National Aeronautics and Space Administration

BUDGET ESTIMATES

FISCAL YEAR 1974

Volume II

CONSTRUCTION OF FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

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VOLUME II

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 principal projects in the 1974 program are described below:

MANNED SPACE FLIGHT: This activity includes funds for space shuttle facilities at various locations.

SCIENTIFIC INVESTIGATIONS IN SPACE: This activity will provide funds for the rehabilitation of a vibration laboratory at the Goddard Space Flight Center, Greenbelt, Md.; modifications of and addition to the 25-foot space simulator building and modifications of the planetary mission support facilities at the Jet Propulsion Laboratory, Pasadena, Calif.

SPACE APPLICATIONS: This activity includes funds for the modification of a space launch complex at the Western Test Range, Vandenberg Air Force Base, Calif.

SPACE AND NUCLEAR RESEARCH AND TECHNOLOGY: No projects for 1974.

AERONAUTICAL RESEARCH AND TECHNOLOGY: This activity includes funding for the rehabilitation and modification of the 600 p.s.i. air supply system at the Langley Research Center, Hampton, Va.

SUPPORTING ACTIVITIES: The estimates for this activity provide for replacement of the transportation facility at the Goddard Space Flight Center; construction of a systems engineering building at the Langley Research Center; rehabilitation of airfield pavement and a communication system at the Wallops Station, Wallops Island, Va.; modification for fire protection improvements at various tracking and data network stations; modification of the power system at the computer complex, Slidell, La.; rehabilitation and modification of facilities not in excess of $500,000 per project and minor construction of new facilities and additions to existing facilities not in excess of $250,000 per project, at various NASA installations and at Government-owned plants, operated by contractors; and facility planning and design.

The appropriation for FY 1973 was $77,300,000, the amount authorized in The Authorization Act. The request for FY 1974 is $112,000,000, an increase of $34,700,000 from the FY 1973 appropriation. Outlays are estimated to be $70,000,000 in FY 1974, an increase of $16,000,000 from the $54,000,000 estimated for FY 1973.

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, [$77,300,000] *$112,000,000,* including [(1) $1,065,000 for rehabilitation and modification of aeronautical, airborne science and support facilities, Ames Research Center; (2) $760,000 for rehabilitation of unitary plan wind tunnel model supports, control systems and model preparation areas, Ames Research Center; (3) $590,000 for rehabilitation and modification of utility systems, Goddard Space Flight Center; (4) $610,000 for rehabilitation and modification of roadway system, Jet Propulsion Laboratory; (5) $8,100,000 for modifications of, and additions to, spacecraft assembly facilities, Kennedy Space Center; (6) $2,040,000 for modification of Titan Centaur facilities, Kennedy Space Center; (7) $2,465,000 for rehabilitation of full scale wind tunnel, Langley Research Center; (8) $1,175,000 for modification of central air supply system, Langley Research Center; (9) $650,000 for environmental modifications for utility operations, Langley Research Center; (10) $9,710,000 for modification of high temperature and high pressure turbine and combustor research facility, Lewis Research Center; (11) $585,000 for modification of fire protection system, Manned Spacecraft Center; (12) $350,000 for warehouse replacement, Wallops Station; (13) $6,800,000 for modification of altitude test facilities, Arnold Engineering Development Center; (14) $1,160,000 for rehabilitation of propellant and high pressure gaseous systems, Mississippi Test Facility; (15) $1,635,000 for modification of entry structures facility, Langley Research Center; (16) $2,545,000 for addition for systems integration and mockup laboratory, Manned Spacecraft Center; (17) $2,770,000 for modification of vibration and acoustic test facility, Manned Spacecraft Center; (18) $4,700,000 for modification of structures and mechanics laboratory, Marshall Space Flight Center; (19) $320,000 for addition for electrical power laboratory, Marshall Space Flight Center; (20) $2,430,000 for modification of acoustic model engine test facility, Marshall Space Flight Center; (21) $5,540,000 for modification of manufacturing and final assembly facilities at undesignated locations] *(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;*

PROPOSED APPROPRIATION LANGUAGE

CONSTRUCTION OF FACILITIES —Continued

(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) $67,200,000 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, Manned Spacecraft Center, (C) modifications for radiant heating verification facility, Manned Spacecraft 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; [(22) $11,580,000] *(13) $14,785,000* for minor rehabilitation and modification of facilities at various locations; [(23) $1,720,000] *(14) $4,600,000* for minor construction of new facilities and additions to existing facilities at various locations; [(24) $8,000,000] *(15) $13,600,000* for facility planning and design not otherwise provided for; to remain available for obligation until June 30, [1975.] *1976: Provided, That, notwithstanding the limitations 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), and except with respect to items (13) through (15) 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 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, 1973; 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		
	1972 actual	1973 estimate	1974 estimate	1972 actual	1973 estimate	1974 estimate
Program by activities:						
1. Manned space flight	18,500	27,900	67,200	10,349	18,300	37,300
2. Scientific investigations in space	15,200	11,205	2,030	4,231	10,000	6,600
3. Space applications	740	.....	980	3,585	600	800
4. Space and nuclear research and technology	.....	.....	.....	1,103	400	400
5. Aeronautical research and technology	7,360	12,935	2,410	5,662	10,700	7,500
6. Supporting activities	12,500	25,260	39,380	21,674	17,000	27,400
Total program costs, funded	54,300	77,300	112,000	46,604	57,000	80,000
Change in selected resources [1]	.....	.....	.....	−1,386	52,600	30,000
10 Total	54,300	77,300	112,000	45,218	109,600	110,000
Financing:						
21 Unobligated balance available, start of year, for completion of prior year budget plans	.....	.....	.....	−53,110	−63,197	−32,297
22 Unobligated balance transferred from other accounts	−1,400	.....	.....	−2,605	−1,400	.....
Reprograming from prior year budget plans	−200	.....	.....	.....	.....	.....
24 Unobligated balance available, end of year, for completion of prior year budget plans	.....	.....	.....	63,197	32,297	34,297
40 **Budget authority (appropriation)**	**52,700**	**77,300**	**112,000**	**52,700**	**77,300**	**112,000**
Relation of obligations to outlays:						
71 Obligations incurred, net				45,218	109,600	110,000
72 Obligated balance, start of year				48,640	43,539	99,139
74 Obligated balance, end of year				−43,539	−99,139	−139,139
90 Outlays				50,319	54,000	70,000

[1] Selected resources as of June 30 are as follows: Undelivered orders, 1971, $32,271 thousand; 1972, $30,885 thousand; 1973, $83,485 thousand; 1974, $113,485 thousand.

Note.—Reconciliation of budget plan to obligations:	*1972 actual*	*1973 estimate*	*1974 estimate*
Total budget plan	54,300	77,300	112,000
Deduct portion of budget plan to be obligated in subsequent years	36,897	18,700	31,220
Add obligations of prior year budget plans	27,815	51,000	29,220
Total obligations	45,218	109,600	110,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1974 ESTIMATES

SUMMARY OF CONSTRUCTION OF FACILITIES BUDGET PLAN
BY BUDGET ACTIVITY SHOWING LOCATION TOTALS INCLUDED IN EACH ACTIVITY

	Fiscal Year 1972	Fiscal Year 1973	Fiscal Year 1974
1. MANNED SPACE FLIGHT.....	$18,500,000	$27,900,000	$67,200,000
Space Shuttle facilities at various locations.....	18,500,000	27,900,000	67,200,000
2. SCIENTIFIC INVESTIGATIONS IN SPACE.....	$15,200,000	$11,205,000	$2,030,000
Ames Research Center.....	---	1,065,000	---
Goddard Space Flight Center..	---	---	710,000
Jet Propulsion Laboratory....	---	---	1,320,000
John F. Kennedy Space Center, NASA.....	15,200,000	10,140,000	---
Various Locations.....	---	---	---
3. SPACE APPLICATIONS.....	$740,000	---	$980,000
Goddard Space Flight Center..	740,000	---	---
Various Locations.....	---	---	980,000
4. SPACE AND NUCLEAR RESEARCH AND TECHNOLOGY.....	---	---	---
5. AERONAUTICAL RESEARCH AND TECHNOLOGY.....	$7,360,000	$12,935,000	$2,410,000
Ames Research Center.....	6,500,000	760,000	---
Langley Research Center.....	---	2,465,000	2,410,000
Lewis Research Center.....	860,000	9,710,000	---

	Fiscal Year 1972	Fiscal Year 1973	Fiscal Year 1974
6. SUPPORTING ACTIVITIES.....	$12,500,000	$25,260,000	$39,380,000
Goddard Space Flight Center..	---	590,000	660,000
Jet Propulsion Laboratory....	---	610,000	---
Langley Research Center.....	---	1,825,000	1,620,000
Manned Spacecraft Center.....	---	585,000	---
Wallops Station.....	---	350,000	1,145,000
Various Locations.....	1,100,000	---	2,970,000
Rehabilitation and Modification.....	7,900,000	11,580,000	14,785,000
Minor Construction.....	---	1,720,000	4,600,000
Facility Planning and Design.	3,500,000	8,000,000	13,600,000
Total Plan.....	$54,300,000	$77,300,000	$112,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1974 ESTIMATES

SUMMARY OF CONSTRUCTION OF FACILITIES BUDGET PLAN BY LOCATION

Location	Fiscal Year 1972	Fiscal Year 1973	Fiscal Year 1974
Ames Research Center.....	$6,500,000	$1,825,000	---
Goddard Space Flight Center.....	$740,000	$590,000	$1,370,000
Jet Propulsion Laboratory.....	---	610,000	1,320,000
John F. Kennedy Space Center, NASA.	15,200,000	10,140,000	---
Langley Research Center.....	---	4,290,000	4,030,000
Lewis Research Center.....	860,000	9,710,000	---
Manned Spacecraft Center.....	---	585,000	---
Wallops Station.....	---	350,000	1,145,000
Various Locations.....	1,100,000	---	3,950,000
Space Shuttle Facilities.....	18,500,000	27,900,000	67,200,000
Rehabilitation and Modification....	7,900,000	11,580,000	14,785,000
Minor Construction.....	---	1,720,000	4,600,000
Facility Planning and Design.....	3,500,000	8,000,000	13,600,000
Total Plan.....	$54,300,000	$77,300,000	$112,000,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1974 ESTIMATES

SUMMARY OF CONSTRUCTION OF FACILITIES PROJECTS BY LOCATION

	Fiscal Year 1974
Goddard Space Flight Center	$1,370,000
Replacement of transportation facility	660,000
Rehabilitation of vibration laboratory	710,000
Jet Propulsion Laboratory	1,320,000
Modifications of and addition to 25-foot space simulator building	740,000
Modification of planetary mission support facilities	580,000
Langley Research Center	4,030,000
Rehabilitation and modification of 600 psi air supply system	2,410,000
Construction of systems engineering building	1,620,000
Wallops Station	1,145,000
Rehabilitation of airfield pavement	570,000
Rehabilitation of communication system	575,000
Various Locations	3,950,000
Modification of power system	1,085,000
Modification of space launch complex 2 west (SLC-2W)	980,000
Modification for fire protection improvements	1,885,000
Space Shuttle Facilities	67,200,000
Rehabilitation and Modification	14,785,000
Minor Construction	4,600,000
Facility Planning and Design	13,600,000
Total Plan	$112,000,000

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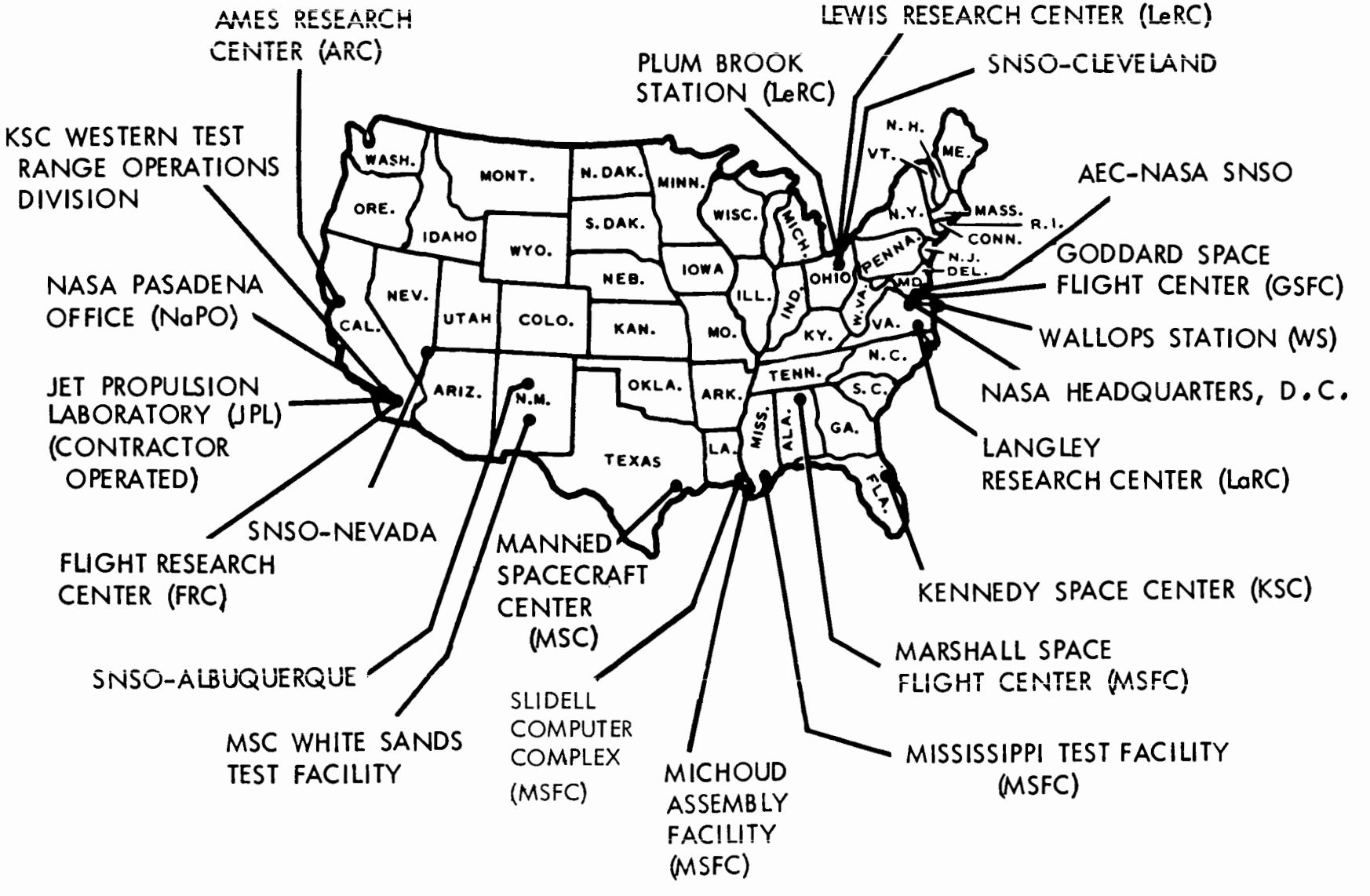
LOCATION OF NASA MAJOR AND COMPONENT INSTALLATIONS



RECORDED VALUE OF CAPITAL TYPE PROPERTY
(IN-HOUSE AND CONTRACTOR-HELD)
AS OF JUNE 30, 1972
(DOLLARS IN THOUSANDS)

Reporting Installation	Real Property							
	Land	Buildings	Other Structures and Facilities	Leasehold Improvements	Total	Equipment 2/	Fixed Assets in Progress	Grand Total
OFFICE OF MANNED SPACE FLIGHT	$ 107,471	$ 753,700	$ 703,537	$ 3,607	$ 1,568,315	$ 1,743,670	$ 31,684	$ 3,343,669
Kennedy Space Center	72,171	286,274	350,028	-	708,473	588,968	13,352	1,310,793
KSC - Florida	72,171	286,274	350,028	-	708,473	175,745	9,038	893,257
Western Test Range Operations Division								
Lompoc, California	-	-	-	-	-	6,351	4,314	10,665
Various Locations 1/	-	-	-	-	-	406,871	-	406,871
Manned Spacecraft Center	9,029	178,011	52,859	-	239,899	622,132	12,334	874,365
MSC - Houston, Texas	5,459	144,298	30,963	-	180,720	293,679	12,334	486,732
White Sands Test Facility								
WSTF - Las Cruces, New Mexico	-	8,691	16,855	-	25,546	35,395	-	60,941
Various Locations 1/	3,570	25,022	5,041	-	33,633	293,059	-	326,692
Marshall Space Flight Center	26,271	289,415	300,650	3,607	619,943	532,570	5,998	1,158,511
MSFC - Huntsville, Alabama	-	112,838	51,858	-	164,696	245,445	2,782	412,924
Michoud Assembly Facility								
MAF - New Orleans, Louisiana	7,505	64,168	25,936	-	97,609	60,503	129	158,241
Mississippi Test Facility								
MTF - Bay St. Louis, Mississippi	18,703	81,649	185,435	-	285,787	34,199	2,544	322,530
Slidell Computer Facility								
SCF - Slidell, Louisiana	63	4,481	879	-	5,423	20,216	-	25,639
Various Locations 1/	-	26,279	36,542	3,607	66,428	172,206	543	239,177
OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY	6,181	526,872	225,692	139	758,884	440,897	50,549	1,250,330
Ames Research Center	2,373	176,188	3,962	-	182,523	87,432	10,609	280,564
ARC - Moffett Field, California	2,373	176,063	3,962	-	182,398	83,767	10,609	276,774
Various Locations 1/	-	125	-	-	125	3,665	-	3,790
Flight Research Center	-	8,479	2,629	-	11,108	47,477	514	59,099
FRC - Edwards, California	-	8,479	2,525	-	11,004	43,591	514	55,109
Various Locations 1/	-	-	104	-	104	3,886	-	3,990
Langley Research Center	116	125,024	149,007	-	274,147	138,525	15,527	428,199
LaRC - Hampton, Virginia	110	109,620	148,982	-	258,712	124,022	15,527	398,261
Various Locations 1/	6	15,404	25	-	15,435	14,503	-	29,938
Lewis Research Center	3,692	198,193	63,164	139	265,188	139,478	23,894	428,560
LeRC - Cleveland, Ohio	328	114,220	41,294	139	155,981	73,241	23,890	253,112
Plum Brook Station								
PBS - Sandusky, Ohio	3,285	80,922	18,221	-	102,428	13,269	4	115,701
Various Locations 1/	79	3,051	3,649	-	6,779	52,968	-	59,747
Space Nuclear Systems Office	-	18,988	6,930	-	25,918	27,985	5	53,908
SNSO/N - NRDS - Jackass Flats, Nevada	-	18,988	6,930	-	25,918	4,304	5	30,227
Various Locations 1/	-	-	-	-	-	6,821	-	6,821
SNSO/G - Germantown, Maryland	-	-	-	-	-	-	-	-
Various Locations 1/	-	-	-	-	-	16,860	-	16,860
OFFICE OF SPACE SCIENCE	3,797	173,843	142,553	546	320,739	763,488	49,889	1,134,116
Goddard Space Flight Center	1,647	91,628	64,147	81	157,503	521,949	11,149	690,601
GSFC - Greenbelt, Maryland	1,308	73,732	14,729	81	89,850	171,362	11,149	272,361
Tracking Stations (Excl. DSN) 3/	339	17,808	49,373	-	67,520	293,747	-	361,267
Various Locations 1/	-	88	45	-	133	56,840	-	56,973
Jet Propulsion Laboratory	1,067	59,887	33,343	465	94,762	192,777	36,740	324,279
JPL - California	1,067	50,279	8,048	465	59,859	122,366	36,740	218,965
Tracking Stations (DSN) 3/	-	9,608	25,295	-	34,903	70,411	-	105,314
Wallops Station	1,083	22,328	45,063	-	68,474	48,762	2,000	119,236
WS - Wallops Island, Virginia	1,083	22,328	45,063	-	68,474	48,529	2,000	119,003
Various Locations 1/	-	-	-	-	-	233	-	233
OTHER	-	-	-	83	83	21,406	-	21,489
NASA Headquarters	-	-	-	83	83	21,406	-	21,489
Washington, DC	-	-	-	1	1	3,172	-	3,173
Various Locations 1/	-	-	-	82	82	18,234	-	18,316
GRAND TOTAL	$ 117,449	$ 1,454,415	$ 1,071,782	$ 4,375	$ 2,648,021	$ 2,969,461	$ 132,122	$ 5,749,604

1/ Includes Capital Type Property in Possession of Contractors at Various Locations.
2/ Includes Contractor-Held Special Test Equipment ($744,136K).
3/ DSN - Deep Space Network.

SUM 10

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

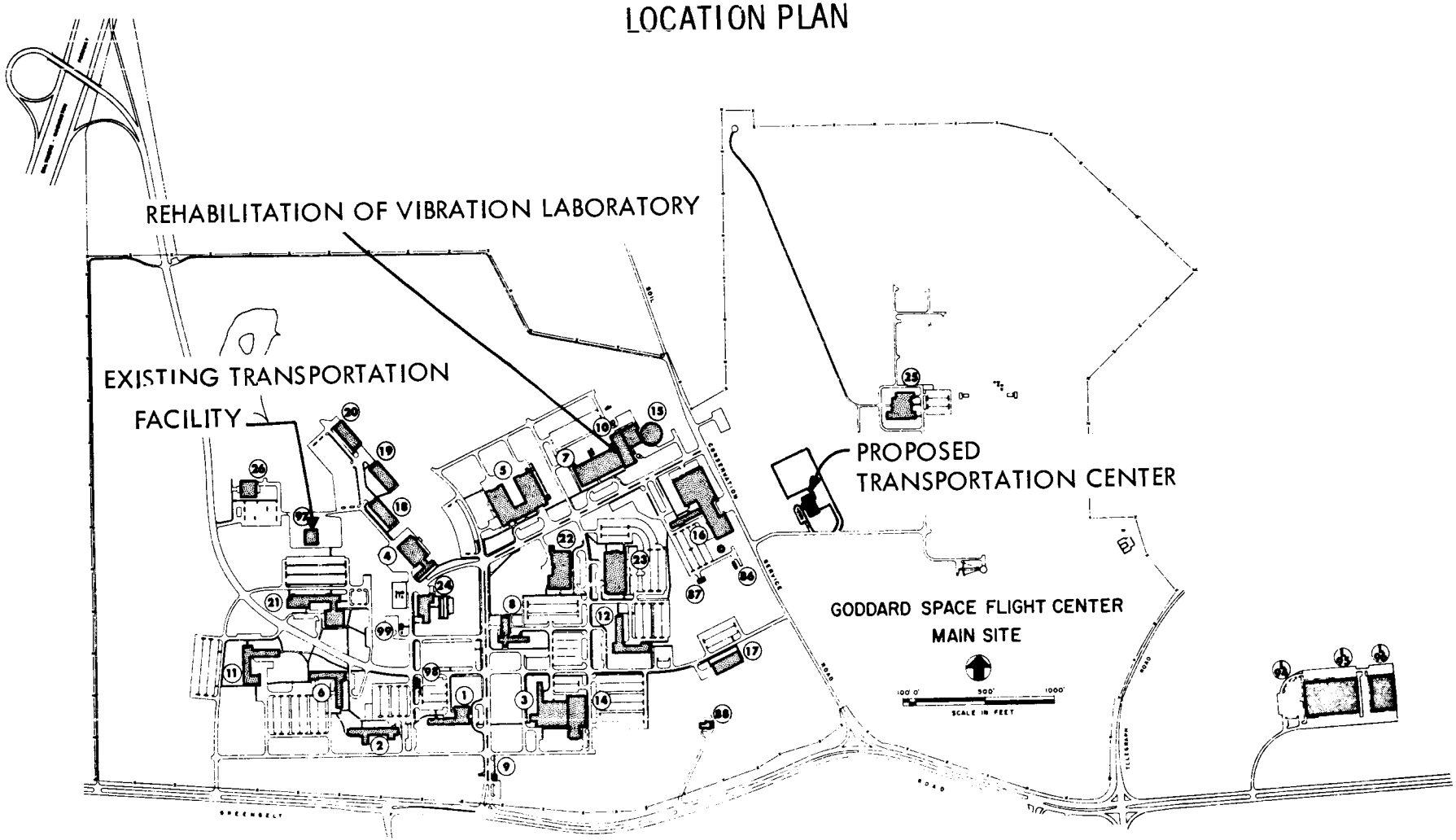
CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

GODDARD SPACE FLIGHT CENTER

GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 19 74 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION		COGNIZANT PROGRAM OFFICE FOR INSTALLATION
Goddard Space Flight Center		Space Science
LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Greenbelt, Maryland	Prince George's	Greenbelt, Maryland

INSTALLATION MISSION

The Center is responsible for complete development of unmanned sounding rockets and orbiting spacecraft experiments in basic and applied science. The work covers scientific satellites, and communications and weather satellites which orbit in cislunar space (region between the earth and moon). In addition, the Center manages NASA's Delta launch vehicle project and two worldwide tracking, data acquisition and data reduction networks.

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 19 74 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Replacement of transportation facility	OSS	65	660	-0-	725
Rehabilitation of vibration laboratory	OSS	43	710	-0-	753
TOTAL			1,370		

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Replacement of Transportation Facility
LOCATION	Goddard Space Flight Center
	FY 1974 CoF ESTIMATE $660,000

COGNIZANT INSTALLATION: Goddard Space Flight Center

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

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$65,200
Construction	---*
Total FY 1973 and Prior Years	$65,200

*No Construction of Facilities funds have been applied to the existing facility since transfer to NASA from DOD.

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide a new facility to replace the existing Transportation Facility. A single story structure of approximately 14,000 square feet is proposed. The new facility will service the assigned motor vehicles and the Center's electronic equipment vans. The existing facility has numerous deficiencies which result in a totally inadequate and inferior facility.

PROJECT JUSTIFICATION:

The facility at the Goddard Space Flight Center consists of a shop for repair, maintenance, and operation of electronic equipment vans and motor vehicles, plus related administrative offices.

The existing facility is a temporary building for which a replacement is required. There are three basic conditions which justify replacement:

1. Serious deterioration.

2. Facility limitations preclude efficient performance of assigned activities.

3. Substandard working conditions which contribute to undesirable health and safety environment.

Deterioration:

The insulation, metal "skin", roof and other portions of the building have deteriorated to such an extent that, based on a recent survey, the estimated cost of needed basic repairs was approximately $320,000. This is almost half the cost of the proposed project. Further, this expenditure would not solve the other problems listed.

Facility Limitations:

This facility currently services 110 trailer vans, 10 tractors, 100 trucks, 50 passenger automobiles, cranes and other miscellaneous wheeled equipment. The following list identifies some of the limitations imposed by the current facility and its present location:

1. The maintenance bays are too small to accommodate the electronic vans. Thus, they must be cleaned and serviced outside the building.

2. Insufficient head room prohibits proper use of truck lifts. This results in an inefficient and marginally safe type of maintenance and repair activity.

3. There is inadequate room to maneuver the large tractor-trailer units used for long distance hauling.

4. There is insufficient electrical power delivered to the facility to operate all of the required equipment.

Substandard Conditions:

1. Provision for quick drenching of the eyes and body for "emergency use" is not available.

2. Inside storage area has no sprinkler system and has no direct egress to the outside in case of fire.

3. The lunch room is located next to the sanitary facilities which need to be replaced.

4. The lack of sanitary facilities for women.

5. Ventilation in the battery room, shop areas and dispatcher's office is inadequate.

6. The individual oil fired heaters do not provide adequate heating, but do contribute to air polution.

7. Water drainage problems exist which tend to create a damp working environment in the present area as well as to accelerate the rate of deterioration of the metal building skin.

PROJECT DESCRIPTION:

The proposed facility will be a one story structure approximately 10,000 square feet in area with a partial mezzanine of an additional 4,000 square feet. Length will be 131 feet and the maximum width 78 feet.

It is planned that the structure will be a continuously welded exposed steel frame with a reinforced concrete floor slab and a lightweight insulated roof deck over long-span open-web steel joists. The exterior walls will be precast tilt-up concrete panels of color and texture to harmonize with other structures in the Center. Existing utility and road systems will be extended to the facility.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Site Preparation	LS	---	---	$135,700
Utilities	LS	---	---	119,300
Construction				356,000
Architectural structural	SF	14,000	$13.55	189,700
Mechanical plumbing, heating and ventilating	SF	14,000	3.69	51,700
Air conditioning	SF	8,000	4.62	37,000
Electrical	SF	14,000	3.08	43,100
Fire protection	SF	14,000	2.46	34,500
Fixed Equipment	LS	---	---	49,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$660,000

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.

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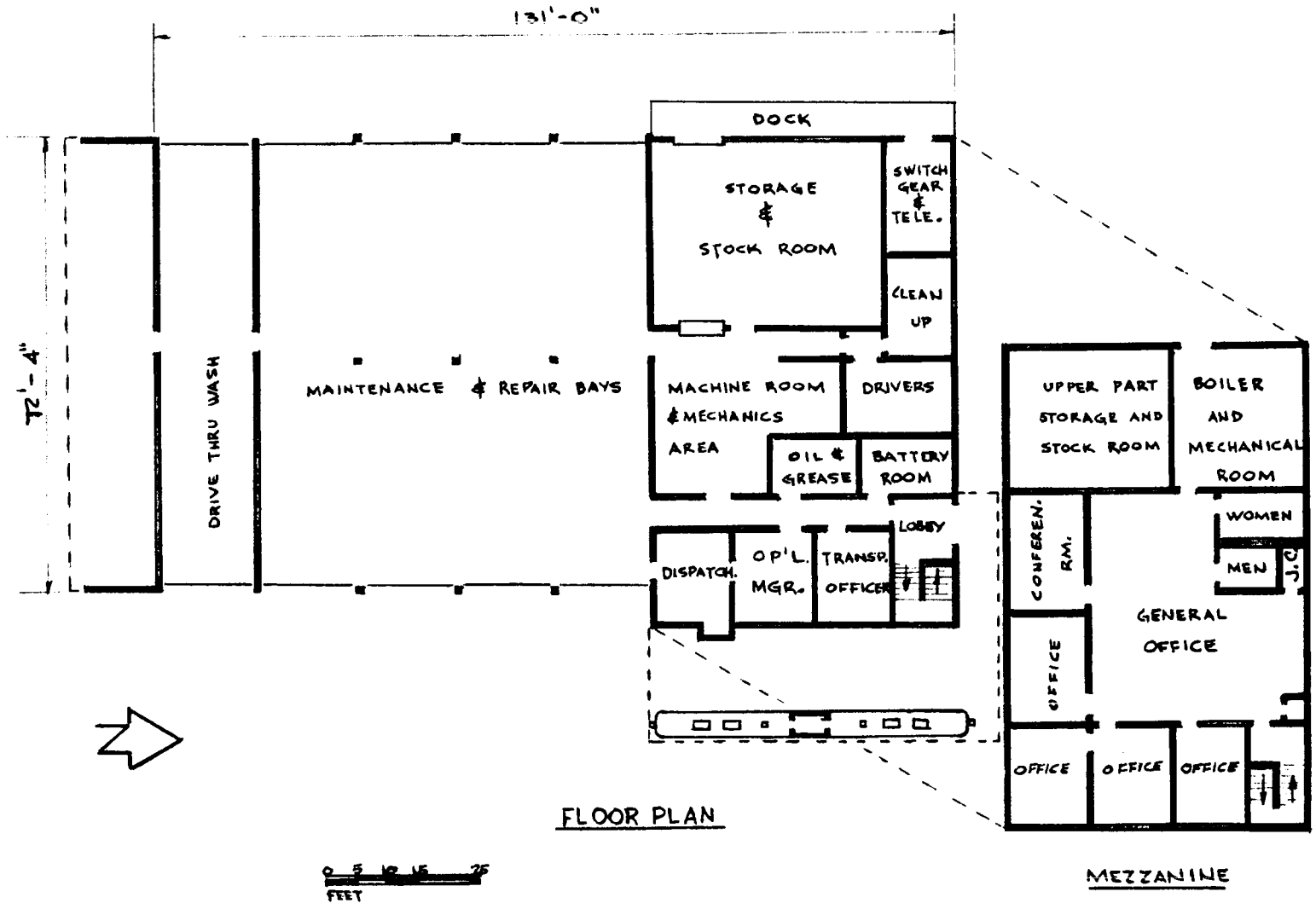
GODDARD SPACE FLIGHT CENTER
FISCAL YEAR 1974 ESTIMATES

REPLACEMENT OF TRANSPORTATION FACILITY



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE Rehabilitation of Vibration Laboratory

LOCATION Goddard Space Flight Center

FY 1974 CoF ESTIMATE $710,000

COGNIZANT INSTALLATION: Goddard Space Flight Center

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

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$42,600
Construction	*
Total FY 1973 and Prior Years	$42,600

*The existing applicable equipment was included with the construction of the original building (the Payload Test Facility, Building #7, at GSFC) and is not separately identifiable.

SUMMARY PURPOSE AND SCOPE:

This project provides for the rehabilitation of the vibration laboratory of the Payload Test Facility, Building #7, to meet the demands of advances in technology and the more sophisticated test requirements of complex current and future spacecraft. Specifically, this project will replace each of the two 10,000 pound force exciter systems with a 17,500 pound force system. It will also provide for rehabilitating and upgrading the existing 28,000 pound force system to a 35,000 pound force system.

PROJECT JUSTIFICATION:

Flight hardware must undergo vibration testing to determine its ability to withstand the launch and preorbit vibration environment. Over the life of the space program, NASA has instrumented spacecraft and launch vehicles to determine this actual environment and to relate these actual flight data to the testing program. With approximately $50,000,000 of flight hardware being tested in the vibration laboratory each year, it is of paramount importance that all of the vibration systems perform reliably and effectively during test.

New test parameters recently have placed more stringent requirements on this equipment. The first of these parameters is the protoflight concept which decreases the overall program cost, but dictates greater reliability in the existing systems. The second is the performance of shock testing on the vibration systems which allows more realistic testing to be performed, but adds greatly to the mechanical stresses on the equipment. The third test is the workmanship vibration test which is performed shortly before a spacecraft launch. Any delay in this test is directly translated to the launch date and adds significantly to the cost of the program.

With these newer conditions being imposed, there is a continuing concern for the safety of the flight hardware being tested on these older and very obsolete systems. All major elements of these existing systems are over ten years old. Components of the systems are failing because of high voltage breakdown and mechanical fatigue, thus subjecting flight hardware to unwanted transient vibrations which can have damaging effects on the item being tested.

Precautions such as the installation of protective devices and the implementation of extensive operating and maintenance procedures have been taken which have resulted in delays to testing programs and have not eliminated the continuing random failures.

Maintenance now requires about 45% of the working hours and this percentage is increasing. Replacement parts are not available, failed parts must be rebuilt at the factory and, in some cases derated, causing the equipment to have less capability than when originally installed.

With the increased size and weight of spacecraft, the 10,000 pound force exciters cannot handle many of the larger test items which in turn increases the work load on the larger 28,000 pound force system. Additionally, all of the existing exciters have a suspension system which induces unwanted vibration inputs to the test items.

A detailed cost effectiveness study showed that the modernization of the vibration laboratory will pay for itself within a relatively short period in manpower savings and will allow more tests to be made with a lesser equipment inventory.

PROJECT DESCRIPTION:

The plan for modernization of the vibration laboratory includes replacing some existing equipment and overhauling the balance of the existing systems. It will be accomplished in two phases in order to minimize exciter-system down time. A typical vibration system consists of one or more exciters, an amplifier and a control console. The control console synthesizes the required shock or vibration data and feeds it to the amplifier where it is amplified electrically. This electrical signal is fed to the exciter which transforms the signal into a desired mechanical excitation which vibrates or shocks the spacecraft being tested.

In Phase I it is planned that the two 17,500 pound force exciters, with improved suspension systems will replace two 10,000 pound force exciters, the high voltage power amplifier will be replaced by a low voltage solid state amplifier and the vibration console will be replaced by a digital control console. In addition, the backup 10,000 pound force system consisting of two exciters and high voltage amplifier, and one control console will be surplused after the new system is accepted and becomes operational.

In Phase II it is planned that the present 28,000 pound force exciter will be upgraded to 35,000 pound force, the high voltage power amplifier will be replaced with the low voltage solid state amplifier and the vibration console replaced with a digital console.

Along with the new vibration equipment being installed, it is planned to remove the wall between the two existing 10,000 pound exciter cells, modify the two existing seismic blocks, remove the two steel stairways, and connect the monorail in each cell. The existing electrical services for the equipment will be modified as necessary by reworking the electrical connections in the immediate vicinity of the new equipment.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$60,000
Architectural and structural	LS	---	---	25,000
Electrical	LS	---	---	3,000
Mechanical	LS	---	---	12,000
Equipment installation	LS	---	---	20,000
Equipment				650,000
Control consoles	Each	2	$152,000	304,000
Power amplifier (17,500)	Each	1	---	74,000
Power amplifier (35,000)	Each	1	---	142,000
17,500 pound force exciter	Each	2	46,000	92,000
Rebuild and upgrade 28,000 pound force exciter	Each	1	---	38,000
Fallout Shelter (Not Applicable)	---	---	---	---
		TOTAL		$710,000

At this time no other equipment items have been identified as being required for the initial operation or use of this facility.

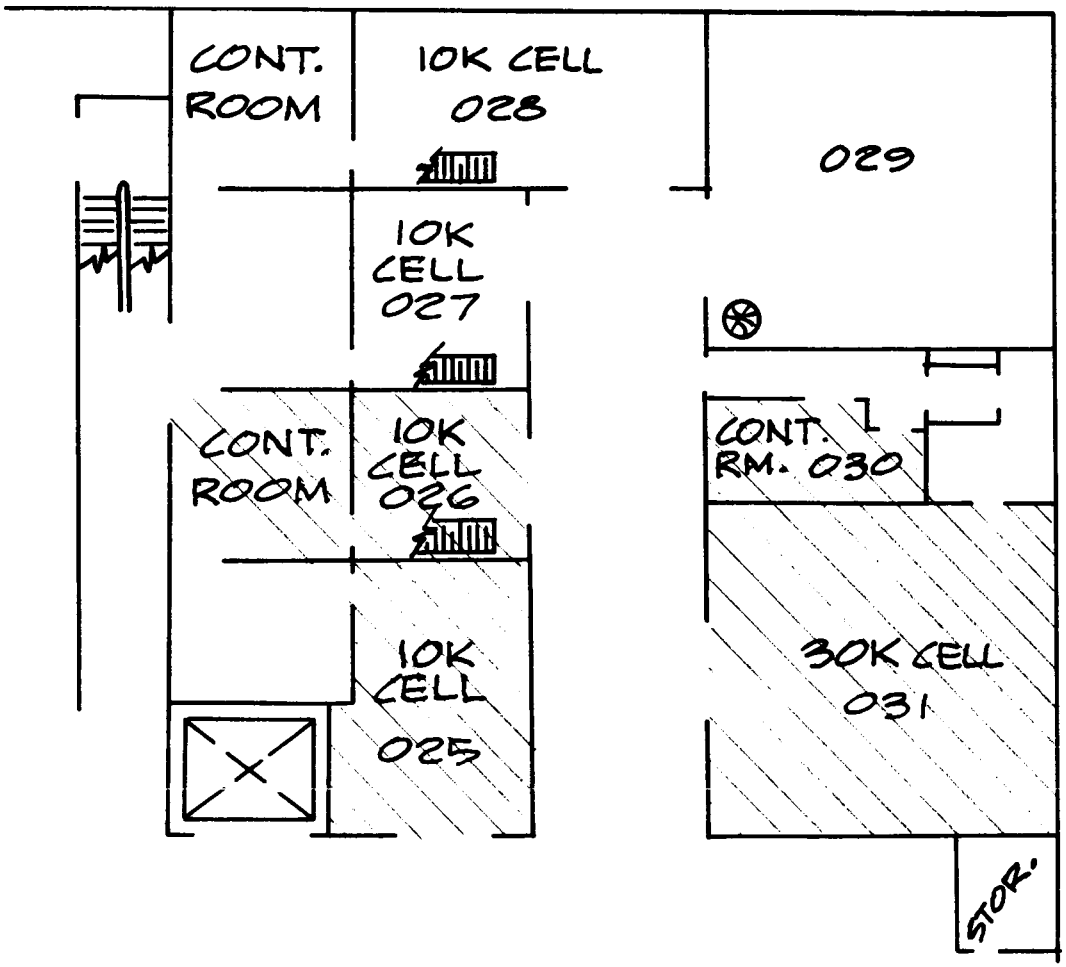
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

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

GODDARD SPACE FLIGHT CENTER

FISCAL YEAR 1974 ESTIMATES

REHABILITATION OF VIBRATION LABORATORY



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

JET PROPULSION LABORATORY

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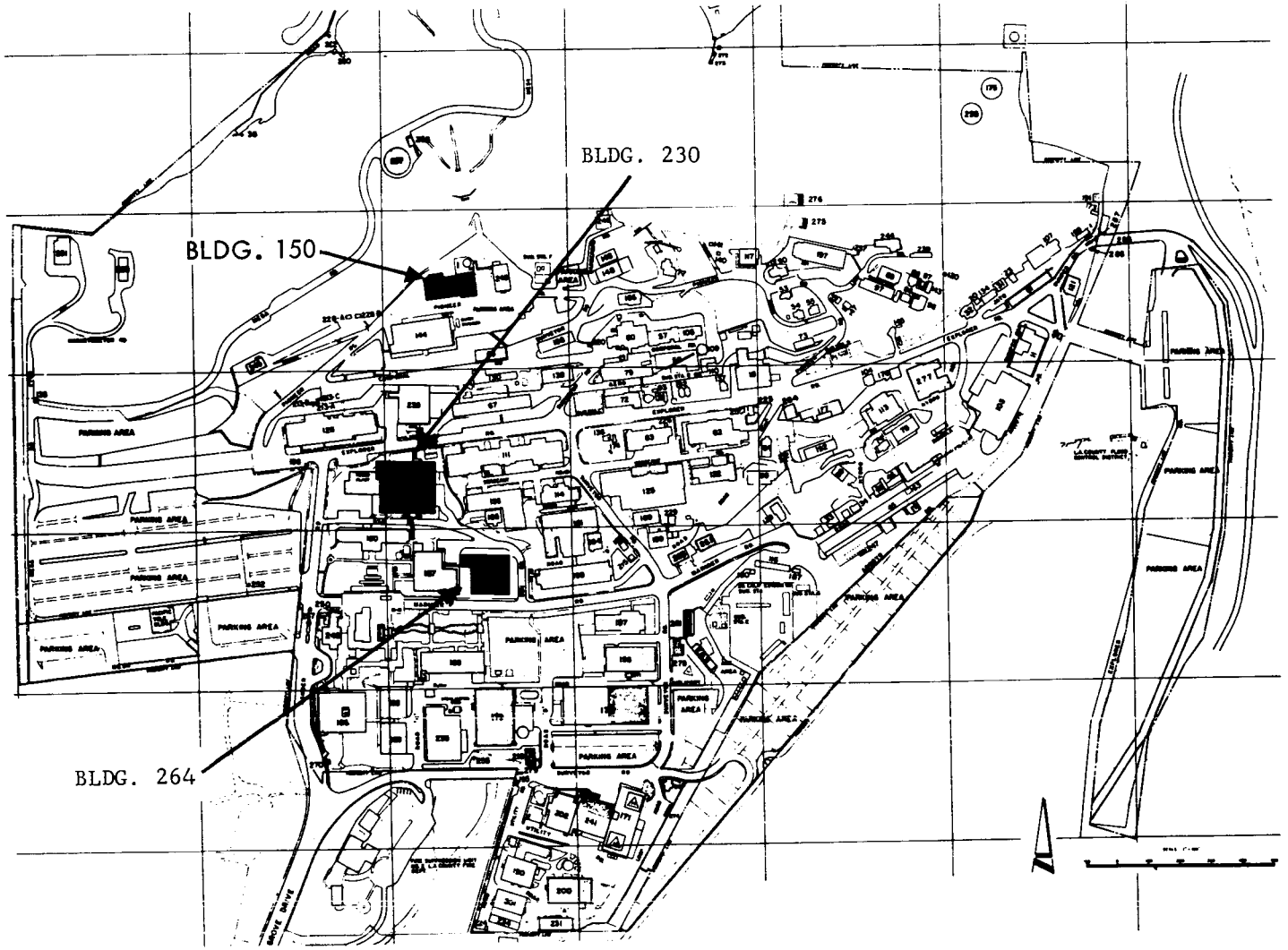
JET PROPULSION LABORATORY
FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION
Jet Propulsion Laboratory	Space Science

LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Pasadena, California	Los Angeles	Pasadena

INSTALLATION MISSION

The Jet Propulsion Laboratory (JPL) is a Government-owned research and development facility, operated by the California Institute of Technology under a contract with the National Aeronautics and Space Administration. The laboratory carries out research programs and unmanned lunar and planetary space projects for NASA, and conceives and executes advanced development and experimental engineering investigations to further the technology required for the nation's space program.

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 1974 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Modifications of and Addition to 25-Foot Space Simulator Building	OSS	7,608	740	-0-	8,348
Modification of Planetary Mission Support Facilities	OSS	7,495	580	-0-	8,075
TOTAL			1,320		

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modifications of and Addition to 25-Foot Space Simulator Building
LOCATION	Jet Propulsion Laboratory
	FY 1974 CoF ESTIMATE $740,000

COGNIZANT INSTALLATION: Jet Propulsion Laboratory

LOCATION OF PROJECT: Pasadena, Los Angeles County, California

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$230,073
Construction	7,377,881
Total FY 1973 and Prior Years	$7,607,954

SUMMARY PURPOSE AND SCOPE:

This project provides a clean airlock for the spacecraft entrance to the 25-foot Space Simulator Building, Building 150, and improves the present setup area to meet acceptable flight project standards of contamination control. Concurrent modifications are made to the second and third floor areas over the existing control console and the new personnel change room to accommodate the air ducts and mechanical equipment required to produce the laminar flow "clean" facility. This proposal represents a permanent correction of the unacceptable contaminant exposure of flight vehicles during their assembly and test.

PROJECT JUSTIFICATION:

All spacecraft flight projects define specific environmental conditions under which spacecraft must be assembled and tested. The lack of adequate facilities at JPL to accomplish these tasks has required that earlier projects improvise and use "portable tents" to maintain limited environmental control. However, the size of Viking and other approved spacecraft prevents this approach from being utilized any longer in Building 150. The present Building 150 setup area is not air conditioned; no barrier exists to prevent entry of atmospheric air and contamination; doorways are a source

of heat and dirt; and no provision exists to clean up the spacecraft prior to its admission into the present setup area. The planned new clean, down flow type air conditioning system for the Building 150 airlock and test setup areas will meet a minimum cleanliness requirement, by approaching a Class 10,000 clean room. This condition will then be consistent with flight project standards.

