Rec'd

National Aeronautics and Space Administration

BUDGET ESTIMATES

FISCAL YEAR 1963

CONSTRUCTION OF FACILITIES

PART 2

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

CONSTRUCTION OF FACILITIES

TABLE OF CONTENTS

PART 1

	Page No.
Appropriation summaries	CF S-1
Summary of Construction of Facilities Programs	CF S-3
Justification by location:	
Ames Research Center (Moffett Field, California)	CF 1-A1
Atlantic Missile Range (Cape Canaveral, Florida)	CF 2-A1
Facility Planning and Design	CF 3-A1
Flight Research Center (Edwards, California)	CF 4-A1
Goddard Space Flight Center (Greenbelt, Maryland)	CF 5-A1
Jet Propulsion Laboratory (Pasadena, California)	CF 6-A1
Langley Research Center (Hampton, Virginia)	CF 7-A1
Lewis Research Center (Cleveland, Ohio)	CF 8-A1
PART 2	
Manned Spacecraft Center (Houston, Texas)	CF 9-A1
Marshall Space Flight Center (Huntsville, Alabama)	CF 10-A1
Michoud Plant (New Orleans, Louisiana)	CF 11-A1
Mississippi Test Facility (Mississippi)	CF 12-A1
Nuclear Rocket Development Station (Nevada)	CF 13-A1
Various Locations	CF 14-A1
Wallops Station (Wallops Island, Virginia)	CF 15-A1

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

APPROPRIATION SUMMARY

	1961	1962	1962 Supplemental	1963
SALARIES AND EXPENSES	$(170,760,000)	$(206,750,000)	$ -	$ -
RESEARCH AND DEVELOPMENT	(670,453,000)	(1,220,000,000)	(85,000,000)	-
RESEARCH, DEVELOPMENT AND OPERATION	841,213,000	1,426,750,000	85,000,000	2,968,278,000
CONSTRUCTION OF FACILITIES	122,787,000	245,000,000	71,000,000	818,998,000
TOTAL	$ 964,000,000	$1,671,750,000	$156,000,000	$3,787,276,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

SUMMARY OF CONSTRUCTION PROGRAMS

	Fiscal Year 1961	Fiscal Year 1962 Appropriated	Fiscal Year 1962 Requested Supplemental	Fiscal Year 1963
Ames Research Center.	$545,000	$6,115,000	---	$14,439,000
Atlantic Missile Range.....	27,321,000	72,225,000 1/	$55,000,000	359,963,000
Facility Planning and Design.....	---	5,154,000	---	10,000,000
Flight Research Center.....	---	---	---	1,807,000
Goddard Space Flight Center.....	9,500,000	9,180,000	---	23,780,000
Jet Propulsion Laboratory.....	8,531,000	3,580,000	---	10,360,000
Langley Research Center.....	11,957,000	6,530,000	---	8,092,000
Lewis Research Center	9,590,000	1,040,000	---	43,833,000
Manned Spacecraft Center.....	---	60,000,000 2/	---	30,755,000
Marshall Space Flight Center.....	26,208,000	25,716,000	---	33,437,000
Michoud Plant.....	---	980,000 2/	---	18,400,000
Mississippi Test Facility.....	---	10,090,000 2/	16,000,000	92,500,000
Nuclear Rocket Development Station	---	15,000,000 2/	---	40,000,000
Pacific Missile Range	492,000	995,000	---	---
Various Locations....	28,235,000	44,786,000	---	127,332,000
Wallops Station.....	2,090,000	7,965,000	---	4,300,000
Total.....	124,469,000	269,356,000	71,000,000	818,998,000
Transferred from "Salaries & Expenses"	-590,000	---	---	---
Transferred from "Research & Development".....	-360,000	-24,356,000	---	---
Transferred from Department of Defense.....	-1,070,005	---	---	---
Reserve.....	338,005	---	---	---
Total appropriation	$122,787,000	$245,000,000	$71,000,000	$818,998,000

1/Includes $4,700,000 authorized under "Various Locations"
2/Included in authorization act under "Various Locations"

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

CONGRESSIONAL BUDGET SUBMISSION

FISCAL YEAR 1963 ESTIMATES

CONSTRUCTION OF FACILITIES-1963 PROGRAMS

Page No.	Location and Project	Project Estimate	Location Total
CF 1	Ames Research Center:		$14,439,000
CF 1-A1	Location Summary		
CF 1-A2	Location plan		
CF 1-A3	Bioscience laboratory.....	$924,000	
CF 1-B1	Mach number 50 helium tunnel.....	1,500,000	
CF 1-C1	Radiative heat system for mass transfer facility.....	2,225,000	
CF 1-D1	Space flight guidance research facility.....	9,790,000	
CF 2	Atlantic Missile Range:		359,963,000
CF 2-A1	Location Summary		
CF 2-A2	Location plan		
	Existing Area:		
CF 2-A3	Modifications to Saturn launch complex No. 34.....	3,765,000	
CF 2-B1	Modifications to Saturn launch complex No. 37.....	1,150,000	
CF 2-C1	Modifications to provide a launch complex for solid suborbital vehicles.....	1,717,000	
CF 2-D1	Supporting facilities.....	3,000,000	
CF 2-E1	Addition to assembly facility for unmanned spacecraft.....	2,000,000	
CF 2-F1	Explosive safe assembly facilities for unmanned spacecraft.....	450,000	
CF 2-G1	Apollo mission support facilities.....	22,510,000	
CF 2-H1	Modifications to Titan II launch complex.....	2,400,000	
CF 2-I1	Utility installations.....	800,000	

Page No.	Location and Project	Project Estimate	Location Total
	New Area:		
CF 2-J1	Advanced Saturn launch complex No. 39.....	$176,550,000(I)	
CF 2-K1	Advanced Saturn-Nova supporting facilities.....	39,121,000	
CF 2-L1	Apollo static test facility....	5,000,000	
CF 2-M1	Nova launch complex.....	79,500,000(I)	
CF 2-N1	Utility installations.....	22,000,000(I)	
CF 3-1	Facility Planning and Design.....	10,000,000	$10,000,000
CF 4	Flight Research Center:		1,807,000
CF 4-A1	Location Summary		
CF 4-A2	Location plan		
CF 4-A3	Building additions.....	1,332,000	
CF 4-B1	Visual flight simulator.....	475,000	
CF 5	Goddard Space Flight Center:		23,780,000
CF 5-A1	Location Summary		
CF 5-A2	Location plan		
CF 5-A3	Applied sciences laboratory.....	3,175,000	
CF 5-B1	Attitude control test facility...	915,000	
CF 5-C1	Conversion of dynamic test chamber.....	3,250,000	
CF 5-D1	Development operations building..	1,850,000	
CF 5-E1	Launch phase simulator.....	3,915,000	
CF 5-F1	Spacecraft operations facility...	7,500,000	
CF 5-G1	Tracking and telemetry laboratory	3,175,000	
CF 6	Jet Propulsion Laboratory:		10,360,000
CF 6-A1	Location Summary		
CF 6-A2	Location plan		
CF 6-A3	Addition to fabrication services building.....	605,000	
CF 6-B1	Data operations and command facility.....	2,420,000	
CF 6-C1	Engineering mechanics building...	3,045,000	
CF 6-D1	Additions to materials research laboratories.....	610,000	
CF 6-E1	Telecommunications laboratory....	2,860,000	
CF 6-F1	Utility installations.....	820,000	

Page No.	Location and Project	Project Estimate	Location Total
CF 7	Langley Research Center:		$8,092,000
CF 7-A1	Location Summary		
CF 7-A2	Location plan		
CF 7-A3	Addition to heating plant	$858,000	
CF 7-B1	Additional equipment for magnetoplasmadynamics research...	1,450,000	
CF 7-C1	Additional power supply and improved arc chamber for 10-megawatt arc tunnel.....	760,000	
CF 7-D1	Environmental research facilities for spacecraft components and materials.....	997,000	
CF 7-E1	Particle accelerator for simulation of micrometeoroid impact.....	936,000	
CF 7-F1	Stabilization and control equipment laboratory.....	1,366,000	
CF 7-G1	Vehicle antenna test facility.....	1,725,000	
CF 8	Lewis Research Center:		43,833,000
CF 8-A1	Location Summary		
CF 8-A2	Location plan		
CF 8-A3	Development engineering building...	4,650,000	
CF 8-B1	Hydrogen heat transfer facility....	2,400,000	
CF 8-C1	Lunar propulsion research facility.	6,275,000	
CF 8-D1	Modernization and reconditioning of Plum Brook service facilities.	1,508,000	
CF 8-E1	Nuclear rocket dynamics and control facility.....	3,500,000	
CF 8-F1	Space propulsion facility.....	25,500,000	
CF 9	Manned Spacecraft Center:		30,755,000
CF 9-A1	Location Summary		
CF 9-A2	Location plan		
CF 9-A3	Flight acceleration facility.....	10,630,000	
CF 9-B1	Thermochemical test facilities.....	6,000,000	
CF 9-C1	Lunar landing simulation facility..	6,500,000	
CF 9-D1	Site development and utility installations.....	7,625,000	
CF 10	Marshall Space Flight Center:		33,437,000
CF 10-A1	Location Summary		
CF 10-A2	Location plan		
CF 10-A3	Addition to computation division building.....	1,255,000	
CF 10-B1	Components test facility.....	4,000,000(I)	

Page No.	Location and Project	Project Estimate	Location Total
CF 10-C1	Components and subassembly acceptance building.....	$950,000	
CF 10-D1	Engineering and administration building.....	2,500,000	
CF 10-E1	Expansion of instrumentation systems in West Area.....	4,000,000	
CF 10-F1	F-1 engine test stand.....	4,500,000(I)	
CF 10-G1	Hydraulic test facility.....	340,000	
CF 10-H1	Low temperature facility.....	575,000	
CF 10-I1	Modification of West side of static test stand.....	2,000,000(I)	
CF 10-J1	Engineering building.....	1,000,000	
CF 10-K1	Instrument laboratory.....	2,000,000	
CF 10-L1	Support facilities in West Area.....	7,800,000	
CF 10-M1	Utility installations.....	2,517,000	
CF 11	Michoud Plant:		$18,400,000
CF 11-A1	Location Summary		
CF 11-A2	Location plan		
CF 11-A3	Modifications to Michoud Plant.....	11,400,000	
CF 11-B1	High pressure test facility.....	1,000,000	
CF 11-C1	Hydrostatic test and cleaning facility.....	3,000,000	
CF 11-D1	Vertical assembly building.....	3,000,000	
CF 12	Mississippi Test Facility:		92,500,000
CF 12-A1	Location Summary		
CF 12-A2	Location plan		
CF 12-A3	Advanced Saturn stage test facilities.....	36,000,000(I)	
CF 12-B1	Nova stage facilities.....	43,000,000(I)	
CF 12-C1	Utility installations and support facilities.....	13,500,000	
CF 13	Nuclear Rocket Development Station:		40,000,000
CF 13-A1	Location Summary		
CF 13-A2	Location plan		
CF 13-A3	Stage static test and maintenance facilities.....	20,205,000	
CF 13-B1	Stage demating, maintenance, and disassembly facilities.....	8,660,000	
CF 13-C1	Radiation effects facility.....	7,125,000	
CF 13-D1	Components test facilities.....	1,885,000	
CF 13-E1	Support facilities.....	2,125,000	

Page No.	Location and Project	Project Estimate	Location Total
CF 14	Various Locations:		$127,332,000
CF 14-A1	Location Summary		
CF 14-A2	Advanced antenna system Goldstone Station.....	$14,250,000	
CF 14-B1	Advanced Saturn dynamic test facility.....	2,100,000	
CF 14-CD1	Antenna facility, Johannesburg Station.....	5,000,000	
CF 14-CD1	Antenna facility, Woomera Station..	5,000,000	
CF 14-E1	Data acquisition facility, Far East Station.....	6,000,000	
CF 14-F1	Data acquisition facility, Rosman Station.....	3,500,000	
CF 14-G1	Facilities for F-1 engine program..	25,000,000(I)	
CF 14-H1	Facilities for J-2 engine program..	4,000,000(I)	
CF 14-I1	Facilities for M-1 engine program..	16,000,000(I)	
CF 14-J1	Manned space flight control centers	18,000,000(I)	
CF 14-K1	Space radiation effects laboratory.	12,382,000	
CF 14-L1	Nova stage manufacturing facilities	16,100,000(I)	
CF 15	Wallops Station:		4,300,000
CF 15-A1	Location Summary		
CF 15-A2	Location plan		
CF 15-A3	Advanced data acquisition system...	1,500,000	
CF 15-B1	Modification and expansion of range control, safety, and support systems and equipment.....	2,000,000	
CF 15-C1	Vehicle checkout facilities and equipment.....	800,000	
	TOTAL, 1963 PROGRAM.....		$818,998,000

(I) Incrementally funded project.

