved must be accomplished prior to their inclusion in a budget request and normally this planning lead time is exceptionally long.

CF 13-1

1. REGULAR REQUIREMENTS

a. Master Planning and Facility Studies

\$900,000

This segment of the requirement includes the necessary updating of development and master plans for field installations and required facilities studies, investigations, and reports which will define facility parameters within which subsequent preliminary engineering efforts will be based to include those requirements for updating of facility "as-built" drawings and the provision of engineering services in those cases where such efforts are not otherwise provided for. Master plans are revised on an average of once every three years for each installation, with about one-third of the installations being involved in any one fiscal year.

Facility studies and specific engineering support have taken on added importance in recent years. The major following requirements for FY 1975 illustrate this point:

- Value Engineering and Analysis
- Design Specifications Update and Support
- Building Research and Advisory Board Support
- Engineering Handbook (Revision)
- Rehabilitation and Modification Program Update and Support
- Facilities Operations and Maintenance Studies
- Facilities Utilization Analysis and Update
- Energy Conservation, Reduction and Management Analysis and Studies

b. Preliminary Engineering Reports

450,000

Preparation of preliminary engineering reports (PER's), investigations and project studies related to proposed facilities projects to be included in the subsequent FY 1977 Construction of Facilities program 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 non-space shuttle construction involving an estimated cost of \$25 million to \$30 million of construction for which updated PER's will be needed and with new projects estimated to cost \$20 million to \$25 million for which complete new PER's will be required.

c. Final Design

\$2,550,000

The amount requested will provide for the preparation of designs, plans, drawings and specifications necessary for the accomplishment of non-space shuttle facility projects in the subsequent FY 1976 Construction of Facilities program. This request will provide for final design work associated with proposed subsequent construction of this nature estimated to cost \$35 million to \$45 million.

Subtotal, Regular
Requirements

3,900,000

2. OTHER REQUIREMENTS

These other facilities planning and design requirements are generated by potential future projects, large in size and of a complex nature. These are associated with future aeronautical and space programs which require a long planning cycle. Early and progressive design work is essential to insure the ultimate best design, cost estimates and schedules. These projects then require added planning effort and associated design lead time well beyond that normally associated with preliminary engineering reports and general type facilities projects. For this reason, these requirements must be provided for over and above the regular and the more recurrent facility planning and design needs covered above.

a. Shuttle Facilities Planning and Design

4,400,000

(1) This portion of the total space shuttle facility requirement is associated with the preparation of preliminary engineering reports (PER's), the conduct of facilities type investigations and the execution of facilities studies related to proposed space shuttle facilities projects to be included in the subsequent FY 1977 Construction of Facilities program. This preliminary work is associated with future construction for that year now estimated to cost in the range of \$65-75 million and is to be carried out in relation to space shuttle related projects such as:

(700,000)

(a) Launch and Landing Facilities. Additional studies will be conducted and PER's will be implemented towards modifying existing facilities, to support the scheduled increased flight rate, and to satisfy service support requirements at the launch and landing complex by incorporating experience gained, new techniques and changes necessitated by refinements in program requirements. Further studies will be needed to better define the appropriate interfaces between launch systems, equipment and facilities.

(b) Ground Test Facilities. Studies and PER's will be continued and extended towards using and modifying existing facilities, as appropriate, to satisfy better defined ground test requirements. Studies relating to mission control facilities requirements will also be required.

The cost of these related studies/ engineering reports is estimated at \$150,000 and the estimated cost for preparation of preliminary engineering reports (PER's) is \$550,000.

(2) This portion of the total facility planning and design requirement for space shuttle facilities is associated with the preparation of final design, drawings and specifications required for the proposed subsequent construction of space shuttle facilities, now estimated to cost \$75-85 million, and which may be included in a FY 1976 Construction of Facilities request. The additional cost of the preparation of these final designs is estimated at \$3,700,000. This design effort is mainly related to launch and launch support facilities at Kennedy Space Center, as well as certain ground test facilities. Included are:

(\$3,700,000)

(a) Launch and Landing Site Facilities. This requirement is directed towards preparation of final design, drawings and specifications for the additional launch facilities needed to support the scheduled higher flight rate; and those facilities required to support recovery and refurbishment operations such as parachute refurbishment and, disassembly and servicing of the solid rocket boosters (SRB) at Kennedy Space Center. This includes that final design directed toward:

- 1) Modifications to Mobile Launcher #2
- 2) Construction of SRB Disassembly and Refurbishment Facilities
- 3) Construction of Hypergolic Pod Processing Facility
- 4) Parachute Recovery and Refurbishment Facility

(b) Ground Test Facilities. Final design will be directed towards modification of existing facilities for phased crew training activities and for modifying existing capabilities in support of certain orbiter testing.

b. Large Aeronautical Facilities Planning and Design \$2,600,000

(1) Final Design for High Reynolds Number Transonic Research Wind Tunnel, Langley Research Center (800,000)

This planning is required for obtaining final facility design relating to the construction of a High Reynolds Number Transonic Research Wind Tunnel capability. This facility will be located at the Langley Research Center. The proposed facility will provide for aerodynamic research on aircraft over a Mach number range from 0.2 to 1.3 and at Reynolds number up to at least 50 million. Test conditions and facility characteristics will be suitable for obtaining accurate and reliable research data not obtainable in present wind tunnels, and will also permit separation of Reynolds number effects from aeroelastic effects of model loads. The proposed facility will be capable of cryogenic operation which permits major reductions in model loads and in tunnel power requirements.

An initial \$400,000 has been funded for engineering studies to more fully define operating and cost parameters, and to verify the feasibility of a cryogenic concept for this facility. It is planned that NASA will request the \$20 to \$25 million needed for the construction of this High Reynolds Number Transonic Research Wind Tunnel in some future program.

(2) Final Design for the Provision of Additional Combustion Air, Propulsion Systems Laboratory, Lewis Research Center (850,000)

As an element of the continued improvement of the capabilities of the PSL, additional combustion air for the testing of large future aircraft engines must be provided. This is a continuation of the long range program to maximize the capabilities represented by this facility.

A Preliminary Engineering Report for the "Increase of Combustion Air Supply and Altitude Exhaust Capacity at the Propulsion Systems Laboratory" has been prepared. This project has been divided into three phases: (1) Refrigerated Air Supply, (2) Combustion Air System, and (3) Altitude Exhaust System.

The detailed design of the Refrigerated Air Supply phase of the total project has been provided for. This phase, estimated to cost \$2,580,000, is included in the FY 1975 construction estimates. In FY 1975 this additional \$850,000 will be required to complete the detail designs of the Combustion Air System portion of the total project. This funding should be made available at the earliest possible date to enable the overall project design approach and equipment selection to be made. It will also provide for detailed design drawings and equipment specifications to be prepared to support the procurement of separate components and for complete site construction work of this Combustion Air System phase.

Additional Facility Planning and Design funding in the amount of approximately \$1,500,000 will be required in later programs to provide for A-E services to perform engineering analyses and complete project design drawings and specifications for acquisition of the Altitude Exhaust System phase of the entire project, the construction of which is estimated to cost about \$25,000,000. This requirement will be considered in future years' estimates.

(3) Final Design for Modification of the 40 x 80-Foot Subsonic Wind Tunnel (National Aeronautical Facility)

(\$950,000)

This work provides for final design of the repowering of the existing 40 x 80-foot wind tunnel and the addition of an open return 80 x 120-foot test section to this facility. Included in this

phase of the design is the final design of the fans, drive motors and control system; the 80 x 120-foot wind tunnel structure including test section balance and model handling systems; the flow diversion vanes, closures and air exit louvers needed to isolate one test section when the other is in operation; and the necessary final design of acoustical and environmental control systems.

Final design of this facility has been initiated to include a comprehensive project plan and a structural analysis of the existing main drive structure along with related studies to verify feasibility of an advanced fan system and main drive system. Acoustic analyses and a preliminary engineering report are also included. Earlier studies (FY 1973 and prior years) on the full-scale subsonic wind tunnel have been applied to the planning for this facility.

It is presently planned that construction of this facility would be undertaken in two phases, one of which would involve the repowering of this tunnel and the other to provide the addition of the 80 x 120-foot test section. This construction will also be considered for future years' estimates.

Subtotal, Other Requirements	<u>\$7,000,000</u>
Total, FY 1975 Request	<u>\$10,900,000</u>

CF 13-7