PROJECT DESCRIPTION:

This project converts the existing 20' x 45' "setup area" inside the west end of Building 150 into a clean, contaminant-free area with filtered down flow type air conditioning. Concurrently a new 30' x 30' clean airlock and personnel change facility completes the required basic configuration. Required access doors, stairs and fire resistance requirements will be met. Some existing mechanical equipment will be substituted or relocated and new mechanical areas will be provided on the third floor to handle the additional air handling equipment.

Exterior construction will match the concrete block walls of the building. The raised roof over the setup area would be steel frame covered with insulated steel panels to match elevated wall sections of Building 150. Mechanical areas will have cast concrete floors and be ventilated. All other areas, not requiring laminar flow, would have standard office type air conditioning.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Modifications				$424,000
Site preparation	LS	---	---	5,000
Architectural	SF	4,600	$20.87	96,000
Mechanical	LS	---	---	229,000
Electrical	LS	---	---	54,000
Miscellaneous modifications	LS	---	---	40,000
Addition				$316,000
Site preparation	LS	---	---	4,000
Architectural	LS	---	---	120,000
Mechanical	LS	---	---	157,000
Electrical	LS	---	---	35,000
		TOTAL		$740,000

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

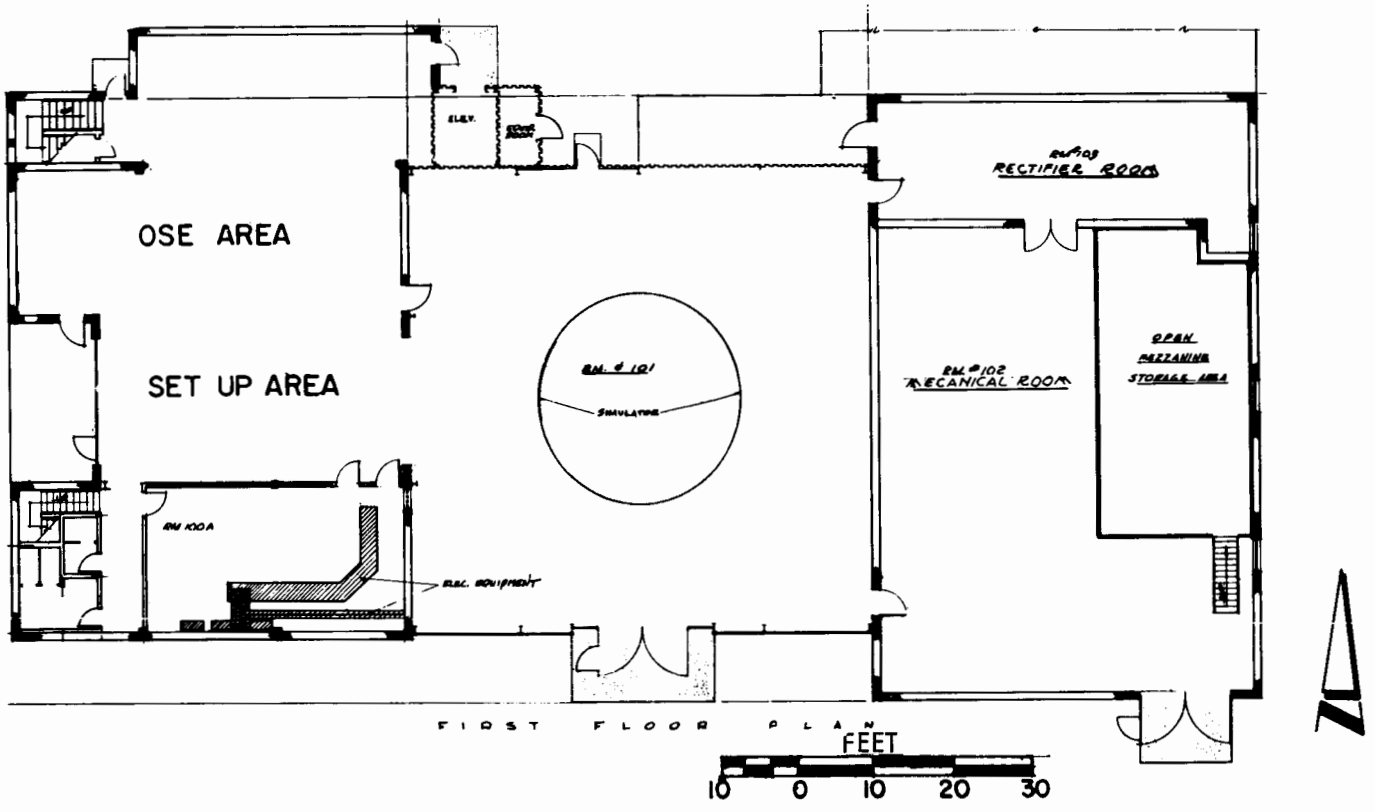
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Under present planning guidelines, no future funding should be required to complete this particular project related to Building 150.

JET PROPULSION LABORATORY

FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF AND ADDITIONS TO 25-FOOT SPACE SIMULATOR BUILDING

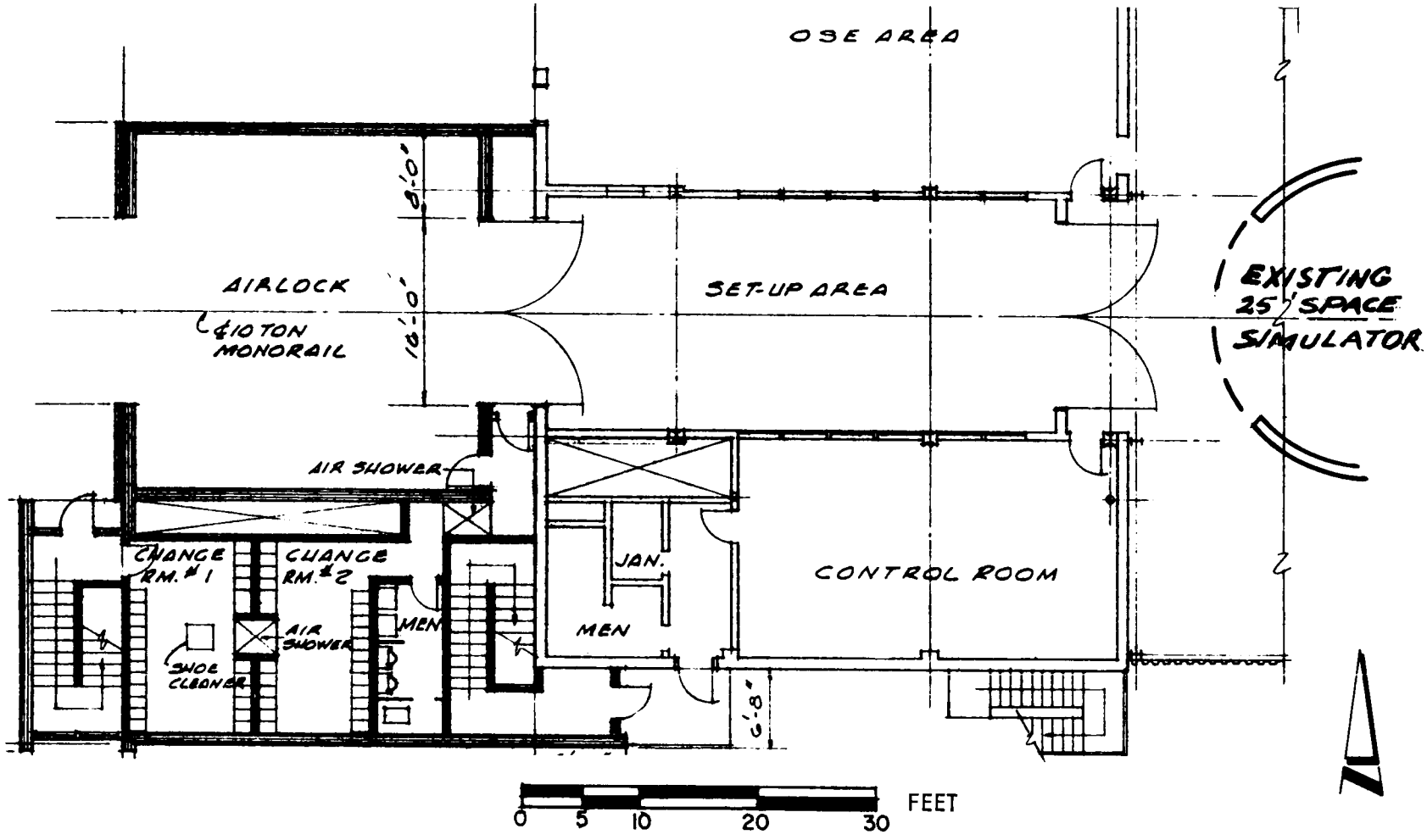


EXISTING FACILITY

JET PROPULSION LABORATORY

FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF AND ADDITIONS TO 25-FOOT SPACE SIMULATOR BUILDING



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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modification of Planetary Mission Support Facilities
LOCATION	Jet Propulsion Laboratory
	FY 1974 CoF ESTIMATE $580,000

COGNIZANT INSTALLATION: Jet Propulsion Laboratory

LOCATION OF PROJECT: Pasadena, Los Angeles County, California

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1973 AND PRIOR YEARS CoF FUNDING:

	SFOF*	SDL**
Planning and Design	$301,565	$153,889
Construction	5,844,949	1,195,000
	$6,146,514	$1,348,889

Total FY 1973 and Prior Years $7,495,403

*Space Flight Operations Facility
**Systems Development Laboratory

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to modify specific areas within two buildings, totaling 17,500 square feet, so that they can accommodate mission control and ground processing equipment and personnel associated with the Viking Project scheduled for launch in 1975.

The highly sensitive and costly mission support equipment must be supported by proper utilities and air handling capability which this project provides.

PROJECT JUSTIFICATION:

Areas which satisfy Viking mission support requirements can be made available in the Space Flight Operations Facility (SFOF) Building 230 and the Systems Development Laboratory (SDL) Building 264, but at the present time they are not capable of accepting the equipment and personnel to be assigned. This project provides the basic utility support including computer flooring, air conditioning, regular and emergency electrical power, partition adjustments,

plumbing, piping and fire alarm systems required. These modifications will complete the facility capability at JPL for the Mission Control and Computing Center (MCCC) required to handle both the Viking Orbiter and Lander mission operations.

Approximately 33,000 square feet of space have been committed to Viking mission support area requirements. Of this amount, approximately 6,000 net square feet in SFOF needs to be prepared for installation of support type equipment to complete the Mission Control and Computing Center. Also included is an allocation of 11,500 square feet in SDL for mission support areas. This area is presently devoted to other uses and will require extensive alterations to meet project requirements.

The Viking Project has two distinct operational support requirements: one for the Orbiter vehicle, and one for the Lander vehicle. The only facilities in the MCCC providing sufficient capability to support the orbiter vehicle are in the photo processing area. A separate technical capability is required to support the Lander vehicle. Visual Imaging Reconstruction non-collateral equipment costing approximately $1 million (R&D funded) is on order for installation as part of the mission support area for Viking. This area must be ready for equipment installation by July 1974, in order to support the scheduled spacecraft/launch and flight operation system compatibility tests.

PROJECT DESCRIPTION:

This project provides for internal modification of two buildings to house support activities for the Viking mission operation. Approximately 6,000 square feet on the third floor of Building 230, (Space Flight Operations Facility) will be reconfigured to house computers, personnel and their necessary support requirements, such as, raised flooring, additional air ducting, air handlers, power, lighting, fire detection devices, and partitions. In Building 264 (Spacecraft Development Laboratory), building partition adjustments in some 9,000 square feet are required to provide Viking support areas while another 2,500 square feet will be developed as a visual imaging ground reconstruction equipment area to handle the Viking Lander system imaging requirements.

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PROJECT COST ESTIMATE:

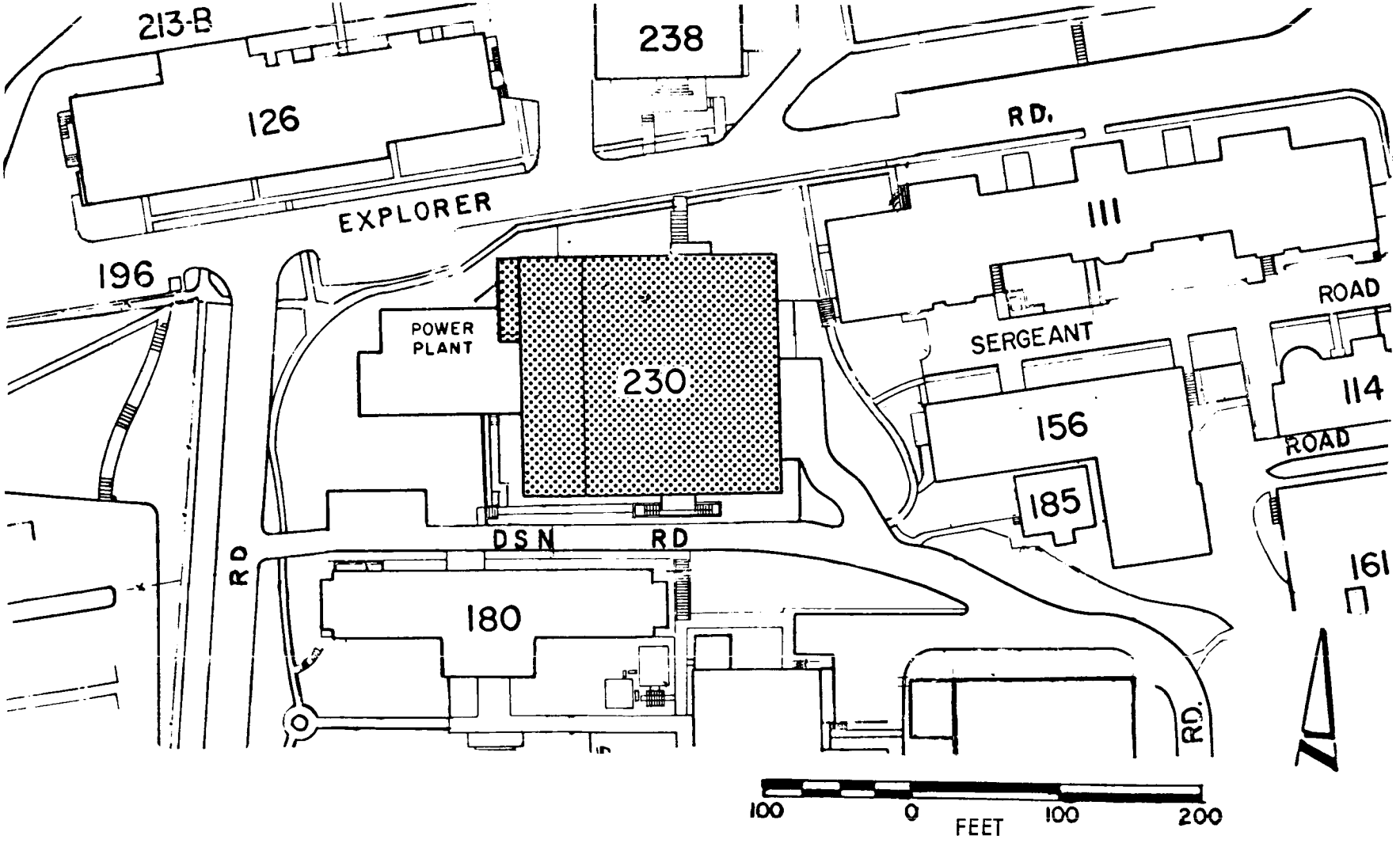
	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$580,000
Architectural structural				230,000
Building 230, SFOF	LS	---		(120,000)
Building 264, SDL	LS	---		(110,000)
Mechanical				85,000
Building 230, SFOF	LS	---		(20,000)
Building 264, SDL	LS	---		(65,000)
Electrical				265,000
Building 230, SFOF	LS	---		(109,000)
Building 264, SDL	LS	---		(156,000)
Equipment	---	---	---	---
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$580,000

Directly related to this proposed project there is approximately $1.0 million of non-collateral (R&D) equipment cited under "Project Justification

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Present mission plans require no further CoF funding to permit installation of the MCCC equipment in these two buildings to proceed. Mission peculiar equipment installations will be R&D funded.

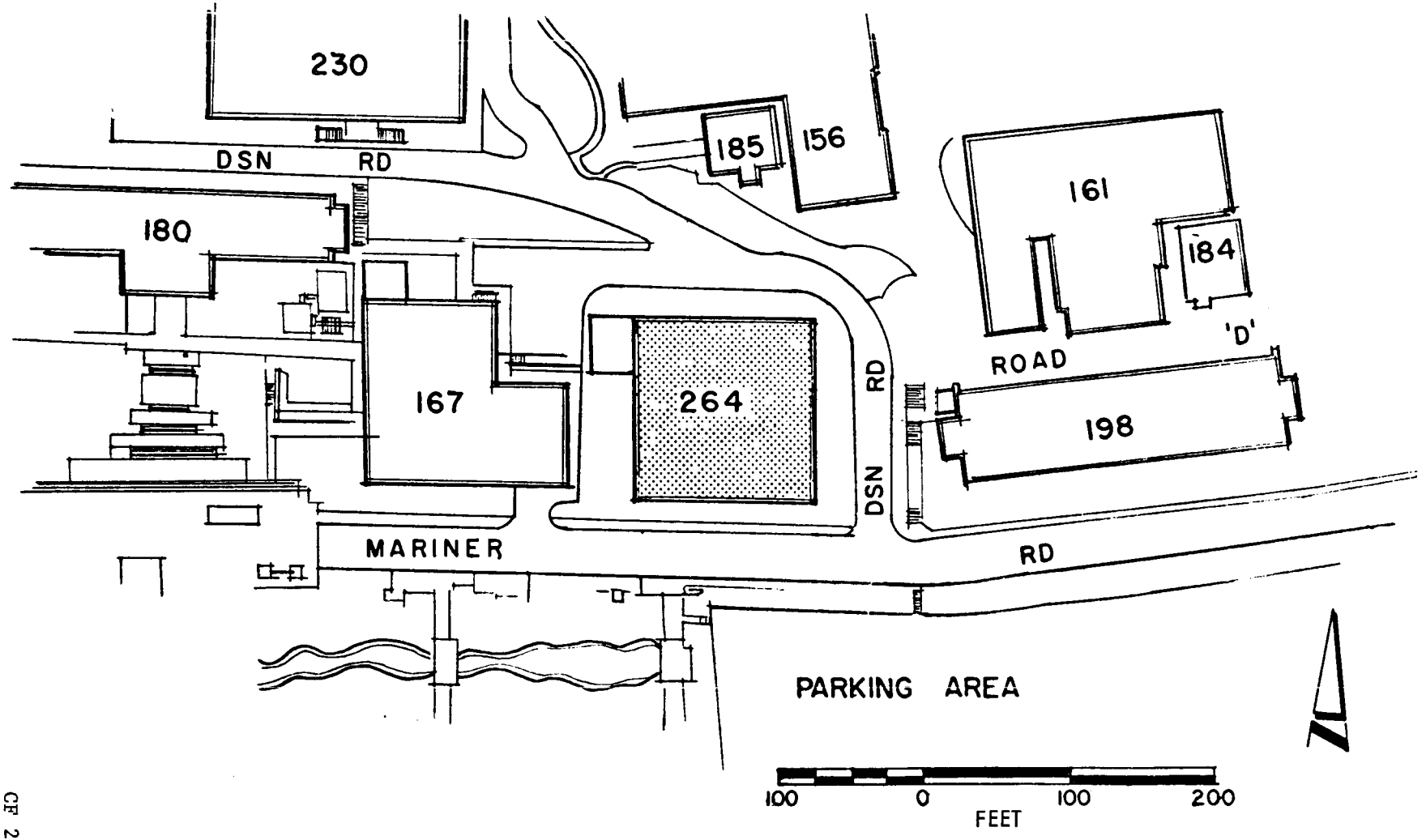
JET PROPULSION LABORATORY
FISCAL YEAR 1974 ESTIMATES
MODIFICATION OF PLANETARY MISSION SUPPORT FACILITIES



JET PROPULSION LABORATORY

FISCAL YEAR 1974 ESTIMATES

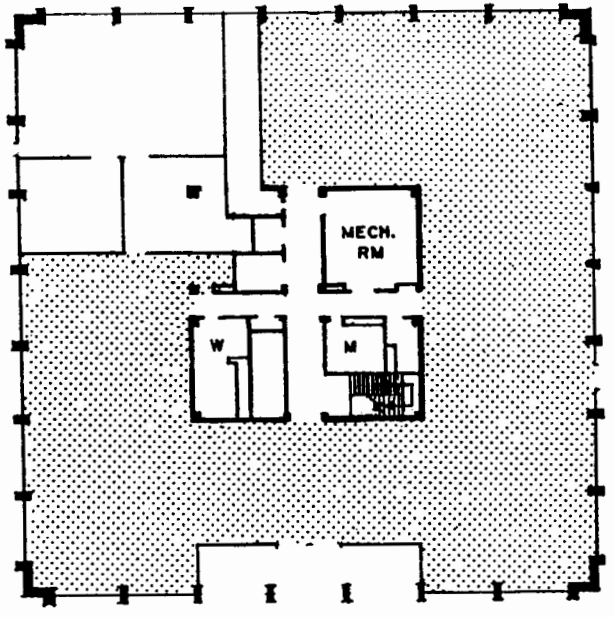
MODIFICATION OF PLANETARY MISSION SUPPORT FACILITIES

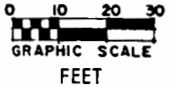


SITE PLAN

CF 2-12

JET PROPULSION LABORATORY
FISCAL YEAR 1974 ESTIMATES
MODIFICATION OF PLANETARY MISSION SUPPORT FACILITIES





BUILDING 264

CF 2-13

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

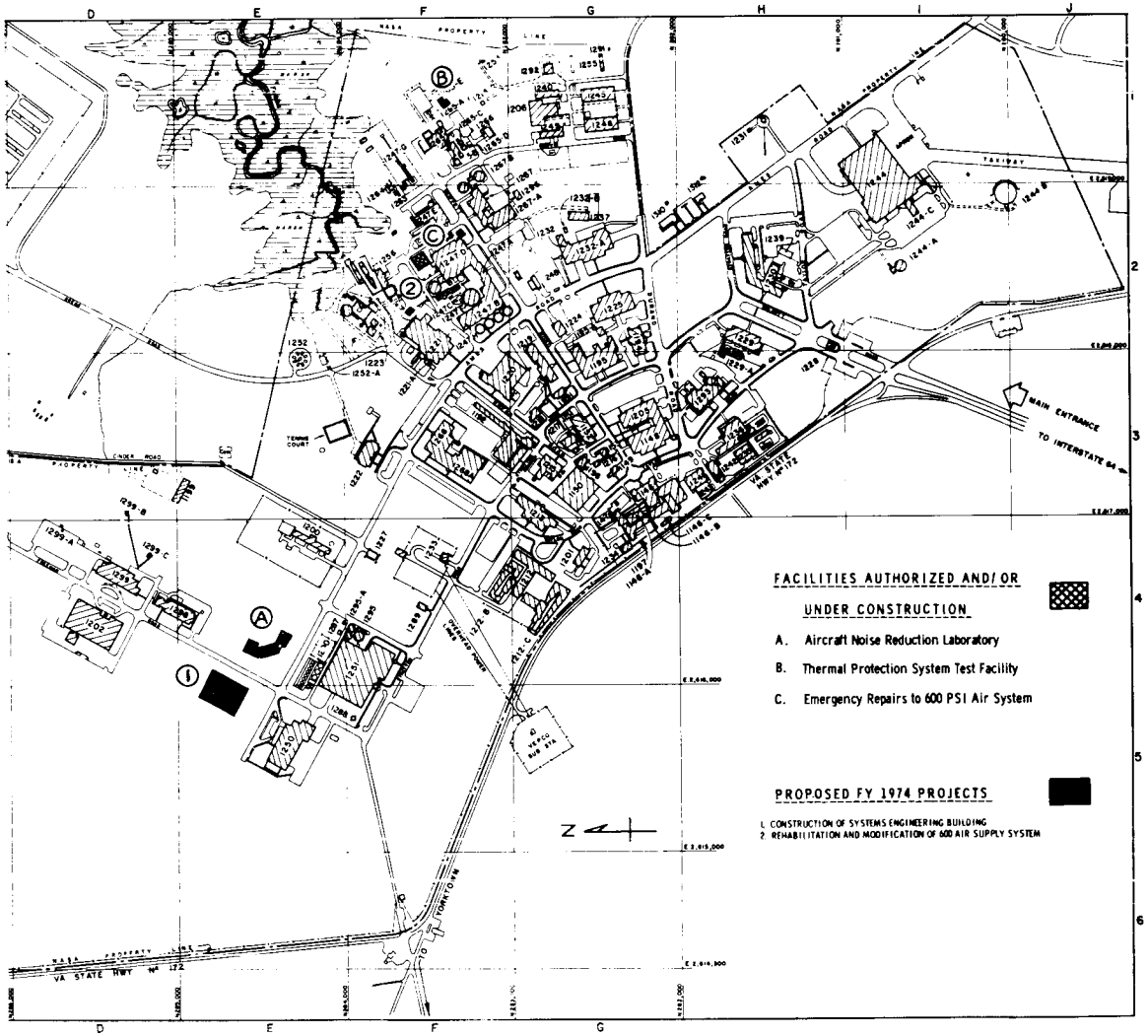
FISCAL YEAR 1974 ESTIMATES

LANGLEY RESEARCH CENTER

LANGLEY RESEARCH CENTER

FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



WEST AREA

CF 3-1

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION		COGNIZANT PROGRAM OFFICE FOR INSTALLATION
Langley Research Center		Aeronautics and Space Technology
LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Langley Station Hampton, Virginia	---	Hampton, Virginia

INSTALLATION MISSION

The Center undertakes research to provide a technical base for such missions as: (1) Manned and unmanned exploration of space; (2) Improvement of performance and utility of airborne flight. The Center plans, develops, and operates necessary facilities; generates new and advanced concepts; provides research advice and assistance to other branches of the government; disseminates scientific and technical information; searches for and identifies potential industrial applications involved in the course of research.

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 1974 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Rehabilitation and Modification of 600 psi Air Supply System	AST	1,310	2,410	2,000	5,720
Construction of Systems Engineering Building	AST	117	1,620	-0-	1,737
TOTAL			4,030		

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Rehabilitation and Modification of 600 psi Air Supply System
LOCATION	Langley Research Center
	FY 1974 CoF ESTIMATE $2,410,000

COGNIZANT INSTALLATION: Langley Research Center

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT PROGRAM OFFICE: Office of Aeronautics and Space Technology

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$144,000
Construction	1,166,182*
Total FY 1973 and Prior Years	$1,310,182

*This figure represents CoF investment subsequent to the transfer of the facility to NASA including recent "emergency repairs". Available records do not provide a discrete "book value" solely for the air supply system.

SUMMARY PURPOSE AND SCOPE:

The provision of 600 psi air, required for numerous research and development projects at Langley Research Center (LaRC), was previously accomplished by a system, including storage, located near the 9 x 6 foot Wind Tunnel Building No. 1256. On September 30, 1971, this sytem was severely damaged by a failure caused by fatigue.

To provide some limited response to urgent R&D needs an "emergency repair" facilities project ($660,000) was undertaken under the provision of Section 307(b), PL 85-568 (1958 Space Act). The proposed project will complete this restoration, in so far as it is now necessary, in order to meet the needs of present low pressure air users. This system now supplies low

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pressure (600 psi) air to some 15 research and development activities involved in such work as research connected with space shuttle related work, combustion, noise and materials. The proposed work in this project includes the restoration of one half (12 tanks) of the existing storage field and the provision of a compressor and dryer.

PROJECT JUSTIFICATION:

The maximum demand for 600 psi air previously was 740,000#/day; however, by revised scheduling and planning a system providing a daily average of 315,000#/day is now considered to be adequate.

A storage field of available storage vessels capable of handling about 110,000 pounds of air at 600 psi is provided for under the referenced "emergency repair" facility work. The restoration of one half of the previously used 600 psi air storage system at Building 1256 will provide an additional 205,000 pounds of 600 psi air storage. This will meet the average daily requirements of about 315,000 pounds per day.

A new 12.5#/sec. compressor and dryer will be provided to insure a more efficient operation. This will meet the average requirements for 600 psi air by continuously pumping for approximately eight hours per day.

There are 15 facilities that are connected to the 600 psi air system at LaRC. The current severity of the reduction in research in these facilities due to the lack of adequate 600 psi air storage has had an impact on the following programs: space shuttle, jet model noise studies, noise abatement, spacecraft research, and the 2 x 2 meter tunnel model. Therefore, it is imperative that the restoration of this air system be undertaken as soon as possible to meet the current 600 psi air facility requirements.

PROJECT DESCRIPTION:

This project covers the restoration, repair and manifolding for the south half of the storage field at Building 1256 (12 vessels) and the provision of a 12.5#/sec. compressor and dryer to be located at the High Intensity Noise Facility, Building 1221.

Studies have shown that the twenty-four basic pressure vessels in the Building 1256 - 600 psi storage field are reusable with fifteen years of useful service remaining. However, the existing manifolding and vessel nozzles will have to be replaced. These vessels are 11 feet in diameter and 63 feet in length and are made of steel.

This project includes examination and elimination, as necessary, of any weld defects found. It also includes a complete stress analysis study of

all nozzles, attachments and supports and their repair to avoid overstressed areas, as required.

An existing building is to be utilized to house a continuous duty dryer with -40°F dew point capability to prevent condensation during blowdown tunnel operations. The compressor and dryer to be provided will utilize existing power and cooling water supply sources at Building 1221. The compressor is to discharge into an existing 24 inch overhead pipeline which is connected to the Building 1256 - 600 psi air storage system. The compressor system is to be fully automated with the necessary safeguards to be operable from Building 1221 with existing personnel.

PROJECT COST ESTIMATE:

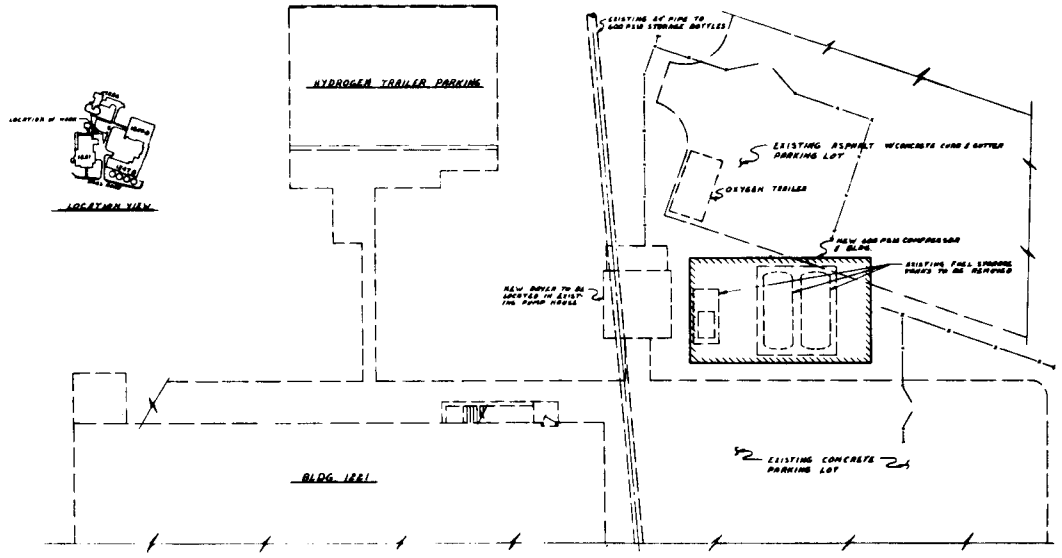
	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	----	---
Construction				$535,000
Building	SF	1,200	$96.00	115,000
Electrical	LS	---	---	420,000
Equipment				1,875,000
Compressor	Each	1	410,000	410,000
Dryer	Each	1	95,000	95,000
Piping	LS	---	60,000	60,000
Manifolding	LS	---	1,150,000	1,150,000
Weld inspection	LS	---	130,000	130,000
Cleaning and painting	LS	---	30,000	30,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$2,410,000

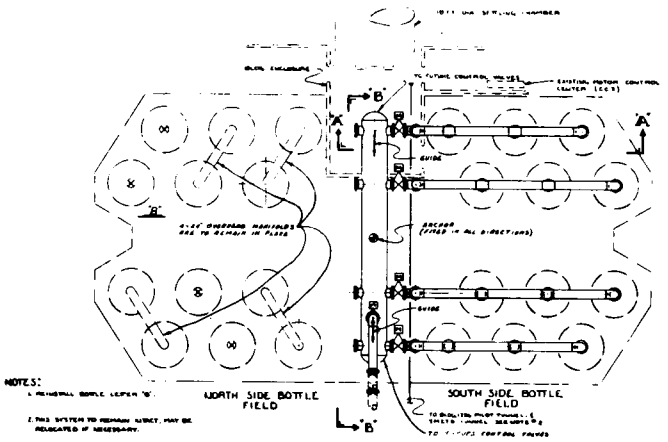
At this time no other equipment items have been identified as being required for the initial operation or use of this facility.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

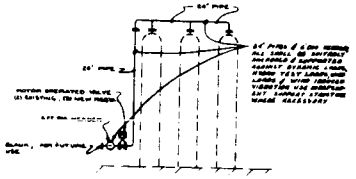
Future funding will depend upon requirements for future research and technology facilities. If such additional requirements do emerge it is estimated that they would be met by restoration of the north half of the existing storage field and that this work would cost $1.5 to $2.0 million.

LANGLEY RESEARCH CENTER
FISCAL YEAR 1974 ESTIMATES
REHABILITATION AND MODIFICATION OF 600 PSI AIR SUPPLY SYSTEM

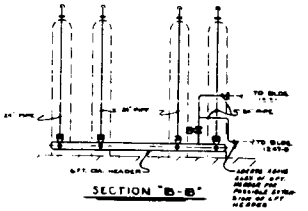




PLAN VIEW
600 PSIA AIR STORAGE FIELD
BLDG. 1256



SECTION "A-A"



SECTION "B-B"

CF 3-6

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Construction of Systems Engineering Building
LOCATION	Langley Research Center
	FY 1974 CoF ESTIMATE $1,620,000

COGNIZANT INSTALLATION: Langley Research Center

LOCATION OF PROJECT: Hampton, Virginia

COGNIZANT PROGRAM OFFICE: Office of Aeronautics and Space Technology

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$117,000
Construction	---
Total FY 1973 and Prior Years	$117,000

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide an engineering building, which when coupled with other appropriate space at Langley Research Center (LaRC) will facilitate a more efficient and functionally effective interface of engineering and research personnel. This project directly relates to the proper support of the rapidly increasing systems engineering requirement of the research project offices at LaRC. At present, many of these supporting engineering personnel are at dispersed locations in both the east and west areas of LaRC. To permit the necessary consolidation of some 300-350 of these engineering personnel a new one story building of about 53,200 gross square feet is required.

PROJECT JUSTIFICATION:

The Langley Research Center does not have a major building provided for use primarily as office space. It has largely improvised over the years and attempted to accommodate the needs for office space by additions to laboratory

facilities or by the conversion of laboratory to office space. The need for office space has continually increased over the years. In the 1969-1971 time period there was an increase of some 375 personnel requiring office space. This was largely due to the evolution of multidisciplinary concepts and the systems engineering approach to the needs of research which require more analytical work and computer based design. Additionally, joint government/industry research effort has created a requirement to house approximately 150 other personnel at Langely since 1970 and this trend is expected to continue.

On the basis of conservative planning, a need exists to adequately house some 2,900 people in office space. This number is approximately 700 greater than the number of personnel which now can be adequately housed in suitable office space. This housing problem can best be solved by construction of the proposed Systems Engineering Building and continuing the current rehabilitation program. Such a new building would be located in the West Area of LaRC.

The application of research technologies requires special consideration of systems problems. During the past year, NASA has placed a heavy emphasis on enhancing aeronautical advancements, particularly those important to improved air transportation, through the NASA sponsored advanced transport technology project, the application of automatic technology for improved aircraft controls and all weather landings, a rotor test vehicle project for joint civil and Army needs, and several others. The Viking and other projects have placed demands on systems support for sometime; more recently, space applications activities have also begun to require systems support in areas of advanced applications flight experiments.

Focused activities of these types place heavy demands on systems engineering to properly interrelate aerodynamics, structures, propulsion, performance, and the facilities and test conditions essential to demonstrating new technologies. Experience has clearly shown that for such activities, the best system results are obtained when teams can be formed of multidisciplinary personnel highly qualified in integrating systems.

To undertake the desired systems activities, LaRC has drawn heavily on its systems engineering staff; however, in several areas, systems engineering personnel have been moved and collocated with discipline oriented aeronautics personnel in order to form the necessary project teams. Such compromises were required because the Systems Engineering Division, consisting of 130 skilled engineering personnel is now housed in the NASA East Area, on the opposite side of Langley Air Force Base from most of the research personnel. Under present conditions, to put systems project groups together, it is necessary to move personnel from or to the East Area. This is a heavy drain on manpower and efficiency. It is, therefore, now necessary that the entire system engineering staff be located near the groups they serve.

A building housing about 300-350 people will significantly assist in developing the strong systems engineering capability vitally needed for the applications of research to the needs of today and tomorrow. Such a facility will be especially helpful in the efforts to improve the "returns" from aeronautics and space research. It will also offer a contribution to the efficiency of the research organization, in a time of diminishing personnel and resources, by permitting their consolidation into a more cohesive team. Systems support efforts for Viking and the Aeronautical Advanced Transport Technology projects have been suitably served in the past, but the multiplicity of new system efforts emerging in recent months simply cannot be developed effectively without strong systems support.

In addition, an economic advantage will be realized by construction of the proposed new building. This results from the recurring savings of trailer depreciation and maintenance, transportation and passenger downtime from the East to West Area, and maintenance of old East Area buildings. This is estimated to amount to approximately $250,000 per year.

In summary, there is an urgent need at the NASA Langley Research Center for a stronger systems engineering effort, in order to encourage the rapid application of aeronautics and space research products to current and future needs. A Systems Engineering Building is the research tool needed to help this happen. Its need has become urgent because of the very recent buildup of aeronautical project activities, which makes it mandatory that all available systems engineering personnel be centralized to assure optimum productivity.

PROJECT DESCRIPTION:

The proposed facility is a new one story structure of approximately 53,200 square feet gross area. The building is basically one with large open spaces that provide the maximum of flexibility. Specifically, the proposed design utilizes (1) a preengineered steel frame, (2) a preengineered combination ceiling/lighting system, and (3) a special heating and air conditioning system.

The building is designed to include a 600 square foot remote computer terminal, and a central service and storage area of permanent type construction. The remainder of the building can be adapted to any floor plan layout desired. The integrated system approach, utilizing the 5' x 5' ceiling/lighting module with flexible ducts and conduit and underfloor electrical ducts, in conjunction with the openness of the perimeter of the building and the possible use of an integral demountable partition system in the future, affords the maximum flexibility obtainable in this facility. Lighting fixtures, diffusers, and partitions can be relocated as interior functions dictate.

The design occupancy of the building will accommodate approximately 300-350 personnel. A parking area is proposed for about 165 vehicles with an

area provided for any reasonable future increase in the building size without interruption in existing paving. The building mechanical and electrical facilities are designed to accommodate a similar modest future increase. The building structure bears on wood friction pilings. Exterior walls are to be masonry with a brick veneer.

The variable volume central heating and air conditioning system will accommodate changes in partition locations for future addition of partitions without rebalancing the supply duct system. Zones may be large open spaces, or one large zone may be broken down into several small zones to provide individual room control for future office spaces. Flexible duct run-outs to ceiling terminals allow their relocation with a minimum amount of time and labor.

Electrical power will be extended at 2,400 volts from "DL" substation in Facility 1227 to the building. Within the building, it will be transformed to 480Y/227 volts for interior distribution and utilization.

PROJECT COST ESTIMATE:

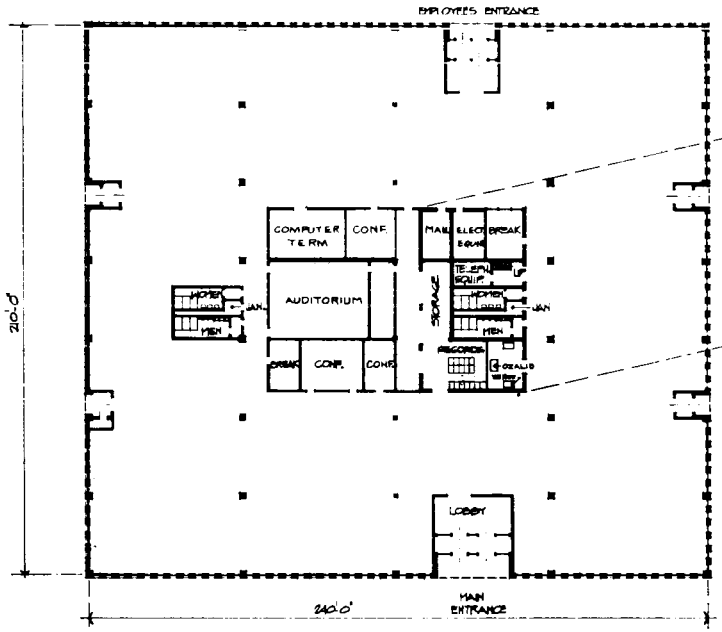
	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,620,000
Site development	LS	---	---	160,000
Building				1,410,000
Architectural and structural	SF	53,200	$16.73	(890,000)
Electrical (inside 5' line)	SF	53,200	3.57	(190,000)
Heating, ventilating, A/C	SF	53,200	5.26	(280,000)
Plumbing	LS	---	---	(50,000)
Utilities (outside 5' line)	LS	---	---	50,000
Equipment	---	---	---	---
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$1,620,000

At this time no other equipment items have been identified as being required for the initial operations or use of this project.

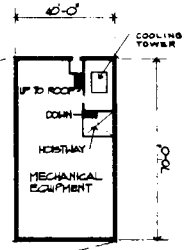
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

At the present time there is no requirement foreseen which would require future CoF funding for this project. However, some flexibility has been designed into this facility to permit limited expansion if such a need might arise in the future.