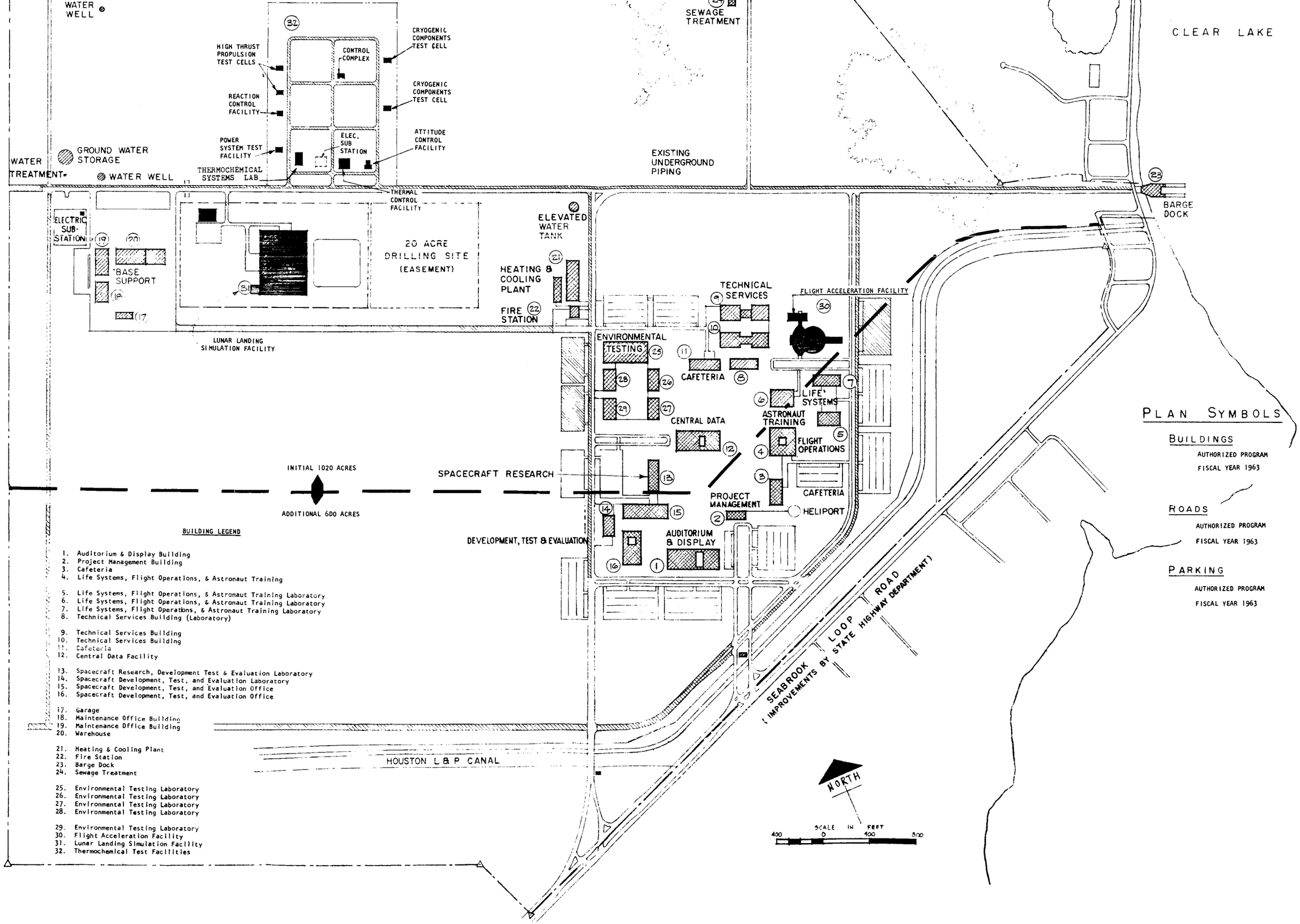
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

CONSTRUCTION OF FACILITIES - 1963 PROGRAM

MANNED SPACECRAFT CENTER

Page No.		
CF9-A2	Location plan	
CF9-A3	Flight acceleration facility.....	$10,630,000
CF9-B1	Thermochemical test facilities.....	6,000,000
CF9-C1	Lunar landing simulation facility.....	6,500,000
CF9-D1	Site development and utility installations.....	7,625,000
	Total.....	$30,755,000



BUILDING LEGEND

1. Auditorium & Display Building
2. Project Management Building
3. Cafeteria
4. Life Systems, Flight Operations, & Astronaut Training

5. Life Systems, Flight Operations, & Astronaut Training Laboratory
6. Life Systems, Flight Operations, & Astronaut Training Laboratory
7. Life Systems, Flight Operations, & Astronaut Training Laboratory
8. Technical Services Building (Laboratory)

9. Technical Services Building
10. Technical Services Building
11. Cafeteria
12. Central Data Facility

13. Spacecraft Research, Development Test & Evaluation Laboratory
14. Spacecraft Development, Test, and Evaluation Laboratory
15. Spacecraft Development, Test, and Evaluation Office
16. Spacecraft Development, Test, and Evaluation Office

17. Garage
18. Maintenance Office Building
19. Maintenance Office Building
20. Warehouse

21. Heating & Cooling Plant
22. Fire Station
23. Barge Dock
24. Sewage Treatment

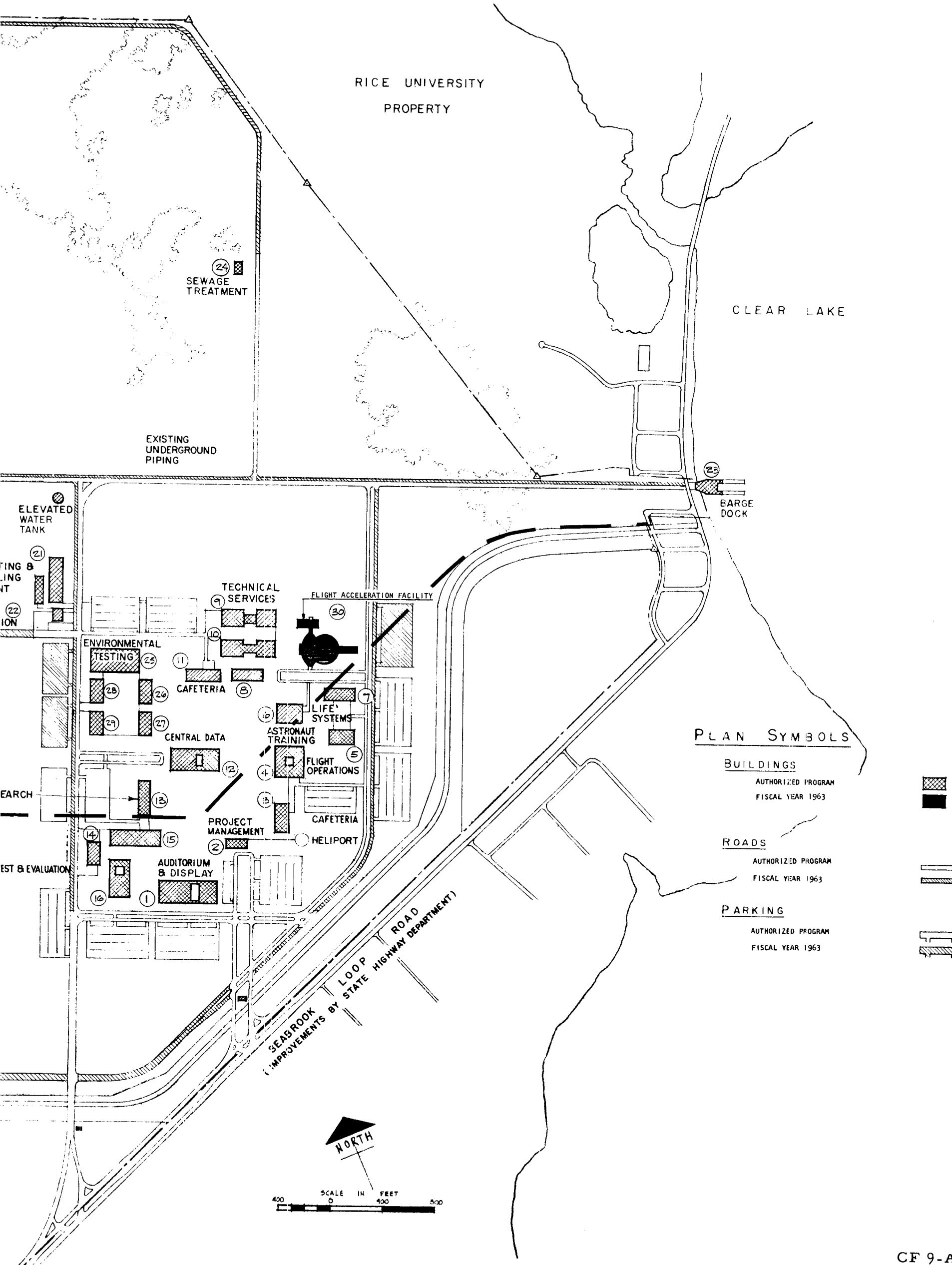
25. Environmental Testing Laboratory
26. Environmental Testing Laboratory
27. Environmental Testing Laboratory
28. Environmental Testing Laboratory

29. Environmental Testing Laboratory
30. Flight Acceleration Facility
31. Lunar Landing Simulation Facility
32. Thermochemical Test Facilities

CF

MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

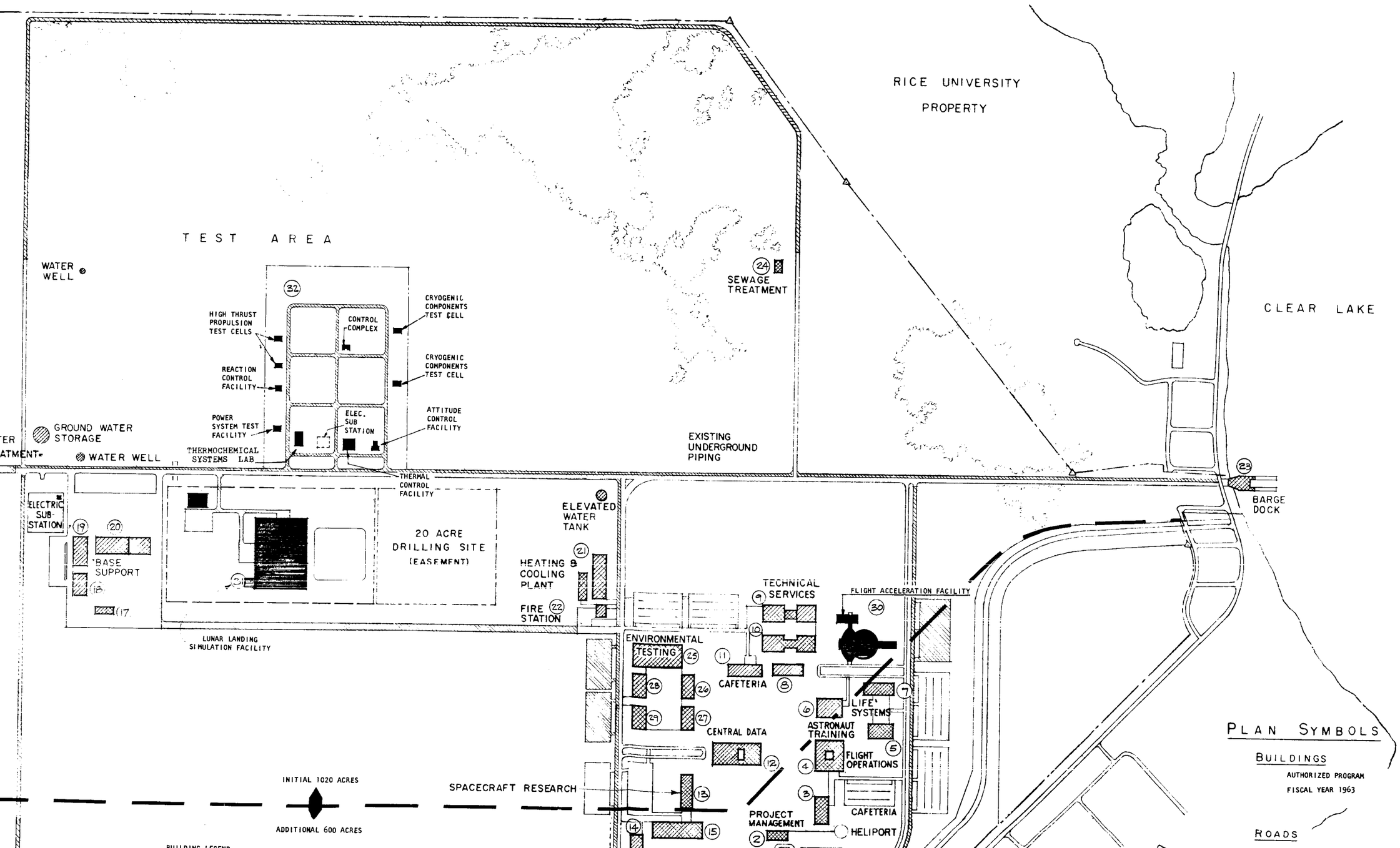
LOCATION PLAN



CF 9-A2

MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

LOCATION PLAN



MANNED SPACECRAFT CENTER

FISCAL YEAR 1963 ESTIMATES

FLIGHT ACCELERATION FACILITY

DESCRIPTION:

The construction of a large, high "G" centrifuge is required to accomplish the following purposes:

(a) Provide an environmentally controlled dynamic simulator which will be used by astronauts for training and experience in the mechanics of space flight.

(b) Provide a dynamic laboratory for the study of psycho-physiological factors in the performance of individuals to develop, evaluate, and perfect man-machine sub-systems, and to determine human tolerance to specific acceleration profiles.

The facility to accomplish these objectives will require the following characteristics:

(a) Forty "g" acceleration at the rate of 15g's per second.

(b) Three degrees of rotational freedom: pitch, 360 degrees; yaw, 360 degrees; roll, plus or minus 180 degrees.

(c) Five rapidly interchangeable gondolas with provisions for control of temperature, humidity, atmospheric pressure, light, and sound.

(d) Ability to simulate complex flight and acceleration profiles through programmed control of gondola motion and instrument presentation.

(e) Instrumentation and channels for data acquisition, transmission, readout, and recording.

The dynamic simulator will consist of a gondola mounted on the end of a rotating arm which will be activated by a prime mover system. The two way flow of data will travel through a complex cable system between the control center and the gondola. The arm length will be approximatley 100

feet, with the final length to be determined by such factors as gondola size, maximum acceleration gradient along the thrust axis of the gondola, and cost.

The centrifuge will be located within a reinforced concrete pit of approximately 42,000 square feet which will be surmounted by a hemispheric dome which will minimize air flow and thus provide greater control over the rotating device. The entire unit will be operated from an adjacent operations center which will overlook the centrifuge pit. The center will also house pre- and post-flight examination laboratories; instrumentation shops for development, assembly, and repair of data acquisition and mensuration systems; a preparation area for larger components; systems engineering space; and an operations area. The project includes a training and administrative building to house computers for programming and data reduction; an assembly and shop building for maintenance, assembly and storage of gondolas and large components; and a generator room.

The entire facility will possess maximum flexibility in order to permit the use of newly developed gondolas, additional instrumentation and increased training requirements. A sketch of the proposed installation is shown on the next page.

JUSTIFICATION:

Training and maintaining the proficiency of an astronaut requires a three pronged program which includes class room instruction, simulator training, and actual flight in space trainers. The program must be completely interrelated and integrated. For example, before actual flight, a simulator is necessary for familiarization and pre-flight training. Following and between flights, the simulator is essential to maintain proficiency and to gain additional experience. The centrifuge will be used to simulate a large number of variables and conditions which will be encountered in actual flight, and thus reduce the danger and the cost of actual flights.

The foregoing functions will occupy about fifty percent of the centrifuge time. The remainder will be devoted to performance and physiological studies in the following areas:

(a) Integration of the human work function with design of the working space.

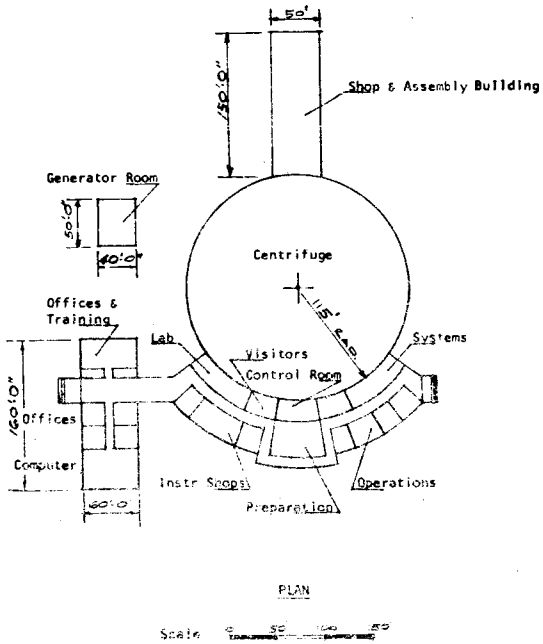
(b) Development and evaluation of restraints for support systems.

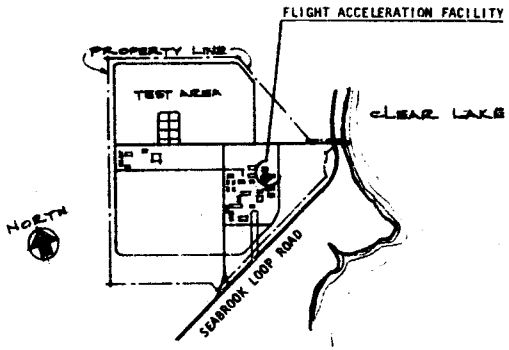
(c) Development and evaluation of protective devices.

(d) Evaluation of specific critical mechanical systems and subsystems suspected of being sensitive to radial acceleration gradients.

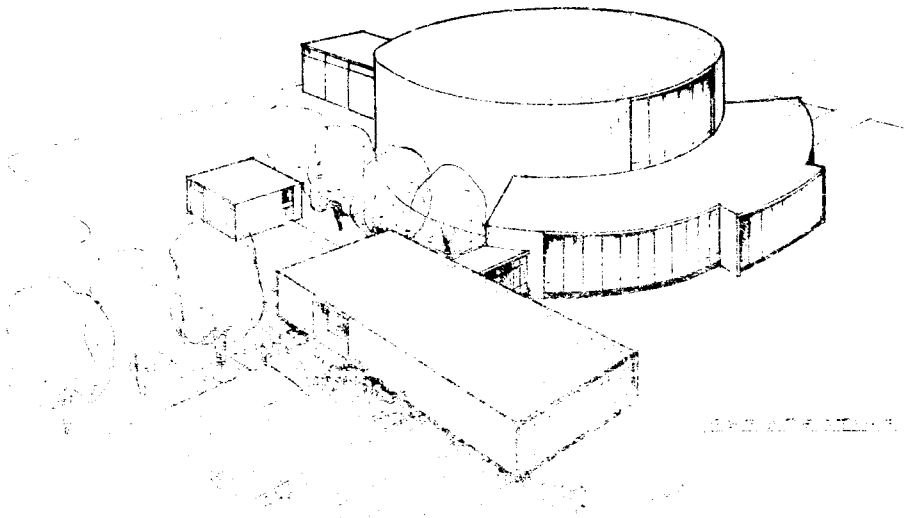
MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

FLIGHT ACCELERATION FACILITY





LOCATION MAP



(e) Basic bio-physical research involving human tolerance to specific acceleration profiles.

Centrifuges are acquiring general use in such areas as propulsion component testing and inertial guidance system evaluation, and each facility is normally designed for a specific purpose. Consequently, there are no devices available with the capability or the available time for training astronauts and for performing the functions discussed above. Of special significance however, is the fact that the training of astronauts must be regarded as a highly integrated function which requires several facilities such as a lunar landing simulation facility, environmental chambers, static simulators, and dynamic simulators. These facilities will form an integrated system available for mission exercises which are realistic and thus yield maximum training for the astronauts.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$215,000
Water lines	$10,000	
Sanitary and storm sewer lines	10,000	
Electric power and communications connections	140,000	
Roads	45,000	
Clearing and grading	10,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		3,228,000
Centrifuge facility foundations and substructure..(42,000 square feet at $40.00 per square foot)	1,680,000	
Centrifuge enclosure..(42,000 square feet at $20.00 per square foot)	840,000	
Control room annex..(18,000 square feet at $20.00 per square foot)	360,000	
Administrative and training building.. (9600 square feet at $16.00 per square foot)	154,000	
Shop and assembly building (7500 square feet at $20.50 per square foot)	154,000	
Generator room..(2000 square feet at $20.00 per square foot)	40,000	

D. EQUIPMENT, INSTRUMENTATION AND SUPPORT SYSTEMS.....		$6,057,000
Variable speed converters.....	$1,200,000	
Drive motor.....	600,000	
Centrifuge arm and gimbals.....	2,685,000	
Gondolas.....	300,000	
Centrifuge control equipment.....	575,000	
Instrumentation including data acquisition, readout, recording, and cabling.....	455,000	
Support systems, equipment, and fixtures.....	242,000	
E. DESIGN AND ENGINEERING SERVICES.....		1,130,000
Total estimated cost.....		$10,630,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1963 ESTIMATES

THERMOCHEMICAL TEST FACILITIES

DESCRIPTION:

Thermochemical test facilities are required for the evaluation and development of active spacecraft subsystems such as propulsion systems, reaction and attitude control systems, auxiliary power systems, and thermal control systems. The project includes the following facilities:

(a) A high thrust propulsion test cell capable of supporting tests of liquid propulsion engines.

(b) A high thrust propulsion test cell capable of supporting tests of solid propulsion engines.

(c) A hydrogen component cryogenic test cell capable of supporting tests on specific components of larger propulsion engines.

(d) An oxidizer component cryogenic test cell capable of supporting tests on specific components of larger propulsion engines.

(e) A reaction control facility capable of supporting tests on reaction control systems to 150 pounds thrust.

(f) A control room complex for remote operation of hazardous tests.

(g) A power systems test facility capable of supporting tests on chemical auxiliary power systems.

(h) A thermochemical systems laboratory capable of supporting tests on static energy conversion systems, and offering component capability relative to thermal control systems and reaction control systems. Office space is provided in this building for supervisory and working groups associated with the entire thermochemical area.

(i) A thermal control facility capable of supporting heat transfer and heat rejection tests of spacecraft subsystems. The basic component of this facility is a 25 foot diameter thermal vacuum chamber to be operated at

10^{-5} mm of mercury. The facility will accommodate Apollo size service modules.

(j) An attitude control facility capable of evaluating certain spacecraft dynamic responses related to the operation of active reaction control jets. A single axis air-bearing table is utilized in this facility.

Sketches of the facilities are presented on the following four pages.

JUSTIFICATION:

The various test facilities requested in this project are required for the development of the Apollo and other manned spacecraft. The facilities will permit developmental tests for the evaluation of all types of flight hardware. They will be used to conduct many of the time consuming and repetitive environmental, evaluation, and qualification tests required for the establishment of design and component reliability. Current designs of components will be tested and evaluated to assure that the proper spacecraft criteria have been met; advanced designs will be tested to develop a readily available in-house knowledge and capability for use on all spacecraft flight systems. Integrated flight systems will be tested for the purpose of determining the interactions and the dynamics associated with such integrations.

Specific justifications for each individual facility or groups of facilities follow:

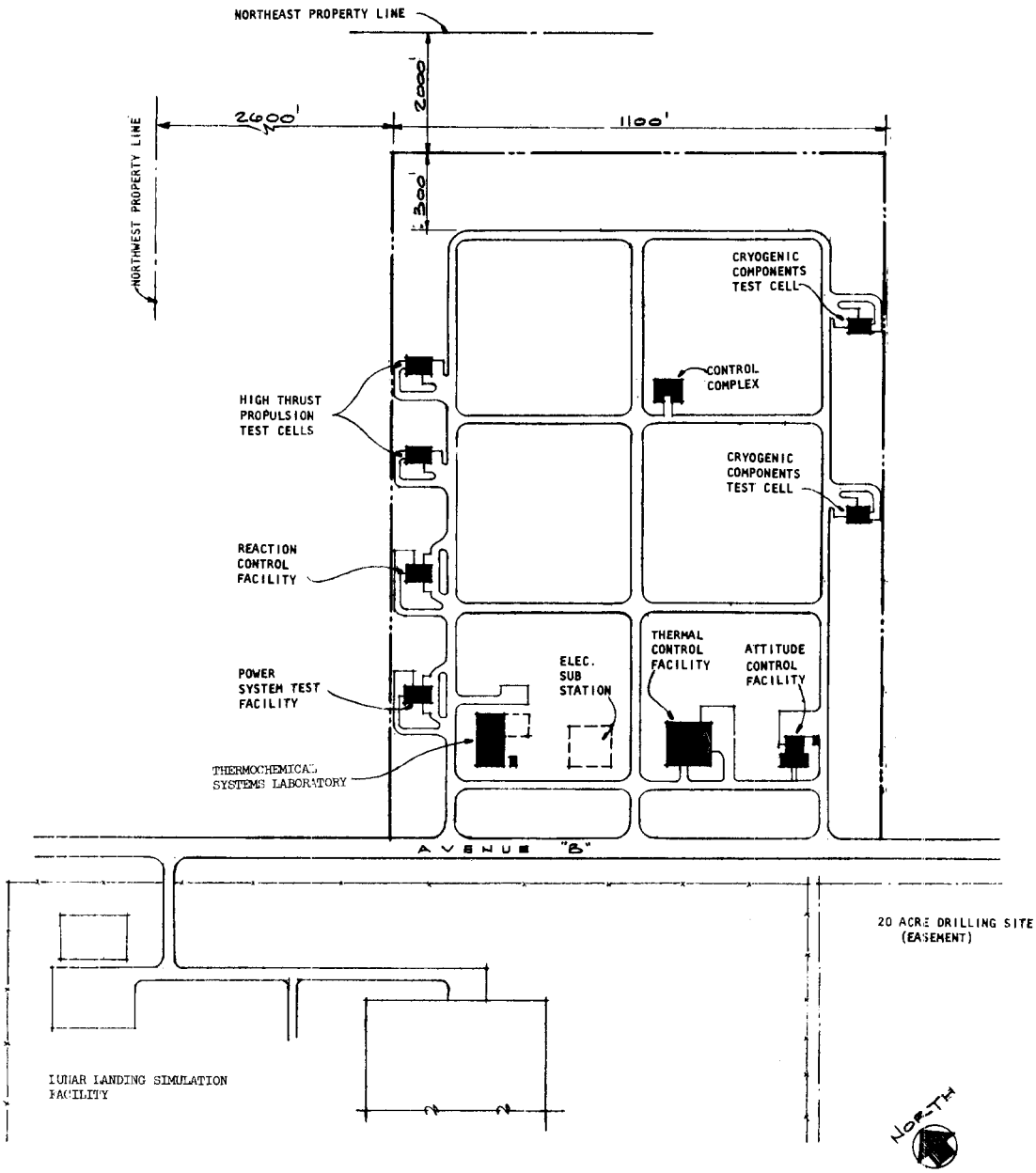
(a) Propulsion and component test cells: Capability is required to allow investigation of the various propulsion systems applicable to manned space flight which will include systems using propellants of high impulse or advanced propulsion systems more suited to the peculiar environments of manned space flight. The facilities will permit test programs to be completed rapidly in accordance with program schedules. The launch escape rocket which generates over 250,000 pounds of thrust is a typical example of a component which will be tested in the 300,000 pound thrust test cell. Tests on the bare motor and tests integrated with associated components will be conducted.

(b) Control complex: The control complex will integrate the propulsion test cells and the component test cells. The complex will allow remote and safe control of all tests involving high energy releases or inherent hazards.