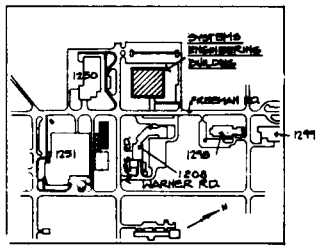
LANGLEY RESEARCH CENTER
FISCAL YEAR 1974 ESTIMATES
CONSTRUCTION OF SYSTEMS ENGINEERING BUILDING



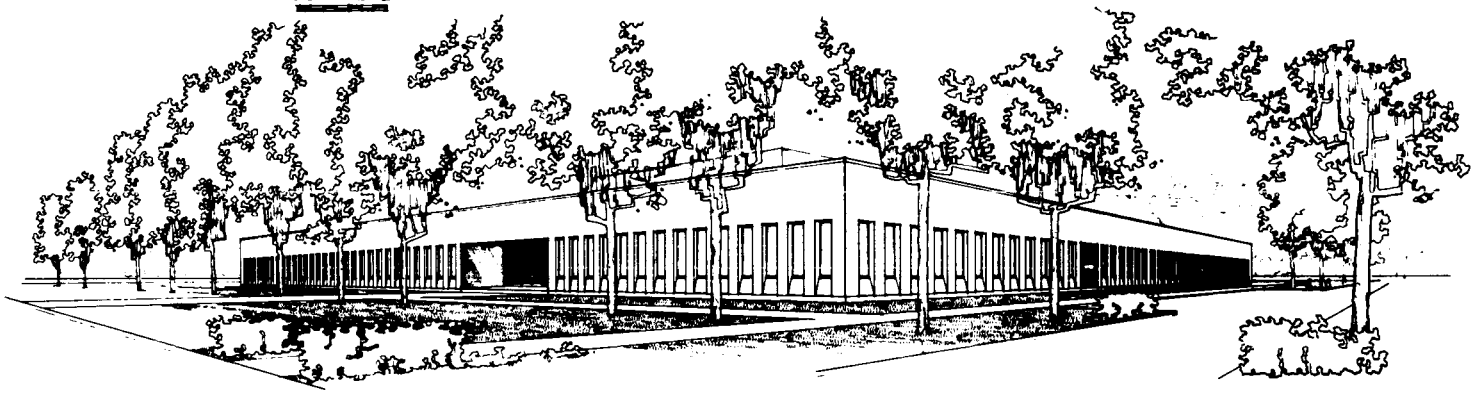
FLOOR PLAN



PENTHOUSE PLAN

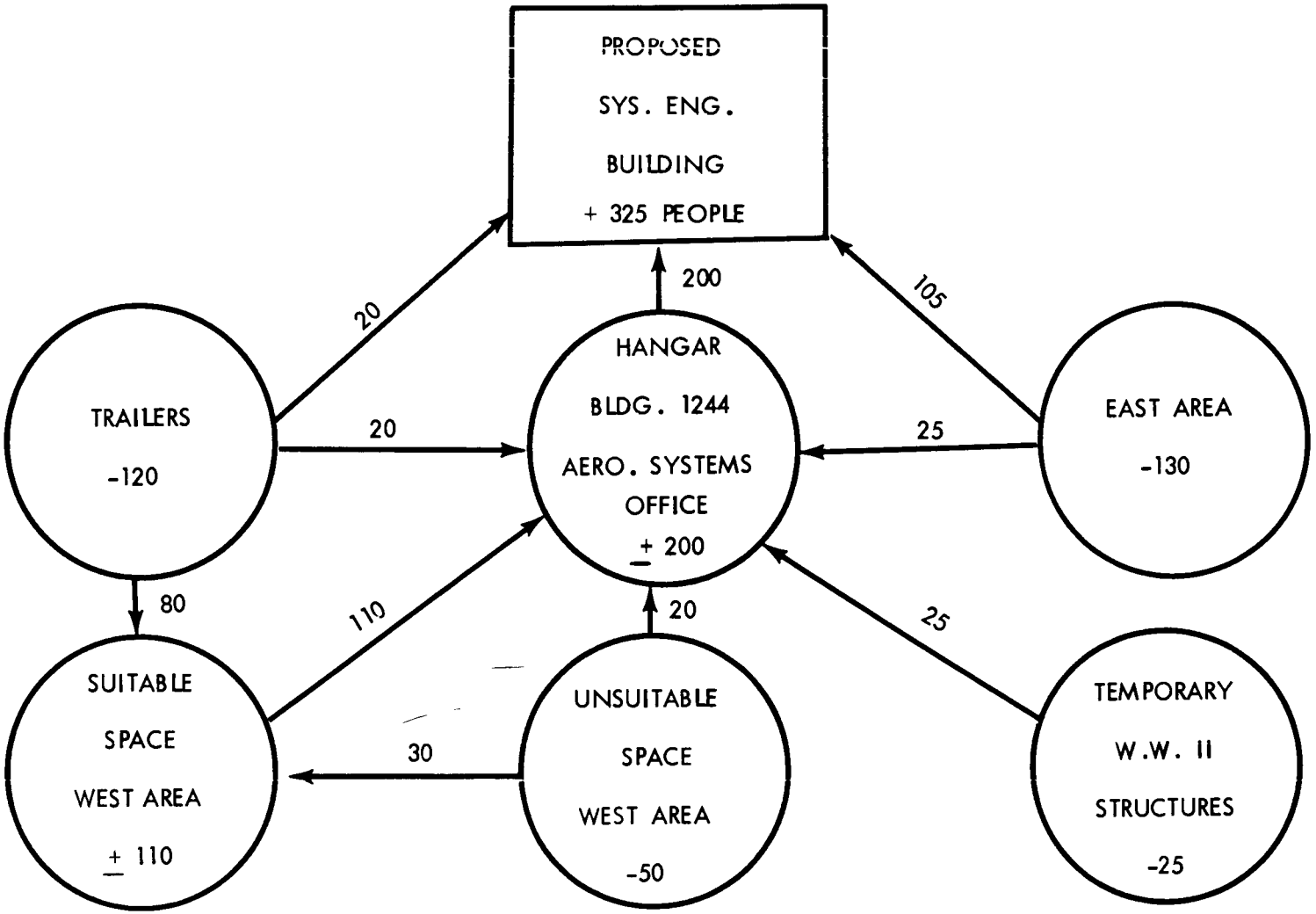


LOCATION MAP



PERSPECTIVE

LANGLEY RESEARCH CENTER
FISCAL YEAR 1974 ESTIMATES



HOUSING PLAN FOR SYSTEMS ENGINEERING
BUILDINGS AND AERONAUTICAL SYSTEMS OFFICE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

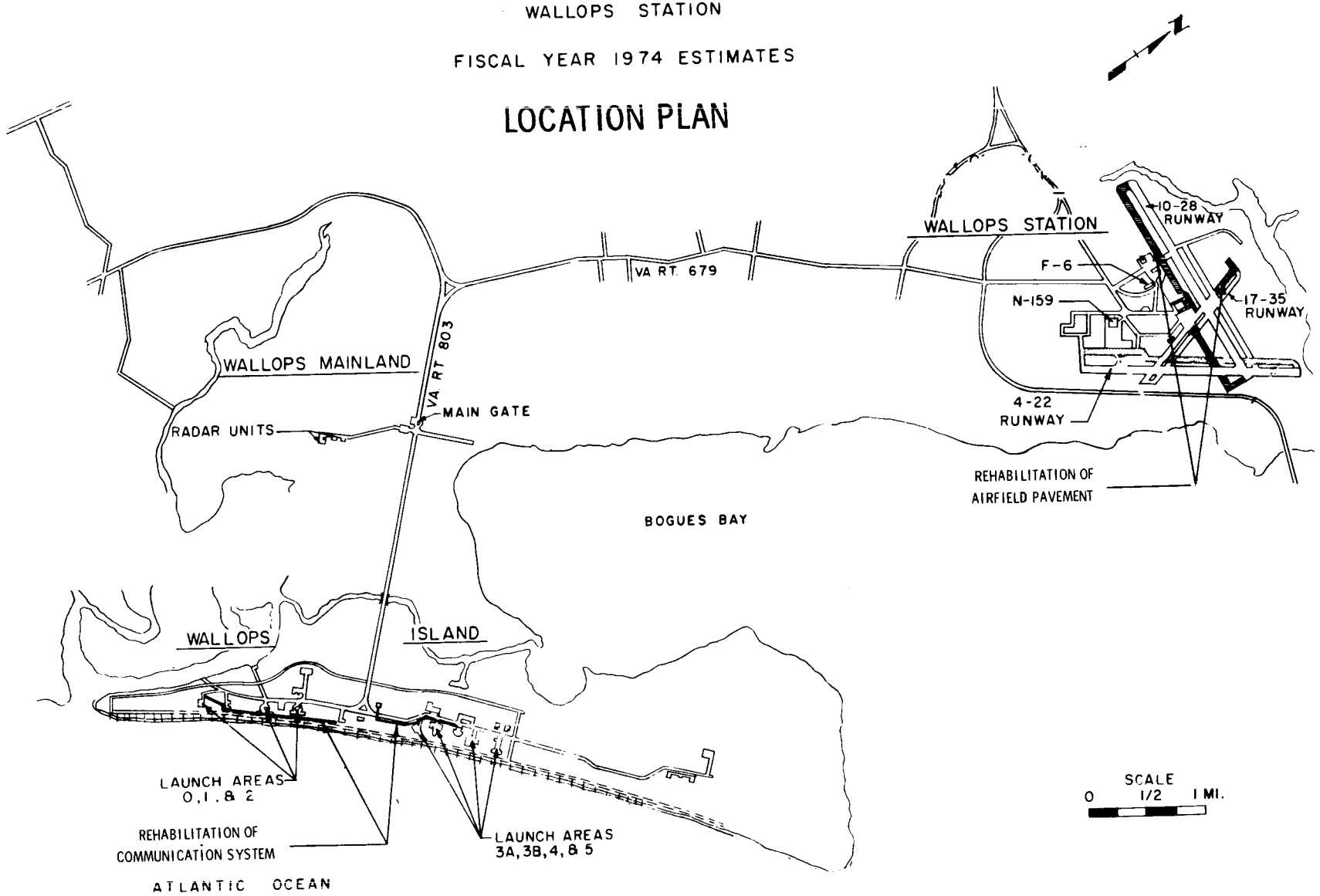
FISCAL YEAR 1974 ESTIMATES

WALLOPS STATION

WALLOPS STATION

FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION		COGNIZANT PROGRAM OFFICE FOR INSTALLATION
Wallops Station		Space Science
LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Eastern Shore of Virginia	Accomack	Temperanceville, Virginia

INSTALLATION MISSION

The basic mission of the Station is to prepare, assemble, and launch scientific experiments; achieve the desired position and velocity in space; and track, acquire and record the data sought. These data are processed and reduced to meaningful form and analyzed.

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 1974 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Rehabilitation of Airfield Pavement	OSS	474	570	1,800	2,844
Rehabilitation of Communication System	OSS	34	575	500	1,109
TOTAL			1,145		

PROJECT TITLE	Rehabilitation of Airfield Pavement
LOCATION	Wallops Station
	FY 1974 CoF ESTIMATE $570,000

COGNIZANT INSTALLATION: Wallops Station

LOCATION OF PROJECT: Wallops Station, Accomack County, Virginia

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$34,000
Construction	440,000*
Total FY 1973 and Prior Years	$474,000

*CoF investment subsequent to the transfer of the facility to NASA.

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to rehabilitate and improve the existing airfield pavement at Wallops Station to make it more suitable for unloading aircraft, and to provide better utilization of the existing runways, taxiways, and ramps used in support of present and future R&D aircraft projects.

PROJECT JUSTIFICATION:

The strengthening of the taxiway for Runway 10/28 is required to meet the requirements of aircraft presently utilizing the airfield. Access and egress to the runway at present are over sections of taxiway paving which are approximately 25 percent of the runway's design strength. At present, aircraft are taxied on the primary runways; this increases the potential of collision. This operation is hazardous during night hours, periods of restricted visibility, and during periods of operation without positive control. It is therefore essential that the taxiways be made fully operable to eliminate these undesirable operating conditions.

The construction of the aircraft parking ramp and the strengthening of the north section of Runway 17/35 to permit ingress and egress to the parking area are required to comply with existing safety standards applying to the loading/unloading of explosives, rocket motors, etc. The ramp will provide an area of sufficient load bearing capacity to support military and commercial cargo aircraft. The parking area will be equipped with a grounding system as required to minimize electrical static discharges, in order to permit compliance with safety regulations concerning loading and unloading of hazardous explosive cargo and fueling of the aircraft. The present site being utilized requires the closing of the Research Radar Facility during explosive handling operations. Although all nonessential personnel are cleared from this area during these operations, the Radar Facility valued at $1.5 million is still exposed to a potential hazard.

PROJECT DESCRIPTION:

This project will provide for patching as required, and a six-inch thick overlay of approximately 25,000 square yards of the taxiway and ramps serving Runway 10/28. The overlay will be of bituminous concrete pavement. A similar overlay will be applied to 27,000 square yards of Runway 17/35, and a 3,400 square yard 15-inch thick reinforced concrete parking ramp will be provided. The parking ramp will be designed to carry single wheel loadings of 57,000 pounds.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$570,000
Rehabilitate and overlay about 25,000 square yards of taxiway serving runway 10/28	SY	25,000	$9.20	230,000
Rehabilitate about 27,000 square yards of the north end of runway 17/35 to include provision of 3,400 square yard ramp	SY	30,400	11.18	340,000
Equipment	---	---	---	---
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$570,000

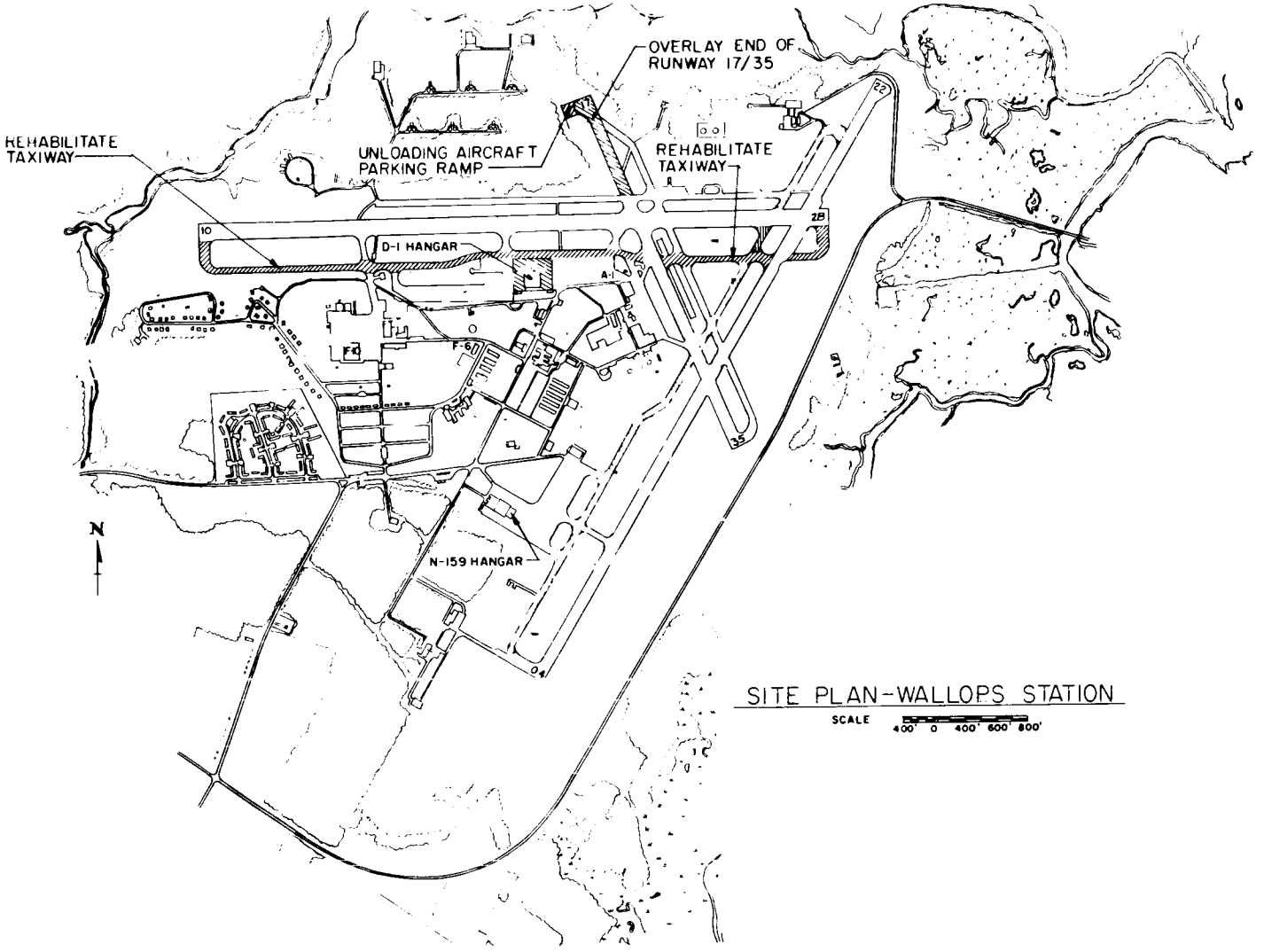
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

For presently planned usage there are no currently foreseen future funding requirements to complete this specific project; however, it is estimated that an additional $1,200,000 to $1,800,000 will be required in future years to complete this general rehabilitation of the airfield pavements at this station.

WALLOPS STATION

FISCAL YEAR 1974 ESTIMATES

REHABILITATION OF AIRFIELD PAVEMENT



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CONSTRUCTION OF FACILITIES

FISCAY YEAR 1974 ESTIMATES

PROJECT TITAL	Rehabilitation of Communication System
LOCATION	Wallops Station
	FY 1974 CoF ESTIMATE $575,000

COGNIZANT INSTALLATION: Wallops Station

LOCATION OF PROJECT: Wallops Island, Accomack County, Virginia

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$34,000
Construction	*
Total FY 1973 and Prior Years	$34,000

*The existing communication system was included in major construction activities and is not separately identifiable.

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to rehabilitate and upgrade approximately 10,000 linear feet of the sounding rocket firing operations communication and instrumentation cabling system on Wallops Island. This includes the replacement of approximately 6,000 linear feet of deteriorated buried cable with new cabling in an above the ground cable tray on the south end of the island between Buildings X-65 and Z-35. In addition, repair will be made to approximately 4,000 linear feet of the underground system between the Island Terminal (Building X-75) and Blockhouse No. 3 (Building W-20) and an additional 200-pair communication cable will be installed to meet current capacity requirements.

PROJECT JUSTIFICATION:

The present underground duct system south of the causeway is deteriorating and overloaded. In several locations the ducts have settled away from the manholes, causing the existing cables to be pinched and cut. In addition, the underground system is under water most of the time due to the very low

lying terrain on the south end of the Island. The proposed new cable tray system will provide means of replacing and adding communication, control and instrumentation cables for all launch areas and facilities south of the causeway on Wallops Island, which includes launch pads 0, 1, 2 and 3.

The existing underground cabling between the Island Terminal Building and Blockhouse No. 3 is now loaded to capacity and in need of repairs requiring additional cable pins.

It is necessary to install the new and additional cabling as well as repair existing cabling, as appropriate, to provide reliable timing, countdown, instrumentation, and communication between the various launch pads, blockhouses and instrumentation sites.

PROJECT DESCRIPTION:

This project will provide approximately 6,000 linear feet of above ground cable tray system, consisting of six 24-inch wide cable trays along the oceanfront on Wallops Island between Buildings X-65 and Z-35. The cable system will include the necessary connections and terminals to serve all launch areas and facilities south of the causeway on Wallops Island. Cable "huts" will be provided for transition of cables from the trays to the existing underground duct system and to the launch areas. The cable trays will be supported by aluminum stanchions on concrete foundations.

In addition, repairs will be made to approximately 4,000 linear feet of line as necessary and upgraded by installing 4,000 feet of 200-pair communication cable between Island Terminal Building X-75 and Blockhouse No. 3 Building W-20. The cable will be installed in the existing underground duct system, direct-buried, as well as in the existing cable tray system. This system is on higher ground and therefore does not require a new above ground system. Necessary terminals and associated equipment will be provided at both ends of the cable.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$575,000
Communication cable between Buildings X-75 and W-20				23,000

	Unit of Measure	Quantity	Unit Cost	Total Cost
Communication cables	LF	4,000	$4.25	(17,000)
Repair, splicing, and terminating cable	LS	---	---	(6,000)
Cable tray system				552,000
Foundation and support for cable trays	Each	400	350.00	(140,000)
Cable trays	LF	6,000	30.00	(180,000)
Cable huts, takeoffs, dropouts, etc.	LS			(20,000)
Instrumentation and communication cables, spliced and terminated	LS			(212,000)
Equipment	---	---	---	---
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$575,000

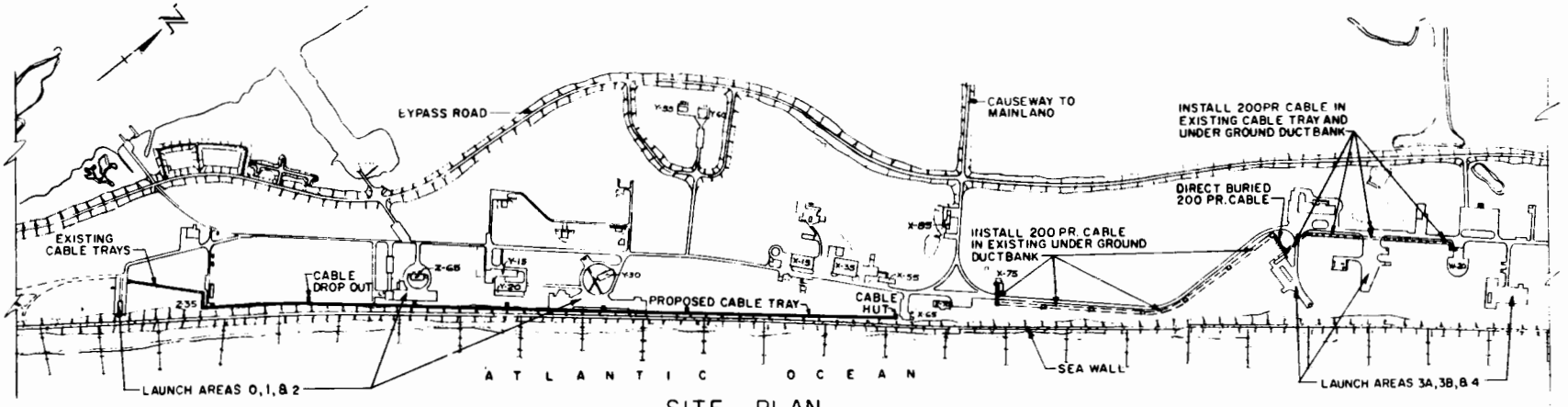
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

There is a continuing need to replace other portions of the island communication and instrumentation system estimated at approximately $500,000. This will probably be accomplished over the next five years.

WALLOPS STATION

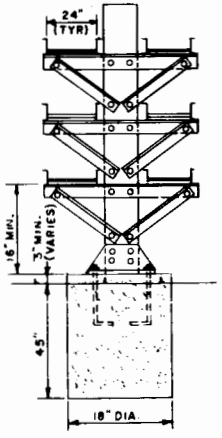
FISCAL YEAR 1974 ESTIMATES

REHABILITATION OF COMMUNICATION SYSTEM



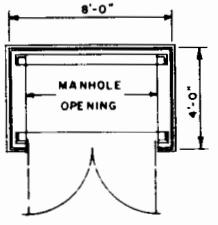
SITE PLAN

SCALE 200' 0 200' 400' 600'

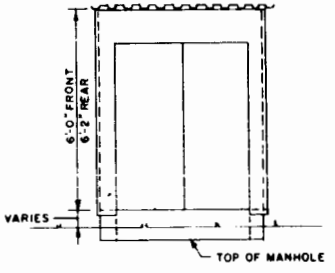


TYPICAL CABLE TRAY SYSTEM

NOT TO SCALE



PLAN



FRONT ELEVATION

CABLE HUT

NOT TO SCALE

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

VARIOUS LOCATIONS

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION	COGNIZANT PROGRAM OFFICE FOR INSTALLATION	
Various	Various	
LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
---	---	---

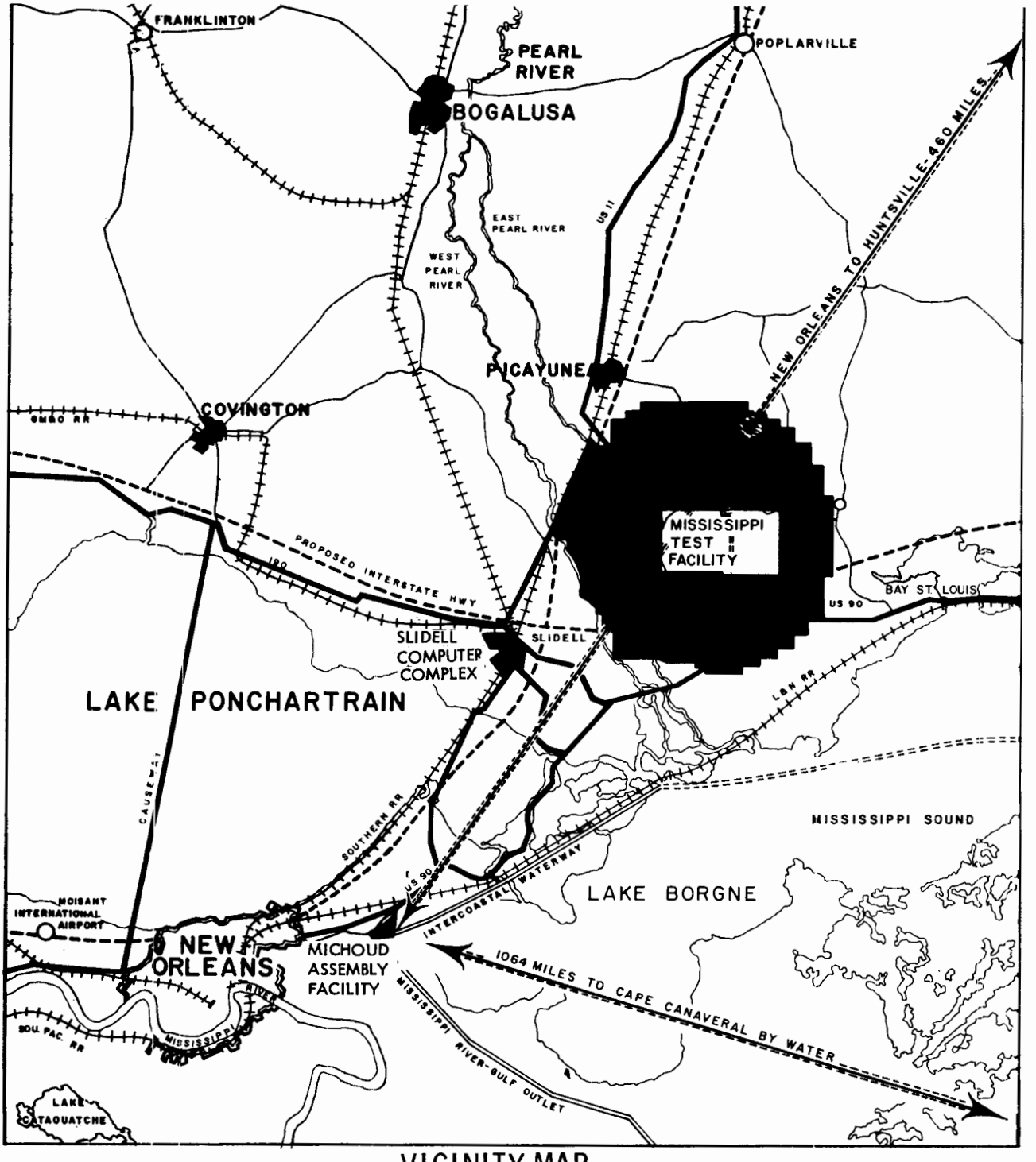
INSTALLATION MISSION

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 1974 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Modification of Power System	OMSF	75	1,085	-0-	1,160
Modification of Space Launch Complex 2 West (SLC-2W)	OSS	7,886	980	-0-	8,866
Modification for Fire Protection Improvements	OTDA	2,500	1,885	1,500	5,885
TOTAL			3,950		

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF POWER SYSTEM

SLIDELL COMPUTER COMPLEX



VICINITY MAP

CF 5-2

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modification of Power System
LOCATION	Slidell Computer Complex
	FY 1974 CoF ESTIMATE $1,085,000

COGNIZANT INSTALLATION: Marshall Space Flight Center

LOCATION OF PROJECT: Slidell, Tammany Parish, Louisiana

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$74,500
Construction	*
Total FY 1973 and Prior Years	$74,500

*This site was transferred to NASA in 1963 from the Federal Aviation Agency. About $2.9 million of facilities was so transferred and about $2.4 million of facilities work has been accomplished by NASA since that time.

SUMMARY PURPOSE AND SCOPE:

This project provides for the installation of a nominal 750 KVA redundant static uninterruptible power system (UPS) as a modification to the existing power system at the Slidell Computer Complex (SCC). This modification is necessary to minimize electrical power irregularities and losses impacting critical computer equipment and thus to provide the necessary effectiveness and reliability required for these computer and computer-related operations.

PROJECT JUSTIFICATION:

The Slidell Computer Complex (SCC) is located on a 14-acre government-owned site at Slidell, Louisiana, about thirty-five miles northeast of

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New Orleans. It consists of a main three-story "office type" building and several smaller support buildings. All of the computer equipment is located in the larger main building, Computer Operations Office Building (COOB). The SCC was established by NASA in 1962 and mainly provided computer support to test operations at the Mississippi Test Facility (MTF), some 17 miles to the east, and to Saturn V stage manufacturing at the Michoud Assembly Facility (MAF) about 22 miles to the southwest.

At the present time, the SCC houses over $20 million of computer, data reduction and related support equipment. This is the "book value" or initial acquisition cost of this equipment and its replacement cost would be considerably higher. The mission of the SCC is to provide pre-computer processing, computer processing, storage and distribution of data, as well as to provide computer support. The complex provides scientific, management, administrative and engineering digital computer work and data reduction, as well as some analog computer service. It also accomplishes key punching, card processing and data transmission services. These services are available to NASA activities mainly at Marshall Space Flight Center (MSFC), Mississippi Test Facility (MTF), and Michoud Assembly Facility (MAF), including NASA contractors. These services are also provided to other authorized users. At the present time, 85-90% of the SCC computer workload is for NASA support of space flight programs.

The SCC, therefore, provides computational support for assigned NASA programs as well as other approved programs. These present NASA programs include such ones as the Skylab missions for which the existing large unit processor (U-1108-14) system has been entirely dedicated. This data, for example, will be used as a basis for decisions during these flights. Additionally, the use of the entire U-1108-14 system by Skylab will then require assigning its normal workload to the already heavily loaded multi-processor/multiprogramming (U-1108-01) system, making the reliability of this system doubly important. Other SCC computer support include programs such as the following:

a. Lower Mississippi River Forecasting Center

This element of the National Weather Service was established in 1971 in the SCC and is required to forecast daily river stages as well as to provide flood warnings to an eight state area. Reliable computer service is mandatory for this user, especially at times when commercial power is most unreliable, i.e., during hurricanes, tornadoes, floods, etc. Serious consequences, involving loss of property or lives, could possibly result from a failure of this warning system.

b. Government Contractor Uses

By far the largest U-1108-01 system user at SCC is a NASA contractor heavily involved in the preparation of flight trajectories and thermal heating analyses of the Skylab missions. Rapid turnaround of this data is extremely important on many of these items, including a trajectory computation 15 minutes before each launch. This contractor is also involved in processing wind tunnel test data for NASA, the Army and the Air Force. This large-scale wind tunnel data program is also committed to a short turnaround time, as the scheduling and use of the various wind tunnels is based on the output from these computer runs.

The SCC is presently operating at very near its maximum capacity, with minor exceptions, in support of the following:

1. NASA direct and contractor activities at MSFC, MAF, MTF, etc.

2. Other government agencies such as Naval Aeromedical Research at MAF, the National Data Buoy Project (Dept. of Commerce), U. S. Geodetic Survey, the Gulf Environmental Project at MTF, and the U. S. Forestry Service, Federal Communications Commission, and U. S. Maritime Administration.

Projections of workload from these users indicate that in the near future, a maximum of available computer time will be required.

Although these projects do not currently require "real time" computation in the sense of direct computer acquisition of data from a satellite or other sensor, the computer does operate in a real time mode for input and control of certain applications. Also, real time functions are performed by the computer for a large number of terminals wherein the computer is interactive with scientists, engineers and administrators. In this regard, these personnel are composing computer programs, updating files, applying modeling techniques, and solving mathematical processes on line to the computer. When the computer fails, it is necessary for the scientist or other person to reconstruct his entire thought processes, repeat all computer interaction, or determine what files in computer storage have been lost, what valid files can be retrieved from magnetic tape, and then reconstruct all updating transactions from that point. Use of computer mass storage files for data banks for on-line, real time, inquiry or updating purposes is severely limited and expensive unless stability of computer operation is maintained.

The SCC is provided electrical power by the local utility company by two 34.5 KV feeders to a substation at the SCC. The dual feeders provide redundancy and service is switched from one to the other in event of a

failure. The substation, located adjacent to the SCC maintenance building, has a separate transformer for "building loads" and one for "electronics loads," each at 480/277 volts. This service is considered very good for normal usage but not now adequate for SCC computer operations.

The SCC has experienced a considerable number of computer equipment outages, however, due to instability and discontinuity of the commercial power supplied by the local utility company. The computer systems must frequently be shut down due to such variations in and losses of power ranging in duration from milliseconds to several minutes. These, in turn, may be caused by load switching operations, lightning, transmission line faults, transients, etc. From February 1, 1971, through 1972 there were recorded a total of about 65 such outages. Many may be designated as "blink," a term used to indicate a discernible drop in voltage of a very short period (about 1-2 seconds).

As a general matter, this project does not deal with a prolonged complete deterioration of commercial electrical power. In the Slidell area, an average of over fifteen high velocity windstorms, some approaching hurricane force, can be expected during a year. For example, the August 1969 Hurricane Camille deenergized electrical service to the complex for more than twenty hours and the whole complex was not restored to normal operation for about two weeks. Remedial action dealing with cases of prolonged outages will be dealt with by a future facility project provided further study and the availability of existing government generators justifies this action. This area is also subject to an average of about seventy moderate to severe electrical storms per year, giving rise to voltage surges and service disruption. As now established, a computer can expect, on the average, to become inoperative due to electrical power service difficulties once every ten calendar days with a loss of over two hours of production. The impact of this situation is as follows:

1. Loss of data processing during:

   (a) the time the power is off, plus

   (b) the time it takes to bring the system back up, plus

   (c) the time required to "debug" and repair any hardware failures caused by the outages, plus

   (d) the time lost in the reruns made necessary by runs which are not finished at the time of the outage.

2. The cost of repairing or replacing damaged hardware caused by the outage.

3. Increased maintenance costs to the equipment.

4. Reduced life of the equipment as a result of component damage through thermal shock and electrical overstresses that take place during an abnormal "cycle down" and outage period.

5. Increased software development costs in certain instances.

To evolve an estimate of the probable cost of electrical outages, certain general assumptions must be made. Using such conservative assumptions, a rationalized cost of outages on an annual basis is between $140,000 and $315,000 based on equipment cost only. If the costs of operating personnel and other costs are added, these annual amounts would be increased significantly. To this total could be added the cost of program slippages and like impacts. Recognizing the difficulties of quantifying every aspect of these costs, it is, however, realistically estimated that the total could well be on the order of $500,000 per year. It is then readily seen, that the provision of more reliable electric power, as proposed by this project, is very cost effective in addition to being a basic and urgent SCC operational requirement.

In a summary manner, the requirement for this project at this time has been brought about by the installation of larger capacity, more complex and more sensitive equipment, the much more difficult task of analyzing the impact of equipment failures with the newer equipment, the larger volume output now required resulting in less redundant/standby equipment and the recent changes in the state-of-the-art in computer services involving more terminals, greater on-line use and less manual control and direction.

PROJECT DESCRIPTION:

It is intended, under this facility project, to modify the existing electric power system to provide a static rectifier/inverter type, battery supported, uninterruptible power (UPS) augmentation. This will be of a nominal 750 KVA redundant capacity and installed as a modification of the existing system in such a manner as to insure the supply of reliable electric power to the computer system. This modification has been sized to provide such power to the estimated 640 KVA electronic (computer) loads only. The UPS envisioned is of a standard commercial type and size. Also involved is the provision of a 2,000 square foot facility, now planned as an addition to the electric equipment room of the COOB, to house the additional equipment. Additional circuit breakers, cabling and conduit work will also be required.

PROJECT COST ESTIMATE:

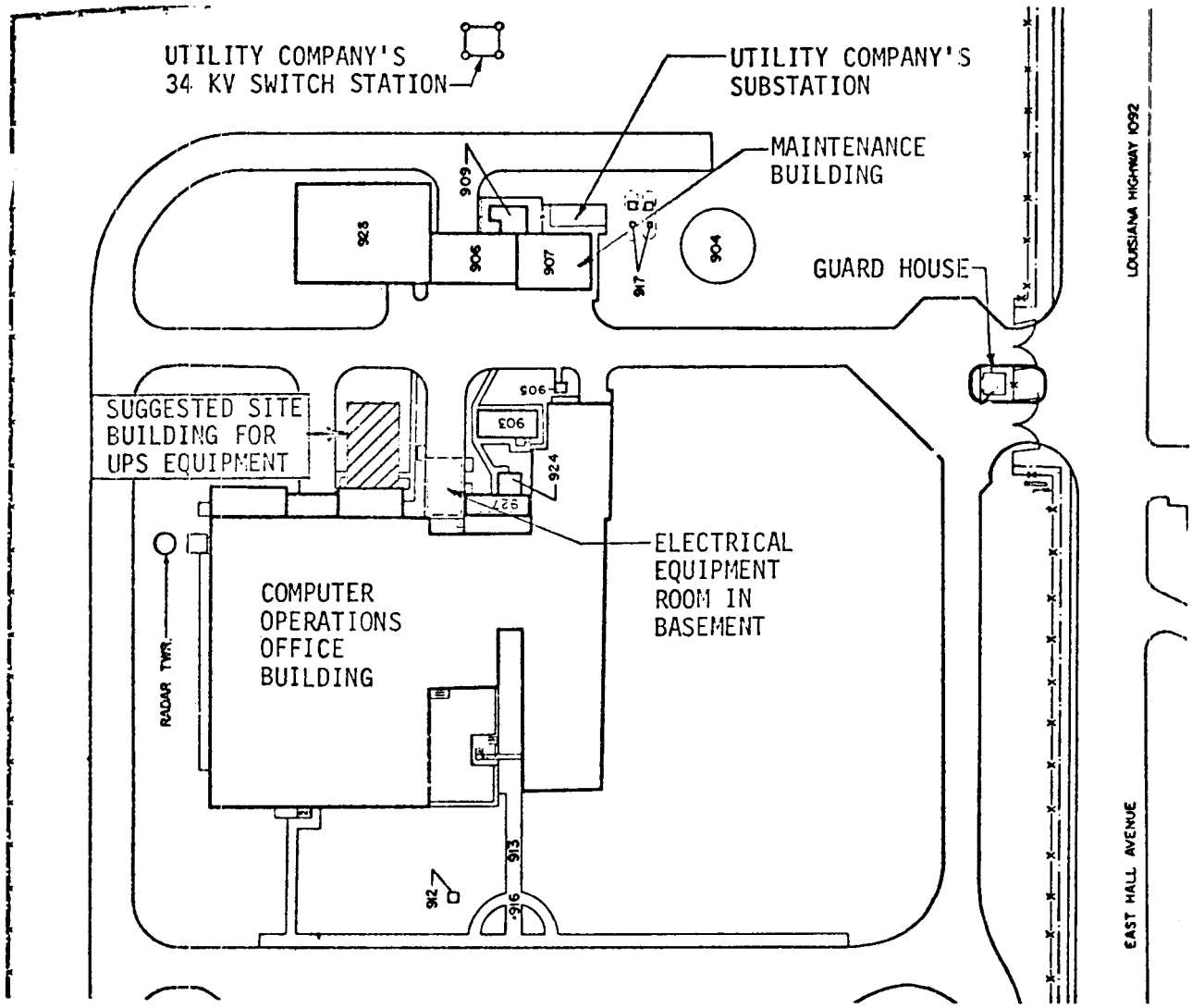
	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$125,000
Site work	LS	---	---	10,000
Building addition	SF	2,000	$30.00	60,000
Electrical modifications	LS	---	---	55,000
Equipment				960,000
Static UPS	LS	---	---	715,000
Battery support	LS	---	---	245,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$1,085,000

FUTURE CoF ESTIMATED FUNDING TO COMPLETE THIS PROJECT:

No additional funding will be required to complete this project; however, if justified by later study it may be necessary to provide coverage for prolonged electric power outages. This request is not now considered justified but changed conditions later could possibly justify the addition of an auxiliary generating plant at least to provide for "building loads."

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF POWER SYSTEM
SLIDELL COMPUTER COMPLEX



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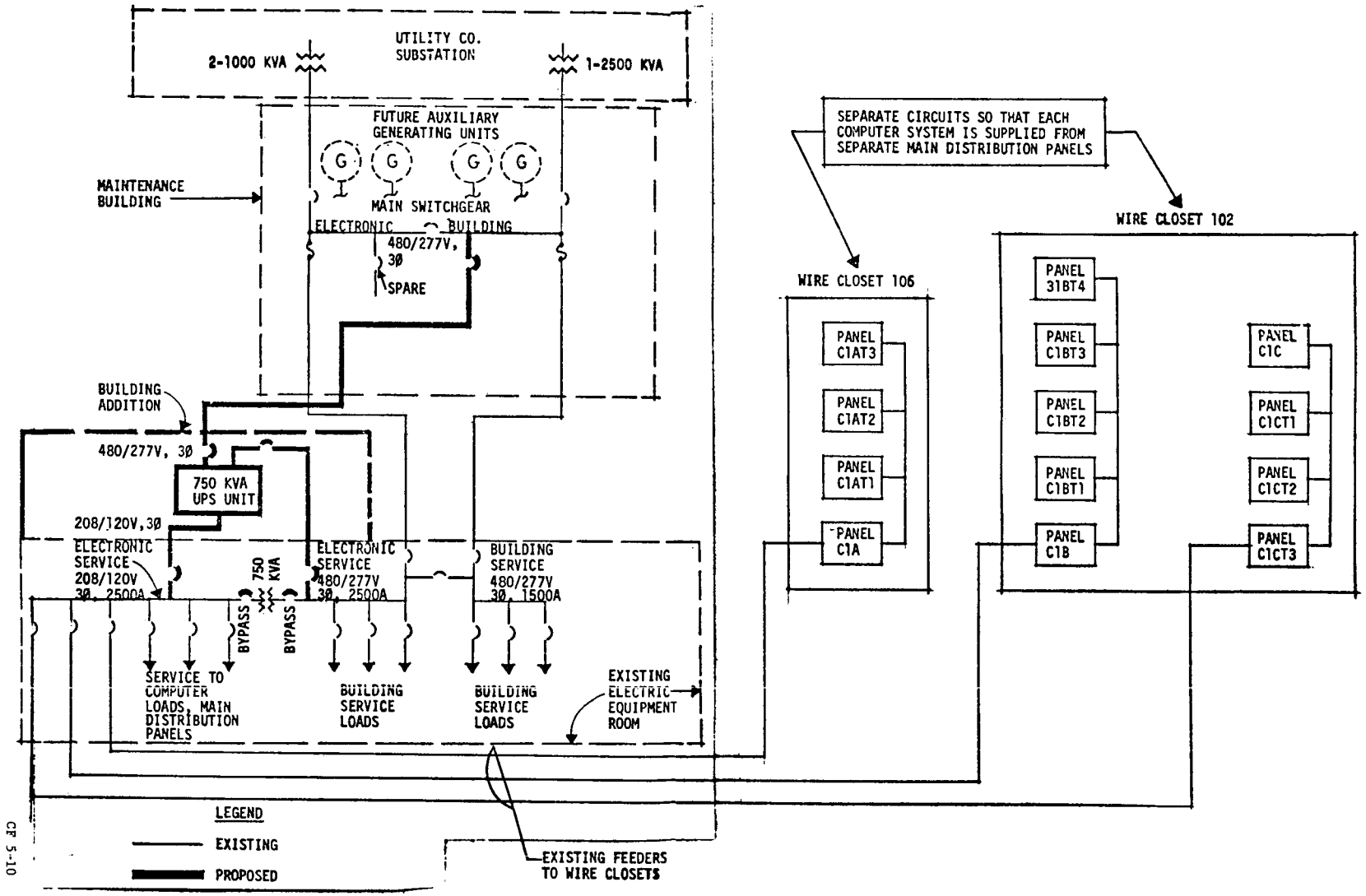
PARTIAL SITE PLAN

(NOT TO SCALE)

CF 5-9

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF POWER SYSTEM
SLIDELL COMPUTER COMPLEX



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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modification of Space Launch Complex 2 West (SLC-2W)
LOCATION	John F. Kennedy Space Center - Western Test Range
	FY 1974 CoF ESTIMATE $980,000

COGNIZANT INSTALLATION: John F. Kennedy Space Center

LOCATION OF PROJECT: Vandenberg Air Force Base - Western Test Range (WTR), California

COGNIZANT PROGRAM OFFICE: Office of Space Science

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$453,375
Construction	7,432,178
Total FY 1973 and Prior Years	$7,885,553

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to modify and improve the safety of launch complex SLC-2W, WTR, to make the complex compatible with the planned new Delta vehicle configuration involving the extended Thor Booster with the RS-27 (H-1) engine and 3, 6, or 9 Castor II thrust augmentation motors. In addition, the capability must be maintained to support the present Delta second stage and 65-inch diameter fairing which will be used on some missions with this extended booster, and the modified Delta second stage and 8-foot diameter aerodynamic fairing which will be used on subsequent missions with this booster.

This project includes the replacement of the SLC-2W complex vehicle air conditioning system and the installation of improved high intensity perimeter lighting to improve the efficiency and minimize the hazards associated with night operations.

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PROJECT JUSTIFICATION:

The SLC-2W is the only active complex at the Western Test Range capable of accommodating the assembly, prelaunch checkout and launch of the Delta vehicle. Spacecraft size, weight, and orbital parameters have dictated various changes in the launch vehicle configuration. These changes require in turn, the adaptation of the launch facilities to assemble, fuel and launch the new vehicle configuration. These modifications are necessary in FY 1974 because the inventory of older first stages will be depleted and only the new configurations will be available for launch.

Significant operational problems were experienced in FY 1973 with the complex air conditioning units during the ERTS A launch preparations. These units were obtained as surplus from the Atlas Agena program at Eastern Test Range, are approximately 13 years old, and replacement parts are no longer available to maintain reliable operations.

There are no other facilities available to support the launch requirement for Delta polar orbiting missions. Therefore, these changes are mandatory.

PROJECT DESCRIPTION:

The project will modify the working platforms on the mobile service tower to match the electrical, mechanical and fueling access panels and doors which will be approximately 10 feet higher on the extended vehicle. New openings will be made in the sliding doors to accommodate the relocated umbilicals. The necessary mechanical and electrical changes to support the changes in the platforms are included in the project. In addition, the existing lightning arrestor will be modified to provide a 45° cone of protection, and other safety features, such as guardrails, will be provided.

Pad lighting to be provided includes additional area lighting utilizing 1,000 watt quartz-iodine lighting units installed on poles at the LOX facility, RP-1 fuel facility, pad trailer area, and service structure storage area to provide a minimum of 25 foot candles at working levels. Existing lighting units and light poles will be utilized to the maximum extent.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$480,000
Structural/electrical mechanical modifications	LS	---	---	240,000
Vehicle air conditioning	LS	---	---	60,000
Area lighting	LS	---	---	125,000
Safety features	LS	---	---	55,000
Equipment	---	---	---	500,000
Electrical	LS	---	---	305,000
Mechanical	LS	---	---	195,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$980,000

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

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

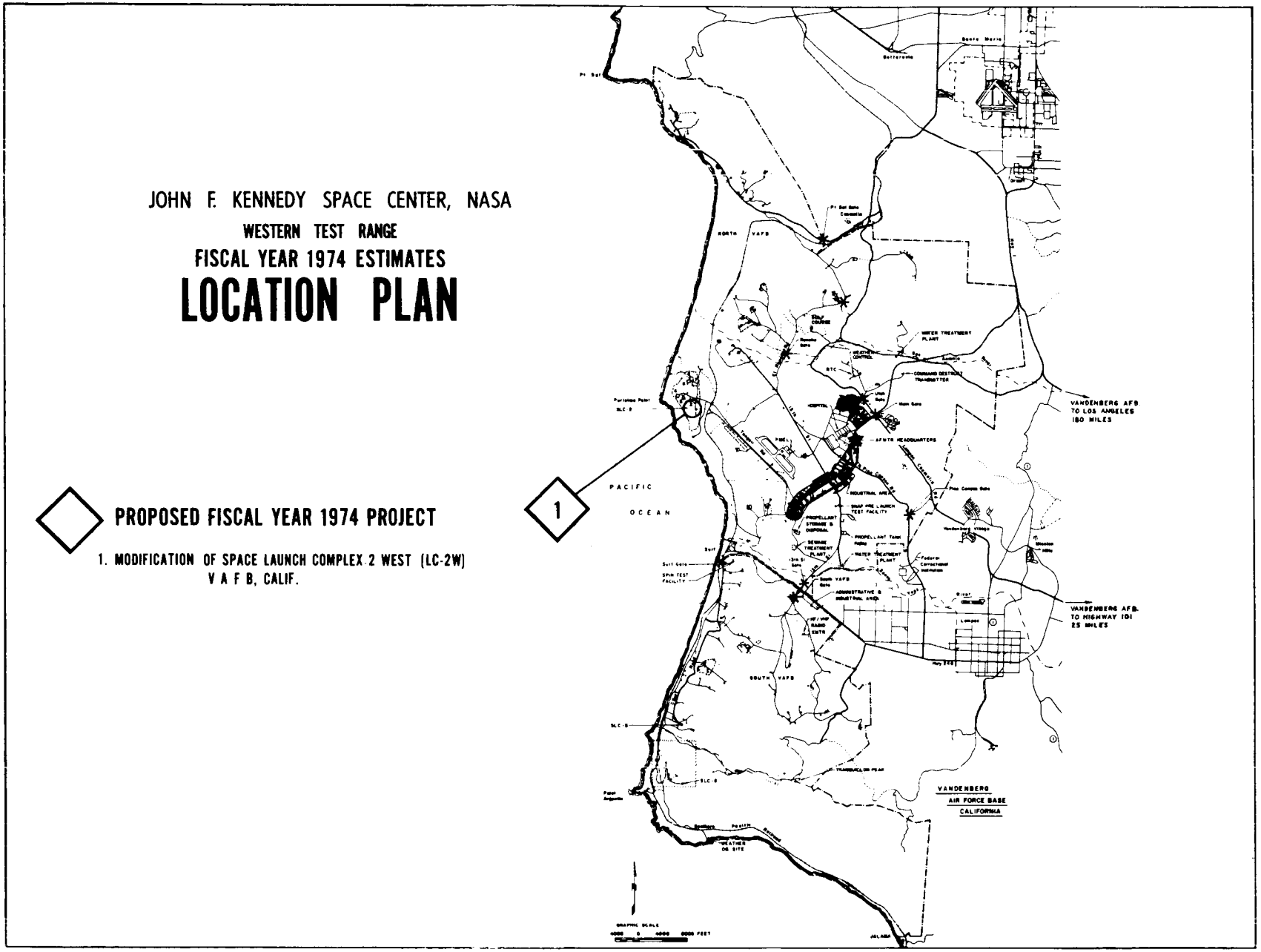
For presently planned usage there are no currently foreseen future funding requirements necessary to complete this project.