(c) Reaction control facility: A considerable effort will be required in the development of reaction control systems involving low thrust devices and fast response modulating

MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

THERMOCHEMICAL TEST FACILITIES



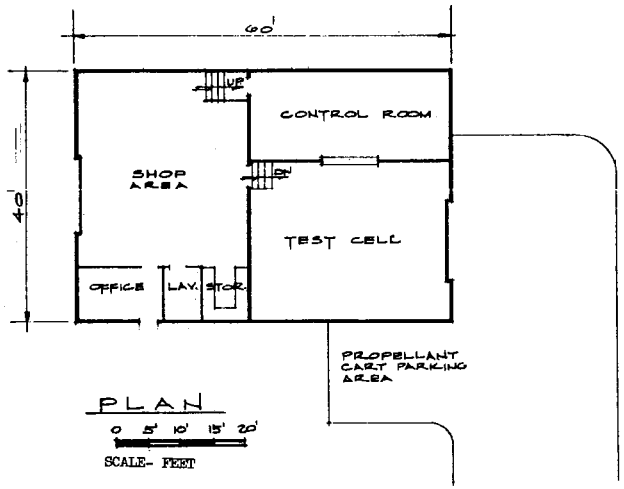
PLOT PLAN

0' 100' 200' 300' 400'
SCALE - FEET

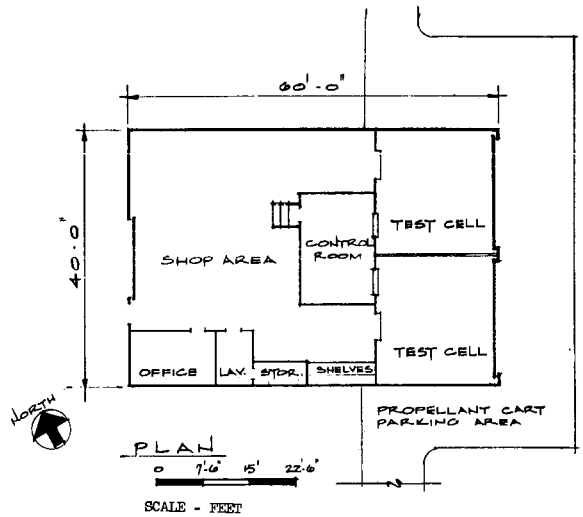
MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

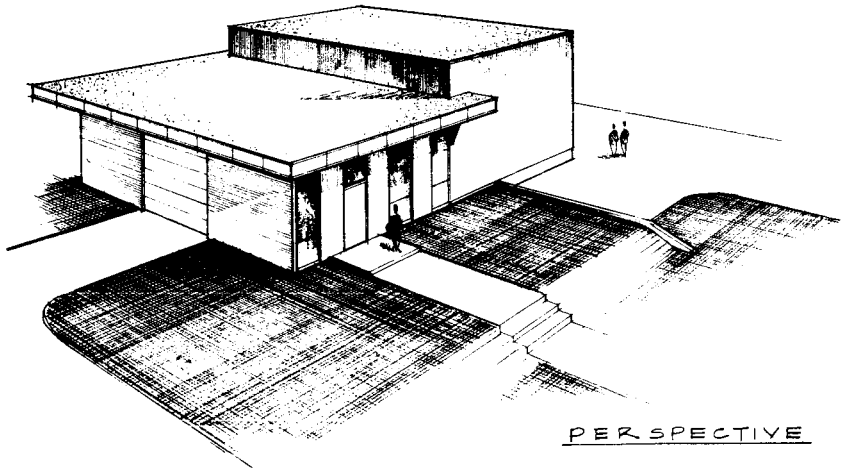
THERMOCHEMICAL TEST FACILITIES

CRYOGENIC COMPONENTS & HIGH THRUST PROPULSION TEST CELLS (4)

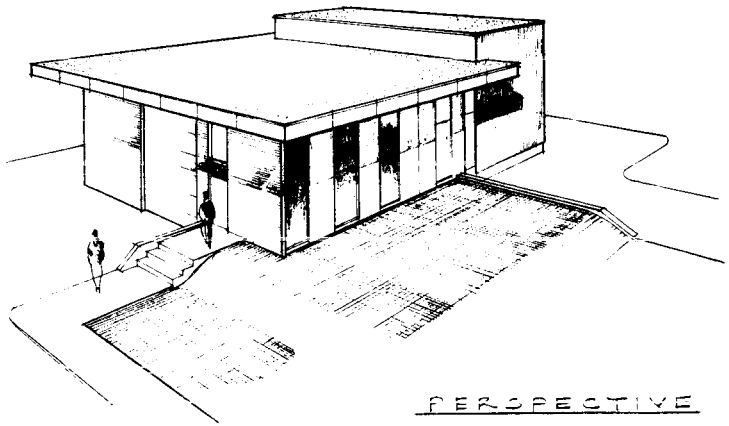


REACTION CONTROL FACILITY
(POWER SYSTEMS TEST FACILITY IS SIMILAR)





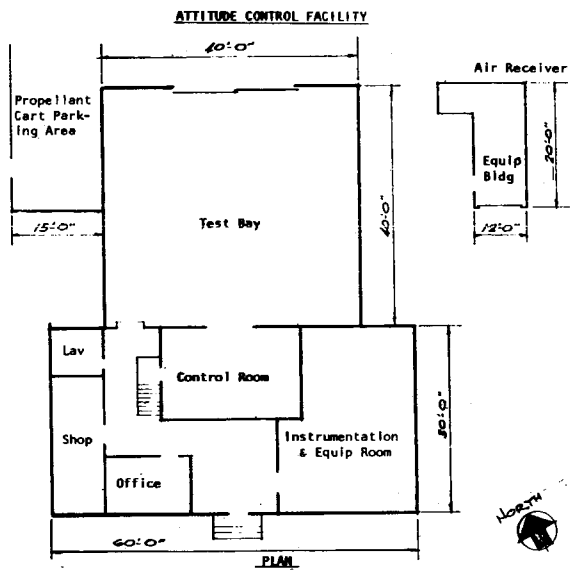
PERSPECTIVE

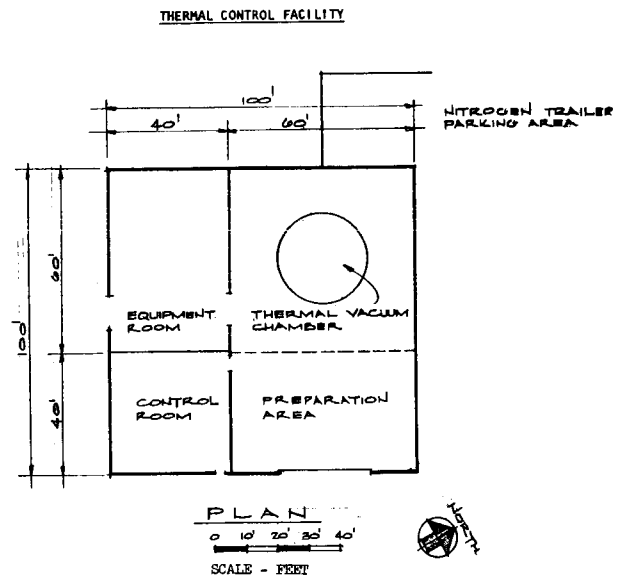


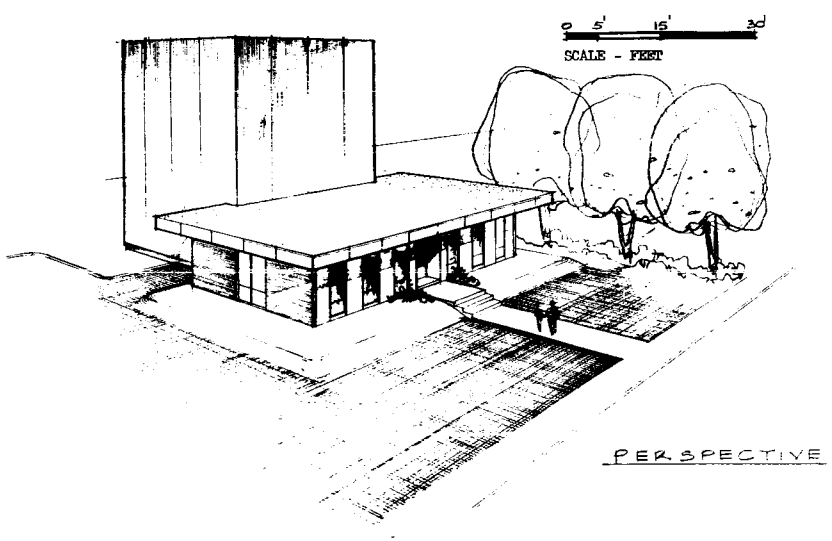
PERSPECTIVE

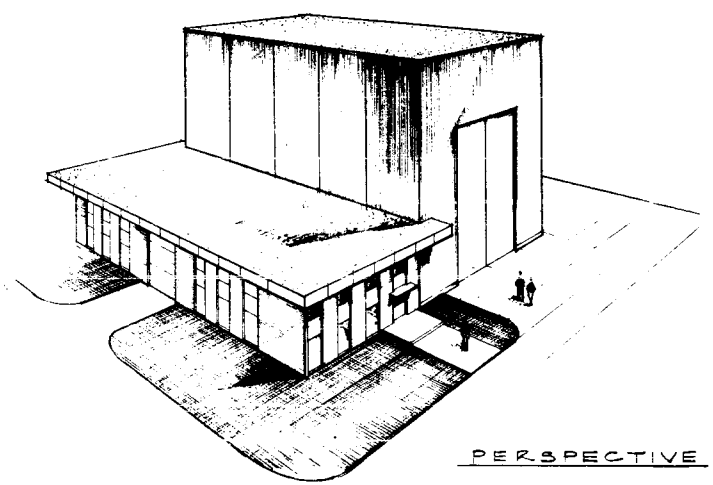
MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

THERMOCHEMICAL TEST FACILITIES





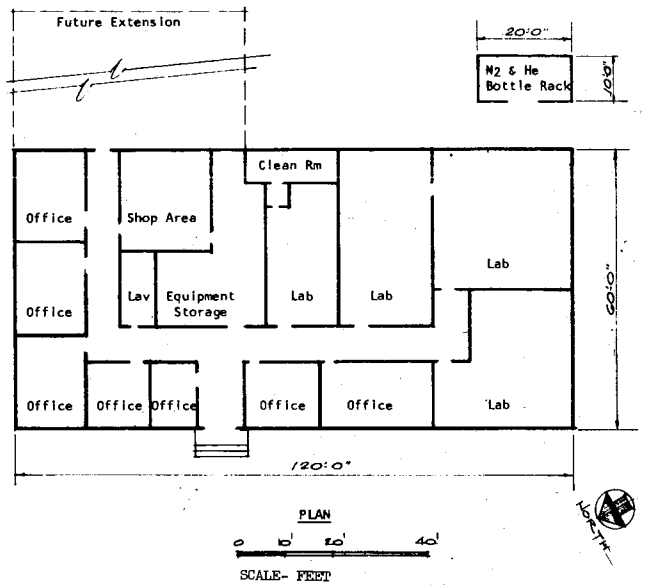




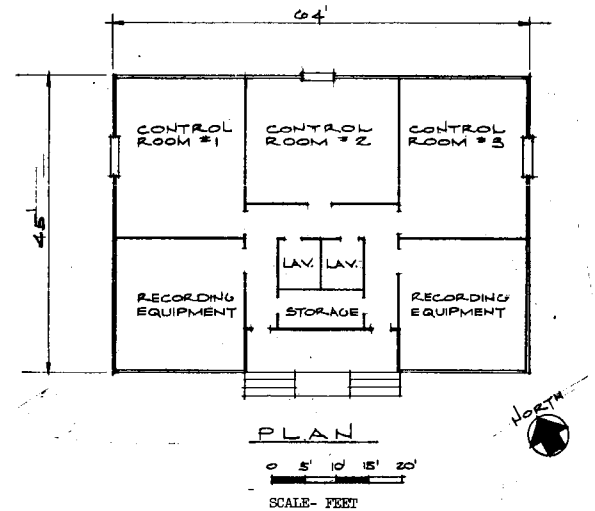
MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

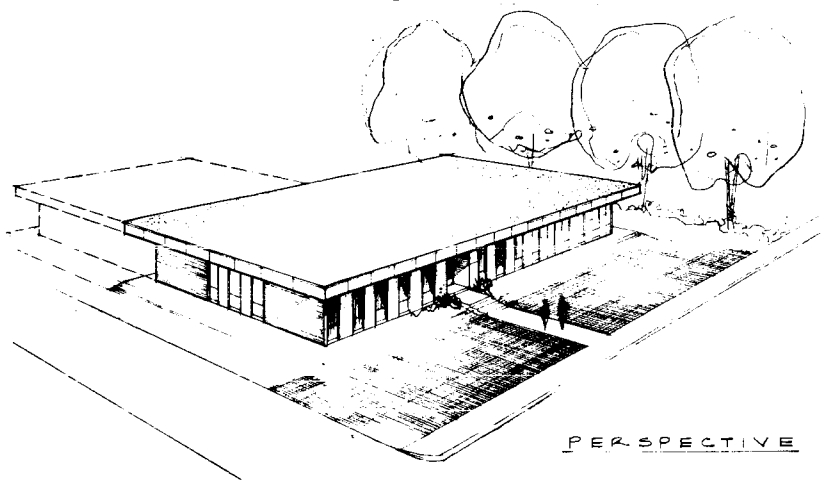
THERMOCHEMICAL TEST FACILITIES

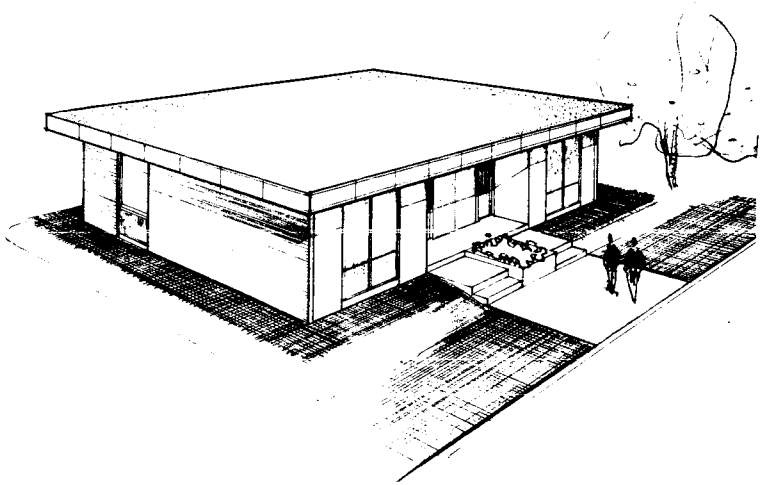
THERMOCHEMICAL SYSTEMS LABORATORY



CONTROL COMPLEX







CF 9-B6

controls. Investigations of restart capabilities, environmental effects, and overall systems response must be made. Separate investigations of thrust chamber and injector geometries will be required.

(d) Power systems test facility: Space power systems involve a complexity of new concepts which must be developed to assure reliable systems. The auxiliary power systems will vary for manned space flight according to mission goals and duration. All concepts of space power including chemical, solar, and nuclear will be utimately utilized. The power systems test facility will permit testing of electrochemical and chemical-dynamic systems in a protected test cell. Other capabilities such as solar and static devices are provided in the thermochemical laboratory adjacent to this facility.

(e) Thermochemical systems laboratory: This facility is required for work on the nonhazardous components involved in energy conversion systems, reaction control systems, and thermal control systems. The laboratory will also be the focal point of personnel assigned to the entire thermochemical area. The laboratory will include a clean room for close tolerance and dust free assembly requirements.

(f) Thermal control facility: The thermal control facility is required for radiator evaluation under simulated environmental conditions. It will be located in a controlled area to allow for the operation of auxiliary power systems requiring the use of cryogenic reactants. A realistic simulation of the extreme variation in the effective space temperature must be imposed on the radiators to fully evaluate system performance for all mission phases.

(g) Attitude control facility: In the simulation of factors influencing the spacecraft dynamic response to the attitude control system, the simulation of the reaction control jets cannot be accurately duplicated. The total impulse of the jets is sensitive to the start up and tail off characteristics as well as to combustion efficiencies. It is, therefore, necessary to use an active reaction control system coupled with realistic vehicle inertias.

COST ESTIMATE:

A. LAND ACQUISITION..... ---

B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$195,000
	Utility connections.....	$55,000	
	Paving.....	100,000	
	Pads.....	40,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,448,000
	Propulsion and component test cells..(2400 square feet at $52.30 per square foot)...	502,000	
	Control complex..(2880 square feet at $45.00 per square foot).....	128,000	
	Reaction control facility..(2400 square feet at $49.00 per square foot).....	116,000	
	Power systems test facility..(2400 square feet at $49.00 per square foot).....	116,000	
	Thermochemical systems laboratory..(7200 square feet at $17.00 per square foot)...	124,000	
	Thermal control facility..(10,000 square feet at $35.00 per square foot).....	350,000	
	Attitude control facility..(3600 square feet at $31.00 per square foot).....	112,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		3,697,000
	Propulsion and component test cells.....	1,228,000	
	Cranes and tracking equipment... $35,000		
	Thrust stands..... 350,000		
	Mechanical and electrical support systems..... 628,000		
	Instrumentation..... 215,000		
	Control complex.....	107,000	
	Mechanical and electrical support systems..... 27,000		
	Instrumentation..... 80,000		
	Reaction control facility.....	201,000	
	Cranes and tracking equipment... 5,000		
	Thrust stands..... 50,000		
	Mechanical and electrical support systems..... 131,000		
	Instrumentation..... 15,000		
	Power systems test facility.....	44,000	
	Mechanical and electrical support systems..... 27,000		
	Instrumentation..... 17,000		

Thermochemical systems laboratory.....		$185,000	
Optical and solar devices.....	$120,000		
Mechanical and electrical support systems.....	35,000		
Instrumentation.....	30,000		
Thermal control facility.....		1,725,000	
Cranes and tracking equipment..	30,000		
Mechanical and electrical support systems.....	220,000		
Thermal vacuum chamber.....	1,435,000		
Instrumentation.....	40,000		
Attitude control facility.....		207,000	
Cranes and tracking equipment..	5,000		
Mechanical and electrical support systems.....	52,000		
Instrumentation.....	150,000		
E. DESIGN AND ENGINEERING SERVICES.....			$660,000
Total estimated cost.....			$6,000,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1963 ESTIMATES

LUNAR LANDING SIMULATION FACILITY

DESCRIPTION:

The purpose of this project is to provide a facility capable of simulating spacecraft response within lunar gravitational environments. The facility will be used to investigate problems, to develop techniques, to develop equipment, and to train crews in the following areas:

(a) Lunar landing.
(b) Staging mechanics.
(c) Lunar launch.
(d) Flight separation of modules during an unplanned mission termination.
(e) Spacecraft docking.
(f) Transferring crews and cargo from one module to another.

The main facility will consist of a test chamber which will allow free or tethered flight within a closed volume approximately 400 feet long, 150 feet wide, and 210 feet high. Two independent carriages will be provided each of which will have a servo controlled vertical tethering capability. One carriage will carry live loads up to about 75,000 pounds; the second will be limited to 25,000 pounds. The servo control vertical tethering system will support test vehicles in simulation of the differing gravitational fields to be encountered, and will act as a safety device for normally free flight operations. A test vehicle will be provided which may be flown in either a free or a tethered state. The vehicle will incorporate the more essential features of a proposed lunar landing craft (propulsion, interfaces, visibility) which are necessary for realistic simulation. General hoist, transport, and drop test capabilities will also be included. An integral adjunct to the test chamber is the control building which will contain the equipment to operate and control the carriages and test vehicles.

A specimen preparation and maintenance shop will also be required. This building will provide 15,000 square feet of space with a clear height of 75 feet. An overhead crane with a 75,000 pound live load capacity is included. A small administration building will provide space for engineering personnel, crew preparation areas, and general office and briefing room space.

In addition to the buildings and structures, a paved free flight test area will be required of approximately the same layout as the chamber; roads, streets, and an isolated fueling and purging area will complete the complex.

From an operational viewpoint the facility will possess a broad capability for the simulation of particular phases of manned space flight and landing operations. For instance, an appropriate representation of lunar gravitational fields can be attained through servo controlled vertical tethering systems. Lunar atmospheric conditions will be considered through the use of scaling techniques and analog models for correlation with crew participation.

Lunar landing problems will be investigated through tethered operation of full scale landing vehicles. Thus, developmental programs and crew training will be facilitated. The effects of lunar gravity on vehicle dynamics will also be simulated through servo control of the vertical tethering device. Scale models and analog representation will also be possible. Lunar soil mechanics will be simulated to the extent permitted by the earth's atmosphere and gravitational field. There will also be a free flight capability for those lunar landing systems which can best be represented by this technique. Safety will be assured through the use of special crew tethering devices, ejection seats, or other necessary appurtenances.

In the development of staging mechanics, full scale interface problems may be investigated where zero or appropriate accelerations may be simulated by servo controlled vertical tethering of either of the modules involved.

Through a representation of applicable gravitational fields by means of servo controlled vertical tethering of either or each of the modules involved, in-flight separation of modules can be studied. This will be of particular importance during an unplanned termination of a mission. The problems to be studied and the subsequent techniques and crew training procedures to be developed will include termination of space flight from trajectory injection near the earth to any stage of lunar landing.

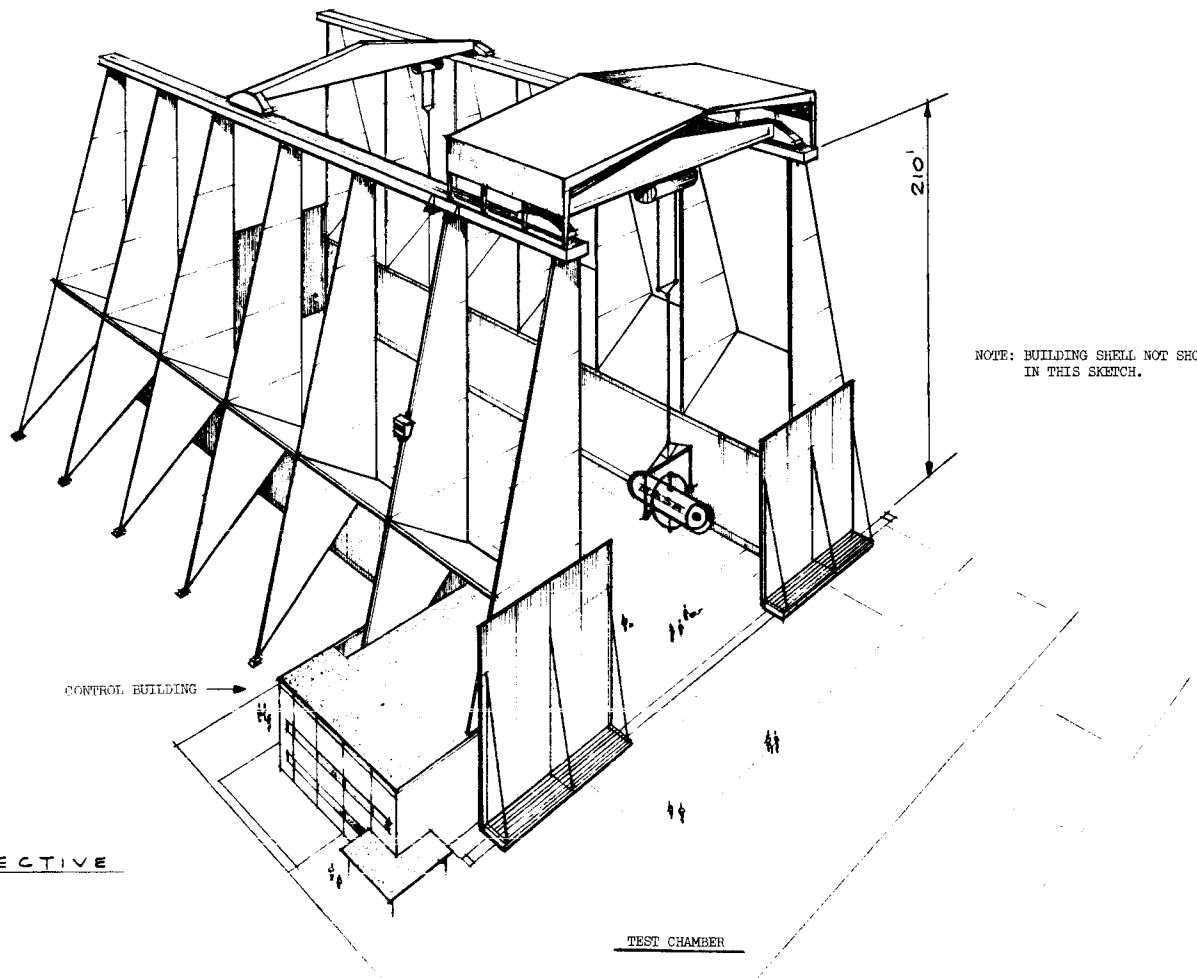
Docking maneuver techniques and crew training involving both tethered and free flight docking will be possible through the servo controlled vertical tethering of each module involved in order to provide a relative zero gravity situation. Impact energy may thus be studied and exercises performed in the mechanical attachment of appropriate interfaces.

The servo controlled vertical tethering device will be used to suspend appropriate modules and equipment so that an analysis of the problems associated with the transfer of crews or cargo from one module to another may be investigated and techniques and equipment developed.

Sketches of the proposed facility are shown on the following three pages.

MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

LUNAR LANDING SIMULATION FACILITY



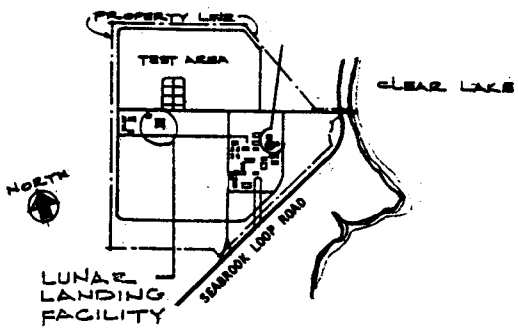
NOTE: BUILDING SHELL NOT SHOWN IN THIS SKETCH.