JOHN F. KENNEDY SPACE CENTER, NASA

WESTERN TEST RANGE

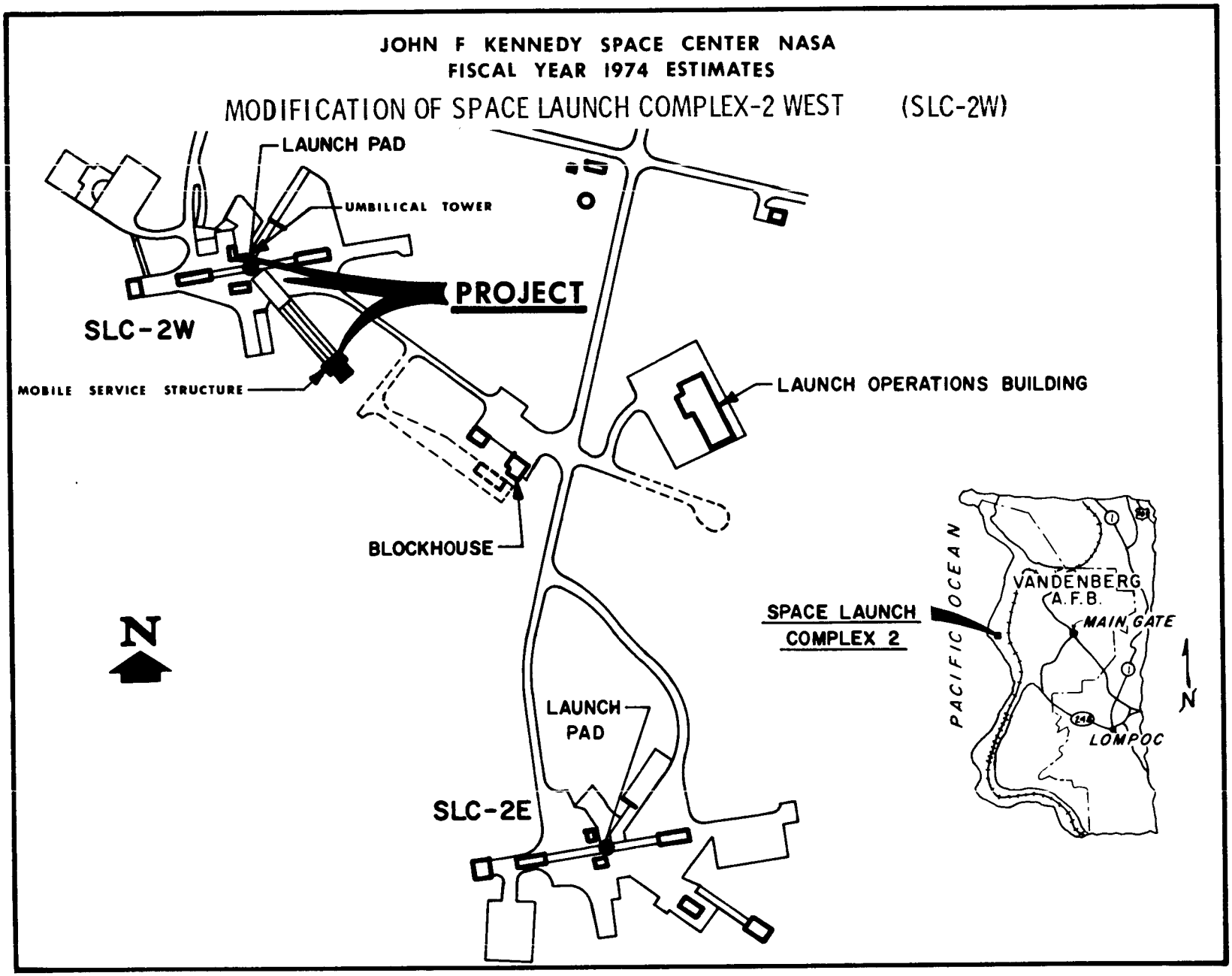
FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



PROPOSED FISCAL YEAR 1974 PROJECT

1. MODIFICATION OF SPACE LAUNCH COMPLEX 2 WEST (LC-2W)
V A F B, CALIF.


JOHN F KENNEDY SPACE CENTER NASA
FISCAL YEAR 1974 ESTIMATES
MODIFICATION OF SPACE LAUNCH COMPLEX-2 WEST (SLC-2W)
LAUNCH PAD
UMBILICAL TOWER
PROJECT
SLC-2W
MOBILE SERVICE STRUCTURE
LAUNCH OPERATIONS BUILDING
BLOCKHOUSE
N
LAUNCH PAD
SLC-2E
SPACE LAUNCH COMPLEX 2
PACIFIC OCEAN
VANDENBERG A.F.B.
MAIN GATE
LOMPOC
N

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modification for Fire Protection Improvements
LOCATION	Various Spaceflight Tracking and Data Network Stations
	FY 1974 CoF ESTIMATE $1,885,000

COGNIZANT INSTALLATION: Goddard Space Flight Center

LOCATION OF PROJECT: Spaceflight Tracking and Data Network Stations

COGNIZANT PROGRAM OFFICE: Office of Tracking and Data Acquisition

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$183,000
Construction	2,317,000*
Total FY 1973 and Prior Years	$2,500,000

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

SUMMARY PURPOSE AND SCOPE:

This is the fourth increment of the program to provide 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 the introduction of newly recognized and more 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. Consideration, 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, etc. This project will complete the storage, distribution, sprinkler and detection systems at Quito, Ecuador; Hawaii; Orroral, Australia; Network Test and Training Facility, Greenbelt, Md.; Ascension Island; Guam; Honeysuckle, Australia; Goldstone (JPL), California; and the MILA STDN Station, Florida. Necessary resources will be allocated as indicated in the following table:

(Dollars in Thousands)

Station	Storage	Distribution	Sprinkler	Detection	Other	Total
Quito	---	$179	$35	---	---	$214
Orroral	$20	60	40	$28	---	148
NTTF	---	---	180	---	---	180
Hawaii	50	238	40	42	---	370
Mila	---	---	25	25	---	50
Ascension	75	273	95	72	---	515
Honeysuckle	30	70	35	35	---	170
Guam	60	---	60	38	---	158
Goldstone	---	---	---	---	80	80
TOTAL	$235	$820	$510	$240	$80	$1,885

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,687,000
Architectural	LS	---	---	449,000
Mechanical	LS	---	---	970,000
Electrical	LS	---	---	268,000
Equipment	LS	---	---	198,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$1,885,000

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

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Approximately $1,500,000 will probably be required to complete the Fire Protection Modifications to the Spaceflight Tracking and Data Network (STDN) and Deep Space Network (DSN). This requirement will be considered in future years.

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

SPACE SHUTTLE FACILITIES

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION		COGNIZANT PROGRAM OFFICE FOR INSTALLATION
Space Shuttle Facilities		Various
LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
---	---	---

INSTALLATION MISSION

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 1974 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Space Shuttle Facilities	OMSF	56,925	67,200		Not Applicable
TOTAL			67,200		

NASA FORM 1029 JUN 69 PREVIOUS EDITIONS ARE OBSOLETE.

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE Space Shuttle Facilities	
	FY 1974 CoF ESTIMATE $67,200,000

COGNIZANT INSTALLATION: Various Locations

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

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$9,025,000
Construction	47,900,000
Total FY 1973 and Prior Years	$56,925,000*

*For Space Shuttle facilities only and exclusive of R&D resources ($18.7 million) directed to facility modifications mainly at Santa Susana, California, for engine component test facilities. The facility planning and design funds associated with each subproject are also included in the detailed following documentation. The prior year construction cost associated with each subproject, unless otherwise noted, reflects the current "Book Value" of the specific facility being modified, insofar as it can be reasonably determined.

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to rehabilitate, modify and add to existing government-owned facilities and construct new facilities to meet requirements generated by and in support of the Space Shuttle program. In FY 1974, these requirements fall into three main areas:

1. Research and Development Facilities required for research, development, testing, evaluation and qualification of each key element of the total

system, such as developmental testing of the auxiliary propulsion system and auxiliary power unit for the orbiter; verification of the avionics flight hardware system and orbiter thermal protection systems; developmental and acceptance testing of the orbiter propulsion system; and structual tests of the external tank.

2. Manufacturing and Final Assembly Facilities required for the manufacture and assembly of certain components of the orbiter; the final assembly and checkout of the orbiter vehicle; and the manufacture, final assembly and checkout of the external tank.

3. Launch and Landing Facilities required for landing the orbiter vehicle after the return from a space mission and for landings incident to orbiter ferry flights.

BRIEF PROJECT JUSTIFICATION:

The FY 1973 program provided the funds to complete the facility modifications required for the main engine testing requirements; modifications and additions to the research and development facilities at Marshall Space Flight Center, Huntsville, Alabama, and Manned Spacecraft Center, Houston, Texas; the early phase of required modifications to existing government-owned facilities for the manufacturing and final subassembly of the orbiter's external propellant tanks at Michoud Assembly Facility, New Orleans, Louisiana; and the initial phase of the modifications to existing government-owned facilities at NASA Industrial Plant, Downey, California, for the program management, engineering, manufacturing and subassembly of the orbiter's crew module, forward and aft fuselage. This proposed FY 1974 program continues and extends these specific increments of the FY 1973 Space Shuttle facilities program. Included in this project are the requirements for:

1. Modifications to the research, development and verification facilities at White Sands Test Facility, White Sands, New Mexico; Manned Spacecraft Center, Houston, Texas; Mississippi Test Facility, Bay St. Louis, Mississippi; and Marshall Space Flight Center, Huntsville, Alabama.

2. A follow-on phase of the modifications to existing government-owned facilities required for manufacturing, final assembly and checkout operations of the orbiter vehicle and external tank. These include the NASA Industrial Plant, Downey, California, for fabrication and subassembly of orbiter components including the forward and aft fuselages and crew module, and the Michoud Assembly Facility, New Orleans, Louisiana, to accommodate the manufacturing, assembly and final checkout of the external tank. The Air Force Plant #42, Palmdale, California, is also to be modified to accommodate the assembly of major sections and final assembly and checkout of the Space Shuttle orbiter vehicle. These efforts will complete the

currently foreseen programmatic needs for manufacturing facilities with the exception of facility requirements at government plants that may be generated by subcontractors not yet selected and by the possible future need for additional production capacity for external tanks at Michoud Assembly Facility.

3. The initial phase of the construction of the launch and landing facilities at John F. Kennedy Space Center, Merritt Island, Florida, which includes the orbiter landing facilities.

PROJECT DESCRIPTION:

This project provides for necessary modifications and additions to existing research and development facilities, manufacturing and final assembly facilities, and the initial construction of launch and landing facilities in support of the Space Shuttle program. It is comprised of nine subprojects shown under the Summary Project Cost Estimate.

SUMMARY PROJECT COST ESTIMATE:

Research and Development Facilities	$19,490,000
Manufacturing and Final Assembly Facilities	19,510,000
Launch and Landing Facilities	28,200,000
Total	$67,200,000

PROJECT COST ESTIMATES:

Research and Development Facilities	$19,490,000
Modifications for Auxiliary Propulsion and Power Systems Test Facilities, White Sands Test Facility, New Mexico	1,290,000
Modifications for Shuttle Avionics Integration Laboratory, Manned Spacecraft Center, Texas	1,240,000
Modifications for Radiant Heating Verification Facility, Manned Spacecraft Center, Texas	1,260,000
Modifications for the Orbiter Propulsion System Test Facilities, Mississippi Test Facility, Mississippi	11,300,000
Modifications for External Tank Structural Test Facilities, Marshall Space Flight Center, Alabama	4,400,000

Manufacturing and Final Assembly Facilities.....	$19,510,000
Modification of Manufacturing and Subassembly Facilities for the Orbiter, NASA Industrial Plant, Downey, California.....	2,650,000
Modification of and Addition to Final Assembly and Checkout Facilities for the Orbiter, Air Force Plant #42, Palmdale, California.....	7,350,000
Modification of Manufacturing and Final Assembly Facilities for External Tanks, Michoud Assembly Facility, Louisiana....	9,510,000
Launch and Landing Facilities.....	$28,200,000
Construction of Orbiter Landing Facilities, John F. Kennedy Space Center, Florida.....	28,200,000
Total	$67,200,000

PROJECT DOCUMENTATION:

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

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modifications for Auxiliary Propulsion and Power Systems Test Facilities
LOCATION	White Sands Test Facility
	FY 1974 CoF ESTIMATE $1,290,000

COGNIZANT INSTALLATION: Manned Spacecraft Center

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

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$99,000
Construction	*
Total FY 1973 and Prior Years	$99,000

*This basic facility was constructed under Section 1(c) of the 1963 NASA Authorization Act. The current "Book Value" involved is about $11.8 million.

SUMMARY PURPOSE AND SCOPE:

This project provides for the modification of three existing altitude test stands at the White Sands Test Facility (WSTF). These test stands were originally built to support the development of the lunar module and the command service module for the Apollo program. The proposed modifications are essential to the development of the Auxiliary Propulsion System (APS) and the Auxiliary Power Unit (APU) for the Space Shuttle.

PROJECT JUSTIFICATION:

The Auxiliary Propulsion System for the Space Shuttle orbiter is to be made up of two primary systems, each of which will require extensive developmental and qualification testing before the orbiter can be committed to space flight.

The first such system is the Reaction Control System (RCS), consisting of some 30-34 small engines, each having a thrust range of about 800-1,000 pounds. This system is required by the orbiter in order that it may be able to accomplish altitude control and make small velocity changes while the vehicle is in orbit or during docking and undocking maneuvers, as well as during vehicle descent. The second system is the Orbital Maneuvering System (OMS), which will use two rocket engines, each having approximately 10,000 pounds of thrust. This system is necessary to effect major orbit adjustments after the orbiter vehicle has attained orbital velocity, as well as to make orbit circularizations and orbit transfers. To perform the required test program under simulated altitude conditions, modifications of existing Test Stands 401 for OMS testing, and 403 for RCS testing are necessary.

The orbiter will also contain an Auxiliary Power Unit (APU) required as backup power for the vehicle primary power system as well as being a primary power source for the orbiter hydraulic system. The APU must be capable of operating under a wide range of altitudes and pressures. To provide for the required developmental testing of this unit individually, as well as to provide capability for an integrated testing of the primary and auxiliary power unit systems, modification to existing Test Stand 302 will be necessary.

The White Sands Test Facility was selected as the site for these developmental test activities because of the unique capabilities existing at this location. These capabilities include the availability of altitude test stands supported by the hypergolic fuel storage and transfer systems that were used for Apollo and are now required for the Space Shuttle. The selected orbiter contractor, as well as studies, has indicated that this facility provides the optimum sites for the above outlined test programs.

To meet Space Shuttle program requirements, system level "hot firing" of the RCS/OMS must be initiated by the end of calendar year 1975. To achieve this goal, fiscal year 1974 resources will be necessary for this work.

PROJECT DESCRIPTION:

This project provides for modifications to Test Stands 401 and 403 for simulated altitude testing of the Shuttle's orbiter maneuvering system and reaction control system, respectively. Test Stand 302 will also be modified for the auxiliary power unit developmental testing.

The modification to Test Stand 401 includes provision for a thrust mount inside the altitude chamber specifically configured for the OMS engine. Chamber platforms will also be modified to provide appropriate access to the test hardware.

The work at Test Stand 403, required for RCS testing, will include the relocation and installation near the structure of a 13,500 gallon existing storage tank for liquid nitrogen storage, provision for a liquid nitrogen transfer system to the stand chamber and the installation of existing panels inside the chamber. The nitrogen cooled panels are necessary to absorb the heat energy from the hot firings. The existing gaseous nitrogen system will be modified and adapted for the test operation. Changes to the diffuser ejector system and modification of existing platforms, support structure and firing system will also be effected.

Test Stand 302 will be specifically modified for testing the APU and the integrated power system. These modifications include provision for the APU mount, adaptations of existing platforms for proper access, and modification to the on-stand and block house instrumentation and control systems. Addition of an exhaust gas pumping system, a steam generating system and a dummy load for the APU will also be provided.

Specific stand support systems will be modified to improve operational safety and reliability in support of the test program. The modification includes replacement of a deformed and embrittled steel steam plenum, relocation of liquid oxygen pumps further away from the storage run tank, the replacement of deteriorated propellant lines and the installation of an additional liquid oxygen ready storage tank.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$1,290,000
Modifications to:				
Test Stand 401	LS	---	---	50,000
Test Stand 403	LS	---	---	500,000
Test Stand 302	LS	---	---	440,000
Support systems	LS	---	---	300,000
Equipment	---	---	---	---
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$1,290,000

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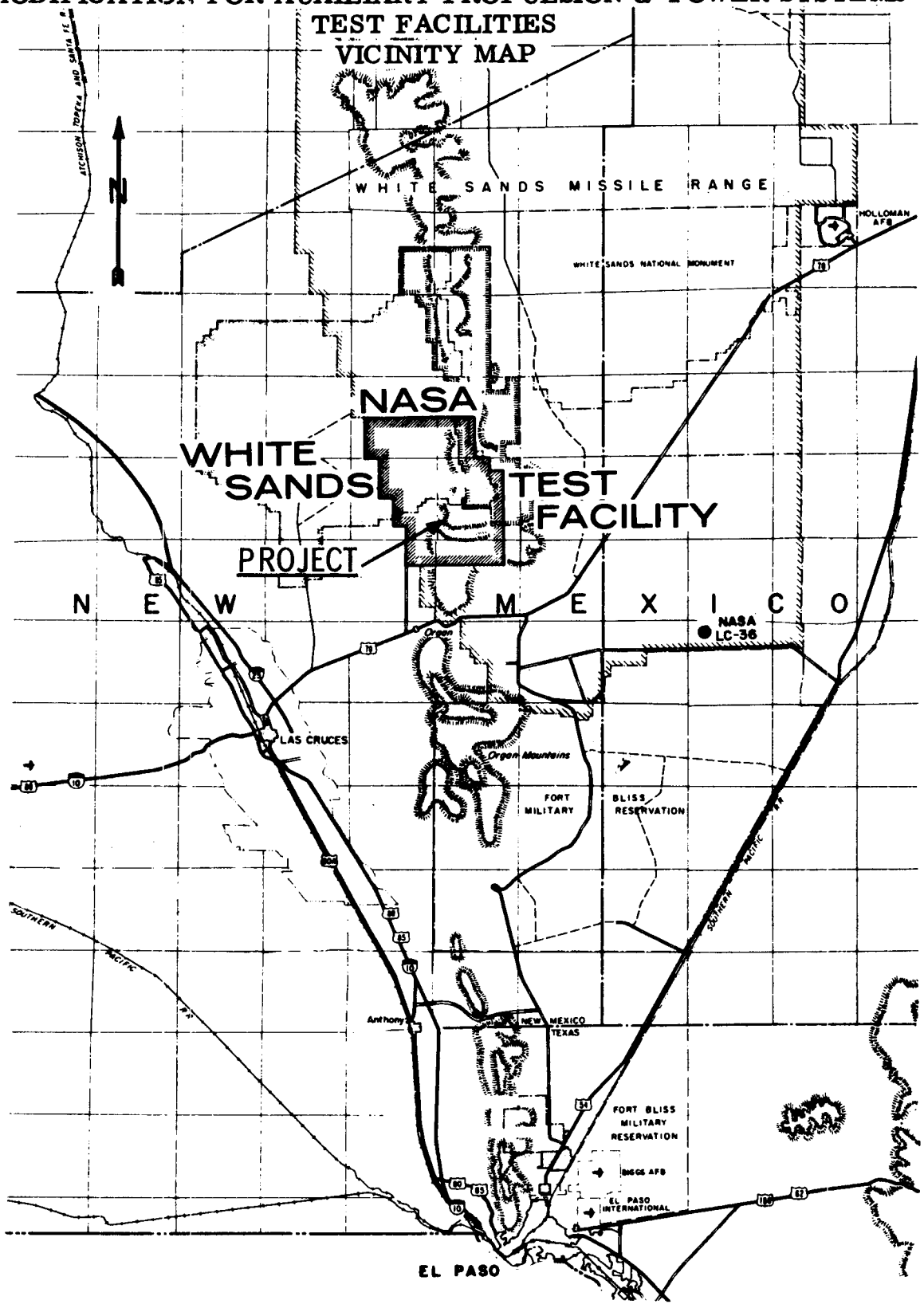
The project includes the cost of installing an existing liquid oxygen run tank, liquid oxygen pumps and associated valves, all designated as collateral equipment and valued at approximately $275,000. No other equipment items either collateral or non-collateral have been identified as being required for the initial operation of this project.

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.

WHITE SANDS TEST FACILITY
Fiscal Year 1974 Estimates

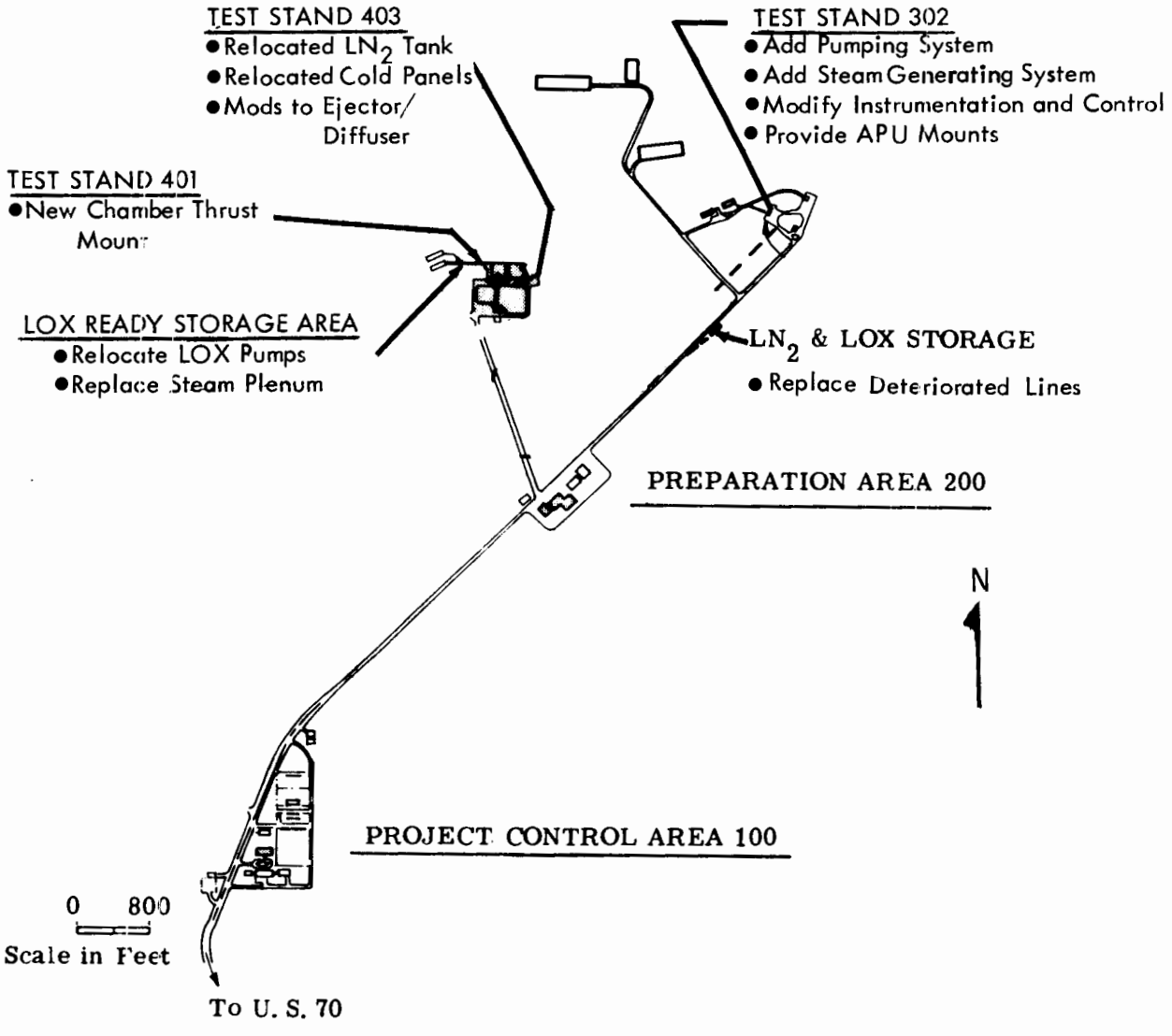
MODIFICATION FOR AUXILIARY PROPULSION & POWER SYSTEMS



WHITE SANDS TEST FACILITY

Fiscal Year 1974 Estimates

MODIFICATION FOR AUXILIARY PROPULSION & POWER SYSTEMS TEST FACILITIES



CF 6-11

PROJECT TITLE	Modifications for Shuttle Avionics Integration Laboratory
LOCATION	Manned Spacecraft Center
	FY 1974 CoF ESTIMATE: $1,240,000

COGNIZANT INSTALLATION: Manned Spacecraft Center

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$101,000
Construction	4,600,000
Total FY 1973 and Prior Years	$4,701,000

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to the existing Spacecraft Research Office and Laboratory, Building 16, to accommodate the flight guidance, navigational and control equipment; flight crew station mockup; and simulators related to the Space Shuttle program. The modified facility will support development and verification of the flight avionics hardware and integration of this hardware with the shuttle flight software.

PROJECT JUSTIFICATION:

Development, verification and integration of the orbiter avionics system will involve demanding and rigorous tasks inasmuch as this vehicle will have to function in space as well as in airborne operational modes. These tasks include the verification and integration of such systems as guidance, navigation and control; communications and tracking; power distribution and control; and on-board performance monitoring equipment. In addition, a number of other related subsystems are either controlled or directly impacted by the avionics system. These include propulsion, power, environmental control and life support, and mechanical systems.

The verification and integration program for the avionics system requires that testing be conducted in a flight simulated environment. This dictates that the physical and electrical relationships between the various parts of the system be maintained and that the interrelationship between the avionics and the above cited related systems be simulated as closely as possible. To provide the essential capability of integrating these flight hardware systems, facility modifications proposed in this project are necessary.

In addition to the flight hardware integration functions, there is a vital need to validate the crew time-lines using flight procedures and flight software. Subsequently, it is necessary, with a "man-in-the-loop", to perform closed loop integration of flight hardware, flight software, crew, and crew procedures. This facility, with the proposed modifications, will be capable of performing these tasks.

The orbiter and shuttle system contractor proposed this facility at the Manned Spacecraft Center. The site was selected because it offers significant advantages in terms of effective utilization of the capability available in this facility to support the cited functions, as well as the availability of the expert technical personnel who would be charged with the avionics integration and shuttle systems management.

Current program milestones are based on achieving a first horizontal flight test of the orbiter in the first quarter of calendar year 1977. To achieve this milestone, a host of activities including integration of the flight communication, guidance and navigational systems must proceed no later than last quarter of calendar year 1975. To meet these needs the facility modification must start in early calendar year 1974, thus requiring fiscal year 1974 Construction of Facilities resources.

PROJECT DESCRIPTION:

This project provides modifications to the existing Spacecraft Research Office and Laboratory, Building 16, required for the test and integration of the shuttle avionics and related prototype flight hardware. The work includes: addition of a 1,200 square foot hydraulic pump room necessary to house hydraulic pumps, two of which are existing, and a control panel that is required to provide the capacity for simulating flight control system elements; extension of utility trench into the new addition; installation of approximately 1,500 square feet of raised floor system; and associated special power, electrical distribution and air conditioning modifications in the high bay area. Inter-building underground cables will also be provided to connect the facility with the Central Data Office, Building 12, and Mission Control Center, Building 30, in order to support the data reduction and software/hardware integration activities.

The project also includes the procurement and installation of support equipment needed for the avionics integration testing. Included are: a master control console; subsystems computerized simulator units; hardware simulators; and communications and associated service equipment.

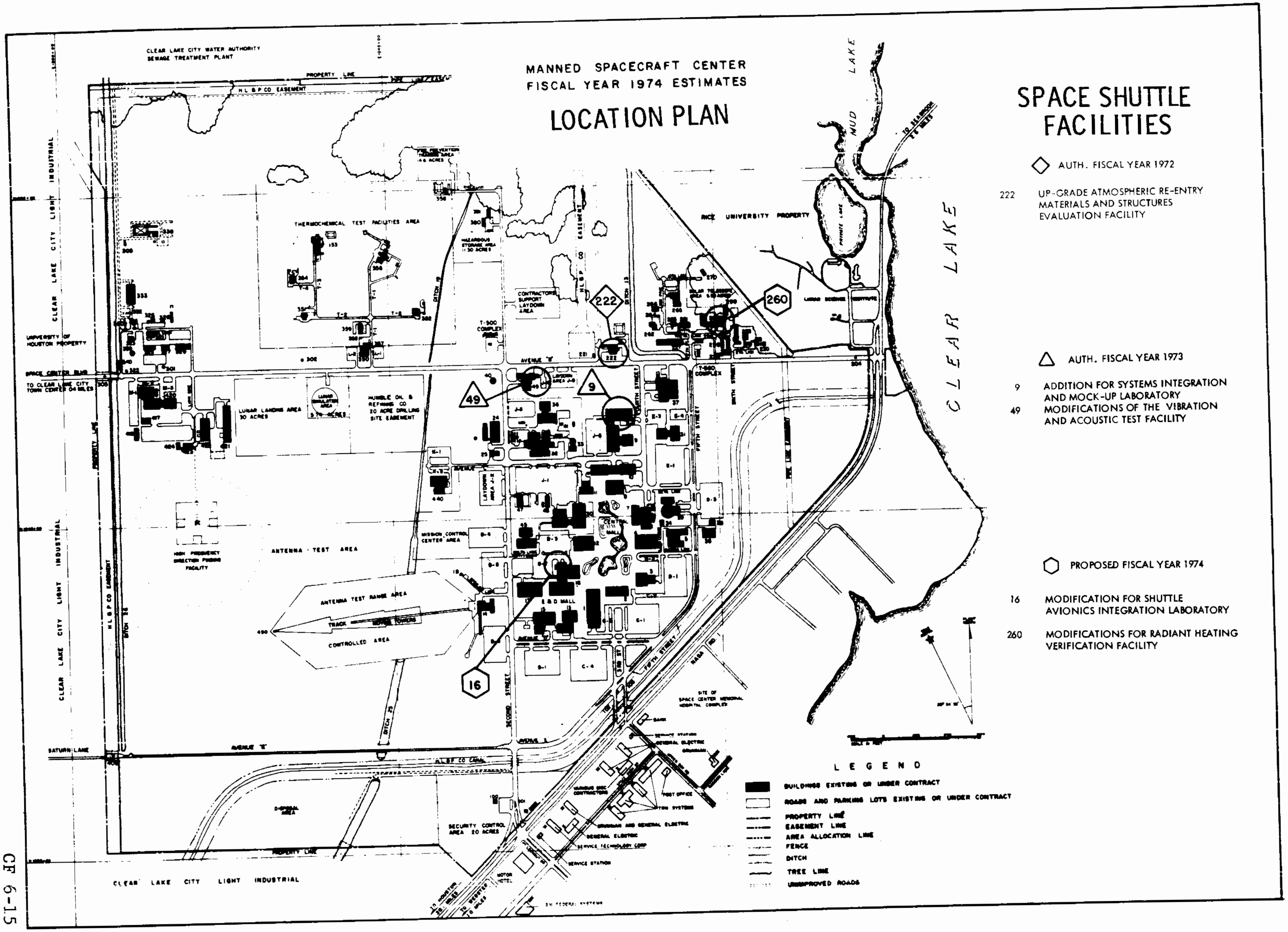
PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$278,000
Pump room addition	SF	1,200	$56.00	67,200
High bay modifications	LS	---	---	45,800
Data cables	LF	4,000	22.00	88,000
Power supply and air conditioning	LS	---	---	77,000
Equipment	---	---	---	962,000
Hydraulic pumps and control panel	LS	---	---	85,000
Master control console	LS	---	---	232,000
Subsystem computerized simulator units	LS	---	---	356,000
Hardware simulators	LS	---	---	142,000
Communication and service equipment	LS	---	---	147,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$1,240,000

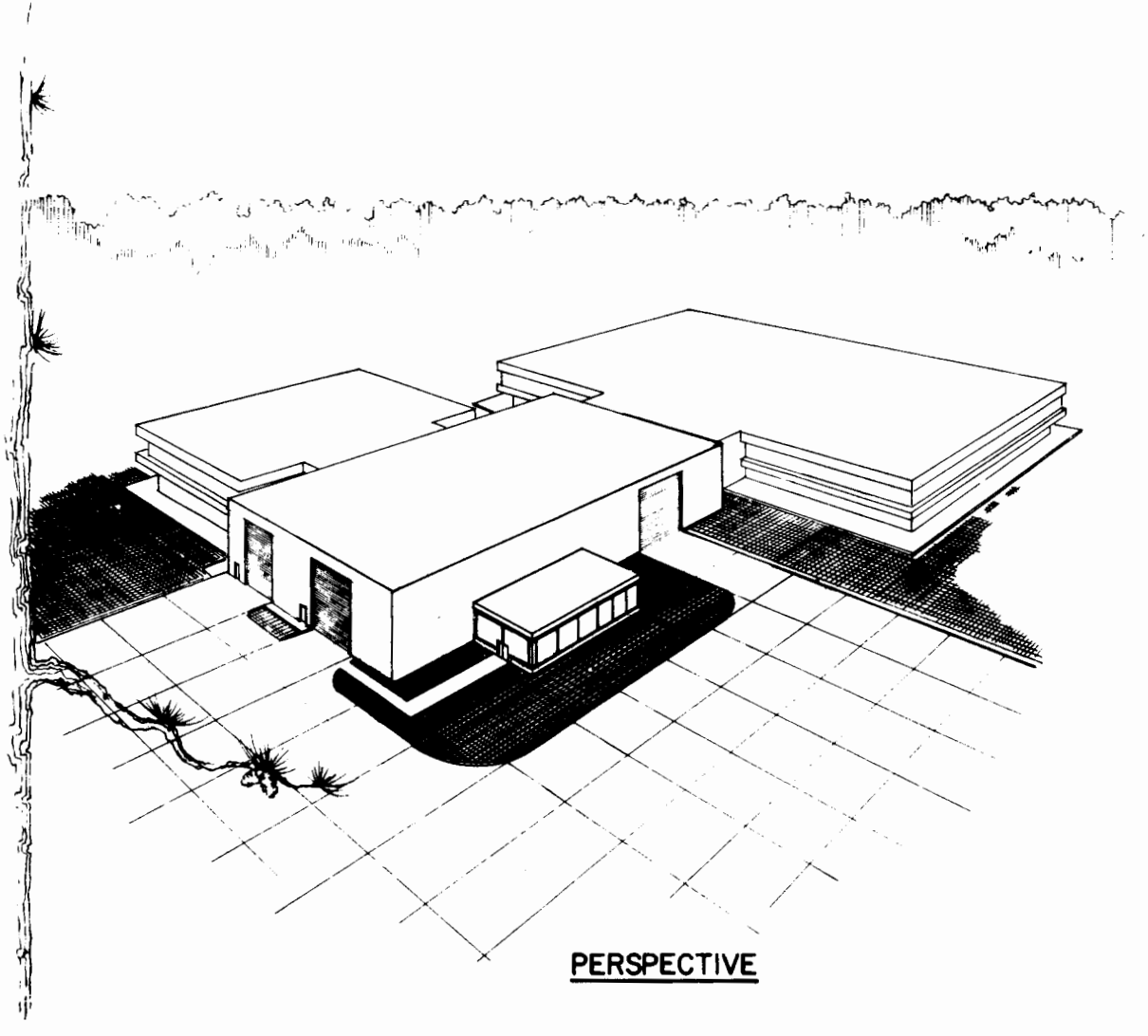
Non-collateral existing avionics equipment valued at approximately $5 million will be used in this facility. In addition, non-collateral avionics interface equipment estimated to cost on the order of approximately $500,000 may be required and would be procured from the Research and Development appropriation. An R&D funded minor construction project, estimated at about $83,000, was approved in fiscal year 1973 to support the early avionics breadboard test activities for the Shuttle as a separate fully usable phase of this total effort.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

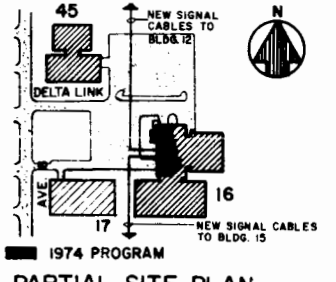
For presently planned usage, there are no currently foreseen future funding requirements necessary to complete this project.


MANNED SPACECRAFT CENTER
FISCAL YEAR 1974 ESTIMATES
LOCATION PLAN
SPACE SHUTTLE FACILITIES
AUTH. FISCAL YEAR 1972
222 UP-GRADE ATMOSPHERIC RE-ENTRY MATERIALS AND STRUCTURES EVALUATION FACILITY
AUTH. FISCAL YEAR 1973
9 ADDITION FOR SYSTEMS INTEGRATION AND MOCK-UP LABORATORY
49 MODIFICATIONS OF THE VIBRATION AND ACOUSTIC TEST FACILITY
PROPOSED FISCAL YEAR 1974
16 MODIFICATION FOR SHUTTLE AVIONICS INTEGRATION LABORATORY
260 MODIFICATIONS FOR RADIANT HEATING VERIFICATION FACILITY
CLEAR LAKE
MUD LAKE
CLEAR LAKE CITY WATER AUTHORITY SEWAGE TREATMENT PLANT
CLEAR LAKE CITY LIGHT INDUSTRIAL
UNIVERSITY OF HOUSTON PROPERTY
RICE UNIVERSITY PROPERTY
THERMOCHEMICAL TEST FACILITIES AREA
LUNAR LANDING AREA 30 ACRES
ANTENNA TEST AREA
ANTENNA TEST RANGE AREA
CONTROLLED AREA
MISSION CONTROL CENTER AREA
CENTRAL MALL
E & D MALL
AVENUE "B"
AVENUE "E"
SATURN LANE
SECOND STREET
FIFTH STREET
NASA 1
SECURITY CONTROL AREA 20 ACRES
DISPOSAL AREA
L E G E N D
BUILDINGS EXISTING OR UNDER CONTRACT
ROADS AND PARKING LOTS EXISTING OR UNDER CONTRACT
PROPERTY LINE
EASEMENT LINE
AREA ALLOCATION LINE
FENCE
DITCH
TREE LINE
UNIMPROVED ROADS

MODIFICATIONS FOR SHUTTLE AVIONICS INTEGRATION LABORATORY



PERSPECTIVE



PARTIAL SITE PLAN

CF 6-16

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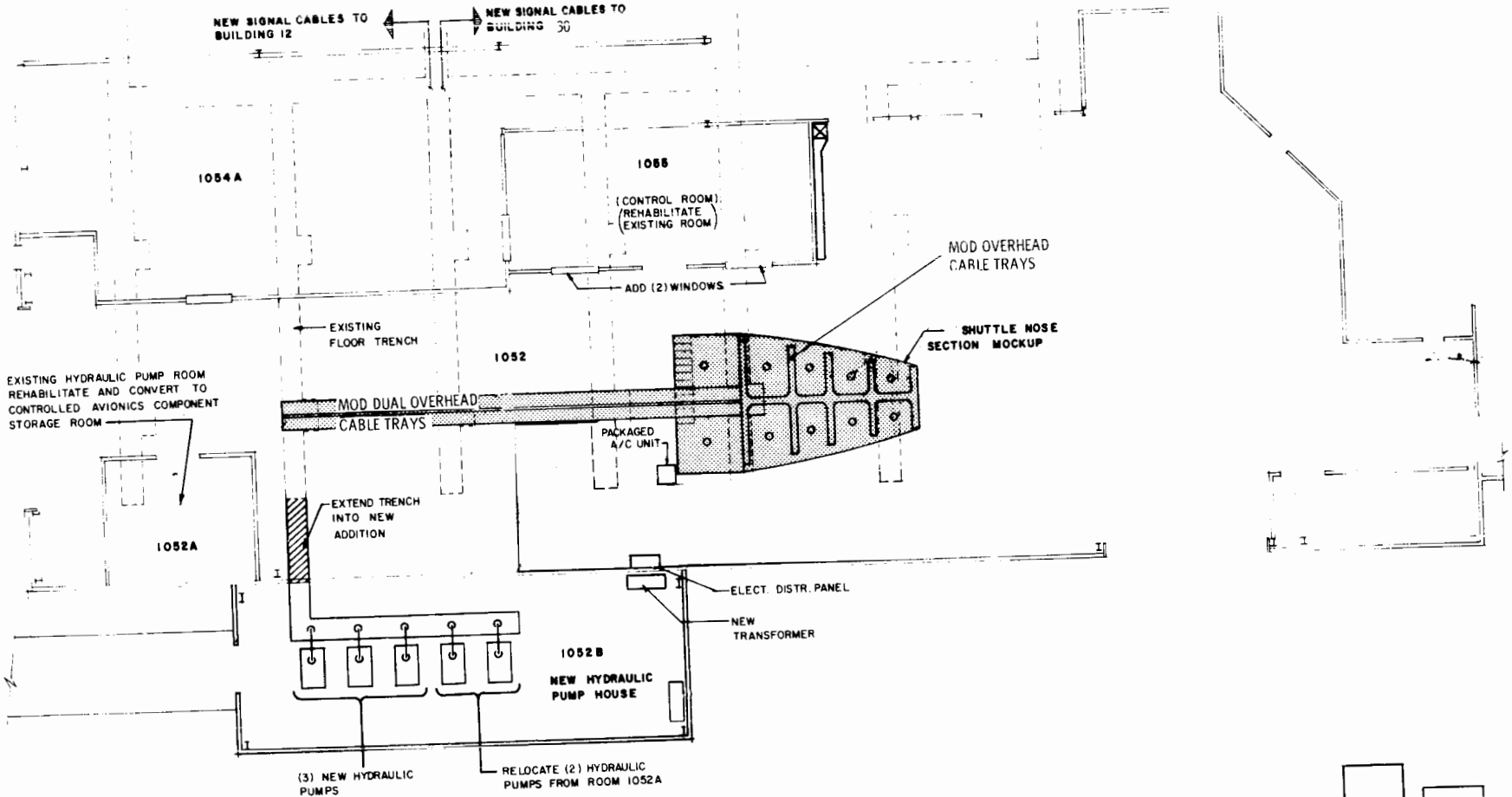
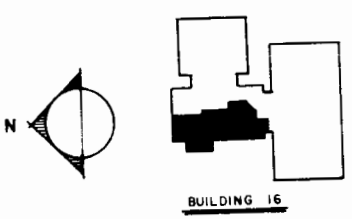
MANNED SPACECRAFT CENTER
FISCAL YEAR 1974 ESTIMATES

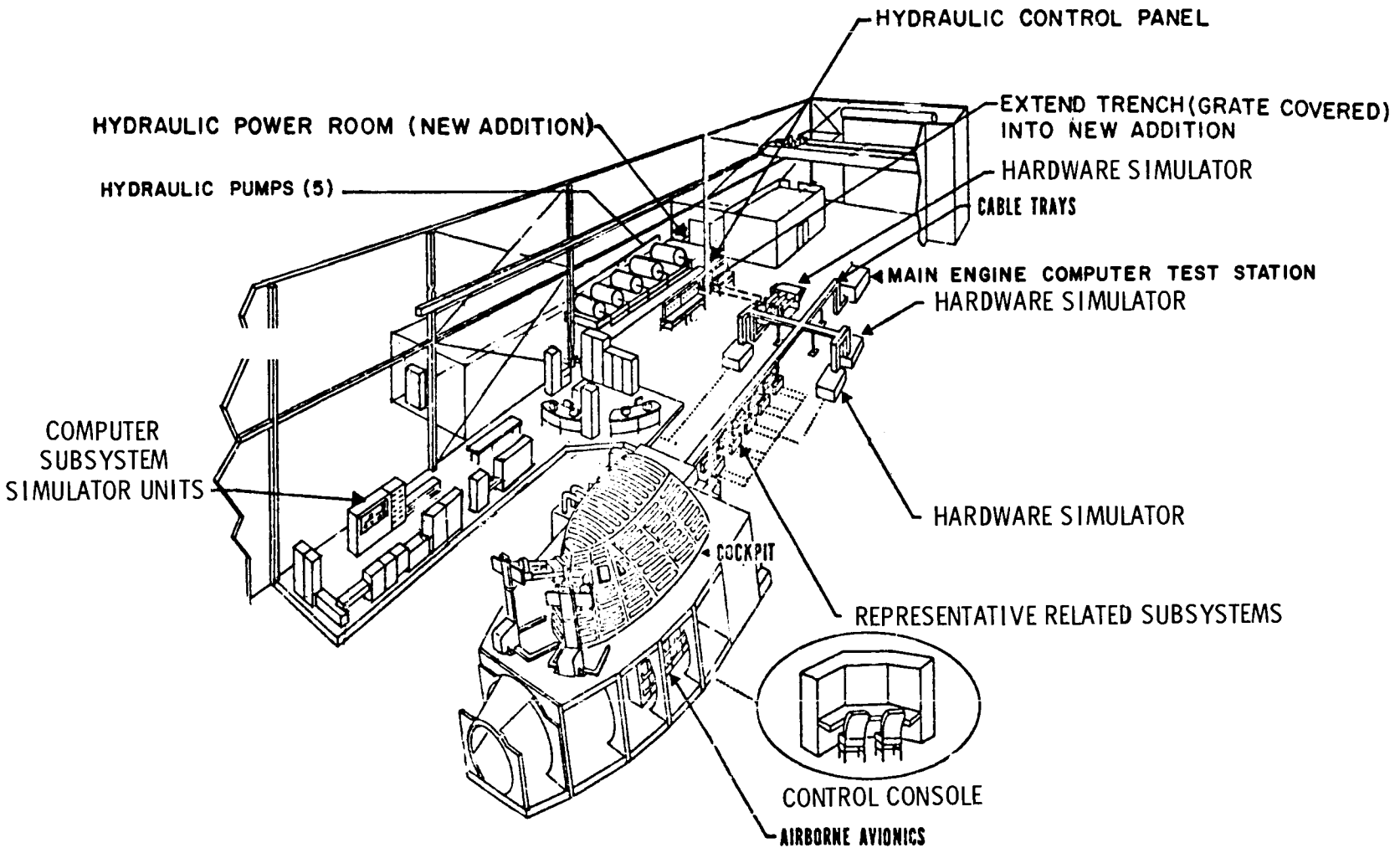
MODIFICATIONS FOR SHUTTLE AVIONICS INTEGRATION LABORATORY



PARTIAL FIRST FLOOR PLAN



MODIFICATIONS FOR SHUTTLE AVIONICS INTEGRATION LABORATORY



CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modifications for Radiant Heating Verification Facility
LOCATION	Manned Spacecraft Center
	FY 1974 CoF ESTIMATE $1,260,000

COGNIZANT INSTALLATION: Manned Spacecraft Center

LOCATION OF PROJECT: Houston, Harris County, Texas

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$80,000
Construction	645,680
Total FY 1973 and Prior Years	$725,680

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications to the Translation and Docking Simulation Facility, Building 260, to provide a high temperature, low pressure capability for verification testing of full scale flight configured thermal protection system test articles. The work primarily consists of installation of new and existing equipment including radiant heaters and a vacuum chamber respectively with ancillary utilities support.