PERSPECTIVE

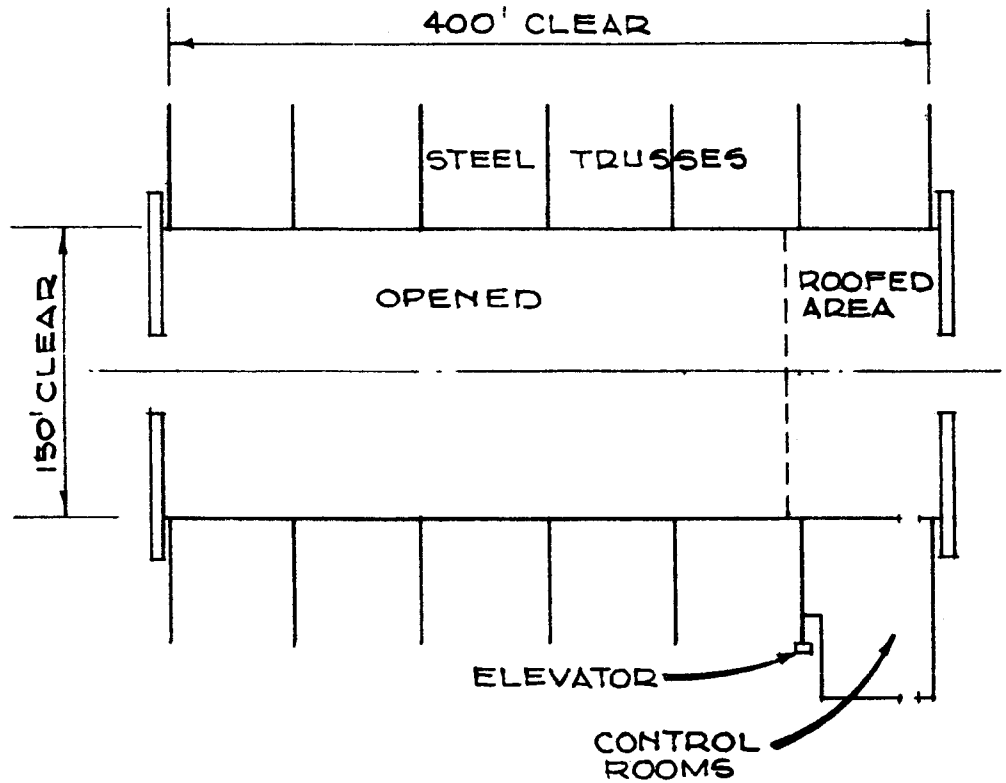
MANNED SPACECRAFT CENTER

FISCAL YEAR 1963 ESTIMATES

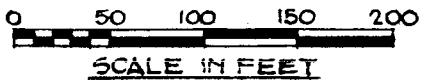
LUNAR LANDING SIMULATION FACILITY



KEY LOCATION MAP



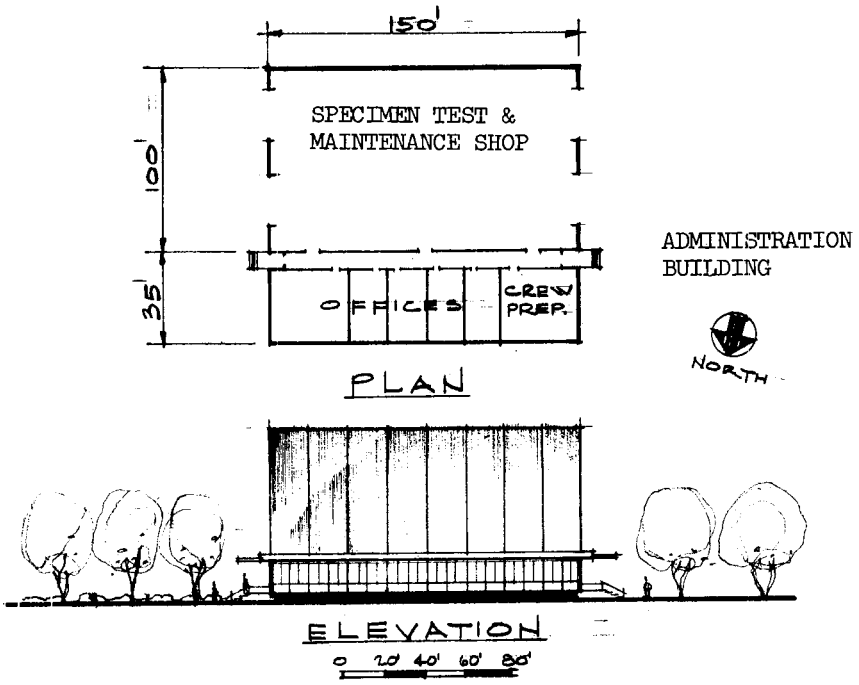
PLAN

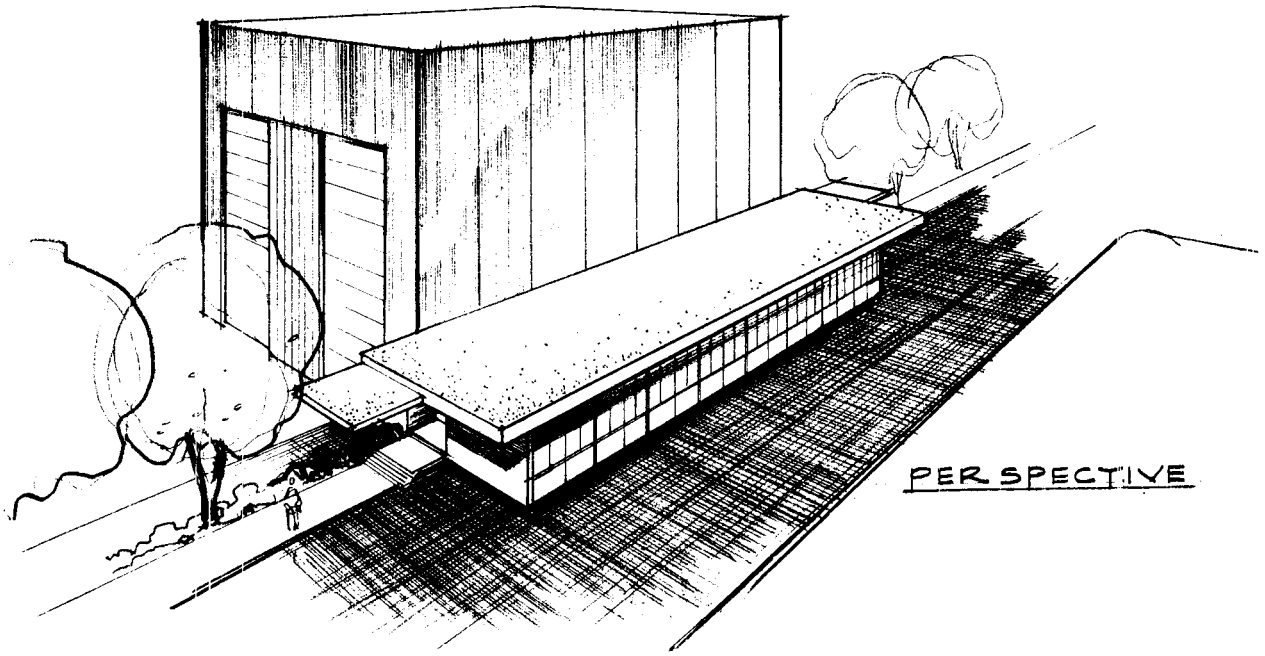


TEST CHAMBER

MANNED SPACECRAFT CENTER
FISCAL YEAR 1963 ESTIMATES

LUNAR LANDING SIMULATION FACILITY





JUSTIFICATION:

The development and evaluation of sub-systems required for successful lunar landing operations requires a simulation facility which will achieve realistic conditions as closely as possible. Only in this way can the necessary techniques be developed, equipment perfected, and crews gain the necessary experience and training to insure the probability of a successful lunar flight. The facility will be used to develop reliable landing and flight systems such as those relating to the direction control of parachutes, rotating wings, flexible wings, personnel parachutes, and load mitigation schemes involving impact bags, discrete shock absorbers, crushable structures, and braking rockets. These are examples of the sub-systems which must be developed, evaluated, and perfected. The facility is also required to train crews in the operation of these systems.

The lunar landing research facility under construction at the Langley Research Center will be used as a basic research tool for study of the factors incident to lunar landing. The facility proposed for the Manned Spacecraft Center will be devoted exclusively to the follow-on development and checkout of system hardware and to the conduct of crew training programs.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$220,000
Utility connections.....	$80,000	
Power distribution lines.....	100,000	
Pavement and parking areas.....	40,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		2,600,000
Test chamber and test facility structure..(60,000 square feet at $32.00 per square foot).....	1,925,000	
Control building..(4000 square feet at $30.00 per square foot).....	120,000	
Specimen preparation and maintenance shop..(15,000 square feet at $30.00 per square foot).....	450,000	
Administration building..(5250 square feet at $20.00 per square foot).....	105,000	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$2,930,000
Cranes.....	$416,000	
Horizontal drive gear and arrestors.....	124,000	
Vertical cable driver and arrestors.....	260,000	
Electric equipment and controls.....	410,000	
Attitude control.....	155,000	
Data recording and evaluation equipment.....	475,000	
Simulator controls.....	485,000	
Communications equipment.....	110,000	
Mobile handling equipment.....	135,000	
Test and checkout equipment.....	360,000	
E. DESIGN AND ENGINEERING SERVICES.....		750,000
Total estimated cost.....		$6,500,000

MANNED SPACECRAFT CENTER

FISCAL YEAR 1963 ESTIMATES

SITE DEVELOPMENT AND UTILITY INSTALLATIONS

DESCRIPTION:

This project discusses the need for additional site development and basic utility installations required for construction and operation of the facilities at the Manned Spacecraft Center. Site development includes clearing and grading, a basic road system, security fencing, docks, ramps, and street lighting. The utility installations will include additions to the electrical power system, central air conditioning system, water supply treatment and distribution system, storm drainage system, and sanitary sewer system. The location of the facilities to be constructed under this project is shown in the Location Plan for the Manned Spacecraft Center at the beginning of this section.

JUSTIFICATION:

Funds for this purpose were provided in the fiscal year 1962 budget in the amount of $4,540,000. At that time, however, the location of the Manned Spacecraft Center had not been determined; estimates were prepared on the basis of previous experience with site development. Following the choice of location, a reappraisal of utility costs has indicated an additional requirement for $7,625,000 which may be ascribed to the following factors:

(a) Commercial water and sewage systems are not available; therefore, water and sewage treatment plants must be constructed.

(b) Subsoil conditions require underground utility systems to be placed within ducts.

(c) The site location adjacent to Clear Lake provides a direct water access route to Galveston Bay. A docking facility is necessary to permit maximum utilization of this water route.

(d) Grading and water table conditions will require increased earth movement and erosion control work.

(e) The final layout of facilities requires an extension of roads and utility runs for the sewer, water, electrical, gas, heating, and cooling distribution systems.

(f) Additional site development and utility installation requirements result from the new facilities proposed for construction in the fiscal year 1963 budget.

A summary of facility requirements and significant design parameters follows:

(a) Site drainage: Surface water and storm water will be removed from the site by a system of open ditches and underground conduits. Curbed areas and roadways with curbs and gutters will drain through inlets into underground storm sewers. The unimproved areas, paved streets, and parking areas not confined by curbs will drain through open surface ditches.

(b) Road system: A primary service system for major access to the building complex area, and a secondary service system for perimeter and other secondary roads will be provided. Primary access to the building complex area will be a four lane divided highway. The basic street system adjacent to and within the major building areas is planned as a four lane arrangement.

The access road from the barge dock to the testing area is planned as a street of adequate width to accommodate the movement of an object forty-feet in diameter by one hundred-feet in length.

The primary and secondary road systems and the parking areas will be designed for flexible bituminous pavements; the primary roads and the parking areas will also have concrete curbs and gutters.

(c) Barge berthing facilities: Facilities will be required at the Center to handle normal cargo barges and to handle a special barge which will carry spacecraft components. The barge dock will be located on Clear Lake, centered on the access road to the project site. An approach channel will be dredged to tie into an existing barge channel about 7300 feet away. The new channel will be sized to accommodate the special barge.

(d) Potable water system: This system will be designed to supply domestic water needs and water requirements of the fire protection system. The water system will consist generally of wells, pumps, a storage reservoir, an elevated tank, a piping distribution system, and chlorination equipment. The piping system will be designed to accommodate anticipated future requirements.

The water supply system can then be expanded by the addition of new wells, pumps, and other equipment as may be required to keep pace with the growth of the Center.

(e) Sanitary sewage system: An activated sludge system will be used consisting of underground concrete piping properly sized and sloped. It is presently anticipated that gravity flow will be used throughout the system. However, the final arrangement of buildings and underground facilities may result in a requirement for a sewage lift station.

(f) Electrical system: A Houston Light and Power Company 138 Kv transmission line connecting two of their generating stations bordering the west edge of the site will be tapped with appropriate switching in the primary unit substation to provide a reliable power source.

The primary unit substation will contain two 138 Kv to 13.8 Kv, 15,000/20,000/25,000 Kva transformers, attendant switch gear and provisions for future additional transformers.

Underground cables in concrete-encased non-metallic conduit will distribute power from the primary unit substation to a 13.8 Kv switching station in the central utilities area. The conduit system will be constructed to provide for future expansion.

The 13.8 Kv switching station will consist of a double-ended 15 Kv air circuit breaker metal-clad unit, with a tie breaker.

(g) Central heating and cooling plant: This plant will be designed to supply in an economical and efficient manner the principal requirements for comfort heating, cooling, and humidity control. Certain special facilities may require separate heating and cooling systems not connected with the central plant.

The plant will be designed to take care of present requirements and will include suitable stand-by equipment to allow for normal maintenance and outage without interruption of service. The capacity of the plant can be increased in the future by the incremental addition of heating and cooling units as required. Suitable provisions will be made to allow the future units to be installed with a minimum of equipment down time.

Several types of heating and cooling systems have been studied to determine the most economical arrangement. The recommended system consists basically of a centrifugal compression refrigeration system with the necessary heat exchangers and accessories for providing chilled water, and a steam generation system for supplying heat to the buildings and motive steam to the turbines. It is anticipated that the boilers will be gas-fired, water tube, package steam generating units utilizing a stand-by fuel oil system for emergency firing. This selection is subject to the results of a fuels study presently being made.

(h) Fuel system: For the purposes of master planning and preliminary design studies, natural gas has been assumed to be the primary fuel for the Center. Studies are proceeding on this basis because of the availability and reliability of natural gas in the Clear Lake area. However, studies are also being made to analyze alternate fuel sources.

(i) Site service buildings: This item covers the central fire station, two gate houses for the control of traffic, the sewage treatment building, and other miscellaneous buildings.

COST ESTIMATE:		Fiscal Year 1962	Fiscal Year 1963
A. LAND ACQUISITION.....		$1,400,000 1/	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		2,740,000	$5,515,800
Underground utility structure.....	$465,000	$796,500	
Site preparation.....	280,000	475,400	
Roads and streets....	340,000	580,600	
Vehicle parking.....	460,000	348,000	
Docks and waterways..	---	222,400	
Landscaping.....	185,000	315,000	
Electrical distribution.....	545,000	1,141,500	
Street and area lighting.....	---	200,000	
Communication and fire alarm conduit installation.....	100,000	159,300	
Gas distribution.....	30,000	50,000	
Sewage treatment and piping.....	85,000	146,300	

		Fiscal Year 1962		Fiscal Year 1963
Water treatment and distribution.....	$250,000		$430,600	
Distribution piping for heating and cooling.....	---		650,200	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$300,200		$759,000
Water treatment building..(216 square feet at $25.50 per square foot).....	5,500		---	
Sewage treatment building..(216 square feet at $25.50 per square foot).....	5,500		---	
Sewage treatment settling tanks.....	80,000		---	
Central heating and cooling plant.. (21,000 square feet at $40 per square foot).....	209,200		641,000	
Fire station..(5200 square feet at $21.50 per square foot).....	---		112,000	
Gate houses; two each (200 square feet at $15 per square foot)	---		6,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		660,000		---
Boilers, feed pumps, and accessories.....	260,000		---	
Water chilling equipment.....	400,000		---	

	Fiscal Year 1962	Fiscal Year 1963
E. DESIGN AND ENGINEERING SERVICES....	$839,800 2/	$1,350,200 2/
Total estimated cost.....	$5,940,000	$7,625,000

1/Proposed for acquisition using emergency construction authorization procedures and funding by transfer from the Research and Development appropriation.

2/Includes a total of $1,614,200 for Corps of Engineers services in connection with the design and construction supervision of the entire Center for the fiscal years 1962 and 1963 not contemplated in the original budget submission for the Center; the balance of the funding requested is required for the normal design and engineering services for the items that comprise this project.

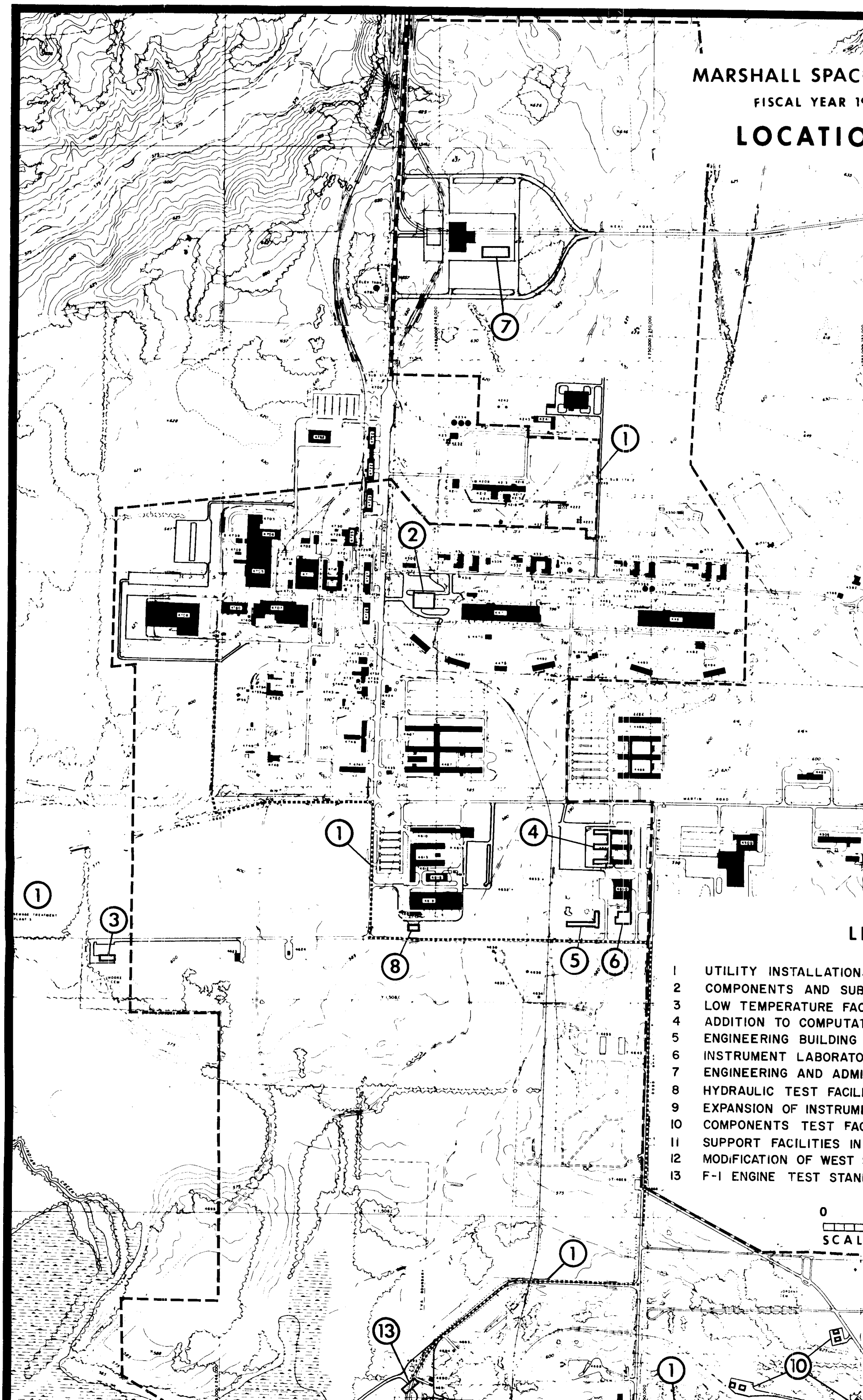
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

CONSTRUCTION OF FACILITIES - 1963 PROGRAM

MARSHALL SPACE FLIGHT CENTER

Page No.		
CF10-A2	Location plan	
CF10-A3	Addition to computation division building.....	$1,255,000
CF10-B1	Components test facility.....	4,000,000
CF10-C1	Components and subassembly acceptance building..	950,000
CF10-D1	Engineering and administration building.....	2,500,000
CF10-E1	Expansion of instrumentation systems in West Area.....	4,000,000
CF10-F1	F-1 engine test stand.....	4,500,000
CF10-G1	Hydraulic test facility.....	340,000
CF10-H1	Low temperature facility.....	575,000
CF10-I1	Modification of West side of static test stand..	2,000,000
CF10-J1	Engineering building.....	1,000,000
CF10-K1	Instrument laboratory.....	2,000,000
CF10-L1	Support facilities in West Area.....	7,800,000
CF10-M1	Utility installations.....	2,517,000
	Total.....	$33,437,000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FISCAL YEAR 19
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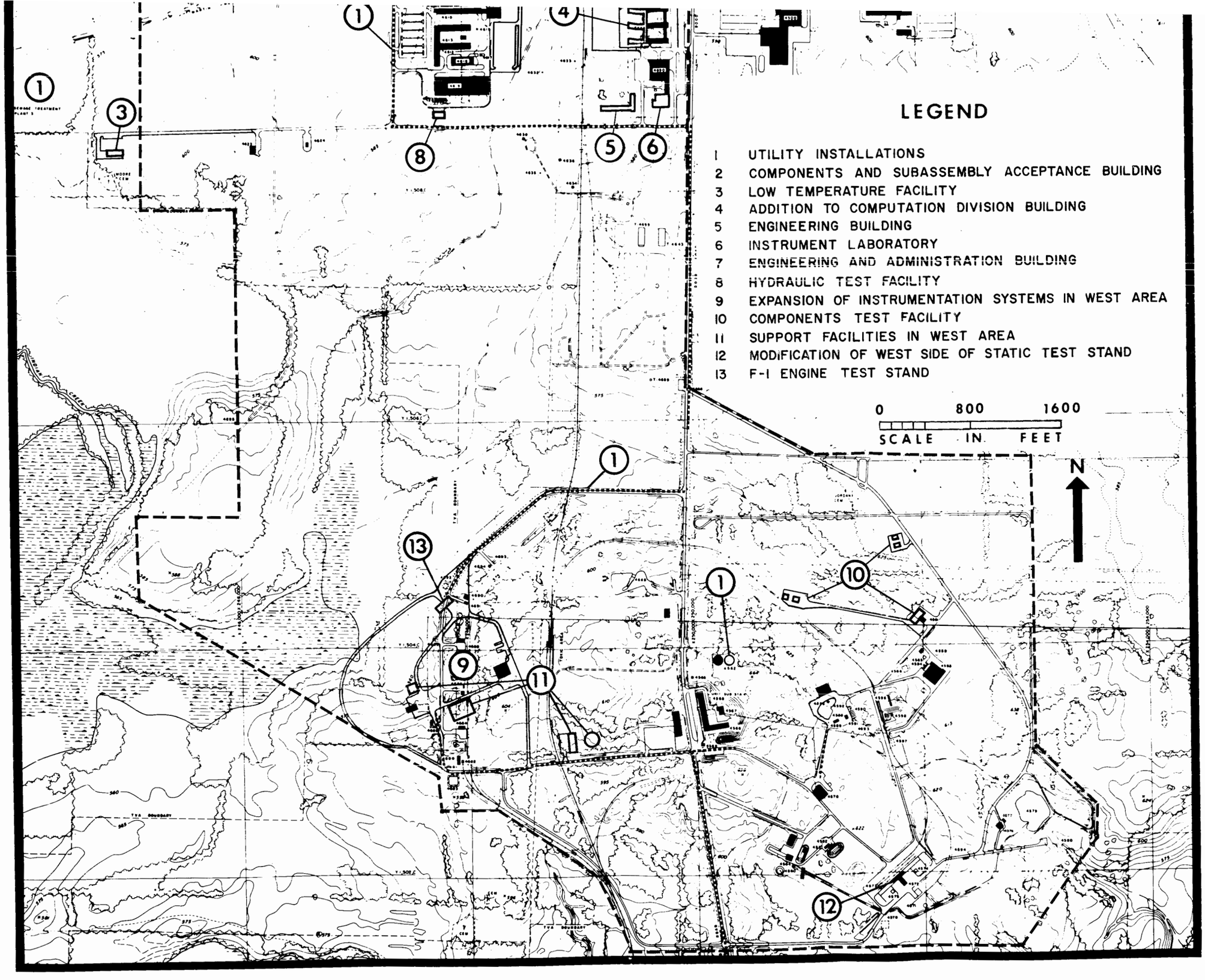
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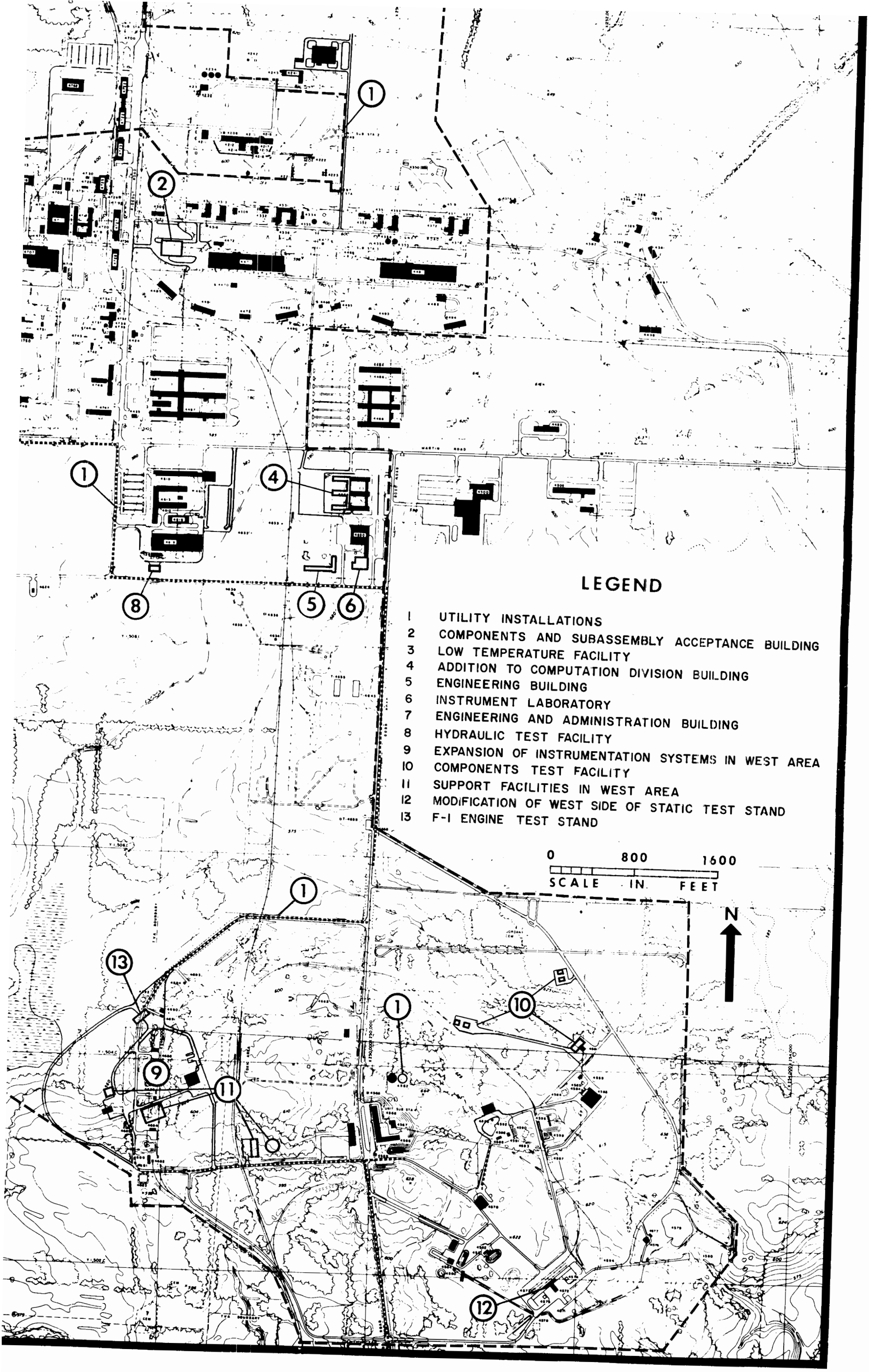
1 UTILITY INSTALLATIONS
2 COMPONENTS AND SUBASSEMBLY ACCEPTANCE BUILDING
3 LOW TEMPERATURE FACILITY
4 ADDITION TO COMPUTATION DIVISION BUILDING
5 ENGINEERING BUILDING
6 INSTRUMENT LABORATORY
7 ENGINEERING AND ADMINISTRATION BUILDING
8 HYDRAULIC TEST FACILITY
9 EXPANSION OF INSTRUMENTATION SYSTEMS IN WEST AREA
10 COMPONENTS TEST FACILITY
11 SUPPORT FACILITIES IN WEST AREA
12 MODIFICATION OF WEST SIDE OF STATIC TEST STAND
13 F-1 ENGINE TEST STAND
0 800 1600
SCALE IN FEET
N