PROJECT JUSTIFICATION:

During reentry, the orbiter will be subjected to severe temperatures and pressures. The temperatures will vary from 340°F along the middle of the wing to approximately 3,000°F at the wing's leading edge and the nose of the spacecraft. These temperatures are accompanied with pressures ranging from 0.001 to 1.0 atmosphere. Such phenomena are unique to the orbiter configuration. The structure and materials proposed for use in construction of the thermal protection system (TPS) must be tested and their behaviour verified in this extreme environment prior to committing them to production and subsequent manned space flight.

The Shuttle TPS program is to be conducted in three phases: material development; design development and evaluation; and system verification. The first two phases involve the testing of mostly small size, simple shaped test items. These phases of the test program are to be conducted in existing and previously authorized TPS facilities.

The system verification phase involves selected testing of large, full scale, complex, flight configured, integrated test articles. These test articles will represent particular problem areas, such as leading edges, the combination of the leading edge and primary structure, the door and hatch areas, and the interactions of the TPS with aerodynamic control surfaces. The extensive testing under high temperature and low pressure conditions will provide the key verification of the system's adequacy prior to first vertical flight.

The high temperature, low pressure testing is required to allow complete simulation of the temperature distribution in the full scale integrated articles throughout the entry and post entry mission phases. The low pressure simulating the entry altitude environment is necessary since the thermal conductivity of the reusable surface insulation material is highly dependent on pressure. The facilities previously authorized for Shuttle TPS testing, in general, address specific development technical issues and are not suitable for the combined environment verification and qualification tests upon which the requirement for the proposed facility is based. This project includes the modifications necessary to provide the high temperature and low pressure needed for the thermal protection system verification testing.

Program requirements for verification of flight TPS elements necessitate that testing must start no later than mid-calendar year 1975. To meet this schedule, facility modification must be initiated in the first quarter of calendar year 1974, thus requiring FY 1974 resources.

PROJECT DESCRIPTION:

This project consists of the modification of Building 260 to provide the capability for simulating the combined environment of high temperature and low pressure on complex test articles representing the shuttle thermal protection system. This work includes: installation of an existing 10 foot diameter by 20 foot long altitude chamber; procurement and installation of three radiant heaters, 5 megawatt capacity, with associated power controllers; and installation of an associated heat exchanger and related pumping equipment. This project also includes the installation of a 2,100 foot primary electrical feeder line between an existing substation and a new substation located adjacent to Building 260. Minor building modifications including provision for raised flooring and partition changes will also be accomplished.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$320,000
Installation of vacuum chamber and associated pumping system	LS	---	---	101,000
Modification of primary power	LS	---	---	56,000
Substation and electrical distribution	LS	---	---	140,000
Building modifications	LS	---	---	23,000
Equipment				940,000
4 foot by 4 foot radiant heater	Each	2	$350,000	700,000
Leading edge radiant heater	Each	1	240,000	240,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$1,260,000

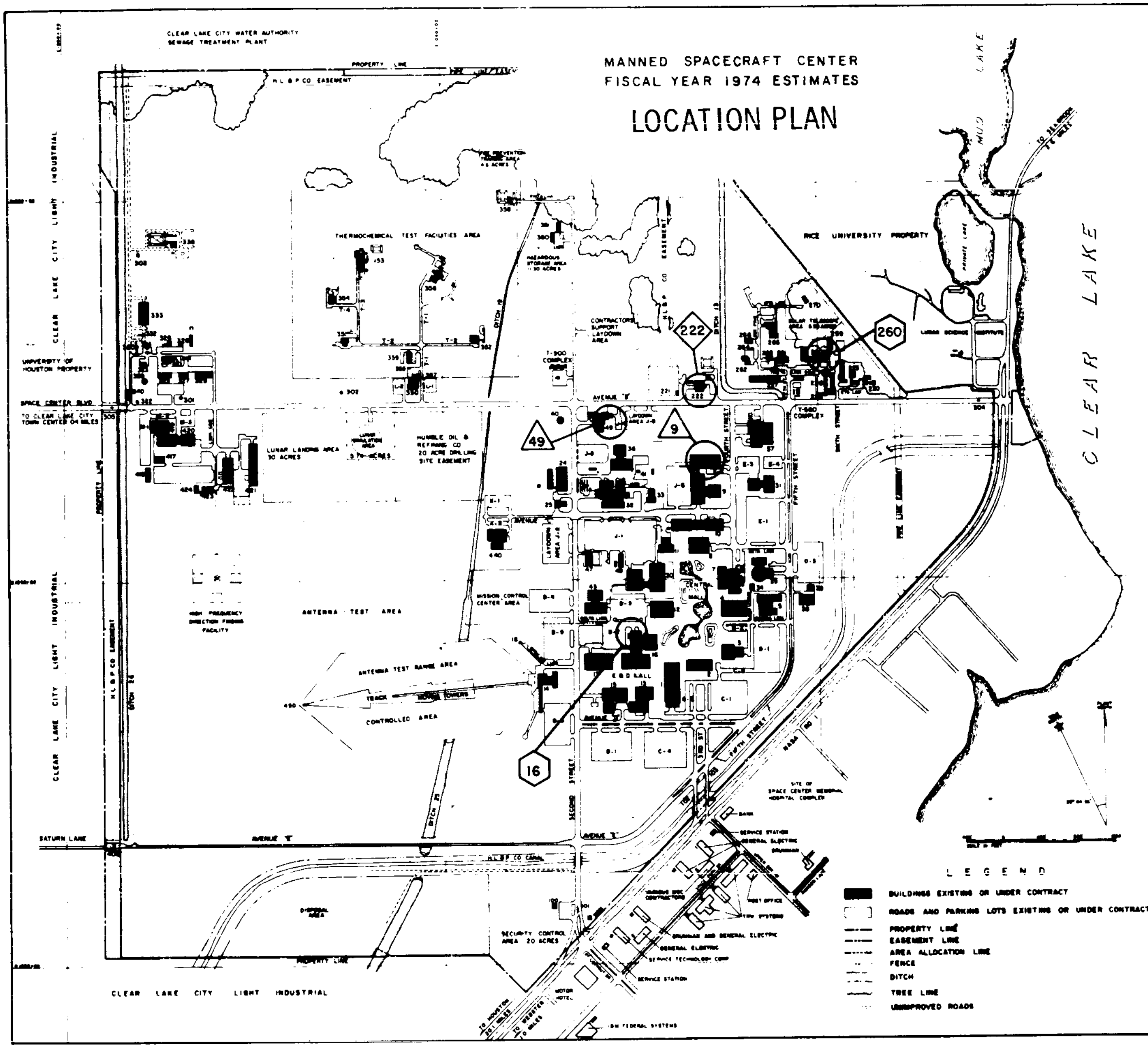
This project involves the use of an existing altitude chamber valued at about $300,000. The installation cost of this item is included in the facility project. In addition, non-collateral existing equipment valued at approximately $800,000 will be used in this facility and new non-collateral equipment at an estimated cost of approximately $50,000 will be procured from the R&D appropriation.

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.

MANNED SPACECRAFT CENTER
FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



CLEAR LAKE CITY WATER AUTHORITY SEWAGE TREATMENT PLANT
PROPERTY LINE
RICE UNIVERSITY PROPERTY
THERMOCHEMICAL TEST FACILITIES AREA
LUNAR LANDING AREA 30 ACRES
HUMBLE OIL & REFINING CO 20 ACRE DRILLING SITE EASEMENT
ANTENNA TEST AREA
ANTENNA TEST RANGE AREA
CONTROLLED AREA
MISSION CONTROL CENTER AREA
SECURITY CONTROL AREA 20 ACRES
DISPOSAL AREA
SPACE CENTER BLVD
AVENUE "B"
AVENUE "E"
SECOND STREET
FIFTH STREET
SIXTH STREET
SATURN LANE
MUD LAKE
CLEAR LAKE
CLEAR LAKE CITY LIGHT INDUSTRIAL
UNIVERSITY OF HOUSTON PROPERTY
T-900 COMPLEX
T-960 COMPLEX
222
260
49
9
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SPACE SHUTTLE FACILITIES

◇ AUTH. FISCAL YEAR 1972

222 UP-GRADE ATMOSPHERIC RE-ENTRY MATERIALS AND STRUCTURES EVALUATION FACILITY

△ AUTH. FISCAL YEAR 1973

9 ADDITION FOR SYSTEMS INTEGRATION AND MOCK-UP LABORATORY

49 MODIFICATIONS OF THE VIBRATION AND ACOUSTIC TEST FACILITY

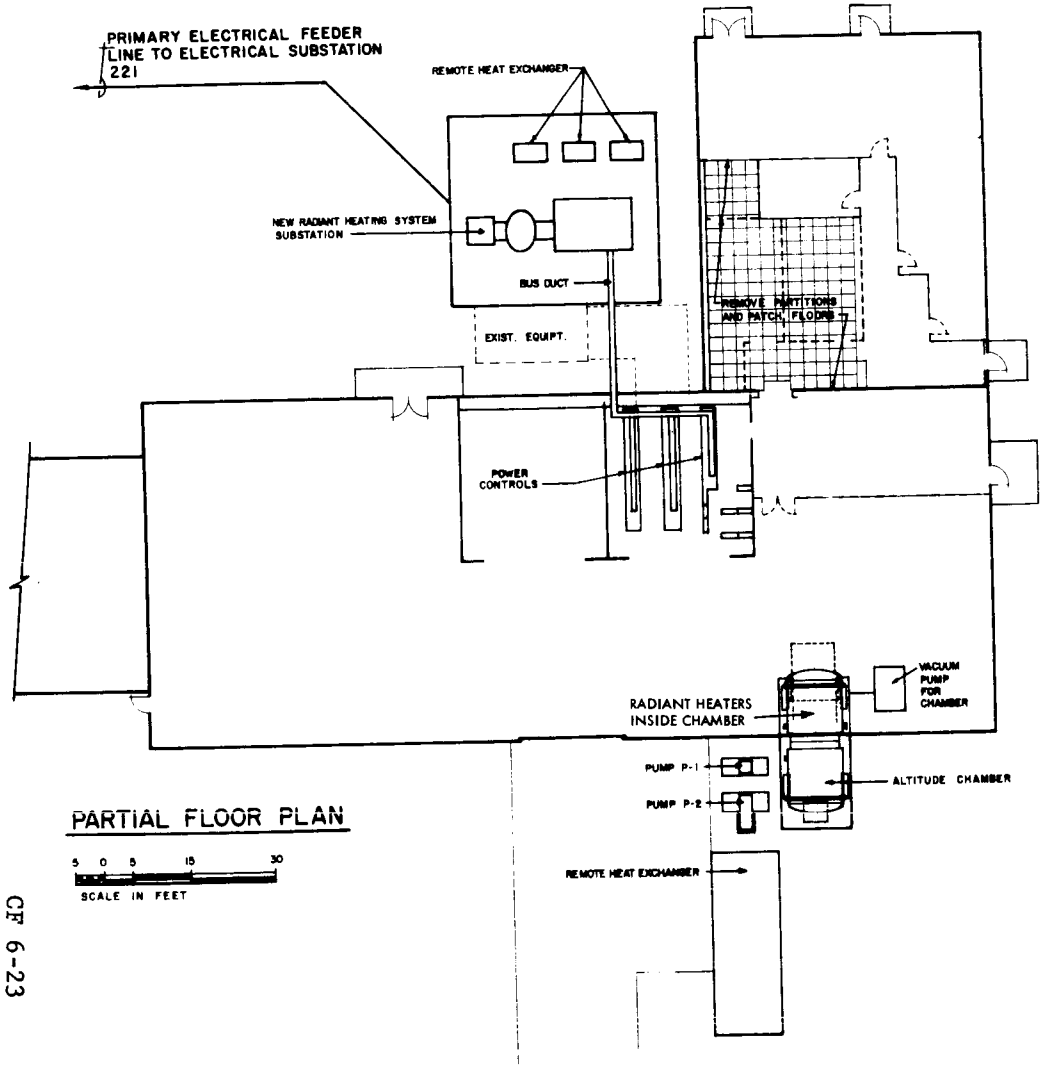
⬡ PROPOSED FISCAL YEAR 1974

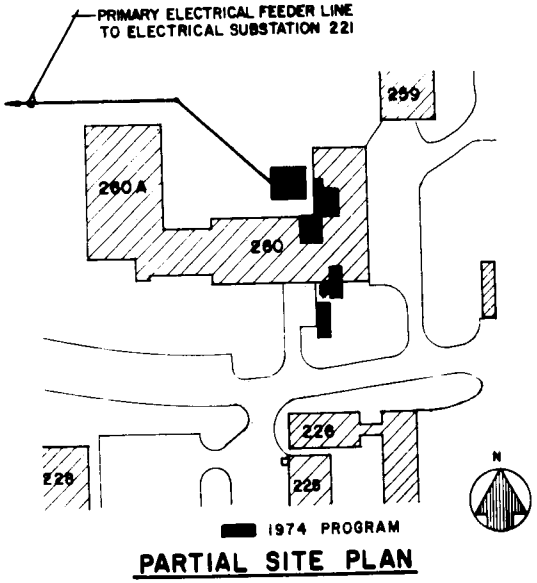
16 MODIFICATION FOR SHUTTLE AVIONICS INTEGRATION LABORATORY

260 MODIFICATIONS FOR RADIANT HEATING VERIFICATION FACILITY

MANNED SPACECRAFT CENTER
FISCAL YEAR 1974 ESTIMATES

MODIFICATIONS FOR RADIANT HEATING VERIFICATION FACILITY





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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modifications for the Orbiter Propulsion System Test Facilities
LOCATION	Mississippi Test Facility
	FY 1974 CoF ESTIMATE $11,300,000

COGNIZANT INSTALLATION: Manned Spacecraft Center/
Marshall Space Flight Center

LOCATION OF PROJECT: Bay St. Louis, Hancock County, Mississippi

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$747,000
Construction	34,300,000
Total FY 1973 and Prior Years	$35,047,000

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to modify the existing Saturn V First Stage (S-IC) Test Stand, Position B-2, at the Mississippi Test Facility to provide capability for developmental and qualification testing of the orbiter's main propulsion system. This testing has been determined to be essential in the overall development of the Space Shuttle.

PROJECT JUSTIFICATION:

This project is required for the developmental and qualification testing of the orbiter propulsion system as a whole. This is a distinct and separate requirement from that for the testing of single engines to be accomplished on the A-1 and A-2 test stands. The system to be tested on this facility will consist of a "cluster" of three of the planned liquid hydrogen/oxygen engines, each having a vacuum thrust level of about 470,000 pounds. The

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propellants are to be supplied to the engines through feed lines from the external tank which is to be an integral part of the planned shuttle vehicle. The design and development of the propulsion system will, therefore, have to consider not only the engine "cluster," but the geometry of the feed line system, the connections to the tank and the performance of the propulsion system as a whole. To meet program requirements the aft section of the orbiter vehicle must also undergo static firings under simulated flight conditions, while integrated with the propellant lines and the external tank. To meet these objectives, the proposed modifications to the S-IC test stand are necessary.

The modified facility will be capable of accommodating an essential test program designed to provide system level data concerning total thrust, acoustics, vibration, propellant inflight behaviour and other vital data required in the design and development of the overall propulsion system. In addition, the facility will be used for qualification and acceptance testing necessary to validate the orbiter propulsion system as flight capable. Other capabilities include the ability to evaluate, analyze, and determine solutions for off-nominal flight conditions as well as the development of flight procedures. To achieve these goals, the facility modifications proposed by this project are required.

Program requirements are such that the test program should be initiated in the third quarter of calendar year 1976. To meet this milestone, the facility modifications must be initiated in the first quarter of calendar year 1974, thus requiring FY 1974 resources.

PROJECT DESCRIPTION:

This project will provide for the modifications to the existing S-IC Test Stand, Position B-2, at the Mississippi Test Facility. These modifications are necessary for the developmental and qualification testing of the orbiter propulsion system. The work includes: addition of a liquid hydrogen transfer, distribution and disposal system; related extension of the gaseous hydrogen system; provision for a liquid hydrogen dock at the test stand; modifications to the structural system, such as load frame and access platforms, rehabilitation and modification to the stand mechanical and electrical systems; and modifications and additions to the instrumentation and control systems in the Test Control Center, on the stand, and in the Data Acquisition Facility.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---

	Unit of Measure	Quantity	Unit Cost	Total Cost
Construction				$8,700,000
Modification to S-IC Test Stand, Position B-2	LS	---	---	2,400,000
Mechanical systems	LS	---	---	(1,300,000)
Structural systems	LS	---	---	(800,000)
Electrical systems	LS	---	---	(300,000)
Construction of LH_2 dock	LS	---	---	600,000
Construction of LH_2 transfer and disposal system	LS	---	---	3,900,000
Extension of the gaseous hydrogen system	LS	---	---	1,800,000
Equipment				2,600,000
Instrumentation and control systems	LS	---	---	2,600,000
On-stand instrumentation control system	LS	---	---	(1,716,000)
Test control center	LS	---	---	(780,000)
Data acquisition facility	LS	---	---	(104,000)
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$11,300,000

Additional special non-collateral test equipment which is closely related and "sensitive" to the orbiter vehicle configuration will be funded from the Research and Development appropriation. The cost of this equipment and its integration and checkout within the facility is estimated to be approximately $2.0 to $3.0 million.

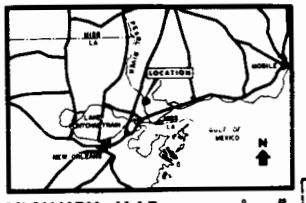
FUTURE CoF ESTIMATED FUNDING TO COMPLETE THIS PROJECT:

For presently planned use, there are no currently foreseen future funding requirements necessary to complete this project. However, should it later become necessary to provide facility capability for engine throttling tests, a requirement which has not now been validated, and additional $1 to $2 million would be required for this purpose.

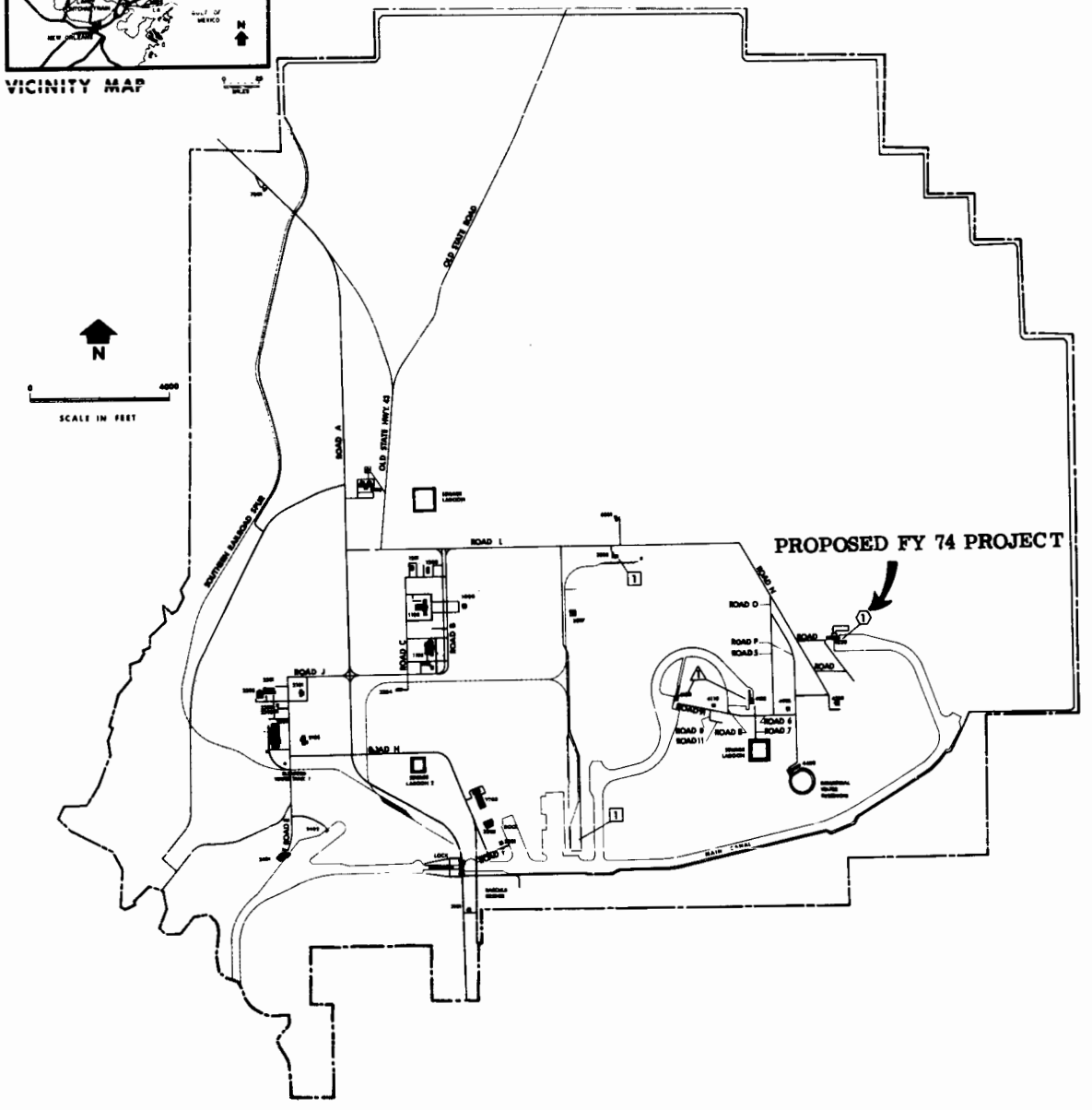
MISSISSIPPI TEST FACILITY

FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



VICINITY MAP



LEGEND

● EXISTING FACILITIES

1000	DATA HANDLING CENTER
1100	LAB AND ENGINEERING BUILDING
1105	ELECTRONICS, INSTRUMENTATION & MATERIALS LAB
1110	ACOUSTICS BUILDING
1200	TEST AREA CONTROL CENTER
1201	TELEPHONE BUILDING
2101	EMERGENCY SERVICE BUILDING
2105	MOBILE EQUIPMENT OPERATIONS BUILDING
2201	SITE MAINTENANCE BUILDING
2202	COMPRESSED GAS CYLINDER STORAGE BUILDING
2203	INFLAMMABLE MATERIALS STORAGE BUILDING
2204	WAREHOUSE
2205	TEST MAINTENANCE BUILDING
2401	CONSTRUCTION DOCK
2402	RP-1 TRANSFER DOCK
3101	SECURITY CONTROL CENTER (SOUTH)
3201	CRYOGENICS BARGE SERVICE BUILDING
3202	S-IC STAGE STORAGE BUILDING
3203	S-II STAGE CHECKOUT AND STORAGE FACILITY
3204	CENTRAL HEATING PLANT
3205	CENTRAL COMPRESSOR BUILDING
3207	RP-1 CENTRAL STORAGE
4110	S-II CONTROL CENTER
4120	S-II TEST STAND (SECOND)
4122	S-II TEST STAND (FIRST)
4210	S-IC TEST CONTROL CENTER
4220	S-IC TEST STAND (FIRST POSITION 220-B)
4221	S-IC TEST STAND (SECOND POSITION 220-A)
4400	HIGH PRESSURE INDUSTRIAL WATER PUMPING STATION
4985	DATA ACQUISITION CENTER
2317	BASCULE BRIDGE
4325	INDUSTRIAL WATER RESERVOIR
2310	NAVARATION LOCK
2404	ELEVATED WATER TANK No.1
3207	SEWAGE LAGOONS
	RAILROADS
	DOCK
7001	SECURITY CONTROL CENTER (NORTH)
8100	COMPONENTS SERVICE FACILITIES
8201	METEOROLOGICAL BUILDING

SPACE SHUTTLE FACILITIES

△ **FY 72/73 CONSTRUCTION**

1. Orbiter Main Engine Sea Level Test Stands

□ **FY 73 AUTHORIZED PROJECT**

1. Rehabilitation of Propellant and High Pressure Gaseous Systems

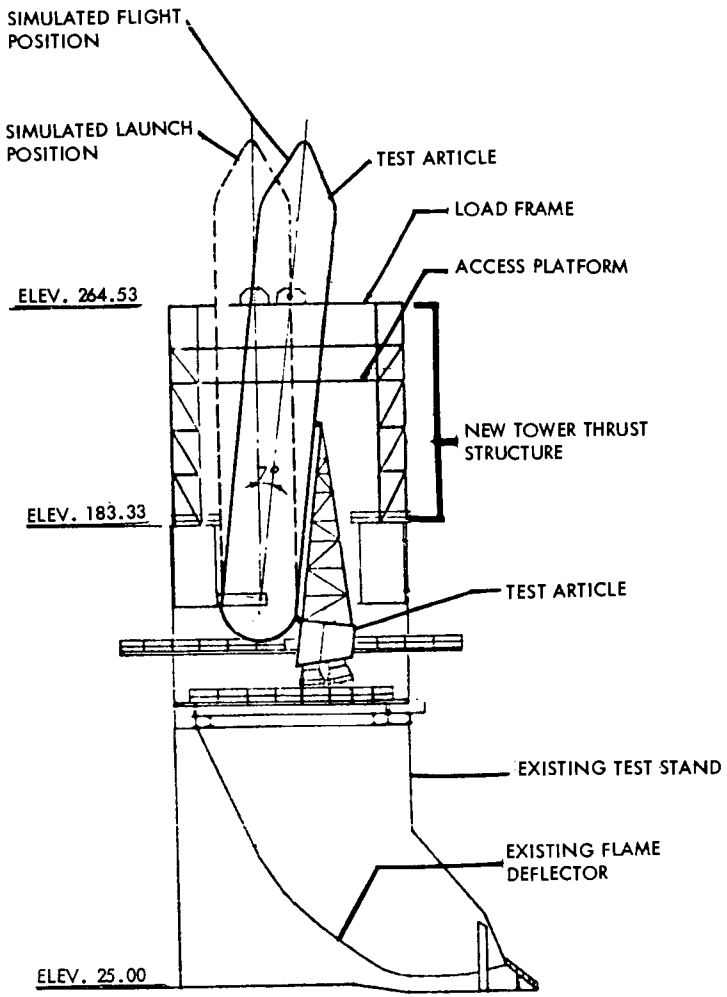
○ **FY 74 PROPOSED PROJECT**

1. Modifications for the Orbiter Propulsion System Test Facilities

MISSISSIPPI TEST FACILITY

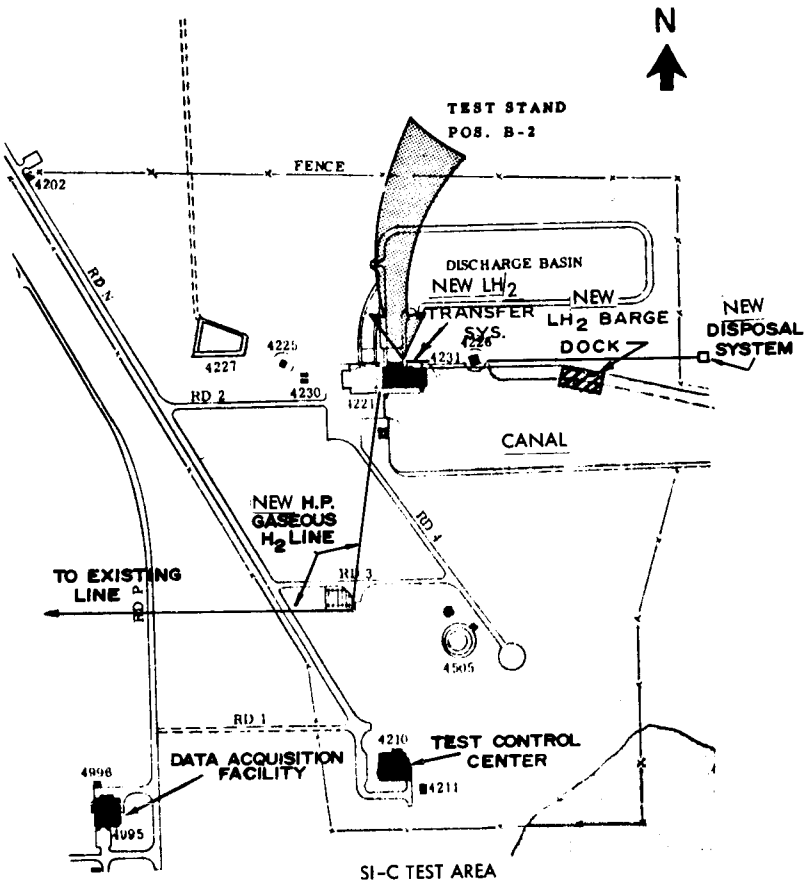
FISCAL YEAR 1974 ESTIMATES

MODIFICATIONS FOR THE ORBITER PROPULSION SYSTEM TEST FACILITIES



EAST ELEVATION SI-C TEST POS. B-2

30 0 15 30 60
FEET



SITE PLAN

0 200 400 800
FEET

CF 6-28

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modifications for External Tank Structural Test Facilities
LOCATION	Marshall Space Flight Center
	FY 1974 CoF ESTIMATE $4,400,000

COGNIZANT INSTALLATION: Marshall Space Flight Center

LOCATION OF PROJECT: Huntsville, Madison County, Alabama

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$350,000
Construction	17,400,000
Total FY 1973 and Prior Years	$17,750,000

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to modify the existing S-1C test facilities at the Marshall Space Flight Center (MSFC) to provide capability for structural testing of the liquid hydrogen tank portion of the shuttle external tank. The liquid oxygen tank and the intertank components, that comprise the remainder of the external tank, will be tested in existing MSFC facilities that do not require facility modifications for the required functions. The proposed capability is determined essential to support the design, development, and verification of the structural integrity of the external tank.

PROJECT JUSTIFICATION:

The Space Shuttle vehicle is comprised of two solid rocket boosters and the orbiter, all attached to the external tank. The tank, which provides the propellants to the orbiter main engines, basically consists of three major components: a liquid hydrogen tank, a liquid oxygen tank, and an intertank structure between these two tanks. The purpose of the intertank is to connect the liquid hydrogen and liquid oxygen tanks, house the external tank avionics equipment and provide for transferring the thrust load from the shuttle propulsion system.

The selected shuttle configuration imposes great static loading on the external tank from the time the three shuttle elements are mated in the Vehicle Assembly Building, through the "rollout" to the pad and especially during the launch phase of each mission. These static loads are compounded by the aerodynamic forces and bending moments that act on the vehicle in the ascent phase of the mission until the external tank is separated from the orbiter vehicle, just after orbit is achieved.

The ability of the external tank to withstand these great forces, coupled with the stringent requirement of minimum weight, dictates the need for a ground structural test program for all the critical components of the shuttle vehicle. Fiscal year 1973 resources provided for modification of the Structures and Mechanics Laboratory, Building 4619 at MSFC to accommodate the testing of shuttle major segments. The facility, without further modifications, will also be used for the structural testing of the liquid oxygen tank and intertank structure. The liquid hydrogen tank, because of its size (approximate 26 foot diameter x 113 foot length) and the hazardous operation involved, requires a very large test facility with a location suitable for the hazardous activities. The S-1C test facility at MSFC, which was previously used for testing a booster having approximately the same size of this tank, can, with certain modifications, provide the needed capability. This project will provide the required modifications for that purpose.

Present Space Shuttle program planning is currently based on achieving a first manned orbital flight by the end of calendar year 1978. To achieve this major milestone, the external tank structural test program must start by late calendar year 1975. The modification and activation work to achieve operable facilities for those functions is estimated to require approximately two years. Correspondingly, this facility work must be initiated in late calendar year 1973 to meet program requirements. This dictates that fiscal year 1974 Construction of Facilities resources be available for that purpose.

PROJECT DESCRIPTION:

This project provides for modifications to the existing S-1C Static Test Facility, Building 4670, the Test Control Center, Building 4674 and support systems required to conduct the structural test program for the liquid hydrogen part of the shuttle external tank. The work includes: relocation of the existing flame deflector, augmenting the adjacent liquid hydrogen storage capability, installation of liquid hydrogen transfer and disposal systems, modification and rehabilitation of the facility high pressure gaseous and water systems, modification to the service platforms and structural members, and modifications and extension of the electrical and mechanical utilities. A forced air pressurization system required to preclude contamination of tower service areas from hydrogen gas will be installed. Procurement and installation of hydrogen instrumentation and control systems in the test control center and on the stand will also be provided.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$3,800,000
S-1C test facility	LS	---	---	2,530,000
Structural systems	LS	---	---	(1,920,000)
Mechanical systems	LS	---	---	(490,000)
Electrical systems	LS	---	---	(120,000)
Liquid hydrogen storage, transfer and disposal systems	LS	---	---	1,150,000
Test stand pressurization system	LS	---	---	120,000
Equipment				600,000
Test stand instrumentation and control systems	LS	---	---	470,000
Test control center instrumentation and control systems	LS	---	---	130,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$4,400,000

This project provides for all facilities and collateral equipment including the cost of relocation and installation of existing liquid hydrogen vessels valued at approximately $0.8 million. Related non-collateral equipment including interface piping, ground support equipment, force application fixtures, strain gauges, sensors and related equipment that is sensitive to the test article will be funded from the Research and Development appropriation. The cost of this equipment is approximately $5-6 million.

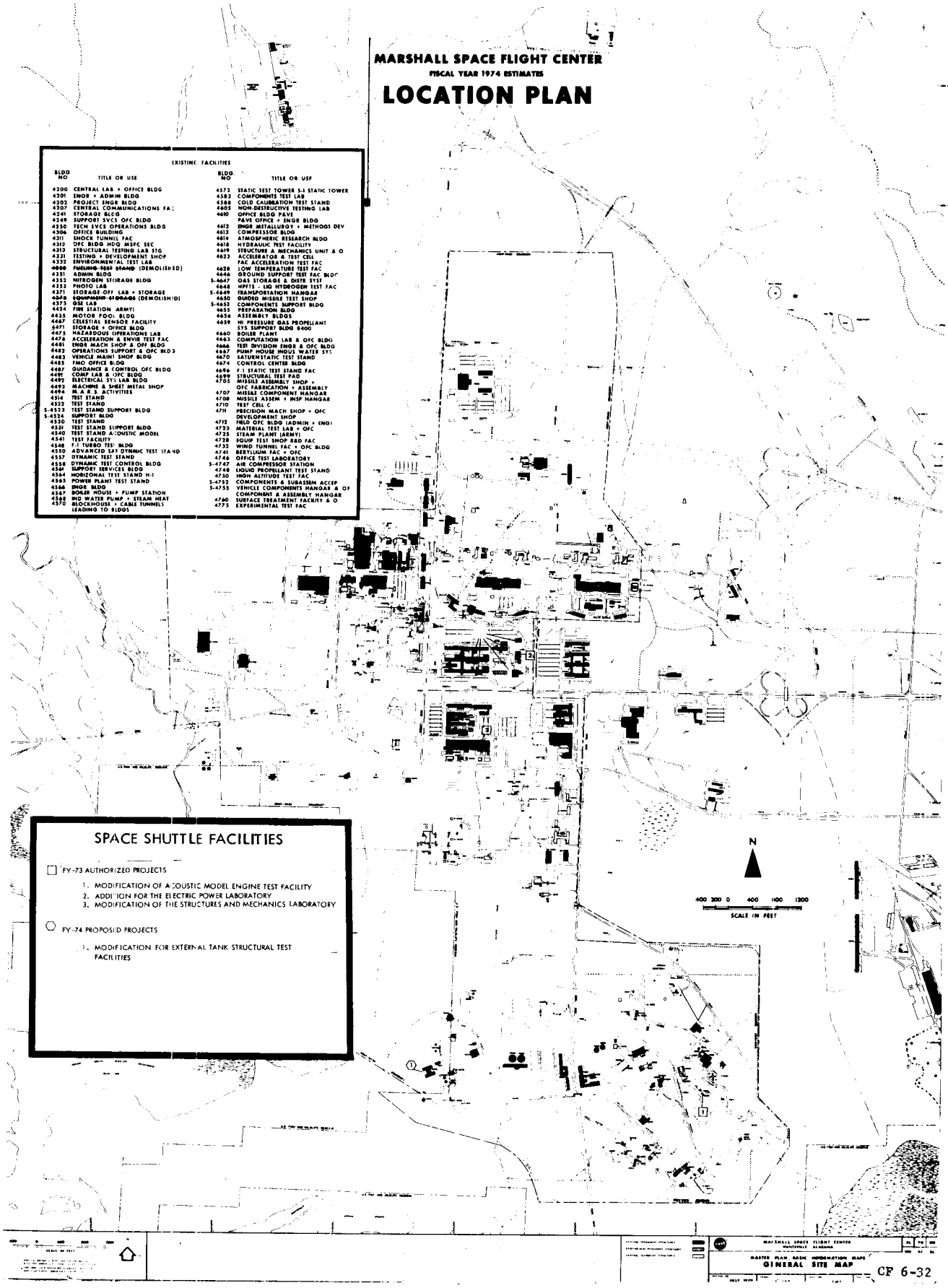
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

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

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



EXISTING FACILITIES

BLDG NO	TITLE OR USE
4200	CENTRAL LAB + OFFICE BLDG
4201	ENGR + ADMIN BLDG
4202	PROJECT ENGR BLDG
4207	CENTRAL COMMUNICATIONS FAC
4241	STORAGE BLDG
4249	SUPPORT SVCS OFC BLDG
4250	TECH SVCS OPERATIONS BLDG
4306	OFFICE BUILDING
4311	SHOCK TUNNEL FAC
4312	OFC BLDG HDQ MSFC SEC
4313	STRUCTURAL TESTING LAB STG
4331	TESTING + DEVELOPMENT SHOP
4332	ENVIRONMENTAL TEST LAB
~~4090~~	~~FUELING TEST STAND~~ (DEMOLISHED)
4351	ADMIN BLDG
4352	NITROGEN STORAGE BLDG
4353	PHOTO LAB
4371	STORAGE-OFF LAB + STORAGE
~~4349~~	~~COMPONENT STORAGE~~ (DEMOLISHED)
4373	GSE LAB
4424	FIRE STATION ARMY)
4425	MOTOR POOL BLDG
4447	CELESTIAL SENSOR FACILITY
4471	STORAGE + OFFICE BLDG
4475	HAZARDOUS OPERATIONS LAB
4476	ACCELERATION & ENVIR TEST FAC
4481	ENGR MACH SHOP & OFF BLDG
4482	OPERATIONS SUPPORT & OFC BLDG
4483	VEHICLE MAINT SHOP BLDG
4485	TNO OFFICE BLDG
4487	GUIDANCE & CONTROL OFC BLDG
4491	COMP LAB & OFC BLDG
4492	ELECTRICAL SYS LAB BLDG
4493	MACHINE & SHEET METAL SHOP
4494	M.A.R.S. ACTIVITIES
4514	TEST STAND
4522	TEST STAND
S-4523	TEST STAND SUPPORT BLDG
S-4524	SUPPORT BLDG
4530	TEST STAND
4531	TEST STAND SUPPORT BLDG
4540	TEST STAND ACOUSTIC MODEL
4541	TEST FACILITY
4548	F-1 TURBO TEST BLDG
4550	ADVANCED SAT DYNMIC TEST STAND
4557	DYNAMIC TEST STAND
4558	DYNAMIC TEST CONTROL BLDG
4560	SUPPORT SERVICES BLDG
4564	HORIZONAL TEST STAND H-1
4565	POWER PLANT TEST STAND
4566	ENGR BLDG
4567	BOILER HOUSE + PUMP STATION
4568	IND WATER PUMP + STEAM HEAT
4570	BLOCKHOUSE + CABLE TUNNELS LEADING TO BLDGS
4572	STATIC TEST TOWER S-II STATIC TOWER
4583	COMPONENTS TEST LAB
4588	COLD CALIBRATION TEST STAND
4605	NON-DESTRUCTIVE TESTING LAB
4610	OFFICE BLDG PAVE
	PAVE OFFICE + ENGR BLDG
4612	ENGR METALLURGY + METHODS DEV
4613	COMPRESSOR BLDG
4614	ATMOSPHERIC RESEARCH BLDG
4618	HYDRAULIC TEST FACILITY
4619	STRUCTURE & MECHANICS UNIT & O
4623	ACCELERATOR & TEST CELL
	FAC ACCELERATION TEST FAC
4628	LOW TEMPERATURE TEST FAC
4646	GROUND SUPPORT TEST FAC BLDG
S-4647	GAS STORAGE & DISTR SYST
4648	HPFTS - LIQ HYDROGEN TEST FAC
S-4649	TRANSPORTATION HANGAR
4650	GUIDED MISSILE TEST SHOP
S-4653	COMPONENTS SUPPORT BLDG
4655	PREPARATION BLDG
4656	ASSEMBLY BLDGS
4659	HI PRESSURE GAS PROPELLANT SYS SUPPORT BLDG 4600
4660	BOILER PLANT
4663	COMPUTATION LAB & OFC BLDG
4666	TEST DIVISION ENGR & OFC BLDG
4667	PUMP HOUSE INDUS WATER SYS
4670	SATURNSTATIC TEST STAND
4674	CONTROL CENTER BLDG
4696	F-1 STATIC TEST STAND FAC
4699	STRUCTURAL TEST PAD
4705	MISSILE ASSEMBLY SHOP + OFC FABRICATION + ASSEMBLY
4707	MISSILE COMPONENT HANGAR
4708	MISSILE ASSEM + INSP HANGAR
4710	TEST CELL C
4711	PRECISION MACH SHOP + OFC DEVELOPMENT SHOP
4712	FIELD OFC BLDG (ADMIN + ENG)
4723	MATERIAL TEST LAB + OFC
4725	STEAM PLANT (ARMY)
4728	EQUIP TEST SHOP R&D FAC
4732	WIND TUNNEL FAC + OFC BLDG
4741	BERTLLIUM FAC + OFC
4746	OFFICE TEST LABORATORY
S-4747	AIR COMPRESSOR STATION
4748	LIQUID PROPELLANT TEST STAND
4750	HIGH ALTITUDE TEST FAC
S-4752	COMPONENTS & SUBASSEM ACCEP
S-4755	VEHICLE COMPONENTS HANGAR & OF
	COMPONENT & ASSEMBLY HANGAR
4760	SURFACE TREATMENT FACILITY & O
4775	EXPERIMENTAL TEST FAC

SPACE SHUTTLE FACILITIES

☐ FY-73 AUTHORIZED PROJECTS

1. MODIFICATION OF ACOUSTIC MODEL ENGINE TEST FACILITY
2. ADDITION FOR THE ELECTRIC POWER LABORATORY
3. MODIFICATION OF THE STRUCTURES AND MECHANICS LABORATORY

○ FY-74 PROPOSED PROJECTS

1. MODIFICATION FOR EXTERNAL TANK STRUCTURAL TEST FACILITIES

N

400 200 0 400 800 1200

SCALE IN FEET

MARSHALL SPACE FLIGHT CENTER HUNTSVILLE ALABAMA

MASTER PLAN BASIC INFORMATION MAPS

GENERAL SITE MAP

CF 6-32

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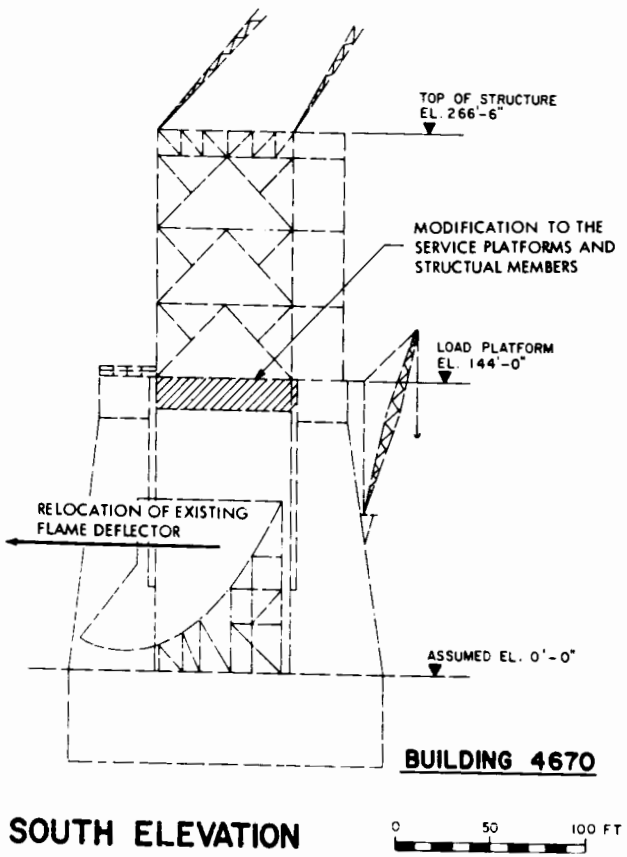
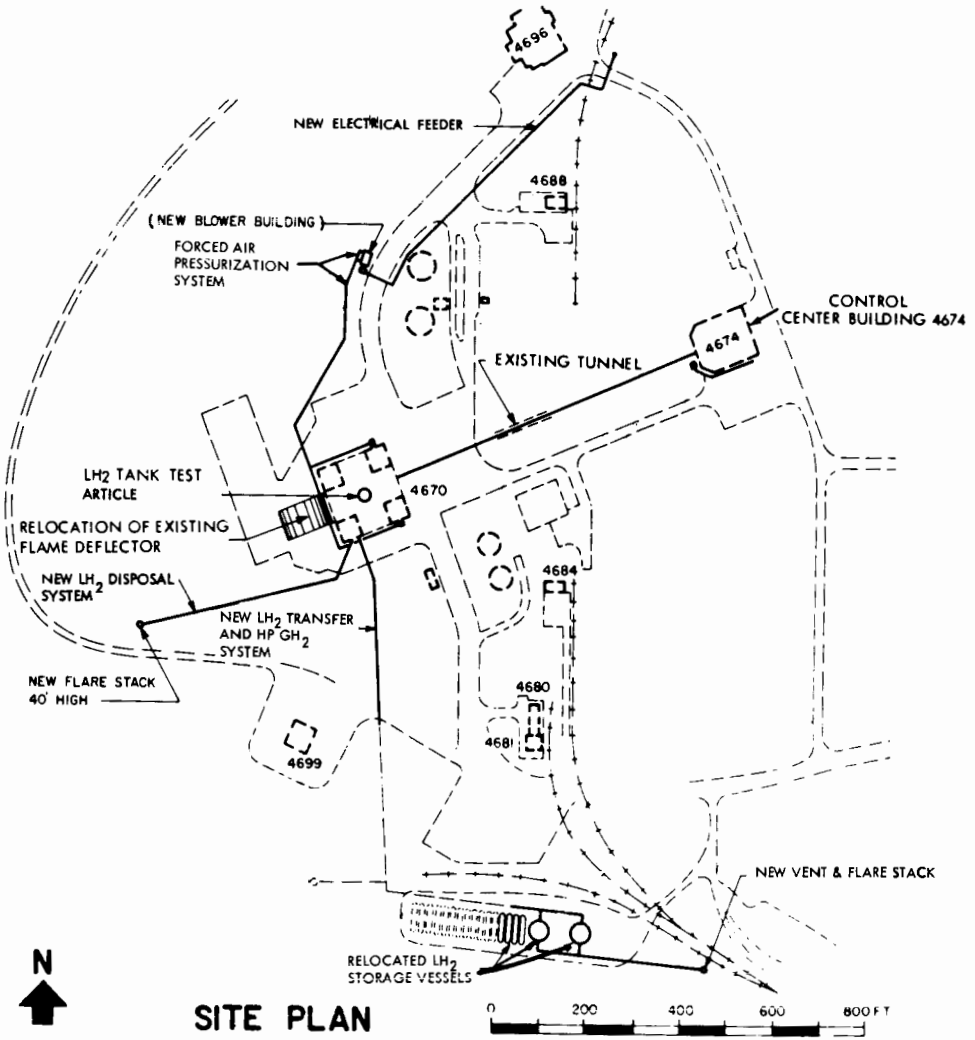
MARSHALL SPACE FLIGHT CENTER
Fiscal Year 1974 Estimates

MODIFICATIONS FOR EXTERNAL TANK STRUCTURAL TEST FACILITIES



SOUTH ELEVATION

0 50 100 FT



SITE PLAN

0 200 400 600 800 FT

CF 6-33

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modification of Manufacturing and Subassembly Facilities for the Orbiter
LOCATION	NASA Industrial Plant, Downey
	FY 1974 CoF ESTIMATE $2,650,000

COGNIZANT INSTALLATION: Manned Spacecraft Center

LOCATION OF PROJECT: Downey, Los Angeles County, California

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$590,000
Construction	38,800,000
Total FY 1973 and Prior Years	$39,390,000

SUMMARY PURPOSE AND SCOPE:

This project is a continuation and extension of the FY 1973 increment which provided for the modifications and alterations to existing government facilities located at NASA Industrial Plant, Downey, California, and is required for the engineering, program management and production of the crew module, and the aft and forward fuselage of the orbiter vehicle. The facilities to be modified in this project are the Manufacturing Building, Chemical Processing Facility, Space System Development Laboratory, Crew Module Testing Building and Systems Installation and Checkout Building. This will complete the facility modification work in support of the orbiter at Downey, with the exception of certain recurrent normal rehabilitation and modification of facilities that may be included in future construction of facilities programs.

PROJECT JUSTIFICATION:

The NASA Industrial Plant, Downey, California, has been selected because of its location and existing capabilities as the site for accommodating

the engineering, program management, manufacturing and assembly of the orbiter forward and aft fuselages and orbiter component testing functions in support of the Space Shuttle program. The orbiter components will then be transported to Palmdale, California, for final assembly and check-out of the orbiter vehicle. To perform the significant tasks that will be done at Downey, certain modifications of the existing plant will be necessary.

Orbiter component fabrication, subassembly, system development, and test will be extensive since the orbiter will be a reusable man-rated vehicle that will operate both in the atmosphere and in the stringent environment of space. Thousands of detailed operations must be performed and verified before the orbiter is released for final assembly and flight. Most of the subassemblies and components, including skin sections, control surfaces, avionics components, engine mounts, tubing and valving, will be chemically pretreated, milled, etched, fitted, and heat-treated; tested in hot, cold, vibratory, acoustic, toxic, and shock environments; and subassembled in these facilities. The specific configurations of various components, the special propellants used, as well as the simulated flight environments, require specially configured facilities equipped to perform all the required operations. These facilities can be economically provided by modifying the existing facilities at the Downey Plant, which has been used for comparable purposes in the past. Therefore, this project is necessary to provide for these modifications.

FY 1973 resources were necessary to start modification work on those elements of the proposed work at Downey requiring long-lead construction time and those initially required to support the fabrication of the first test article. This project is a continuation and extension of the FY 1973 increment providing additional modifications to the Downey facilities necessary to complete manufacturing and systems development and test capabilities. The facilities to be modified in this project are the Manufacturing Building, Chemical Processing Facility, Space System Development Laboratory, Crew Module Testing Building and Systems Installation and Checkout Building.

Current space shuttle planning is based upon achieving the first horizontal flight test in the first quarter of calendar year 1977. To achieve this major program milestone, manufacturing of the orbiter structural test article must start by the second quarter of calendar year 1974. Considering the construction and activation lead time this will require the start of facility modification in the first quarter of calendar year 1973 and a completion by late calendar year 1974 to meet program requirements. Consequently, fiscal year 1973 resources were required to initiate the work and fiscal year 1974 funds are required to continue and complete the necessary modifications.

PROJECT DESCRIPTION:

This project consists of modification of existing facilities at the NASA Industrial Plant, Downey, coupled with the work initiated in fiscal year

1973, to provide capability for performing the shuttle engineering and program management, and the manufacturing, assembly and test functions in support of the orbiter vehicle. The work includes:

Manufacturing Building, Building 001 - The FY 1973 project provided operable work stations especially tailored to the geometry, weight and other characteristics required for the production of the crew module, forward and aft fuselages. The stations included sheet metal fabrication, parts machining, and the subassembly area. The FY 1974 increment will provide for the tube forming and the structural subassembly work stations, and for replacement of obsolete cooling and heating units located in the engineering area which have exceeded their useful life. The environmental system will be connected to the existing central heating and cooling plant.

Chemical Processing Facility, Building 244/277 - This complex will be rehabilitated for use as a chemical processing facility for orbiter components. Major items of work include procurement and installation of air handling units for exhaust, fume control, and make-up air supplies; installation of approximately 60 new chemical tanks; installation of an electrical power distribution system, internal renovation and space rearrangement, and miscellaneous utility rehabilitation.

Space System Development Laboratory, Building 288 - The development laboratories in this building will be upgraded to support structural, climatic, dynamic, acoustic and thermal vacuum testing of the orbiter components and subsystems. The modification work includes providing a data acquisition area, a hydraulic pump, and a gaseous nitrogen and liquid hydrogen system. The existing electrical power, chilled water and vacuum system will also be upgraded. The fiscal year 1973 project provided for the modification work related to specific laboratories required early in the development program. This project will complete the modification work in this building, which includes providing a thermal vacuum test capability and upgrading the existing Mechanical and Fluid Component Test Laboratory.

Crew Module Testing Building, Building 260 - This facility will be modified to provide the capability to conduct pneumatic testing on the crew module. The existing underground 25 foot deep test cell will be lengthened 12 feet to accommodate the crew module. A new access stairway and airlock will also be provided.

Systems Installation and Checkout Building, Building 290 - The installation and checkout of electrical, electronic and fluid systems in the orbiter crew module, aft fuselage and forward fuselage will be performed in this building.

A new air and ventilation system must be installed to assure that adequate oxygen content and proper ventilation exist in the areas where nitrogen gas is being discharged from the purging activities related to the system installation functions. Air pollution control equipment will also be installed in the touch-up paint area.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$2,650,000
Modification and rehabilitation of Manufacturing Building 001	LS	---	---	1,135,000
Modification of the chemical processing facility, Buildings 244/277	LS	---	---	900,000
Modification of the space system development laboratory, Building 288	LS	---	---	320,000
Modification of the crew module testing building, Building 260	LS	---	---	115,000
Modification of the systems installation and checkout building, Building 290	LS	---	---	180,000
Equipment	---	---	---	---
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$2,650,000

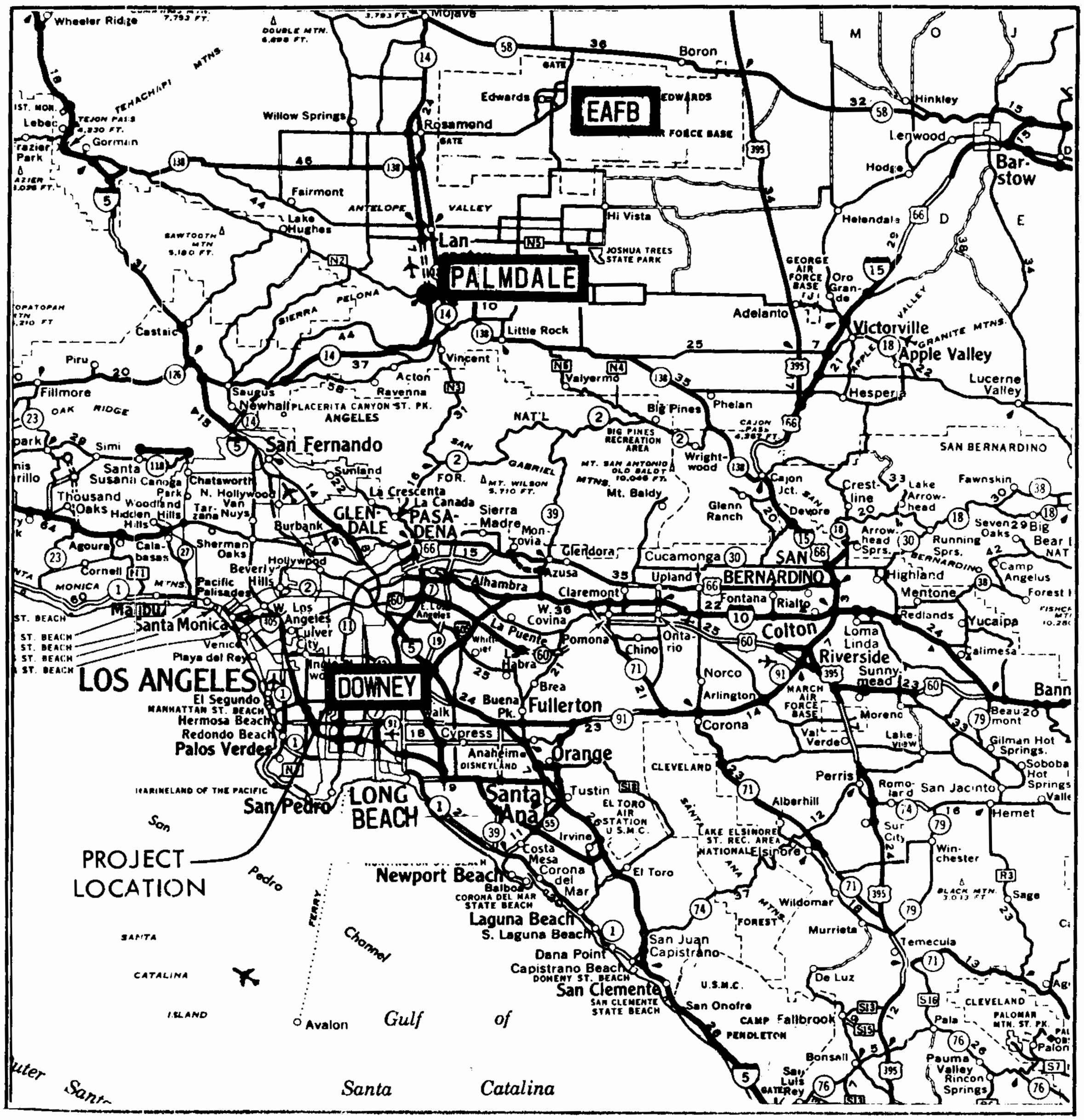
This project completes facility modifications, including related collateral equipment, required to provide capability for assembling the orbiter's crew module, forward and aft fuselages. Non-collateral equipment, estimated to cost approximately $3 million and required for initial operations will be funded from the Research and Development appropriation. In the manufacturing and assembly operations, special tooling that is unique to the development vehicle and is not affixed to the facility, would be procured with the hardware itself and will, therefore, also be funded from the Research and Development appropriation. It is intended, however, to make maximum use of the existing Apollo tooling, with modifications, whenever necessary.

FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

Certain rehabilitation and upgrading work currently estimated in the order of $1-2 million will probably be required at a later date and, consequently, may be included in future CoF programs.

MODIFICATION OF MANUFACTURING AND SUB-ASSEMBLY FACILITIES FOR THE ORBITER

NASA INDUSTRIAL PLANT, DOWNEY, CALIFORNIA

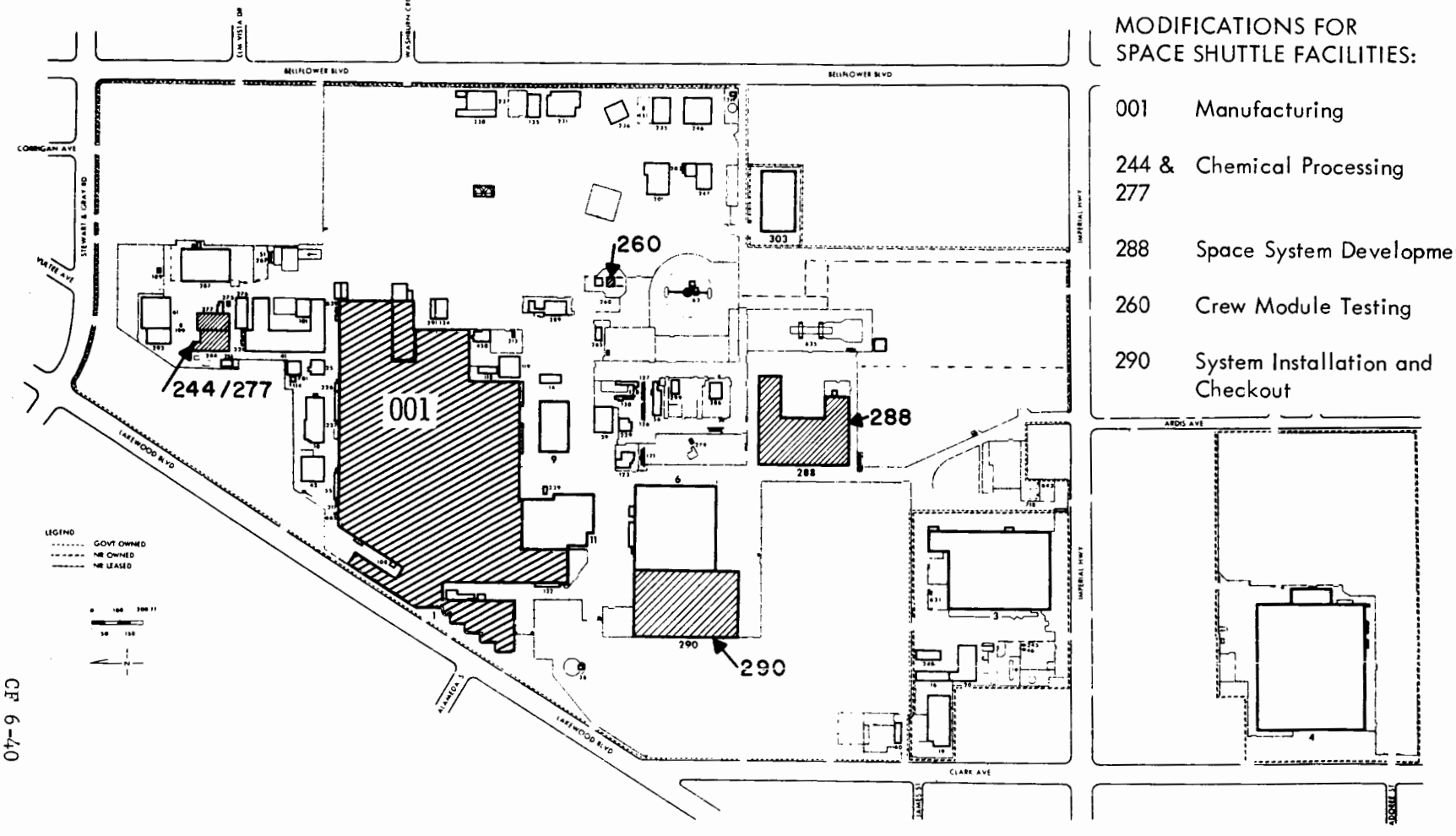


VICINITY MAP

MANNED SPACECRAFT CENTER
FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF MANUFACTURING AND SUBASSEMBLY FACILITIES FOR THE ORBITER

NASA INDUSTRIAL PLANT, DOWNEY, CAL.



MODIFICATIONS FOR SPACE SHUTTLE FACILITIES:

001	Manufacturing
244 & 277	Chemical Processing
288	Space System Development
260	Crew Module Testing
290	System Installation and Checkout

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CF 6-40

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE: Modification of and Addition to Final Assembly and Checkout Facilities for the Orbiter

LOCATION: Air Force Plant #42

FY 1974 CoF ESTIMATE $7,350,000

COGNIZANT INSTALLATION: Manned Spacecraft Center

LOCATION OF PROJECT: Palmdale, Los Angeles County, California

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$526,000
Construction	*
Total FY 1973 and Prior Years	$526,000

*This facility is owned by the United States Air Force.

SUMMARY PURPOSE AND SCOPE:

This project provides for modifications and additions to the Flight Production Test Facility, Building 294, at Air Force Plant #42, Palmdale, California. This work is needed to accommodate the subassembly of major sections and final assembly and checkout of the Space Shuttle Orbiter.

PROJECT JUSTIFICATION:

This project is required to provide the capability for final assembly and integrated checkout of the orbiter vehicle. Air Force Plant #42 was selected as the optimum site for these functions because of its proximity to the program management, engineering, and the component manufacturing operation of the prime contractor at Downey, California; its accessibility to a 12,000 foot runway; and its proximity to Edwards Air Force Base which is presently a candidate site for the orbiter horizontal flight test program.

Current Space Shuttle program development schedules require the start of the horizontal flight test program in the first quarter of calendar year 1977. To achieve this major program milestone, the final assembly of the orbiter structural

test article must start in the second quarter of calendar year 1975. This requires that the final assembly and checkout facilities be operationally ready by this date, making fiscal year 1974 resources necessary.

The Flight Production Test Facility, Building 294, has previously served as a flight test hangar in support of high performance jet aircraft production. It will, therefore, require major modifications and expansion to accommodate the final assembly and checkout functions for the orbiter. The 20,000 square foot by 68 foot high bay proposed addition to this building is necessary to provide space required for one final assembly position and one final checkout position. The 68 foot height is dictated by the need to accommodate the assembly of the vertical stabilizer which is now estimated to be 56 feet high. The additional clearance is needed to permit lifting and positioning of the vertical stabilizer by the overhead bridge crane. The remaining modifications and additions are essential to support the major assembly and prefinal assembly staging operations for the wings, elevons, and mid-fuselage; to house the automatic checkout equipment (ACE) and telemetry stations; and to provide the necessary support areas for the cited operations.

PROJECT DESCRIPTION:

This project provides for the following modifications and additions to Building 294 to accommodate the final assembly and checkout of the Space Shuttle orbiter vehicle.

a. High Bay Area: A 20,000 square foot, 68 foot clear height addition to the north end of the existing high bay area will be constructed. This 100 foot by 200 foot extension will be provided with a bridge crane, and with a 200 foot wide by 68 foot high motorized sliding door. This extension will be provided with the required utilities, air, vacuum, nitrogen and helium systems. The existing high bay area will be modified by providing additional utility trenches, relocating partitions, and changes to mechanical and electrical systems.

b. Support Areas: A 50 foot by 100 foot, three story mezzanine extension, containing 15,000 square feet, will be constructed at the north end of the existing mezzanine area. The existing area will be modified by constructing partitions, installing elevated false flooring, painting, and extending the air conditioning system and other utilities. The total modified area will support such functions as: bench console maintenance and tubing shops; x-ray room; two class 100,000 clean rooms; electrical shop; drawing storage; automatic checkout equipment control and computer rooms; telemetry ground station and administrative space for approximately 150 people. This portion of the facility will be environmentally controlled.

c. Utility Annex: An 8,000 square foot addition to the northeast corner of Building 294 will be constructed to house hot water and steam boilers and air conditioning, vacuum, electrical and emergency power equipment.

d. Adjacent Site: An access roadway approximately 24 feet wide and about 1,100 feet long will be constructed to serve Building 294. Parking areas will be provided for approximately 575 vehicles. Utilities and pavements will also be provided to accommodate approximately 34,000 square feet of contractor furnished temporary modular facilities, to be used to house approximately 260 administrative and engineering personnel. A 6,600 square yard aircraft apron and ramp will be constructed to provide access for the orbiter from Building 294 to the runway. A gaseous storage and transfer area, security fencing and a guardhouse, and the necessary outside utilities are also included.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$6,260,000
Sitework	LS	---	---	364,000
Utilities	LS	---	---	430,000
Asphalt pavement	SY	56,000	$10.50	588,000
Gaseous transfer and storage area	LS	---	---	445,000
Guardhouse	SF	860	18.60	16,000
Modifications to existing building	SF	70,000	16.50	1,155,000
Building additions				3,262,000
High bay area	CF	1,760,000	1.40	(2,464,000)
Mezzanine area	SF	15,000	34.75	(521,000)
Utility annex	SF	8,000	34.60	(277,000)
Equipment				1,090,000
Mechanical equipment	LS	---	---	350,000
Transformer station	LS	---	---	250,000
Standby generators	Each	2	140,000	280,000
Bridge cranes	LS	---	---	210,000
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$7,350,000

The project provides for facility modifications including the related collateral equipment required to provide capability for the final assembly and checkout of the Space Shuttle orbiter vehicle. In the assembly and checkout operations, special tooling such as jigs, fixtures and workstands, will be required which are unique to the development and production of the orbiter vehicle. This tooling will be procured with the hardware itself and will therefore be provided from the Research and Development appropriation. It is planned to make maximum use of existing Apollo tooling and equipment,

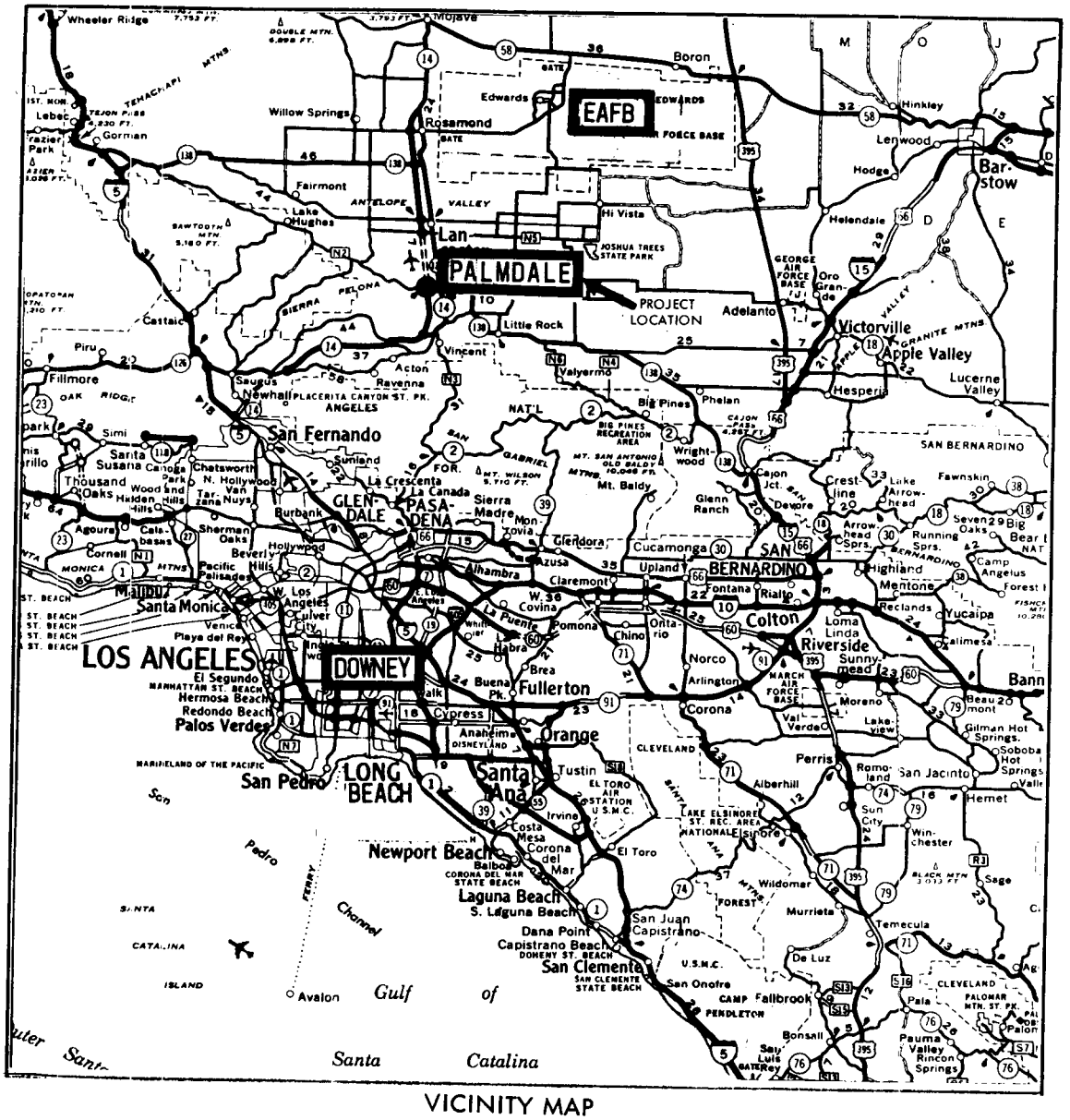
with modifications where necessary. In this respect, the existing automatic checkout equipment which was used for Apollo and valued at approximately $11 million will be relocated and used here for the checkout of the orbiter. New non-collateral special test equipment estimated at $5-6 million will also be required for the initial operation, and will be funded from the Research and Development appropriation.

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 nonprogrammatic rehabilitation/modification work may follow but it is not identified at this time.

VARIOUS LOCATIONS
FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF AND ADDITION TO FINAL ASSEMBLY AND CHECKOUT FACILITIES FOR THE ORBITER AIR FORCE PLANT #42, PALMDALE, CAL.



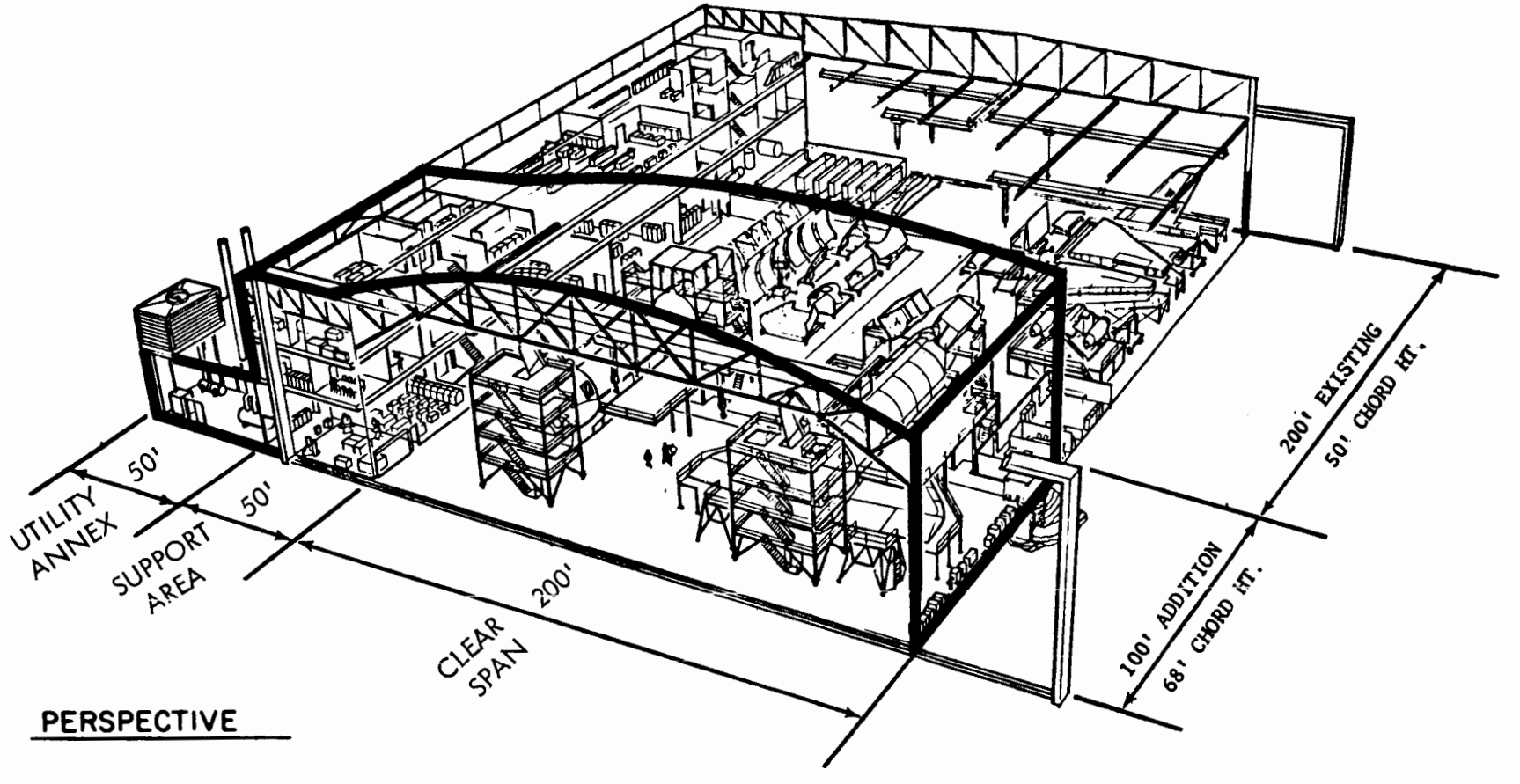
VICINITY MAP

CF 6-45

MANNED SPACECRAFT CENTER
FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF AND ADDITION TO FINAL ASSEMBLY AND CHECKOUT FACILITIES FOR THE ORBITER

AIR FORCE PLANT #42, PALMDALE, CAL.

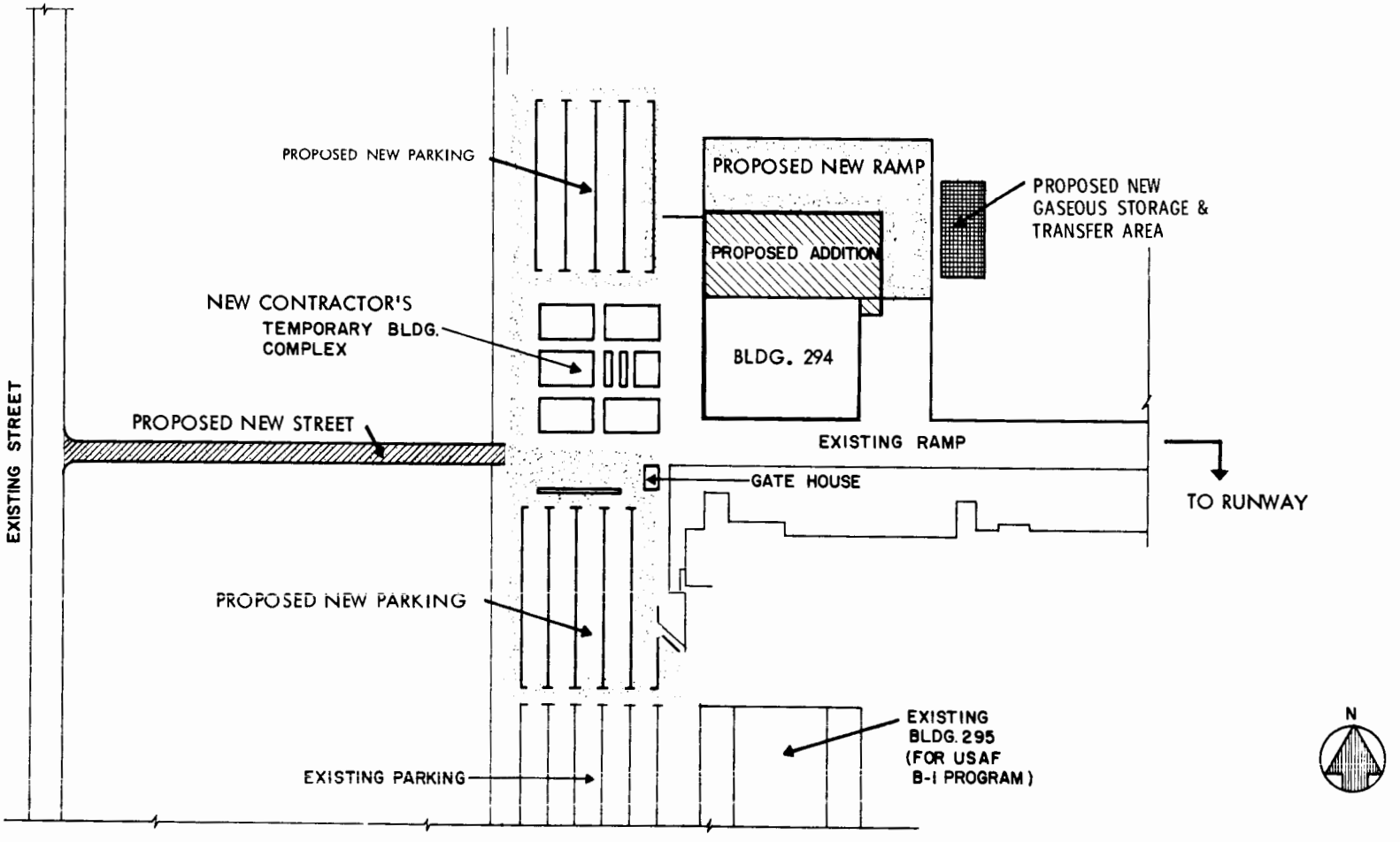


PERSPECTIVE

CF 6-46

MANNED SPACECRAFT CENTER
FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF AND ADDITION TO FINAL ASSEMBLY AND CHECKOUT FACILITIES FOR THE ORBITER AIR FORCE PLANT #42, PALMDALE, CAL.



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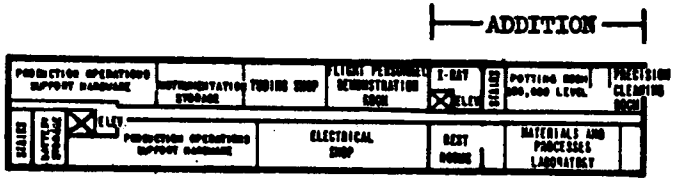
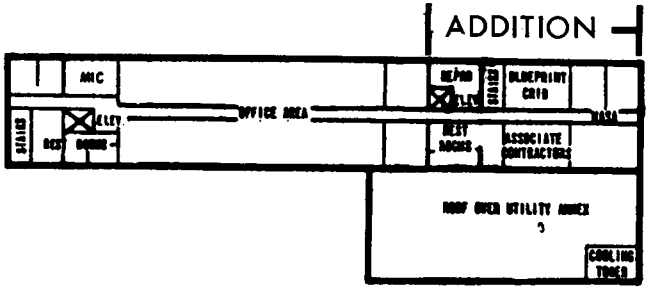
MANNED SPACECRAFT CENTER
FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF AND ADDITION TO FINAL ASSEMBLY AND CHECKOUT FACILITIES FOR THE ORBITER AIR FORCE PLANT #42, PALMDALE, CAL

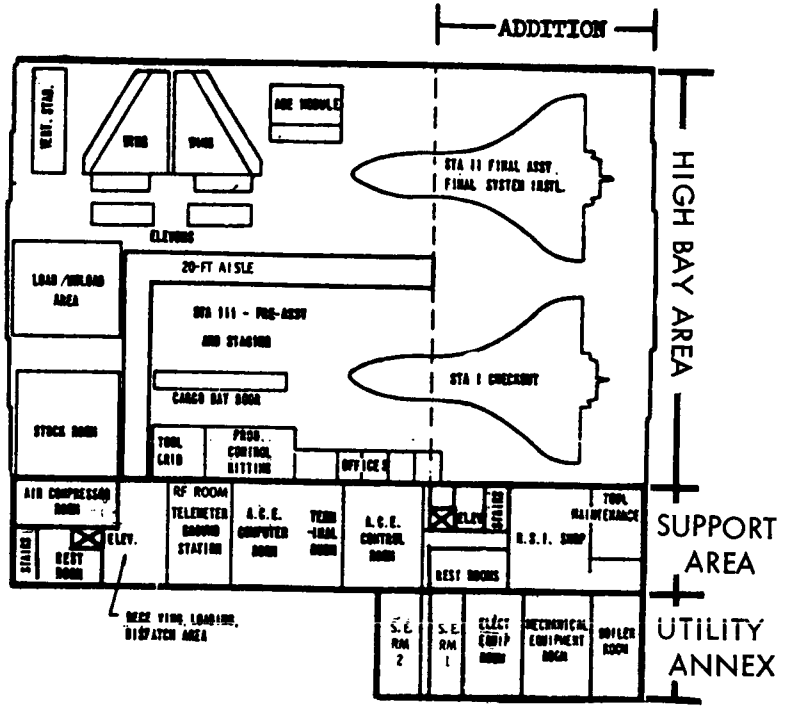
SECOND FLOOR SUPPORT AREA



THIRD FLOOR SUPPORT AREA



FIRST FLOOR



N

FLOOR PLAN

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Modification of Manufacturing and Final Assembly Facilities for External Tanks
LOCATION	Michoud Assembly Facility
	FY 1974 CoF ESTIMATE $9,510,000

COGNIZANT INSTALLATION: Marshall Space Flight Center

LOCATION OF PROJECT: New Orleans, Orleans Parrish, Louisiana

COGNIZANT PROGRAM OFFICE: Office of Manned Space Flight

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$982,000
Construction	162,561,000*
Total FY 1973 and Prior Years	$163,543,000

*Book Value of MAF and planned FY 1973 CoF funding.

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide for modifications and additions to the existing NASA-owned Michoud Assembly Facility (MAF), New Orleans, Louisiana, for the manufacture, final assembly and checkout of the space shuttle liquid hydrogen/liquid oxygen external tanks. This work generally includes modifications and a high bay addition to the main manufacturing building, modifications to the vertical assembly building, a high bay addition to the booster hangar facility and construction of a heat treatment facility.

PROJECT JUSTIFICATION:

The Space Shuttle planning is currently based upon achieving a first manned orbital flight by the end of calendar year 1978. Before this major milestone can be met, the first of the Space Shuttle external tanks must be developed, manufactured, assembled and tested to insure required and reliable performance.

To meet this major task, a fiscal year 1973 project was authorized and appropriated to provide manufacturing space and work stations in support of the early manufacturing operations, including welding and structural subassembly areas as well as modifications and rehabilitation of the plant's air conditioning and overall lighting systems. This proposed fiscal year 1974 facility work is a continuation and extension of the FY 1973 project and is required to provide for fully operable major assembly, final assembly, test and checkout facilities with a capability of producing complete external tanks at the rate of approximately 24-28 per year.

Funding for these facilities is required in the FY 1974 CoF budget to permit sufficient time for facility modifications and construction, tooling arrangement, certification, and activation before the actual starting of the hardware production. Current program schedule requires that manufacturing of the external tank "structural test article" start in mid-calendar year 1974, with final assembly and checkout of this first tank to start by mid-calendar year 1975. Correspondingly, the required assembly facilities must be operationally ready by these dates to support the program requirements now established.

The Michoud Assembly Facility has been selected for the site of the external tank manufacturing and assembly operations because of its acknowledged capabilities for this type of work and its unique location, which includes the needed water transportation capability for these tanks to the launch and landing site. Based on detailed engineering and economic analysis, the Michoud Assembly Facility has been determined to be the optimum site for these operations.

PROJECT DESCRIPTION:

This project provides for a continuation and extension of the work authorized in FY 1973 and is required to provide operable facilities for external tank production at the rate of 24-28 tanks per year. The work includes modifications to the Manufacturing Building 103, a high bay addition between Building 103 and the Vertical Assembly Building 110, modification to Building 110, a high bay addition to the Booster Hangar Facility, Building 303 and upgrading the existing chemical waste well. Specifically, the project provides the following:

1. Modification of approximately 25,000 square feet of the existing chemical processing area, Building 103, to provide operable surface treatment facilities for the external tank skin sections.

2. Construction of a 30,000 square foot x 95 foot high bay addition between Building 103 and Building 110, to provide six final assembly positions for the liquid oxygen tank and six major assembly positions for liquid hydrogen tank.

3. Modification of the Vertical Assembly Building (VAB) to provide one final assembly position for the liquid hydrogen tank and one final assembly position for the complete external tank.

4. Construction of a 6,250 square foot x 135 foot high (clear hook height, 120 feet) and a 4,000 square foot x 80 foot high addition to the Booster Hangar Facility, Building 303, to provide operable stations for application of spray foam insulation to the LH_2 tank and ablative insulation to the LOX tank, respectively. Demolition of the existing lean-to and removal of the rail spur and existing pavement. Additionally, a new paved access will be provided to the new high bay area.

5. Construction of a weather shelter building in front of a new heat treat oven including an access pad, approximately 11,500 square feet, with an installed rail system. The oven is required to heat treat, strengthen the welding joints and properly condition the tank material.

6. Upgrading the existing chemical waste well by installing new screens and gravel bed.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$7,110,000
Modification to Building 103	SF	25,000	$12.20	305,000
High bay addition, Buildings 103/110	CF	2,850,000	1.10	3,135,000
Vertical assembly Building Modifications, Building 110	LS	---	---	915,000
Addition to Building 303	CF	1,163,750	1.70	1,978,000
Construction of heat treatment facility	LS	---	---	190,000
Upgrade chemical waste well	LS	---	---	240,000
Utilities and site work	LS	---	---	347,000
Equipment				$2,400,000
Thermal insulation and ablative insulations	LS	---	---	1,275,000
Heat treatment oven	Each	1	400,000	400,000
Surface treatment	LS	---	---	725,000
Fallout Shelter (Not Feasible)	---	---	---	---
	TOTAL			$9,510,000

The project provides for facility modifications including the related collateral equipment required to provide capability for manufacturing and assembling the external tanks at the rate indicated. Non-collateral plant equipment estimated to cost $4 to $5 million (R&D funded) will be purchased. In the manufacturing and assembly operations, special tooling and other equipment, such as welding jigs, forming and handling fixtures and alignment tools, will also be required. These are unique to the development and production of the external tanks. This non-collateral equipment and tooling will largely be procured with the hardware itself and will therefore be provided from Research and Development appropriation. It is planned to make maximum use of existing Apollo tooling, with modifications as required.

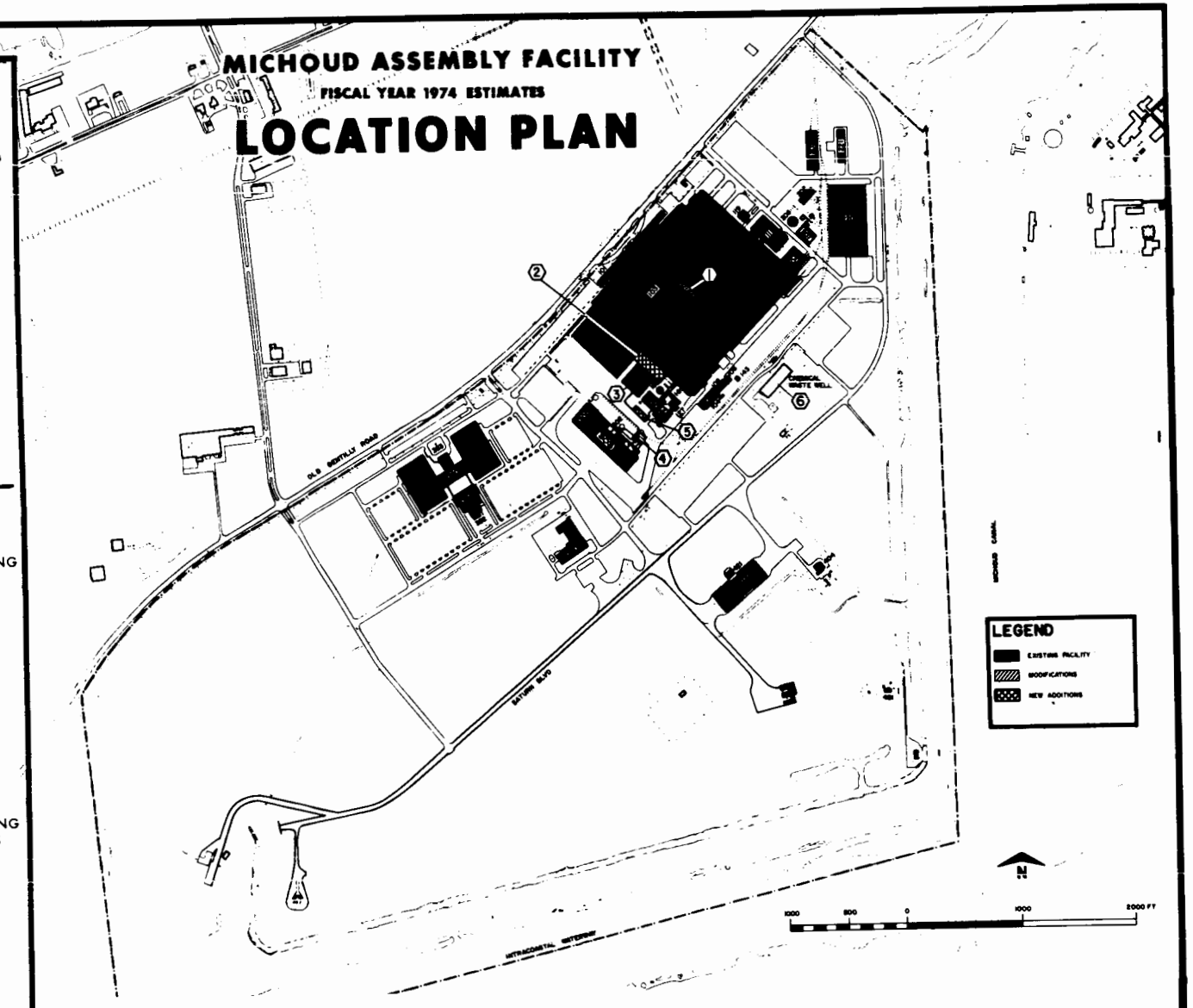
FUTURE CoF ESTIMATED FUNDING TO COMPLETE THIS PROJECT:

It is estimated that $3 to $4 million will be required in a future CoF program to complete this project if it becomes necessary to increase the tank production rate indicated. These CoF resources would be used to provide additional final assembly and checkout positions in Building 110 and 420, respectively, capable of achieving production at a rate of about 50-60 tanks/year. Additional stations for application of insulation, modifications to the marine dock and access roadway and possibly additional storage space for the completed tanks may also be required for this added production.

MICHOUD ASSEMBLY FACILITY

FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN



BLDG NO.	EXISTING FACILITIES TITLE OR USE
101	ADMINISTRATION BLDG.
102	ENGINEERING BLDG.
103	MANUFACTURING BLDG.
104	BATTERY CHARGING & STORAGE BLDG
105	GARAGE BLDG.
110	VERTICAL ASSEMBLY BLDG.
111	LABORATORY BLDG.
130	SYSTEMS ENGINEERING BLDG
203	MAINTENANCE SUPPLY BLDG.
207	BOILER HOUSE
220	VEHICLE COMPONENT SUPPLY BLDG.
221	HAZARDOUS MATERIALS STOR. BLDG.
301	MAINTENANCE SHOP
303	BOOSTER HANGAR BLDG.
320	CONTRACTORS SERVICES BLDG.
350	OFFICE & ENGINEERING BLDG.
351	CAFETERIA & EQUIPMENT BLDG.
404	HIGH PRESSURE TEST FACILITY
420	STAGE TEST POSITION FACILITY
421	HYDRAULIC PUMP HOUSE
480	BARGE DOCK
902	ADMINISTRATION BLDG.
904	WATER STORAGE TANK
906	GARAGE BLDG.
907	MAINTENANCE SHOP
926	CARD & TAPE STORAGE BLDG.

FY-72 CONSTRUCTION: NONE

FY -73 SHUTTLE PROJECT:

MODIFICATIONS OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES

Sub-Projects:

1. Mod., Comp't Weld Area - Bldg. 103
2. Mod., Struct'l Sub-ass'y Area - Bldg. 420
3. Mod., Minor Ass'y Area - Bldg. 103
4. Pneumatic Test Facility - New
5. Mod., Air Conditioning System
6. Mod., Lighting System - Bldgs. 101 and 102

⬡ FY 1974 SHUTTLE PROJECTS:

MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES FOR EXTERNAL TANKS

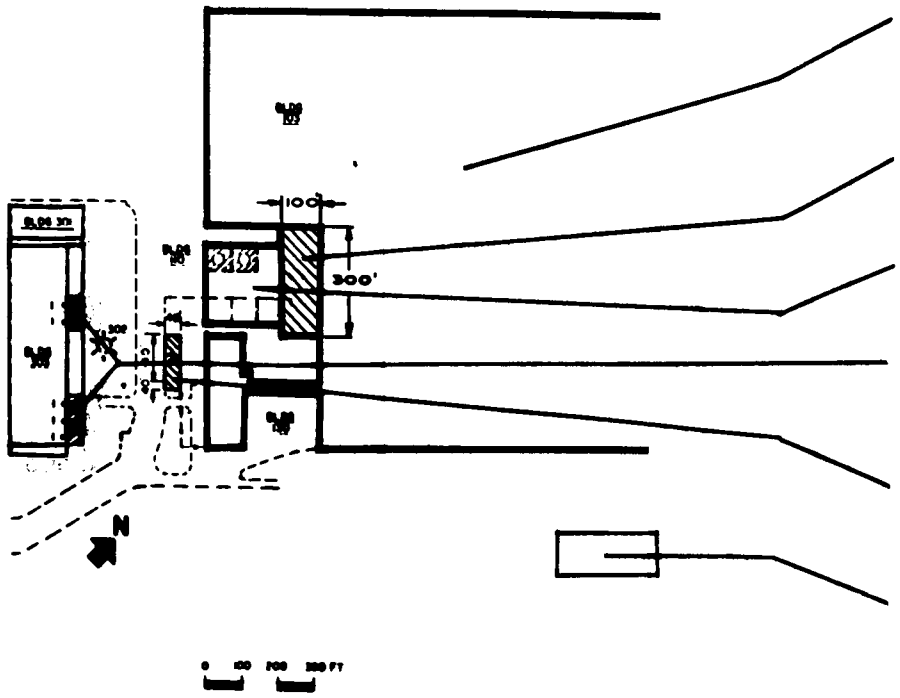
Sub-projects:

1. Modification to Bldg. 103 for Surface Treatment
2. High Bay Addition Between Bldgs. 103 and 110
3. Modification to Vertical Assembly Bldg. 110
4. Addition to Bldg. 303 for Spray Foam and Ablative Insulation
5. Construction of Heat Treatment Facility
6. Upgrade Chemical Waste Well

MICHOUD ASSEMBLY FACILITY

FISCAL YEAR 1974 ESTIMATES

MODIFICATION OF MANUFACTURING AND FINAL ASSEMBLY FACILITIES FOR EXTERNAL TANKS



1. Modification to Building 103 for Surface Treatment
2. High Bay Addition, Between Bldg. 103 & 110
3. Modification to Vertical Assembly Bldg. 110
4. Addition to Bldg. 303 for Spray Foam and Ablative Insulation
5. Construction of Heat Treatment Facility
6. Upgrade Chemical Waste Well

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Construction of Orbiter Landing Facilities
LOCATION	John F. Kennedy Space Center
	FY 1974 CoF ESTIMATE $28,200,000

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	$1,820,000
Construction	---
Total FY 1973 and Prior years	$1,820,000

SUMMARY PURPOSE AND SCOPE:

The purpose of this project is to provide for the construction of the landing facilities for the Space Shuttle orbiter vehicle. These proposed facilities include a runway, parking apron, orbiter "tow-way" and related utilities. The "tow-way" is required to connect the landing facility with the existing Vehicle Assembly Building (VAB) area where the orbiter will be maintained and checked out.

PROJECT JUSTIFICATION:

The Space Shuttle vehicle at launch will be made up of a manned reusable orbiter attached to an external propellant tank and two solid fueled rocket boosters. The booster and orbiter engines will be used to place the orbiter in outer space. After completing its space mission, the orbiter will return to the launch site and land on an airfield type runway in a manner similar to a conventional aircraft. Operations following this landing will require that the orbiter be "safed and deserviced" prior to its movement to a maintenance and checkout facility for processing and reuse.

This project provides the first but major portion of the facilities required for landing the orbiter after the return from a space mission, for

recovery of the vehicle in the event of an abort during launch or shortly thereafter, and for landing incident to orbiter "ferry" flights. These facilities will also be required by logistics aricraft used for delivery of paylaods and general supplies, specially equipped maintenance aircraft for safing and servicing the orbiter at alternate landing sites, chase aircraft for observing and photographing the vehicle in flight, flight simulation and training aircraft and other related aircraft usage.

A 15,000 foot long by 300 foot wide runway is provided in this proposed project primarily for landing the orbiter. These dimensions stem from studies and analysis of the orbiter technical requirements and design capabilities, temperature and altitude factors, safety considerations, and the size of similar facilities constructed for comparable aircraft type operations. The parking apron is required for loading and unloading cargo. servicing and maintaining support aircraft, and servicing and preparing an orbiter for checkout and ferry flights. The apron will be sized and configured to provide parking for two large logistic aircraft at one time.

The "tow-way" connecting the runway to the Vehicle Assembly Building area is required to move the orbiter from the proposed landing facilities to the maintenance and checkout facilities where the vehicle will be processed and prepared for reuse.

The current Space Shuttle development schedule requires that the first manned orbital flight be flown by the end of calendar year 1978. To meet this major milestone, the orbiter must be delivered to the Kennedy Space Center 12 to 14 months before this date for its integration into the complex and extended prelaunch activities which are necessary. 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, and integrated checkout of the mated Shuttle vehicle and possible flight readiness firing of the orbiter rocket engines. Therefore, the landing facilities must be operationally ready by late calendar year 1977 in order to receive the flight orbiter for the manned mission. To achieve this critical goal, facility construction must begin in early calendar year 1974. This schedule makes FY 1974 programming necessary in order to accommodate the extensive site work, earthwork and paving operations involved. This is a large facility undertaking with potential impediments as well as a 12-14 month period of activation and checkout. For these reasons, it must be undertaken and completed as scheduled.

PROJECT DESCRIPTION:

This proposed project includes:

Site Preparation

The site of the landing facilities, approximately two miles northwest of

the Vehicle Assembly Building, will require clearing and grubbing over approximately 1,350 acres of land, construction of 4,200 feet of drainage structures and 1,240 feet of 90 inch culvert to provide for the "tow-way" crossing of the Banana Creek waterway.

Earthwork

Extensive earthwork is also necessary to prepare the base for the paving operations which will follow and are a part of this project. Approximately 1,850,000 cubic yards of excavation, 2,175,000 cubic yards of borrow and 1,088,000 square yards of grading and rolling will be required.

Paving

A runway 300 feet wide and 15,000 feet long with 1,000 foot overruns at each end will be constructed. An accessway 75 feet wide and about 1,200 feet long will connect the south end of the runway to the parking apron of approximately 30,000 square yards. A 100 foot wide turn-around will be located at the north end of the runway. A "tow-way" 50 feet wide and approximately 10,600 feet long will connect the runway to the existing Vehicle Assembly Building area.

Airfield Lighting

Airfield lighting will be provided for Space Shuttle night operations and for periods of low visibility. The system will consist of standard approach and runway lighting installed in accordance with established guidelines.

Utilities

Electrical power to this area will be supplied from the Launch Complex 39 substation west of the Vehicle Assembly Building. Two new 13.8 KV industrial feeders will be installed in a concrete encased duct bank from the existing substation to a new switching station. An electrical power distribution system, which will be included in a future program, will later extend service from this switching station to the landing facilities.

A 12 inch water line will be installed from the existing 24 inch main adjacent to the Kennedy Parkway at the Vehicle Assembly Building area, to the vicinity of the parking apron. A water distribution system, which will be included in a future program, will extend from the parking area to the various facilities to provide water for fire protection, operations, and domestic use.

Approximately 3,900 feet of two lane asphaltic concrete access road will be constructed from the Kennedy Parkway to the parking apron area and the tow-way. Approximately 11,300 feet of single lane bituminous surface treatment road will be constructed to provide access to instrumentation sites and for use by emergency vehicles.

PROJECT COST ESTIMATE:

	Unit of Measure	Quantity	Unit Cost	Total Cost
Land Acquisition	---	---	---	---
Construction				$28,200,000
Site preparation				2,550,000
Clear and grub	Acres	1,350	$950.00	(1,282,000)
Drainage structures	LF	4,200	88.00	(370,000)
Banana Creek culvert	LF	1,240	492.00	(610,000)
Other (fencing, seeding, etc.)	LS	---	---	(288,000)
Earthwork				4,750,000
Excavation and borrow	CY	4,025,000	.95	(3,825,000)
Grade and roll	SY	1,088,000	.85	(925,000)
Paving				15,800,000
Runway	SY	500,000	19.00	(9,500,000)
Runway overrun and shoulder treatment	SY	317,000	11.00	(3,487,000)
Turn-around	SY	26,430	30.00	(793,000)
Apron with accessway	SY	40,000	28.00	(1,120,000)
Tow-way	SY	60,000	15.00	(900,000)
Airfield lighting				3,270,000
Approach	LF	3,000	280.00	(840,000)
Runway edge	LF	15,000	90.00	(1,350,000)
Centerline	LF	18,000	60.00	(1,080,000)
Utilities				1,830,000
Power system	LS	---	---	(1,227,000)
Water system	LF	7,600	46.00	(350,000)
Access roads	SY	23,000	11.00	(253,000)
Equipment	---	---	---	---
Fallout Shelter (Not Feasible)	---	---	---	---
		TOTAL		$28,200,000

For initial operations, it is anticipated that approximately $12 million of R&D resources will be required to provide non-collateral equipment for the instrument landing system, navigation and communications systems, and for the activation of these into a total landing system.

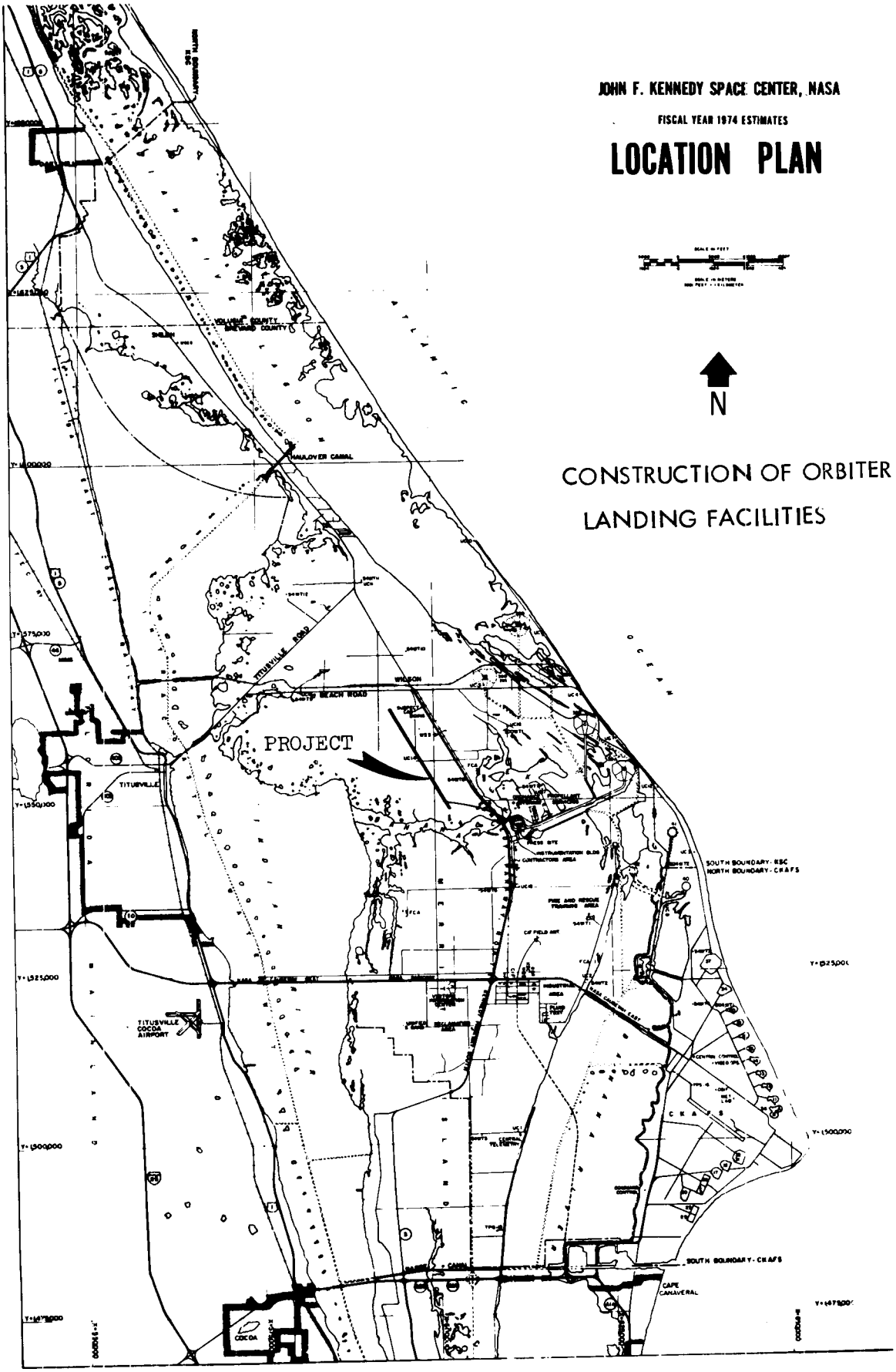
FUTURE CoF ESTIMATED FUNDING REQUIRED TO COMPLETE THIS PROJECT:

It is estimated that about $10.0 million will be required in future CoF programs to complete this project. The funds will be used to provide such facilities as a flight operations building and control tower, an orbiter safing facility, emergency mechanical arresting gear, utilities and site work.

JOHN F. KENNEDY SPACE CENTER, NASA

FISCAL YEAR 1974 ESTIMATES

LOCATION PLAN

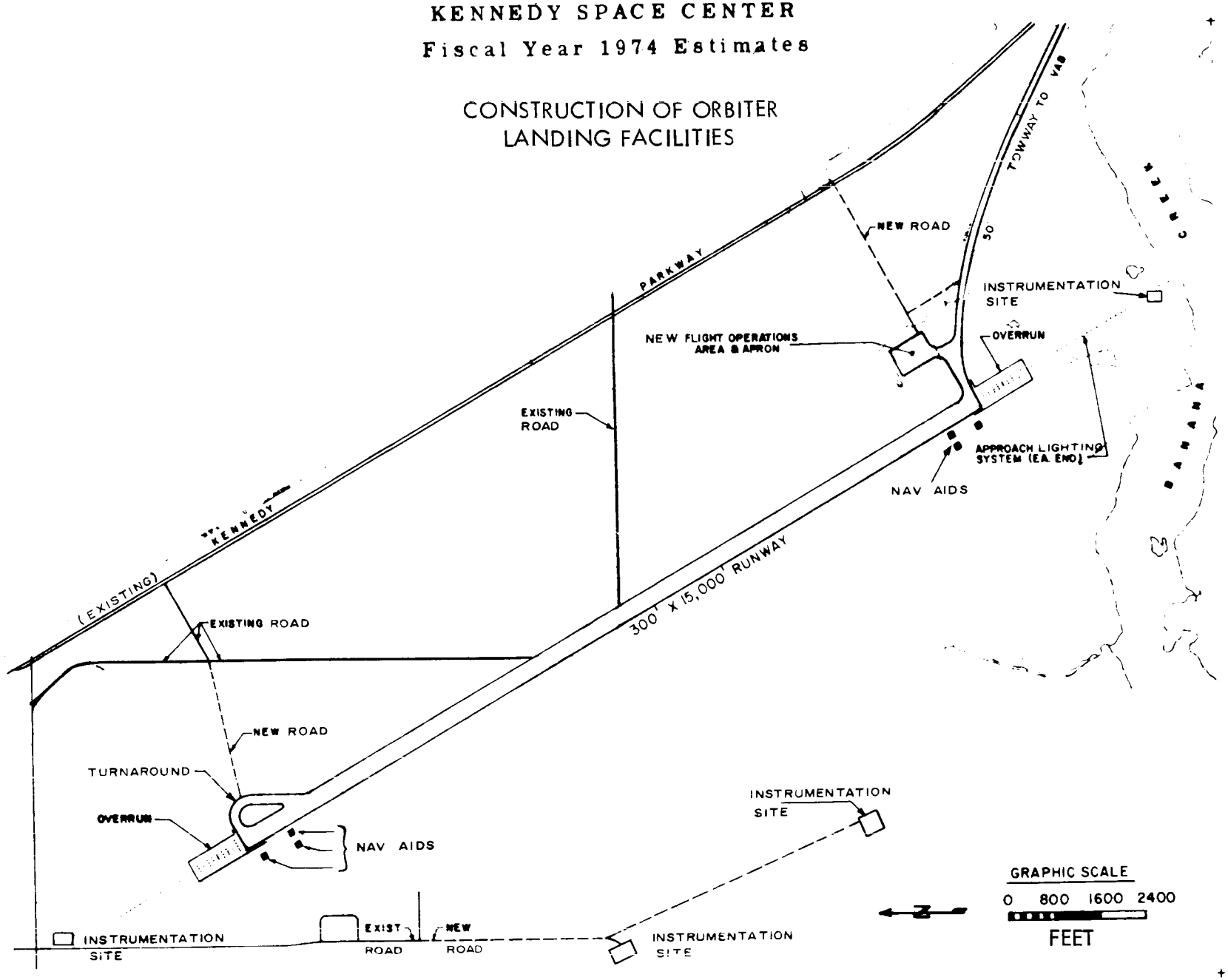


CONSTRUCTION OF ORBITER LANDING FACILITIES

KENNEDY SPACE CENTER

Fiscal Year 1974 Estimates

CONSTRUCTION OF ORBITER
LANDING FACILITIES



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

REHABILITATION AND MODIFICATION OF FACILITIES

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 19 74 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION		COGNIZANT PROGRAM OFFICE FOR INSTALLATION
Various Locations		Office of The NASA Comptroller
LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
Various Locations	---	---

INSTALLATION MISSION

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 19 74 *(Estimated)*	FUTURE YEARS *(Estimated)*	TOTAL ALL YEARS *(Estimated)*
Rehabilitation and Modification of Facilities Not In Excess of $500,000	Compt	47,022	14,785		Not Applicable
TOTAL			14,785		

NASA FORM 1029 JUN 69 PREVIOUS EDITIONS ARE OBSOLETE.

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Rehabilitation and Modification of Facilities Not In Excess of $500,000
LOCATION	Various Locations
	FY 1974 CoF ESTIMATE $14,785,000

COGNIZANT INSTALLATION: Various Locations

LOCATION OF PROJECT: Various Locations

COGNIZANT PROGRAM OFFICE: Office of The NASA Comptroller

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$4,117,000
Construction	42,905,000*
Total FY 1973 and Prior Years	$47,022,000

*This amount is for this activity as previously structured and funded from CoF only and does not reflect rehabilitation and modification type facility projects estimated to cost not in excess of $250,000 which in FY 1972 and prior years were not funded from the CoF appropriation.

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 1974 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 the past, this particular program has been specifically directed toward the general nonprogrammatic segment of NASA facilities, this year more attention has been given to facility modification type requirements generated by specific programs or projects.

491-315 O - 73 - 19

PROJECT JUSTIFICATION:

At its initial cost, the existing NASA physical plant totals about $5.7 billion (June 30, 1972). This physical plant inventory is composed of two major segments.

The first and oldest segment consists of the research centers and industrial plants which are now, in many cases, over 25 years old. For example, at Langley Research Center, Virginia, approximately 50% of the buildings are over 20 years old and 15% are over 30 years old. Langley, as is common with most NASA Centers, has experienced growth and change over the years. As a result, some of the building systems in over 70 buildings, of about 2,000,000 gross square feet area, are a composite of old and new. Some are obsolete and repair parts are difficult if not impossible to obtain. In some cases, large numbers of smaller systems rather than larger, more economical commercial systems were installed. Lighting and wiring systems are old, deteriorated, and insufficient for the tasks being performed. In many cases, these and other systems are overloaded and in need of modification to keep abreast of current needs.

The second segment of this physical plant inventory is composed of facilities acquired more recently to support the Manned Space Flight program. However, even these facilities are now rapidly approaching 10 years in age and are beginning to show the effects of exposure to hard and continued usage. This is especially true at a center such as Kennedy Space Center which involves over 300 buildings, with a gross area of about 5 million square feet. Most of these buildings were built in the 1963 to 1966 time period. Current major problems, in general, exist with roof coverings, air conditioning equipment, fire protection and detection systems, exterior building surfaces, and certain general safety items. Salt air corrosion requires replacement or protection of exposed metal surfaces. Roadway and electrical utility work are becoming urgent features of the total program at this Center.

Both segments, in addition to age and usage, have experienced a history of changing utilization and adaptation which has contributed to the total facility problem which this rehabilitation and modification program is directed toward at least partially solving.

A continuing program of rehabilitation and modification of these facilities is required to:

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

b. 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 environment for all personnel.

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 and 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) project required in FY 1974. This latter requirement is provided for by a separate project included in the CoF estimates entitled "Minor Construction".

PROJECT DESCRIPTION:

Items of rehabilitation and modification type work proposed to be accomplished within this program for FY 1974 are outlined under "PROJECT COST ESTIMATE" and totals $14,785,000. Of this total, $13,285,000 is represented by discrete work packages at designated NASA installations. The remaining $1,500,000 relates to that 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 $44 million. This $14,785,000 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 1974 estimate includes only about $5,875,000 for the Aeronautics and Space Technology installations. A recent survey conducted for NASA by an architect-engineer firm at these field installations indicated that about $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 $125,000,000 (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 rearrangement 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 estimated facilities rehabilitation and modification requirement, a tentative listing of projects is set forth under "PROJECT COST ESTIMATE". This list totals $13,285,000 of discrete projects which relate to the following broad categories of facilities:

a.	Utility Systems	$4,440,000
b.	Fire Detection/Protection Systems	250,000
c.	General Purpose Buildings	1,625,000
d.	Technical Buildings/Structures	5,185,000
e.	Pavements and Drainage	455,000
f.	Building Exteriors and Roofs	790,000
g.	Other Work	540,000

In addition, there are the "lump sum" estimates for smaller project work, thus making the total of this list $14,785,000.

The FY 1974 requests for facility rehabilitation and modification work, therefore, are directed toward the most urgent current needs for work of this type in the continuation of this essential program at NASA installations.

REHABILITATION AND MODIFICATION:

SUMMARY

a.	Office of Manned Space Flight	4,100,000
b.	Office of Space Science	1,950,000
c.	Office of Aeronautics and Space Technology	5,875,000
d.	Office of Tracking and Data Acquisition	1,360,000
e.	Smaller "Lump Sum" Projects	1,500,000
	Total	$14,785,000

1. OFFICE OF MANNED SPACE FLIGHT ($4,100,000)

A. Kennedy Space Center 1,090,000

(1) Rehabilitation of Cooling Towers 150,000

This project involves rehabilitation of cooling towers at the Operations and Checkout Facility Building M7-355, Central Instrumentation Facility, Building M6-342, and the Vehicle Assembly Building Utility Annex, Building K6-994. The work on the cooling tower at Building M7-355 will consist of replacement of gear boxes, repair of wood framing, replacement of fan stacks and overhaul of acid storage and feed systems. The work at Building M6-342 consists of rehabilitation of two 1,800 ton cooling towers by replacing fan gear boxes and fan stacks on the east tower, and replacement of three 2,000 gpm vertical turbine condenser water pumps and rehabilitation of the acid feed and storage systems serving the two towers. Cooling tower work in Building K6-994 consists of rehabilitating the acid feed and storage system serving the two 5,000 ton cooling towers. These cooling towers supply condenser water for air conditioning in the above buildings which are considered vital to manned launch operations. Sensitive electronic gear cannot function without this air conditioning. The cooling towers have been in constant service for approximately eight years and are no longer economically repairable due to deterioration from the more severe climatic conditions of this area.

(2) Rehabilitation of High Temperature Hot Water System 250,000

This facility work involves the replacement of approximately 3,400 feet of high temperature hot water (HTHW) piping in the Industrial Area. This piping has deteriorated and insulation has failed due to submergence in the ground water which is acidic in the Kennedy Space Center area. The HTHW lines involved have been installed since the 1963-1964 time frame and have been in continuous use since then. Depending on the height of the water table at any given time they are sometimes partially or even completely submerged. Because of the acidic condition of the ground water the casing housing the insulated HTHW lines has been deteriorating in many places. This permits water to enter the casing where at times it becomes steam and gradually further impairs the insultation making it less effective and eventually useless. This chain of events has resulted in an increasing amount of heat losses to the ground which in turn requires additional fuel in the Central Heating Plant to compensate for these loses. The situation must now be corrected.

(3) Rehabilitation of Roofs at LC 39 $400,000

This work provides for the replacement of approximately 46,000 square feet of roofing on high and low bay of the Vehicle Assembly Building (VAB), to include replacement of flashing, rehabilitation of roof joints, installation of roof vents, degraveling, hot mopping and regraveling all areas of roofs not be replaced. Complete replacement of the roof, approximately 59,000 square feet, on the Launch Control Center (LCC), will also be required as a part of this project. These buildings have been in use since 1966 but regular maintenance has been limited only to spot repairs in view of the very large area of the roofs. The roofs are subject to "thermal shock" during the summer thunderstorm period and this has accelerated cracking of the roof coverings causing leaks to develop. To determine the extent of repair work required, a consultant was engaged to perform a survey of these roof areas. This survey indicated the location and extent of water penetration and is the basis for this project. Since these buildings house launch assembly preparation and launch control equipment for all LC 39 launches, and will continue in use for the support of Apollo-Soyuz Test Project and Space Shuttle, the work must be done on a timely basis to avoid damage to the interior of these facilities.

(4) Rehabilitation of Roofs at Industrial Area 290,000

This work includes the rehabilitation of roofs on the Operation and Checkout Facility, Central Instrumentation Facility, Headquarters Facility Building and the Communication, Distribution and Switching Facility. It provides for the replacement of approximately 45,000 square feet of roofing; replacement of flashing, rehabilitation of roof joints, installation of roof vents, degraveling, hot mopping and regraveling of all areas not to be replaced. These buildings were completed in the 1964-1965 time frame and regular maintenance has been limited to spot repairs. The roofs are subject to "thermal shock" during the summer thunderstorm periods. This has accelerated cracking of the roof coverings, causing leaks to develop. To determine the extent of repair work required, a consultant was engaged to perform a survey of the roof areas. This survey indicated the location and extent of water penetration and is the basis for this project. These buildings house the personnel and equipment critical to manned and unmanned launch operations and will continue in use for the foreseeable future in support of unmanned activities as well as Apollo-Soyuz Test Project, and the Space Shuttle. For these reasons it is essential that this roofing work be done on a timely basis to avoid damage to the interior to these facilities.

B. Manned Spacecraft Center $750,000

(1) Rehabilitation of Chilled Water System 70,000

This rehabilitation of the existing chilled water system utility tunnel will be accomplished by replacing 40 worn and inoperative valves in the utility tunnel. This is the second phase of a five year planned replacement program. The first phase was included in the FY 1973 Rehabilitation and Modification Program at $140,000. These valves are all approaching an eight year age and must now be replaced to prevent maintenance shutdowns, protect personel and other systems and equipments, and prevent system failure.

(2) Rehabilitate Steam System 200,000

This facility work involves the rehabilitation of the steam system by replacing inoperative valves and expansion joints; retubing and rebricking one boiler located in the Central Heating and Cooling Plant, Building 24. There are approximately 175 expansion joints and 200 steam and condensate valves located in the utility tunnel. These valves are control devices used to regulate flows. At the present time, several of the automatic valves will not close under emergency conditions. This situation presents a potential safety hazard to personnel and could cause extensive damage to other systems in the tunnel such as electrical distribution and sump pumps. In recent years, there have been an average of 24 to 36 system failures per year in the equipment to be replaced or repaired by this project. Failures could cause extensive recycling of test programs in various buildings. The second part of the project is to retube and rebrick one boiler of the five existing boilers. These boilers have been in operation since 1963 and are approaching a major rehabilitation program requirement. This determination is based on studies which have been made to determine the internal conditions of the brick and tubes of these boilers and the normal life expectancy of this type of equipment. This boiler work is "phase one" of a planned five year program to completely retube and rebrick each boiler in the Central Heating and Cooling Plant in order to provide safer and more reliable steam generation.

(3) Rehabilitation of Roofs 100,000

This project involves the rehabilitation of roofs on several buildings including but not limited to Buildings 13, 33, 35, 48, 261, 263, 265, 420, 421, and 422. This is the second phase of an overall effort to correct roof deficiencies. The buildings selected represent the next most urgent grouping.

This work provides for the total replacement of approximately 40,000 square feet of roofing and 25,000 linear feet of flashing. Modifications, aging and penetrations on a "spot" basis, have reduced the roof integrity on these buildings. These buildings were built in the 1964 to 1965 time frame. The deterioration reflected by blistering, weathering and sealant failures from moisture penetrating the roof seals at gravel stops, drains and penetrations has caused numerous leaks. Repairs to these roofs are needed to preclude any further damage not only to the structure itself, but also to interior equipment, ceiling panels, walls, floors, electrical panels and sensitive electronic equipment.

(4) Rehabilitate Heating and Cooling Water Systems in Various Buildings — $240,000

This project plans the replacement of heating and cooling valves expansion joints and actuator valves, expansion joints and actuator valves in the following ten buildings: 5, 8, 12, 15, 29, 30, 37, 45, 49 and 440. 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 one of a four phase program 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) Rehabilitation of Water Removal System, Photographic Technical Laboratory, Building No. 8 — 140,000

This work involves the provision of a small utility tunnel under Building 8 for chemical drains, removal of the existing pumping and piping system and installing a complete new gravity chemical waste drain system. This project is required to replace a most inadequate integrated sump and pump waste removal system that requires continual and high cost maintenance. The new gravity system will reduce maintenance cost and by virtue of the small utility tunnel it will simplify access for required maintenance and for any later modification made necessary by future equipment relocations.

C. Marshall Space Flight Center $1,360,000

(1) Modification to Structure and Mechanics Facility, Building 4619 185,000

This modification work to Building 4619 will be for use in shuttle payload carrier simulation and will include modification of a 3,500 square foot area for control center purposes. Included in this work will be electrical and mechanical system modifications and the installations of a gaseous nitrogen and gaseous oxygen system which is required to provide an atmosphere condition for the payload carrier simulator. The work is required to support the testing program for evaluation of various shyttle payloads, payload systems and payload experiments. There is additional non-collateral equipment to be procured from the Research and Development appropriation for this facility.

(2) Rehabilitation of Guidance and Control Facility Building 4487 120,000

This facility work consists of rehabilitation of the heating, ventilating and air conditioning system in the high bay area, modifications to the power and floor systems for computer facilities, and acoustic abatement to reduce noise levels. This work is required to support the Optical Mass Storage Memory Program (OMSMP). This program involves the use of sensors to detect optical deformations, and the use of actuators to correct these deformations. The deformations are measured and the compensations for these are fed into the computer and stored. These can be used to correct the flight lens under varying conditions.

(3) Modification of Guidance and Control Facility Building 4487 110,000

The planned facility work consists of modifications to the air conditioning system serving the computer and rooms A-162 and A-166; installation of additional signal cable trays; installation of an emergency power disconnecting switch for the computer; and the removal of partitions between rooms A-162 and A-166. This work is required to support the Sortie Laboratory simulation to be performed on the Apollo Telescope Mount (ATM) hybrid simulator.

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(4) Rehabilitate Computation Laboratory and Office, Building 4663 $180,000

This project work involves upgrading the power systems and air conditioning systems in the first and second floors of the center wing of building 4663, an area of approximately 50,000 square feet. This work also includes the rehabilitation of the following interior finishes: ceilings, flooring, doors, frames, acoustical treatment and painting. Work is required now to improve the major computer facility at MSFC by reducing noise levels in computer areas, replacing damaged acoustical ceiling tiles, balancing power and air conditioning loads, and by repairing and replacing damaged doors and frames. The work will enhance the structural appearance of this building, reduce possible safety hazards, and improve working conditions for computer operations personnel.

(5) Rehabilitation of Motor Pool, Building 4435 and Steam Generating Plant Water Pump Facility, Building 4567 70,000

In Building 4435 this work covers rehabilitation of exterior and interior finishes, replacement of substandard sanitary facilities and minor repair to the heating, ventilating and air conditioning system. Work is required to avoid a potential health problem due to over-crowded conditions and to eliminate possible fuel storage and handling hazards. In Building 4567 a safety hazard will be eliminated by re-routing the exposed high pressure main line from the area occupied by operating personnel. Minor repair of HVAC, roofing, boiler stacks, diesel mufflers, lighting and power systems are also included. This building provides major support to the hazardous test area at MSFC. Work is required to eliminate potential safety hazards for operating personnel, upgrade the facilities and prevent further deterioration.

(6) Modification of Space Science Laboratory, Building 4481 485,000

This work includes major exterior wall treatment, reroofing, adding windows, replacement of interior walls, door frames, hardware, ceilings, flooring, painting, replacement of heating, ventilation, air conditioning, lighting systems and electrical power systems. Since occupying the present facilities, the Space Science Laboratory has doubled in strength and has changed from a study and planning organization to an active scientific research organization. In accomplishing this

transition, it has been necessary to adapt research laboratories into areas initially built for other purposes. Extensive and sophisticated equipment has been installed in small areas creating crowded conditions and making normal operations difficult. Inadequate power, poor humidity control, low water and air pressure, dirt and dust have all caused adverse impacts on the conduct of research test experiments in these areas. This is the second phase of modification work for this building. The first phase was included in FY 1973 Rehabilitation and Modification at $140,000. Additional final work will also be required in subsequent years.

(7) Electrical Modifications to Assembly Facility, Building 4656 $100,000

This modification work will provide for an increase in the electrical substation capacity for Building 4656 and communication ducts necessary for the transmission of system signals between Building 4656 and the Guidance and Control Office, Building 4487. In the present configuration, Building 4656 does not have the necessary electrical substation capacity and communication duct capability to support research and development of hydraulic actuators. These modifications will permit Building 4656 to be utilized for the development of hydraulic actuators for Space Shuttle and other programs. Existing hydraulic facilities at MSFC are located in five different areas in Building 4487. These facilities are inadequate in their present location. The entire hydraulic actuator development facility is planned to be consolidated into Building 4656, however, this building at present does not have the necessary electrical capacity and connecting communication duct. Location of these facilities in Building 4656 will provide a more versatile and efficient development and test area sufficient to accommodate the larger and more complicated hardware.

(8) Rehabilitation of Components Subassembly Acceptance Facility, Building 4752 and Impulse Base Flow Facility, Building 4733 110,000

This project involves rehabilitation in Building 4752 which consists of adding lead shielding protection to X-ray room, replacing controls on shop turntable, upgrading of the heating, ventilating and air conditioning system (HVAC),

electrical power system, flooring and ceilings. In Building 4752 subassemblies and components are received and inspected. The building must be kept in good repair and the laboratories maintained abreast of the state-of-the-art. The proposed work will upgrade Building 4752 and eliminate a potential hazard from the X-ray room. Building 4733 was built in 1953 and is in need of rehabilitation to permit safer use of combustible gases. The work in this building involves improvement of ventilation and electrical wiring as well as the HVAC system plus minor structural rehabilitation.

D. Michoud Assembly Facility $300,000

(1) Rehabilitation of Area Storm Drainage System 150,000

This work provides for the replacement of various underground drainage piping and rebuilding of catch basins to provide the means for proper drainage of various areas of the Michoud facility site. The old underground drainage piping is of corrugated metal which was installed when the original facility was constructed in 1943. Some of these underground lines have deteriorated and collapsed, causing water to stand in certain areas after a hard rain. The catch basins will also require relocation for better drainage of the site. This relatively flat low lying land is most sensitive to proper drainage and this work is now required.

(2) Rehabilitation of Utilities and Insulation, Manufacturing Building, Building 103 150,000

This project will replace deteriorated piping and insulation in the chilled water system, the steam and condensate system and the potable water system supporting the main manufacturing building. In conjunction with this work several condensate return pumps will be replaced. The insulation replacement and the piping renewals are required due to normal deterioration common to these various systems which are now approximately 30 years old. Most of the work is located above the 40 foot level in the building.

E. Mississippi Test Facility $200,000

(1) Rehabilitate Underground Transmission Lines 200,000

This proposed work involves the removal and replacement of approximately 18,000 feet of the 13.8 KV underground transmission lines and the installation of sectionalizing switches to reserve power outages to limited areas of the site. The 13.8 KV underground transmission lines have been in service for approximately eight years. During this time, cable faults have frequently been the source of power outages and low reliability. Because of the absence of sectionalizing switches certain large areas are often without power while trouble shooting and repairs are being made. This project will replace faulty cables, provide improved splicing capability, reduce wide area outages and improve safety and reliability.

F. Various Locations 400,000

(1) Rehabilitation and Modification of Industrial Plants 400,000

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 (1,950,000)

A. Goddard Space Flight Center 640,000

(1) Rehabilitation and Modification of Power and Communication Distributions Systems 230,000

This work provides for the upgrading and modernization of the intracenter electric power and communication distribution cables and duct system servicing the primary technical

facilities. These facilities include: the Mission Control Centers, Buildings 14 and 23; the NASCOM terminus, Building 3; and the spacecraft environmental test and evaluation facilities, Buildings 7, 10 and 15. This project includes the rehabilitation of existing electrical power distribution by replacement of deteriorated electrical distribution components of the main substation and in the underground cable system. Building load and motor control centers will be replaced and modified; and synchronizing equipment and high speed "fast response" voltage regulators will be installed on the existing generators located in the Data Interpretation Laboratory, Building 23, and a connection of this plant to the master remote diesel start console will be made. An additional 4 inch communication duct, electrical power distribution feeders, and switching unit at the main substation will also be installed. The work is required to ensure the continued reliability, responsiveness and effectiveness of flight mission activities.

(2) Rehabilitation of Central Plant Cooling Towers $60,000

This project provides for rehabilitation of two cooling towers including the replacement of decking and some structural members and piping, and replacement of four stacks, wall panels and siding. These towers are over seven and ten years old respectively and require major rehabilitation. This work is required to prevent further deterioration and possible failure of the central cooling system which serves the entire center.

(3) Modification to Boilers and Sanitary Waste System 75,000

This work provides for the conversion of the central heating plant oil burning capability from Number 6 oil to the low sulfur content Number 2 oil fuel. Fuel oil will be used to back up the primary natural gas supply. The proposed work is needed to improve the control of possible air pollution which might be generated by the heating plant. Also included is the rerouting of sanitary waste collection lines and the installation of a new lift station to supplement the existing lift station which is of inadequate size as a result of converting Warehouse Buildings 4, 18, 19 and 20 to office/laboratory use.

(4) Modification to Primary Mission Support Areas $55,000

This project provides for the rearrangement of the mission control center and adjoining mission support areas by reconfiguration of existing space in the Mission Control Center and Data Interpretation Laboratory, Buildings 14 and 23, respectively. The work includes partitioning and electrical and air conditioning renovations to adapt these facilities to changes in mission control and support area requirements for such future potential missions as Earth Resources Technology Satellite (ERTS-B), and the Atmosphere Explorers -C, -D, and -E.

(5) Modifications to Buildings 60,000

This project provides general safety related modifications to office/laboratory Buildings 4, 5, 6, 16, 18, 21 and 26 and includes installation of emergency and exit lights, maintenance platforms and guardrails for access to mechanical building equipment, and roof vents. This work is required to improve general facilities safety in these buildings and represents the most urgent work of that type remaining to be done.

(6) Modification of Underground Pipe Lines 65,000

This work provides for installation of cathodic protection devices on existing underground utility pipe lines including 17,500 linear feet of chilled water supply lines and 14,250 linear feet of steam and condensate lines. This work is required to minimize possible future need for premature and costly replacement and consequent extended disruption of vital services to facilities supporting or directly related to various center programs.

(7) Rehabilitation of Laboratory, Building 2 and Multipurpose Building 16 95,000

This project proposes the rehabilitation of heating, ventilating and air conditioning systems in the two buildings. This work includes the expansion of zone controls, an increase in cooling capability by the addition of chillers and the reduction of the effect of solar heat loads by the application of a heat reflective material to the windows. Building 2 houses research project laboratories for high energy physics, astrophysics, solar physics, and extraterrestrial physics. Since the

basic usage of this building has changed significantly during the period from its original occupancy to the present time, it is essential that a controlled environment be provided to satisfy existing sensitive requirements dictated by the present functions performed in these laboratories. Building 16 houses personnel engaged in administrative and management support functions. Problems encountered in the maintenance and operation of the present air conditioning system have resulted in a requirement to substantially modify and update the equipment in order to provide a balanced ventilation output to the building more in keeping with realistic needs for a facility of this type.

B. Jet Propulsion Laboratory $595,000

(1) Rehabilitation of Spacecraft Assembly Facility, Building 179 205,000

This project provides for general overhaul and upgrading of heating and air conditioning (HVAC) systems, necessary to raise the level of filtered air from 20 to 25 feet above the high bay floor in order to accommodate assembly and testing on larger future spacecraft. The present 125 ton chiller will be refurbished and a second unit added to provide for partial redundance which would then be available to meet a failure situation during critical operations. Rearrangement of the air handling unit and filtration will be accomplished in the mechanical room and high bay area. The crane control will be remoted and a hydroset vernier control added to enhance the present spacecraft handling capability in the high bay area.

(2) Modification of Fire Protection Systems 100,000

This project provides for the installation of a fire alarm and automatic sprinkler system in the Environmental Test Laboratory, Building 144, fire alarm and smoke detection equipment in the computer programming offices, Building 156, and fire alarm systems in seven additional buildings (150, 158, 161, 202, 241, 244, and 250). All alarm and detection systems will be connected to the central reporting system. Guardrails and walkways in eight buildings (111, 125, 170, 183, 186, 197, 238, and 264) will be modified to meet regulatory essential safety requirements. The sprinkler

system will provide protection for high value computer equipment, software and spacecraft components. Alarm and detection systems will provide personnel warning and evacuation capability in addition to fire department notification. Improvement in fire protection is a continuing program at JPL, and this project represents the most urgent work of that remaining to be done.

(3) Modification of Laboratory Buildings $290,000

This project will provide a structural "stiffening" of the nine story Central Engineering Building, Building 180, and the seven story Telecommunications Laboratory, Building 238, in accordance with revised building codes and will thus minimize the possibility of loss of life and property damage potentially due to earthquakes in the proximity of the San Andreas Fault. The assessment of damage to these buildings sustained during the 1971 earthquake identified specific structural design deficiencies which will be remedied by upgrading of basic structural features in Building 180 and addition of new supports and core area shear walls in Building 238.

C. Kennedy Space Center 265,000

(1) Modification to Launch Complex 17 205,000

This project provides for the addition of the capability to lift the second stage of the "straight eight" Delta configuration on Pad A; and safety modifications to the electrical terminal room and cable tunnels at Pads A and B. The eight foot diameter upper stage configuration was approved subsequent to the development of the FY 1972 project (CoF) which also modifies Pad A. This work was therefore not a part of that modification and is now separately required. This modification will enlarge the existing guide system on the mobile service structure of Pad A, including the installation of a two-ton auxiliary hoist, lengthening and widening the vertical rails, adding a new catwalk and providing wind curtains. The second portion of this project provides additional air conditioning in the terminal room and cable tunnels at each pad to maintain a positive pressure and thereby minimize the possibility of explosion or fire resulting from inadvertent hypergolic propellant spills. This requirement is a result of studies performed after the recent fire on Pad B and is designed to reduce fire hazards.

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(2) Rehabilitation of Centaur Launch Complexes $60,000

This project provides for the replacement of existing translucent fiberglass panels and insulation weather protection panels on Complexes 36A and 36B, with materials having more acceptable fire retardant properties. The combustibility of the presently installed material was tested as a result of studies performed following the fire at Complex 17B where similar material was used in the clean room area. These studies indicated that the existing fiberglass panels were flammable and should be replaced to avoid undue hazards to spacecraft and launch activities.

D. Wallops Station 450,000

(1) Rehabilitation of Photographic Laboratory Building, Building E-2 360,000

This project provides for rehabilitation of the photographic laboratory located in Building E-2 and is necessary to ensure the environmental conditions and control essential to the production of precision photographic data being processed for scientists and engineers engaged in programs ranging from the remote sensing of the earth's resources to the evaluation of rocket borne experiments and aeronautical research projects. Improved voltage control is necessary for proper operation of the existing photographic equipment. This building also houses the station cafeteria. The work proposed includes major roofing repairs, gutter and downspout replacement, renovation of heating, ventilating and air conditioning systems and controls, a filtration system on water supply to the photographic laboratory, the installation of an automatic fire detection system, the bricking-up of unused door and window openings in the Photographic Laboratory and the replacement of portions of ceiling tile damaged by roof leaks. This rehabilitation, as it applies to various sections of the building, is also necessary to prevent further deterioration of the facility.

(2) Modification of Central Heating Plant 90,000

This project provides capability to store and utilize low sulfur fuel oil by providing insulation for existing tanks and installing steam heaters in the tanks and on the fuel lines. This work is required

in order to assure greater compliance with the more stringent clean air standards and to ensure that low sulfur fuel can be kept at a sufficiently high temperature so that fuel will flow to the three main boilers at all times. Natural low sulfur fuel must be kept at considerably higher temperatures than high sulfur fuel to ensure that the paraffin in the low sulfur fuel will not "set up" in the tanks or fuel lines to the boiler house.

3. OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY ($5,875,000)

A. Ames Research Center 1,580,000

(1) Modification of the Aerodynamic Facility, Building No. 234 150,000

This project provides a modification to add a high pressure water cooling system for the 10 foot and the 15 foot diameter vacuum pipes at the Aerodynamic Facility, Building 234. A 30 foot long water jacket will be added externally to the 10 foot and 15 foot diameter vacuum pipes. Turning vanes to be installed in the 10 and 15 foot header pipes will be constructed of stainless steel and will be water cooled. The necessary piping, valves, controls and interlocks will be integrated with the existing water systems. The present arc heaters at the Aerodynamic Facility are capable of operating at 4 megawatts for 30 minutes, or at 20 megawatts for 5 minutes. This addition will permit the testing of ablation and heat shield materials and other high temperature processes at 20 megawatts for 45 minutes which is required to test these materials and panels for the Space Shuttle. A complete header cooling system is required to keep the temperature of the vacuum header within allowable limits necessary for structural integrity.

(2) Rehabilitation and Modification of Ballistics Range Building N-223 450,000

This project envisions the rehabilitation of the current Hypervelocity Ballistic Range Building, No. N-223 to convert about 18,000 square feet to offices and laboratories for polymer and chemical research. The work includes the removal of existing ballistic equipment, foundations, and control rooms plus installation of new partitions, plumbing, acoustical ceilings,

lighting, resilient flooring, air conditioning, fume hoods and laboratory equipment. This project will also modify and strengthen the roof structure to support air conditioning equipment, fume scrubbers, and exhaust fans. This facility work will provide laboratory space to increase the efficiency and safety of these research operations. This is the first phase of a two phase program to provide for this research requirement but completes all of the work now envisioned in Building N-223. The second phase of this type of work in Building N-224, will be accomplished at a later time.

(3) Rehabilitation and Modification of Aircraft Taxiway $455,000

This project will provide for the rehabilitation of the aircraft apron east of the Airplane Hangar and Shop, Building N-211, by replacing 16,700 linear feet of joint filler and accomplishing other "spot" rehabilitation. Portland cement concrete widening of the taxi strip will involve about 1,800 square yards on the north side and 9,000 square yards on the south side. Aircaft traffic volume including large jet transports (CV-990 and C-141A) require larger areas for taxiing, parking ramps, and work stands and therefore the existing taxi apron complex must be modified to accommodate the requirement. This increased aircraft traffic is generated by the aircraft support necessary for the airborne sciences and earth resources programs.

(4) Rehabilitation and Modification of Aviation Fuel System 200,000

The existing underground fuel tanks adjacent to the hangar are of marginal capacity, deteriorated, and require replacement and relocation. This will be done with larger tanks and when completed will release critical ramp space about the hangar for other uses and improve fire safety conditions. This project will provide for the installation of a 50,000 gallon and a 8,000 gallon above ground fuel storage tanks. Included is the installation of approximately 2,000 linear feet of 8 inch fuel line, 400 linear feet of 12 inch fuel line, eight fuel hydrants and two fuel pumps.

(5) Rehabilitation and Modification of Bioscience Laboratory, Building N-236 $190,000

This project provides for the modification of about 1,000 square feet of office and laboratory areas of Building N-236. Rehabilitation and minor modification will also be made in 16 rooms of the animal holding facilities. Acoustical ceilings and roof areas will be replaced or repaired. Modifications will be made to the existing boiler equipment to include the installation of an additional low pressure boiler. A central air conditioning system and a new roof will be provided for the especially fitted animal holding trailers which are adjacent to and are used in conjunction with Building N-236. For the purposes of the proposed project, the auxiliary trailers are considered as a part of the N-236 complex. The air conditioning system is required to reduce the maintenance and heat load problems.

(6) Modification of Equipment Areas 135,000

This project will provide for the modification of mechanical and electrical equipment as well as unique storage containers in (55) buildings and (5) substations throughout the center. This work will include installation of required anchors, bracing, flexible connections and other devices that are necessary to minimize damage to critical mechanical, and electrical equipment, and structures, as well as to gas and chemical containers in the event of an earthquake. This seismic protection will provide lateral restraint for the boilers, chillers, cooling towers, compressors, transformers and other electrical items, toxic gas and chemical storage containers and certain high value laboratory equipment. The items selected for seismic protection are considered critical from a safety standpoint, and essential to continued research operations and center support. This proposed work is the result of analysis of the impact of the February 1971 earthquake. Experience has shown that the movement, under earthquake conditions, of heavy equipment not only can do severe damage to the equipment itself but also to the surrounding building areas and adjacent furnishings and equipment.

B. Flight Research Center $140,000

(1) Modification of Storm Sewer System and Open Storage Area 140,000

This project provides for the modification of the storm sewer system by the provision of 1,150 linear feet of 36 inch concrete storm sewers by extending it northward along an existing drainage ditch east of Warehouse No. 4. This work is required to prevent erosion which has become an increasingly difficult problem with regard to the adjacent storage area. The storm sewer will be covered and surfaced with approximately 4,000 square yards of asphaltic concrete paving to provide additional required storage area.

C. Langley Research Center 2,200,000

(1) Rehabilitation of Cooling Towers 350,000

This proposed facility work will replace an existing old "four cell" cooling tower serving the 8 foot Transonic Pressure Tunnel, Building 640, and the 8 foot Tunnel Office Building 641, with a single new cooling tower. This project includes the foundation, basin, distribution lines and a dry pipe sprinkler system. The present tower is about 30 years old and has now deteriorated to the extent that it requires excessive repair. The foundation is cracked and the reservoir leaks. Rehabilitation by complete replacement is now necessary.

(2) Rehabilitation of the Drive System for the 7 foot by 10 foot Tunnel Facility, Building 1212 305,000

This project will provide for the rehabilitation of the drive system and the main drive fan blades of the 7 foot by 10 foot Tunnel Facility, Building 1212. The 18 fan blades have begun to fail due to fatigue and age and need to be replaced. The heat exchanger on the liquid rheostat for the main drive system has deteriorated and needs rehabilitation. The armature on the constant speed motor requires rewinding. The maintenance on the heat exchanger and constant speed motor will be reduced by this rehabilitation and the overall tunnel operation improved.

(3) Rehabilitation of Electrical Power Distribution, Stratton Road, East Area $310,000

This project will remove old existing electric cables from the Stratton Road substation to the Yorktown Road substation and install three new replacement cables in the existing duct bank. The existing cables were installed in 1949 and water is now penetrating the deteriorated jackets increasing the probability of cable failure. This work includes the replacing of the parallel busses on the secondary side of the transformer in the Yorktown Road substation. Water has deteriorated these old busses to the extent that replacement is also required. Also, included is the replacement of three old wood line poles between the Stratton Substation and the 4 foot by 4 foot tunnel, Building 1290. Cooling fans will be installed on transformer "DD" at the Moffett Road Substation to increase transformer capacity to handle new loads. This overall rehabilitation project is needed due to the importance of this distribution system to the research activities conducted in this area.

(4) Rehabilitation of Electrical Power Distribution, Thornell Avenue 450,000

This project will replace three single phase transformers in the Thornell Avenue substation with a single new three phase transformer. The three original transformers were installed in 1930, are very hard to maintain, have given poor test readings, and must be replaced. The work also includes replacement of seven oil circuit breakers with outdoor metal-clad switch gear and air circuit breakers. The oil circuit breakers are old and obsolete, and replacement parts are not available. A new 300 KVA transformer will also be provided along with the primary switch, and secondary switchgear at the Gas Dynamics Laboratory Complex, Building 1247 area. This new transformer and switchgear is required to adequately handle present and future loads. Starting equipment for the 580 H.P. synchronous motor generator spin tunnel drive of the Engineering Technology Laboratory, Building 646 will be replaced as will the starting equipment for the 350 H.P. synchronous motor-generator free flight tunnel drive in the 20 foot Vertical Spin Tunnel, Building 645. The starting equipment in Building 646 was installed in 1934, and the starting equipment in Building 645 was installed in 1941. The starting equipment in each case is obsolete and repair parts are no longer available for maintaining them.

(5) Rehabilitation of Sanitary Sewer System $155,000

This work involves the rehabilitation of the sanitary sewer along Ames Road from Freeman Road to Gregg Road and northeast to the High Intensity Noise Facility, Building 1221 by removing the existing 2,000 linear feet of 10 inch line and replacing it with 18 inch vitrified clay pipe (VCP) line and connecting all existing laterals to this new line. The 10 inch sanitary sewer was constructed in 1952 solely to service the Unitary Plan Wind Tunnel, Building 1251. Later construction of additional facilities in the area and deterioration of the existing 10 inch line now requires that it be replaced by a new and larger line. The work also includes the rehabilitation of the sanitary sewer from the northwest corner of Building 1221 to Lift Station No. 4 by removing the 610 feet of existing 10 and 15 inch lines and replacing them with 24 inch VCP line, and connecting all existing laterals to the new line. This part of the sanitary sewer is the terminal end of the west area collection system and was installed in 1943. The 10 and 15 inch mains can no longer provide the capacity needed for the six million gallon per month average flow and must be replaced with a larger line. The capacity of the sanitary sewer Lift Station No. 3 will also be increased by removing the existing station and replacing it with a new "package" having two 300 GPM pumps. The present lift station is operating at capacity, and the new lift station is required to handle planned new facilities in the area as well as any future facilities which may later be built in this area. A replacement 8 inch VCP sanitary sewer 495 feet long and parallel to Ames Road and running northeast to an existing manhold at the northeast corner of Durand and Ames roads will be done. This existing sewer now serving Buildings 1310 and 1312 does not provide the proper flow and frequent stoppages now occur.

(6) Rehabilitation of the Helium and Hypersonic Laboratory, Building 1247B 275,000

This project provides for the rehabilitation of the exterior walls and windows that have been damaged by vibration and expansion. New heating, air conditioning and ventilating equipment will also be installed. The flooring, lighting, and ceilings will be rehabilitated in some areas and the roof will be repaired. This facility was originally constructed in 1947 and many areas originally built as shops or laboratories are now and will continue

to be utilized for office space. Rehabilitation of the air conditioning equipment is also required and included in this project since the existing equipment is deficient due to age and capacity.

(7) Rehabilitation of Mach 6 and 8 Laboratories and Wind Tunnel Facility, Building 1247-D $355,000

This project provides for major rehabilitation of heating, ventilating and air conditioning systems in 45,000 square feet of area. A replacement pump for the 41 foot sphere and high pressure air control valves will also be provided. Toilet facilities will be improved by the installation of new fixtures. Repairs will also be made to the windows and the roof. This facility was originally constructed in 1947 and many areas originally built as shops or laboratories are now being and will continue to be utilized as office space. A complete rehabilitation of the air conditioning system is required due to age and lack of capacity.

C. Lewis Research Center 1,955,000

(1) Rehabilitation of Engine Research Building, Building 5 350,000

This project provides for the rehabilitation of about 9,500 square feet of Building 5 for improved use as a photographic laboratory. Included in this work will be the provision of new partitions; and the electrical system, and chemical piping and plumbing systems will be rehabilitated and modified. The heating, ventilating and air conditioning systems will be replaced. New modern photographic processing collateral equipment will also be provided. The present photographic laboratory which occupies this space is obsolete and inadequate due to the changes in processes and techniques. Its initial installation was made on a minimal basis. Subsequent growth and adjustments have compounded the problem of fundamental use, circulation, materials storage, and safety. Photography and associated graphic arts are essential support services to the Center's research activities, and complete rehabilitation of this area is required.

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(2) Rehabilitation of Technical Services Building, Building 14 $350,000

The project provides for the rehabilitation of about 11,000 square feet with a mezzanine in Building 14 and includes a minor addition of about 2,000 square feet with the total area to be used by the Lewis fire fighting force. The existing area will be cleared and rearranged and coupled with the minor addition to provide space for seven pieces of existing motorized fire and safety related apparatus. Also provided will be a shop area for the repair of fire equipment and protective signalling devices. New walls, floors, ceilings, windows, doors, heating, ventilation, air conditioning, utility extensions, and toilet facilities will be included. All mechanical, electrical, and communications systems will be upgraded as required. The present Plant Protection Facility is located in a temporary wood structure (Building No. 29) built in 1944 as an engine test stand and later converted to its present use. Rehabilitation is not practical and the building will be demolished under this project.

(3) Rehabilitation of Water Systems 185,000

This project will provide cathodic protection for 3,450 linear feet of 24 inch steel water main (from meter house to Emergency Water Reservoirs, Building 31) as well as two 12 inch lines on Westover Road running between Walcott and Durand Roads. It will also include rehabilitation of six 100 H.P. pumps required for Cooling Tower No. 1 and two 350 H.P. pumps for Cooling Tower No. 4. These existing pumps have been in continuous service for up to 25 years and recently have required frequent emergency repairs. The work also will remove and replace some 1,300 linear feet of cooling water distribution lines between Engine Research Building, Building No. 5 and Refrigeration Building No. 9, and between Tower No. 2 and the 8 foot by 6 foot SWT Drive Equipment Building 53. These water lines are nearly 30 years old, have required frequent emergency repairs, and have deteriorated to an extent that further repairs are not economical. Cathodic protection also will be provided for approximately 10,000 linear feet of bare steel cooling water lines varying from 6 to 84 inches in diameter. Involved also is the rehabilitation of some 1,600 linear feet of 6 inch chilled water line from Refrigeration Building 9 to Administration Building 3, including replacement of a portion of this line. This piping has been in use for some 28 years and is beyond the point of economic repair.

(4) Rehabilitation of Air Distribution System $495,000

This project provides for the general rehabilitation of the center's air distribution system, some of which has been in service for over 20 years. It will remove and replace the thermal insulation from the overhead combustion air and steam piping associated with the Propulsion System Laboratory combustion air heaters, Building 76, and Propulsion System Laboratory Access Building, Building 66. Deteriorated insulation on one desiccant dryer also will be replaced. The exposed insulation on the combustion air piping connecting the air heaters to the main heater has deteriorated after 20 years of service to the extent that it is now impractical to continue patching. The project will also replace 2,500 linear feet of 7 inch service air piping between Propulsion System Laboratory Equipment Building, Building 64 and High Energy Fuels Laboratory, Building 51 and 2,100 linear feet of 4 inch service air piping between High Energy Fuels Laboratory, Building 51 and "South 40 Area". The pipe to be replaced is bare steel pipe that has been in service over 20 years with increasingly frequent repairs necessary due to leaks. Cathodic protection will be provided on 175 linear feet of 12 inch underground combustion air piping between Engine Research Building 5 and Icing Research Tunnel, Building 11, and 1,650 linear feet of 4 inch air service lines between Buildings 5 and Aero Test Building 112. Five exhauster intercooler "tube nests", five intercooler tanks, and ten expansion joints on the altitude exhaust system in the Propulsion System Laboratory Equipment Building 64, will be rehabilitated. New insulation will be installed on 50 linear feet of 48 inch and 80 linear feet of 24 inch overhead combustion air lines from the PSL heaters in Propulsion System Laboratory Air Heaters, Building 76 to the test chamber in Propulsion System Laboratory Altitude Chamber, Building 65.

(5) Rehabilitation and Modification of Gas Fuel System 140,000

This project provides for the installation of cathodic protection on 4,360 linear feet of 12 inch natural gas line along Walcott Road including stubs connecting various buildings to the mains. The natural gas loop main along Taylor Road and the stubs connecting the buildings thereto will also be included in this work. These unprotected underground natural gas lines

are 8 to 25 years old and have developed leaks due to galvanic corrosion. Some 1,225 linear feet of the existing 10 inch natural gas line running from Walcott Road to Technical Services Building 14 will be replaced including the installation of two new natural gas valves and the provision of cathodic protection. This existing bare steel line was constructed 20 years ago and has developed serious leaks with increasing frequency. It is now considered to be hazardous and uneconomical to maintain in service.

(6) Rehabilitation and Modification of Steam System $260,000

This project provides for the rehabilitation and modification of the center's steam system. It involves installation of 200 linear feet of 6 inch insulated pipe in conduit to interconnect the steam boilers in the Electric Propulsion Laboratory, Building 301, and the Energy Conversion Laboratory, Building 302. This will permit one boiler to provide the requirements of both buildings during periods of light loading for more efficient operations. The project also will replace 1,575 linear feet of 1 to 3 inch condensate return and high pressure drip lines. The condensate return lines have deteriorated to the point that further repairs are uneconomical. The coal fired No. 2 boiler in the Steam Plant, Building 12, will be converted to gas (primary) and oil (secondary) burning. The boiler feed water heater will be replaced with a new unit. The existing standby boiler will also be converted to gas and oil burning to eliminate the need for renovation and activation of the inoperative standby coal handling equipment.

(7) Rehabilitation and Modification of Data Cable System 175,000

This project provides for the rehabilitation of the center's data cable system. Some 330 linear feet of new duct bank and cable will be provided from Westover Road to the Propulsion Systems Laboratory, Building 66; the Propulsion Systems Laboratory Equipment Building, Building 64; and from manhole 21 to the Electric Propulsion Research Laboratory, Building 16. A new manhole will be constructed at Walcott and Moffet Roads and new duct and cable installed to the Chemistry

Laboratory Building No. 6, and to the Engine Components Research Laboratory, Building 102. These research facilities have utilized nearly all available data capacity for data transmission between each facility and the central data processing equipment located in the Computer Center, Building 86. Sufficient duct capacity is proposed to accommodate future as well as current requirements. Some 1,460 linear feet of new 4 inch concrete duct with 600 pair cable will be installed from the telephone switchboard station to the Materials and Stresses Laboratory, Building 49; connections also will be made to the Special Projects Laboratory, Building 24 and the Materials Processing Laboratory, Building 105. Some 40 linear feet of 4 inch concrete duct also from the telephone switchboard to a new manhole near manhole 19 will be installed to permit rerouting of cable presently routed through hazardous areas in the paint and computer shops. Essential center systems such as the safety protection and the data processing systems are now in need of additional duct and cable capacity which this project will provide.

4. OFFICE OF TRACKING AND DATA ACQUISITION	($1,360,000)
A. Various Locations	1,360,000
(1) Relocation of Deep Space Station, Woomera/ Honeysuckle, Australia	200,000

The close down of the existing Woomera Station (DSS 41 Australia) and the relocation/installation of its existing equipment to Honeysuckle Station, Canberra, Australia, requires certain modification and rehabilitation of existing facilities at the Honeysuckle site. The work includes changes to electrical, water, air conditioning systems, building modifications, and extension and modification to fire detection and protection system. It is planned that this project will be completed to support Deep Space Network activities and its implementation must be phased so as to be initiated immediately after the completion of Skylab coverage, early in 1974.

(2) Modification to Site Power Distribution Systems at Various Locations (DSN)

Increased reliability of the electrical power distribution systems at the Deep Space Network (DSN) stations

is required. Included will be the installation of electrical distribution panels in various buildings and new distribution circuits from the generator building. The site power distribution systems at these stations are inadequately rated due to the continuing growth of station loads and the up-grading of power generating equipment. Major components of the distribution system are being over-loaded, not adequately protected, obsolete, and are reaching their normal life expectancy for reliable operation. This project also implements results of circuit breaker coordination studies to provide selective tripping of circuits for isolation of faulted areas and equipment. The above work is applicable to the following locations:

a. Goldstone, California	$315,000
b. Tidbinbilla, Australia	160,000

Each of the above items will be managed as a separate facilities project because of the different locations involved.

(3) Modification of Magnetic Tape Facility 190,000

This work provides for alterations and refurbishment of the off-site Glen Dale Building No. 3, GSFC, to include partitioning, air conditioning, electric power and fire detection/protection. This work is required to provide adequate facilities for the expanding magnetic tape rehabilitation program carried out in this building. This facility also provides a random sampling, test and check of all new tape purchased for network operations. This quality control is necessary so that vital data received at the tracking station is not recorded on poor quality tape.

(4) Modifications to Site Power Distribution Systems at Various Locations (STDN)

Increased reliability of the electrical power distribution system at five Spaceflight Tracking and Data Network (STDN) facilities is required. This will be accomplished by providing radial loop systems to insure continued operation if a feeder failure occurs. Included will be the installation of electrical power feeders, electrical load banks and power transformers. The various network facilities are a minimum of five

years old and a maximum of sixteen years old. Operations at these stations are now dependent on one set of power feeders. This project will permit improvement of the electrical systems and the installation of a more reliable maintenance free system. Critical operations at these stations are dependent on the total electrical power systems and these projects are most important to future reliability and effective operations. This work is applicable to the following locations:

a. Santiago, Chile	$95,000
b. Goldstone, California	60,000
c. MILA, Florida	65,000
d. Bermuda	145,000
e. Ascension Island	130,000

Each of the above items will be managed as a separate facilities project because of the different locations involved.

5. MISCELLANEOUS PROJECTS LESS THAN $50,000 EACH	(1,500,000)
TOTAL	$14,785,000

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 1974 ESTIMATES

MINOR CONSTRUCTION

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 19 74 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION		COGNIZANT PROGRAM OFFICE FOR INSTALLATION
Various		Office of The NASA Comptroller
LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
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INSTALLATION MISSION

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 19___ (Estimated)	FUTURE YEARS (Estimated)	TOTAL ALL YEARS (Estimated)
Minor Construction of New Facilities and Additions to Existing Facilities Not In Excess of $250,000	Compt	2,082	4,600		Not Applicable
TOTAL			4,600		

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CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE	Minor Construction of New Facilities and Additions to Existing Facilities Not In Excess of $250,000
LOCATION	Various Locations
	FY 1974 CoF ESTIMATE $4,600,000

COGNIZANT INSTALLATION: Various Locations

LOCATION OF PROJECT: Various Locations

COGNIZANT PROGRAM OFFICE: Office of the NASA Comptroller

FY 1973 AND PRIOR YEARS CoF FUNDING:

Planning and Design	$362,000
Construction	1,720,000*
Total FY 1973 and Prior Years	$2,082,000

*Prior to FY 1973 this activity was not included in the CoF Appropriation.

SUMMARY PURPOSE AND SCOPE:

This program is intended to provide for minor facility construction at NASA field installations and at Government-owned industrial plants engaged in NASA activities. This includes minor facility projects involving the construction of minor new facilities or minor 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 1974 to improve the usefulness of NASA's physical plant by making it possible to accomplish needed adjustmenst in the utilization and for minor augmentations 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 facility projects of this type which must be accomplished in FY 1974 to meet 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 1974 to meet the peculiar or special 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 1974 have been carefully selected from a list totalling about $13 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 $4,600,000. Of this amount, about $4,200,000 represents specific, discrete items of proposed work, and $400,000 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 each.

PROJECT COST ESTIMATE:	$4,600,000
1. OFFICE OF MANNED SPACE FLIGHT	420,000
A. Kennedy Space Center	235,000
(1) Addition to Launch Equipment Shop, Building K6-1247, LC-39	235,000

This project provides for the construction of a 8,700 square foot addition to the east end of the existing Launch Equipment Shop (LES). The addition will be equipped with electrical receptacles, shop air connections, domestic water hose bibbs, overhead fluorescent lighting and a floor surface suitable for heavy equipment traffic. This addition is required to provide a covered work area to be used for the fabrication, modification, and refurbishment of platforms, test fixtures, environmental chambers, tanks, and various large assemblies

which will be required for future programs. The facility will be adequate to accommodate most of the large work now envisioned for future programs.

B. Marshall Space Flight Center $75,000

(1) Addition of Communications Facility, Building 4207 75,000

This project provides for the construction of a one story 4,000 square foot addition to Building 4207. The addition will contain a small lavatory, tile floor, industrial type sink, 16 foot cargo door, shop area lighting, and temperature and humidity control. Some area paving and extension of utilities will also be required. The addition will provide a suitable enclosed area for the assembly and checkout of telecommunications systems. These systems include video, audio, acoustic measuring, public address, operational intercoms, video camera chains, and control consoles. Expensive checkout and test equipment now temporarily located in Warehouse Building 7205 will be relocated to Building 4207 and combined with bench stock now located in part of the signal switching area. This addition to Building 4207 is essential to permit rearrangement and expansion of the signal distribution center.

C. Mississippi Test Facility 110,000

(1) Addition to Warehouse Facility, Building 2204 110,000

This work involves the construction of a 4,000 square foot addition to Building 2204. Included in this addition will be lighting, heating, air conditioning, toilet facilities, telephone and power outlets and movable partitions. When Building 2204 was built it included only minimum office area. Cataloging of government property records has been housed in trailers and various scattered locations. Provision of this additional office space adjacent to the present office will permit all work related to purchasing, cataloging, and warehousing to be located together for improved operating efficiency.

2. OFFICE OF SPACE SCIENCE $670,000

A. Ames Research Center 240,000

(1) Addition to Aircraft Service Dock 240,000

This project provides for the construction of about 6,000 square foot of building addition to the C-141 service dock now being installed. This requirement is additional to that for which the basic dock is being provided and will include areas for shops, laboratory and equipment support for telescope and aircraft tests, checkout and maintenance. The addition will be a single story structure, with utilities, toilet, and environmentally controlled areas for equipment test and checkout. It will house laboratories, shops and storage areas for the telescope simulator and provide areas for installation of existing test and checkout equipment required in aircraft maintenance support.

B. Goddard Space Flight Center 130,000

(1) Addition to Truck Dock, Building 11 130,000

This project provides for the construction of a 2,100 square foot air lock addition on the north side of the high bay of the Spacecraft Assembly Building, Building 11, for loading and unloading trucks transporting assigned sensitive spacecraft and like type loads. This addition will contain utilities, heating, lighting, sprinkler system and a 5-ton hoist monorail system. This project is required to minimize contamination of the Class 10,000 clean room satellite assembly, checkout and test area. The effectiveness of the air lock dock will be augmented by a preliminary cleaning capability outside the truck dock, and thus working together prevent direct entry of outside contamination into the clean room. With progressively larger spacecraft involved, the need for this addition is brought about by the increased frequency and importance of this phase of the total operation.

C. Jet Propulsion Laboratory $150,000

(1) Construction of Radio Astronomy Building 150,000

This project provides for the construction of a new laboratory-type building at the remote Table Mountain, California, site of about 2,500 square feet to house control consoles, data gathering equipment and instrumentation associated with the existing 18 foot diameter radio-telescope antenna and the planned second antenna installation for interferometry work. The building will be heated and air conditioned and will utilize computer-type floors in about two-thirds of its area. This will permit demolition of a 45 year old facility (TM-5) which currently houses this equipment. The existing antiquated wood frame "cottage type" structure housing this equipment was built in the 1920's. It is entirely inadequate regarding size, air conditioning, floor strength and safety for the equipment housed. Annual maintenance costs are high due to damage caused by winter storms. Equipment failures in summer are frequent due to inadequate cooling and ventilation, and test operations are seriously impacted by the substandard building features.

D. Kennedy Space Center 80,000

(1) Construction of Ready Storage Buildings 80,000

This project provides for the construction of two 600 square foot buildings (14 feet ceiling height) at the Explosive Safe Area (ESA) at the Eastern Test Range, Florida, for isolated storage of fully loaded propellant modules. The two propellant modules required for Viking launches, and a third backup module which will be loaded prior to launch, must be kept in explosive safe areas, separated from each other to prevent loss of other space hardware in the event of an explosion. Each of the first two modules will be moved to one of the proposed buildings after propellant loading. The third module will remain in the Propellant Laboratory, also in the ESA area, until required at the launch pad. Each building will include

personnel doors, utilities, lighting, air conditioning, grounding and water to meet necessary environmental and safety conditions of the loaded modules. No existing facilities are available to meet this unique storage requirement, which involves storage in the vertical position and thus necessitates the 14 foot ceiling height. All facilities that possibly could have been adapted for this requirement have been examined and it was determined that the proposed project provides the most economical and operationally effective solution to this requirement.

E. Wallops Station $70,000

(1) Addition to Aircraft Fire Crash Building, B-129 70,000

This project involves the construction of a 2,500 square foot addition to the present Aircraft Fire and Crash Building to provide a heated garage for the station's foam fire truck at a location near the airfield. The addition will be masonry block, built-up roof, motorized roll-up doors, with heating and utilities. This work is required to provide a heated storage area for the foam truck and additional fire and fire protection related equipment adjacent to the airfield. Included also is the enlargement of the existing food service area utilized by the fire fighter force. Currently, in the winter, the fire truck must be parked a considerable distance from the crash building because of the lack of an adequately heated nearby storage facility. When an emergency occurs on the airfield, considerable time is lost due to inability to bring the truck quickly to the scene. The proposed addition will locate the truck with other firefighting equipment, where the crash crew is on duty and thus greatly enhances the responsiveness of this operation.

3. OFFICE OF AERONAUTICS AND SPACE TECHNOLOGY 1,230,000

A. Ames Research Center 230,000

(1) Addition to Vertical Takeoff and Landing Area 220,000

This work involves construction of a "hard surfaced" pad approximately 200 feet by 200 feet to be located adjacent and as an addition to the present Vertical Takeoff and Landing (VTOL) Test Facility. The added test area will be large enough for hover evaluation maneuvers related to such vehicles as the X14B, XV-5B, V/STOL and V/STOLAND. The existing taxiways and runways, when subjected to the severe conditions of jet blast and heat, are susceptible to erosion and chipping which creates a high potential risk of "foreign object damage". The concentration of other work spaces and activities adjacent to the aircraft ramp further precludes use of the existing concrete ramp areas for these purposes.

(2) Addition to Life Sciences High Bay, Building N-239A $60,000

This project provides for the construction of a 2,400 square foot (two story) structure within the Life Sciences High Bay, Building N-239A. The facility work includes wall framing and covering, new vinyl floor covering, lighting, electrical power and air conditioning systems. Laboratory equipment and cabinets will be included in the project as collateral equipment. This work is required to permit the relocation of the Teleoperator and the Pressure Suit Laboratory from the basement of the Life Sciences Research Laboratory Building N-239 to the high bay area of Building N-239A. The existing area used for these activities was so used as a "temporary accommodation" and is too small and functionally inadequate. This relocation is also required to permit the presently used space to be allocated to other life sciences activities. A Teleoperator Laboratory complete with control room and the capability of accommodating roving vehicles is required to carry out the teleoperator program. The teleoperator development and the pressure suit development work will support planned applications for future programs such as the Space Shuttle.

B. Flight Research Center $245,000

(1) Construction of an Aircraft Servicing Dock 245,000

This project provides for the construction of a new Aircraft Servicing Dock of about 10,500 square feet to be located between the existing Aircraft Construction and Modification Hangar, Building 4801 and the High Temperature Loads Calibration Facility, Building 4820. The proposed building will be of pre-engineered steel framing, sidewalls, and roofing about 140 feet wide and with a 40 foot eave height. The building will be provided with large sliding doors, a reinforced concrete floor, insulated, heated, electrical power and lighting. Also provided will be an apron of about 140 feet wide and 100 feet between this dock and the existing taxiway. This project will provide the required additional hangar space to support current and near current flight research programs, and to lessen potential hazards due to overcrowding of aircraft in the present facilities. The center aisle (fire lane) in the existing hangar is frequently blocked or impassable due to congestion. Four of the six F-104 aircraft now at the Center will initially be maintained in this aircraft servicing dock. It will be used for aircraft flight maintenance activities, instrumentation and avionics systems installation, checkout, analysis, and calibration in preparation for flight operations. Comparable future aircraft will also be assigned this facility.

C. Langley Research Center 645,000

(1) Addition to Data Reduction Center, Building 1268 245,000

This project will provide for a two-story addition to the Data Reduction Center, Building 1268. This addition of 9,000 square feet will be constructed on wood pilings and will have brick veneer masonry exterior walls, aluminum windows, and an aluminum wall facade architecturally similar to the existing facility. Electrical, heating, air conditioning and plumbing systems will be included in the addition. This addition will provide space to house the new Institute for Computer Applications in Science and Engineering (ICASE) and the Flight

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Dynamics and Control Division (FDCD) personnel. The ICASE was established at Langley in July 1972 to provide a focal point for the conduct of research in the disciplines of applied mathematics and computer science. It is necessary that the offices for approximately 35-50 ICASE and FDCD personnel be located in the same building as the computer complex. This addition is the only practical means for providing the required office space.

(2) Construction of a Laser and Optics Instrumentation Laboratory $235,000

This project will provide for the construction of a new one story structure of approximately 8,000 square feet between the present Fabrication Shop, Building 1232A and Marvin Road. The building will be constructed of lightweight concrete masonry units compatible with the existing shop complex construction. Necessary plumbing, heating, electrical work, exhaust ventilation and air conditioning systems will be provided. The proposed facility will be used to house the Facilities Electronics Laboratory and the Laboratory Glass and Optical Instrumentation Facility. The Facilities Electronics Laboratory will provide a common central work area for facility instrumentation fabrication, audio/visual support and administrative area for the management of the electronic wiring support activities. At present these activities are housed in three scattered areas that are inadequate. The Laboratory Glass and Optical Instrumentation Unit is presently conducting limited operations in the Fabrication Shop, Building 1232A. The building is small, inadequate, and restricts the needed capabilities of the unit. The present Glass Laboratory area is potentially hazardous because of the use of hydrogen, oxygen, and propane in such a confined area. The proposed facility is needed to better support expanding laser research projects, and is necessary for the glass laboratory to expand its present facilities and permit installation of existing equipment such as a glass-blowing lathe, optical coating equipment to coat lasers, mirrors

and an optical bench. The installation of this optical equipment is essential to carrying out of the many unusual optical projects required by the research programs.

(3) Addition to V/STOL Wind Tunnel, Building 1212C $165,000

This project provides for the construction of a 1,600 square foot addition to the existing second floor level of the model preparation area of the V/STOL Wind Tunnel, Building 1212C. This building extension of the second floor will be the width of the present building, and at the level of the test chamber floor of the V/STOL tunnel. The additional area will be adjacent to the north wall of the existing test chamber and accessible thereto through a new pressure door. The construction work includes a structural steel and concrete floor slab system, concrete masonry walls, with the related mechanical and electrical systems. Approximately 1,200 square feet of the existing first floor will require modification and alteration to provide for the foundation for the proposed new second floor. The construction of a computer control area of 500 square feet with a raised floor system is also included in the proposed work. The purpose of this proposed project is to improve the methods of preparing, handling and storing research models for the V/STOL tunnel by providing, at the second floor level, additional floor space for model preparation and data acquisition activities. Assembly, checkout, and disassembly of models being tested in the V/STOL tunnel are presently performed in the test chamber area immediately adjacent to the tunnel test section, in an area that is crowded and also used for lifting models and equipment from the ground floor level to the test section.

D. Lewis Research Center 80,000

(1) Addition to Vehicle Repair Building No. 104 80,000

This project will provide for the construction of an addition of 2,640 square feet with a mezzanine floor of 850 square feet to the Vehicle Repair Building No. 104. The addition

is to be of clear span metal frame and siding approximately 16 feet high at the eaves and will be on a concrete floor slab with a metal roof, roll-up door, windows, and pits for equipment. Toilet facilities, a shop office, heating, ventilation, and shop type lighting and electrical power service will be provided. This addition will provide a work area for heavy equipment maintenance, storage areas for tires and spare parts, and include toilet and locker facilities for the mechanics. The present structure now being used for automotive repair work has approximately 3,000 square feet of floor area, is too small and congested, causing hazardous working conditions, and is without toilet facilities. In this minimum area over 300 pieces of motorized equipment must now be serviced, requiring that some work be performed outside in adverse weather. The planned addition will make available a total of about 6,500 square feet for this activity and improve the overall effectiveness of this operation.

4. OFFICE OF TRACKING AND DATA ACQUISITION $1,860,000

A. Various Locations 1,860,000

(1) Network Consolidations

A number of relocations of existing antenna systems are proposed to begin the consolidation of the Manned Space Flight Network (MSFN) and the Space Tracking and Data Acquisition Network (STADAN) into a single network, the Spaceflight Tracking and Data Network (STDN). The facilities to be relocated include Range and Range Rate System, Unified S-Band, Satellite Automatic Tracking Antenna Network (SATAN) and Satellite Command Antenna Medium Power (SCAMP) antenna systems and UHF/VHF capabilities. The relocations will require construction of new antenna foundations, boresight tower foundations and guy anchors, transmitter building, power and signal trenches, building modifications and necessary roads and parking areas. Fire detection and protection, electrical systems

and grounding systems will be modified as necessary. These relocations will initiate the merging of the capabilities of the two networks into a single integrated network of fewer stations with a more flexible capability to support the total workload of all earth orbital missions.

The proposed relocations are listed below:

a. Antenna Relocation and Addition to Operations Building, Madrid, Spain	$245,000
b. Antenna Relocation and Addition to Operations Building, Bermuda	235,000
c. Antenna Relocation and Addition to Operations Building, Hawaii	240,000
d. Addition of Unified S-Band Antenna, Orroral, Australia	185,000
e. Addition of Range and Rate System, Quito, Ecuador	175,000
f. Addition of Unified S-Band Antenna and Addition to Telemetry Building, Madagascar	235,000
g. Antenna Relocation and Addition to Operations Building, Canary Islands	205,000

Each of the above items will be managed as a separate project because of the different locations involved.

(2) Construction of Mobile Laser Facilities

Construction of three precise laser tracking ground stations is required for calibration of the Geodetic Earth Orbiting Satellite (GEOS-C) mounted radar altimeter. The construction will consist of site grading, trailer hardstands, boresight tower, wind holddowns, connections to commercial power, grounding, and sanitary facilities. The three ground stations will be located at:

a.	Merritt Island, Florida	$60,000
b.	Antigua, West Indies	70,000
c.	Bermuda	60,000

Each of the above items will be managed as a separate project because of the different locations involved.

(3) Addition to Water Supply, Madrid, Spain — 50,000

This project provides for the installation of approximately 10,000 feet of waterline from an existing off-site well to the tracking station. Much of the trenching for the proposed waterline will be through difficult terrain. During the dry season the existing on-site well can not supply sufficient water. This project will eliminate the need for drilling an additional well on the station and the uncertainty of finding an adequate flow in the new well.

(4) Construction of Maintenance Building, Madagascar — 100,000

This project provides for construction of a 2,600 square foot concrete and masonry structure to provide work areas for the following functions: paint shop, machine shop, welding area, parts and tools, sanitary facilities and two bays for vehicle maintenance and repair. Existing facilities constructed as a temporary structure were improvised for use to service the station vehicles. This building has deteriorated to the point where it has been condemned and a replacement is now required.

5. MISCELLANEOUS PROJECTS LESS THAN $25,000 EACH — 400,000

TOTAL — $4,600,000

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 1974 ESTIMATES

FACILITY PLANNING AND DESIGN

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

INSTALLATION SUMMARY

CONSTRUCTION OF FACILITIES

FISCAL YEAR 19 74 BUDGET ESTIMATES

(Dollars in thousands)

NASA INSTALLATION		COGNIZANT PROGRAM OFFICE FOR INSTALLATION
All		Office of The NASA Comptroller
LOCATION OF INSTALLATION	COUNTY	NEAREST CITY
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INSTALLATION MISSION

PROJECT LINE ITEM	COGNIZANT OFFICE	FY 1959 THRU CURRENT YR	FY 1974 (Estimated)	FUTURE YEARS (Estimated)	TOTAL ALL YEARS (Estimated)
Facility Planning and Design	Compt	78,374	13,600		Not Applicable
TOTAL			13,600		

CONSTRUCTION OF FACILITIES

FISCAL YEAR 1974 ESTIMATES

PROJECT TITLE Facility Planning and Design	
	FY 1974 CoF ESTIMATE $13,600,000

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

a. The accomplishment of necessary development and master planning for field installations and, where not otherwise provided for, the 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 $13.6 million requested for facility planning and design for FY 1974 is composed of two major segments:

a. Regular requirements - $4,300,000

b. Other requirements - $9,300,000

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. 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.

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1. REGULAR REQUIREMENTS

a. Master Planning and Facility Studies

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 1974 illustrate this point:

-Value Engineering and Analysis
-Design Specifications Update and Support
-Building Research and Advisory Board Support
-Engineering Handbook (Revision)
-Rehabilitation and Modification Study (Revision)
-Facilities Operations and Maintenance Study

"As-built" drawings are normally updated along with each major facility project impacting a given facility. However, the added importance to such drawings generated by the Occupational Safety and Health Act of 1971 makes it necessary that any accumulation of this type of work, not specifically and otherwise provided for, be accomplished within this estimate.

Subtotal for Master Planning and Facility Studies ($1,250,000)

b. Preliminary Engineering Reports

Preparation of preliminary engineering reports (PER's), investigations and project studies related to proposed facilities projects to be included in the subsequent FY 1976 Construction of Facilities program are provided for by this esti-

mate. 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 $35 million to $40 million for which complete new PER's will be required.

Subtotal for Preliminary Engineering Reports	(800,000)

c. Final Design

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 1975 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 $40 million.

Subtotal, Final Design	(2,250,000)
Subtotal, Regular Requirements	$4,300,000

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. Space Shuttle Facilities

(1) This portion of the total requirement associated with space shuttle facilities is in part 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 1976 Construction of Facilities program. This preliminary work is associated with proposed subsequent construction estimated to cost $75 million to $85 million and is to be carried out in relation to such future space shuttle related projects as:

(a) Launch and Landing Facilities. Studies and preliminary engineering reports which will be conducted towards providing new facilities or modifying existing capabilities to meet requirements for disassembly and servicing of the solid rocket booster, servicing and storage of the hypergolic pods, recovery and refurbishment of parachutes for the solid rocket booster.

(b) Solid Rocket Booster Facilities. Studies and preliminary engineering reports will be directed towards modifying existing facilities for manufacturing and, propulsion, structual, and hydro-proof testing of the solid rocket boosters (SRB). This preliminary effort is necessary to permit the early development of the testing and production facilities for the SRB.

The cost of the preparation of these preliminary engineering reports (PER's) for FY 1976 is estimated at $1,250,000. In addition, for related studies and engineering support it is estimated that $550,000 will be required.

(2) This portion of the total requirement involved with space shuttle facilities is associated with the preparation of final design, drawings and specifications necessary for the accomplishment of subsequent space shuttle facilities to be included in a FY 1975 Construction of Facilities request. This final design work is associated with this increment of proposed subsequent construction estimated to cost $120 million to $130 million and is carried out in relation to future space shuttle related projects. The cost of the preparation of these final designs for FY 1974 is estimated at

$7,100,000. This will essentially complete design on facilities for the ground test program, systems integration and crew training facilities, and will provide for such future facilities as those related to solid rocket boosters and to other direct support facilities at Kennedy Space Center, Florida related to launch, landing, servicing and maintenance. Included are:

(a) Ground Test Program/System Integration and Crew Training Facilities. Final design will be directed toward modifying existing capabilities to the extent possible or providing new facilities for dynamic testing of the shuttle orbiter, booster, external tank, and a mated configuration; for thermal vacuum and materials testing; and for crew training facilities.

(b) Solid Rocket Boosters. Final design will be associated with modification of existing facilities or provision of new facilities for the initial increment of facilities related to solid rocket booster testing and production.

(c) Launch and Landing Site Facilities. This portion of the requirement is directed towards preparation of final design, drawings and specifications for launch, launch support and landing facilities for the space shuttle vehicle at Kennedy Space Center.

(1) Modification of the launch pad

(2) Modification of the mobile launcher

(3) Modification of the Vehicle Assembly Building for maintenance, checkout, mating and integration.

(4) Modification of the launch control center

(5) Provision of a facility to receive, assemble and store the solid rocket boosters

(6) Modification of the Launch Complex 39 fire system

(7) Provision of the flight readiness firing system

(8) Provision of a Thermal Protection System refurbishment facility

(9) Modification of maintenance shop for component refurbishment

(10) Provision of safing facilities, operations building, and mechanical gear at the orbiter landing site.

Subtotal, Space Shuttle Facilities	($8,900,000)

b. Other Facilities

This planning requirement specifically relates to the development of preliminary engineering related to the construction of a high reynolds number transonic wind tunnel capability. This capability would be at either Ames Research Center or Langley Research Center dependent on the subsequent analysis of engineering data and other factors. This proposed facility involves many complex engineering problems the solution of which may heavily impact the technical capability of the tunnel as well as its ultimate cost. The purpose of this facility is to perform aerodynamic tests at RN up to 50 million and Mach Number 0.2 to 1.4. The amount requested will permit the continuation of essential facilities engineering into the preliminary design phase and the establishment of more specific engineering and cost data which is essential to adequate future programming.

Subtotal, Other Facilities	(400,000)
Total, Other Requirements	$9,300,000
Total, FY 1974 Request	$13,600,000

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