LEGEND
1 UTILITY INSTALLATIONS
2 COMPONENTS AND SUBASSEMBLY ACCEPTANCE BUILDING
3 LOW TEMPERATURE FACILITY
4 ADDITION TO COMPUTATION DIVISION BUILDING
5 ENGINEERING BUILDING
6 INSTRUMENT LABORATORY
7 ENGINEERING AND ADMINISTRATION BUILDING
8 HYDRAULIC TEST FACILITY
9 EXPANSION OF INSTRUMENTATION SYSTEMS IN WEST AREA
10 COMPONENTS TEST FACILITY
11 SUPPORT FACILITIES IN WEST AREA
12 MODIFICATION OF WEST SIDE OF STATIC TEST STAND
13 F-I ENGINE TEST STAND
0 800 1600
SCALE IN FEET
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MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

ADDITION TO COMPUTATION DIVISION BUILDING

DESCRIPTION:

This project discusses the need for an addition of approximately 34,700 square feet to the computation building. The three existing two-story wings will each be extended 120 feet west with an overhead enclosed corridor between the wings. The new construction will be compatible with the existing structure with respect to architecture, material, power, heating, and air conditioning. The type of construction will be steel, concrete, and masonry blocks. Elevated floors will be required for the first floors of the additions to wings A and B, and for the second floor of the addition to wing C. The project includes a new outdoor unit-substation, new air conditioning equipment complete with precise humidity and temperature controls, a new freight elevator, and a new parking area west of the building addition for 150 cars. Drawings of addition are shown on the following page.

JUSTIFICATION:

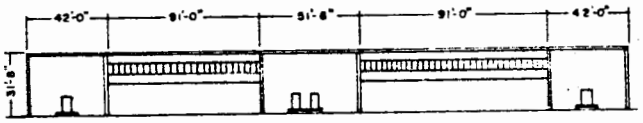
The proposed addition is required to provide space for computer equipment and for additional personnel required in the Advanced Saturn program. Specific requirements for each wing follow:

A wing: Space is required for additional vibrational, telemetry, optical, data translation, and plotting equipment. Present data reduction equipment was designed to support the Jupiter and Pershing programs and has been modified to the limit of its capability in supporting the Saturn C-1 program. The equipment cannot be adequately modified further to support the more Advanced Saturn programs. Working space is also for the additional mathematicians needed to handle an increased workload. With this addition, the Marshall Center will maintain capability to reduce all Saturn data.

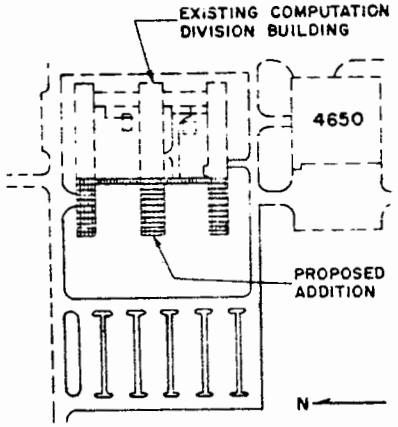
B wing: Space in this wing is required for an additional large size digital computer. Presently there are two major scientific digital computer systems housed in this wing. It was necessary to temporarily move another computer, used basically for management operations, to a converted warehouse when the second major computer was added in 1960. Environmental conditions in the warehouse have not permitted fully satisfactory operations. It is planned to relocate the warehouse computer into the 3 wing addition.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

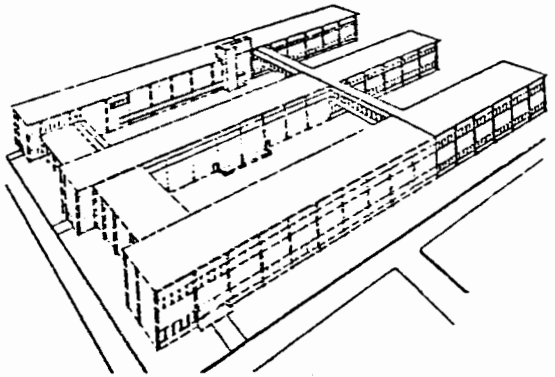
ADDITION TO COMPUTATION DIVISION BUILDING



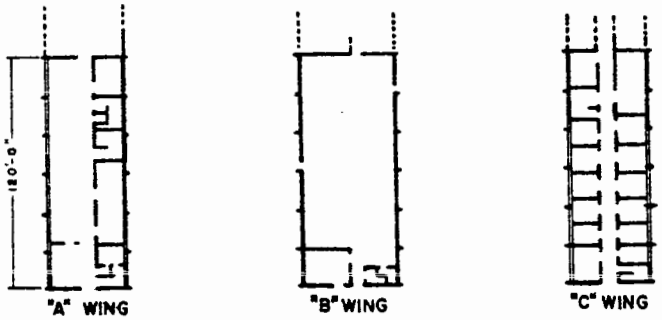
WEST ELEVATION



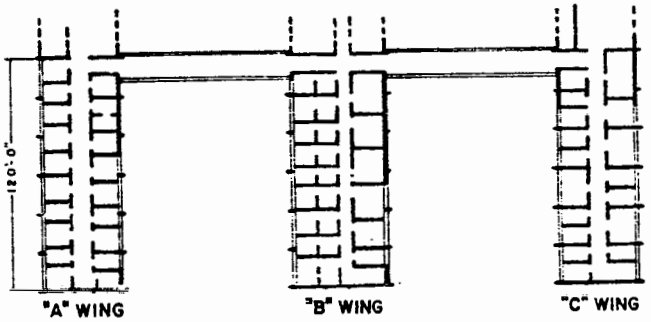
SITE PLAN



PERSPECTIVE



FIRST FLOOR



SECOND FLOOR

C wing: More space is required in this wing to provide additional supporting facilities for a three axis flight simulator; a room for patching problem boards; space for approximately 180 additional amplifiers; equipment necessary to couple digital computers in B wing with an analog computer in this wing (this system will provide precise real time data in digital form); a dark room for novel simulating equipment; computer training facilities; and space for additional specialized and support personnel. The complexity of the Advanced Saturn program requires that more calculations and measurements be made; the additional equipment and facilities listed above are required for the increased workload in the analog computer field.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$ 110,000
	Site development	$20,000	
	Utility installation	40,000	
	Parking facilities	50,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,041,000
	Building addition (34,700 square feet at $30.00 per square foot)	1,041,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		---
E.	DESIGN AND ENGINEERING SERVICES		104,000
	Design services	70,000	
	Engineering services	34,000	
	Total estimated cost		$1,255,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

COMPONENTS TEST FACILITY

DESCRIPTION:

A new components test facility is required for the testing of vehicle and propulsion system components. The new facility will supplement existing facilities which are becoming inadequate due to the physical limitations of the test cells and to the inadequate quantities of propellants that can be handled in the test cells. The major items in this project include modifications to the existing components test laboratory, two new test stands, a cable transmission tunnel, a control and operations center, an instrumentation system, and a test control system.

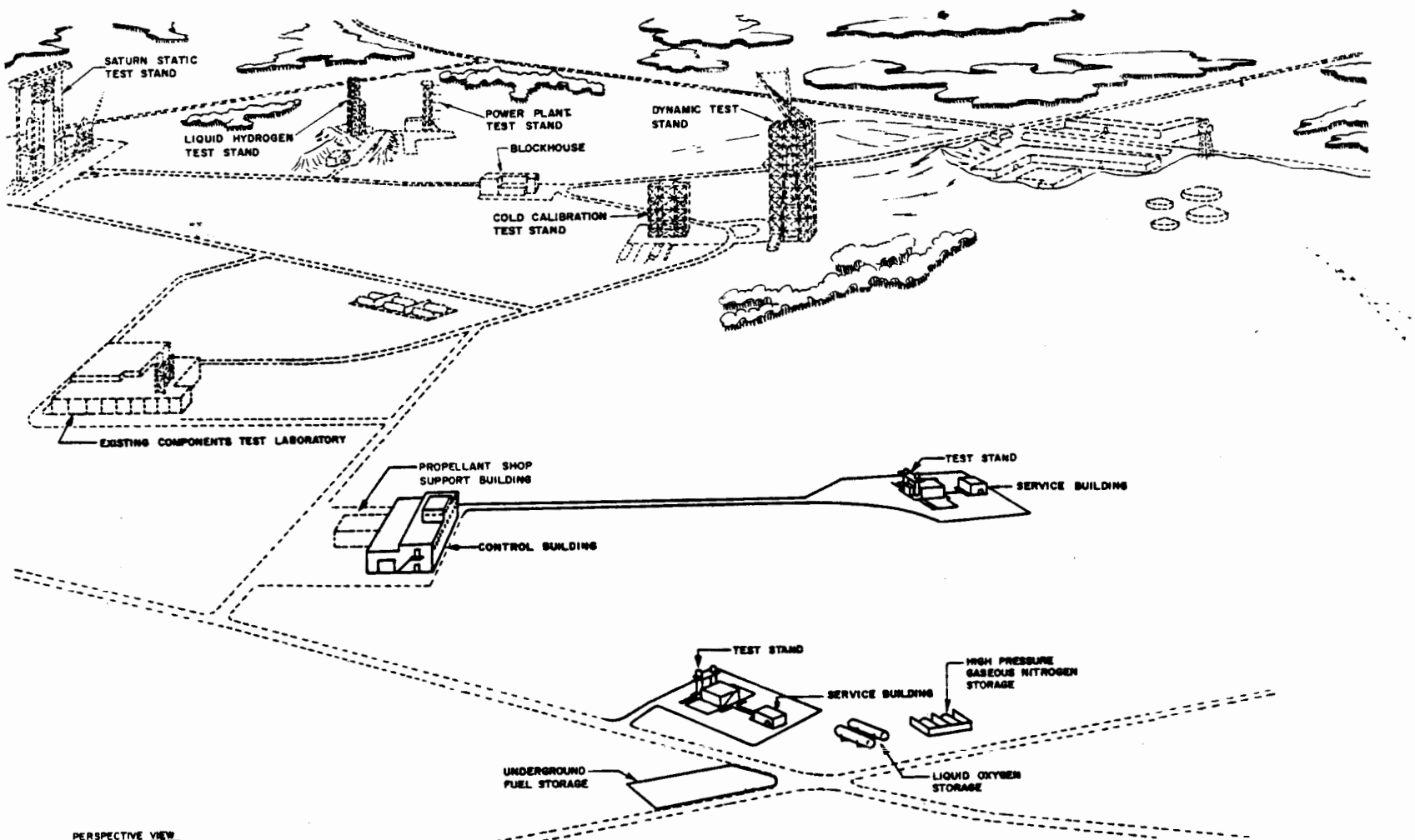
Drawings of the significant features of the project are shown on the next two pages. A more detailed description of the project follows below:

(a) Modifications to the existing components test laboratory: Modifications to and an extension of the existing structure are necessary to accommodate the installation of approximately 500 additional channels of instrumentation, cable termination columns, patch panels, and signal conditioning equipment. The modifications will include the removal of all mechanical support functions to the new control and operations center; erection of concrete block partitions; installation of ceilings with integral fluorescent lighting; expansion of the existing mechanical equipment room to provide air conditioning to all new areas; the construction of a 3,300 square foot addition on the south side of the building to accommodate the terminal room, cable patching area, and instrument preparation area. Offices for engineers and a data reviewing area will also be provided. The addition will be constructed of reinforced (blast-resistant) concrete. A new 11,250 square foot support building will be constructed to house the relocated mechanical support functions.

(b) Instrumentation system: The instrumentation system will be located in a modified area of the existing components test laboratory. The system will be designed to permit maximum utilization of the recording channels to support the two new test stands and to supplement the instrumentation presently supporting the test cells in the existing components test laboratory. For high-density testing in

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

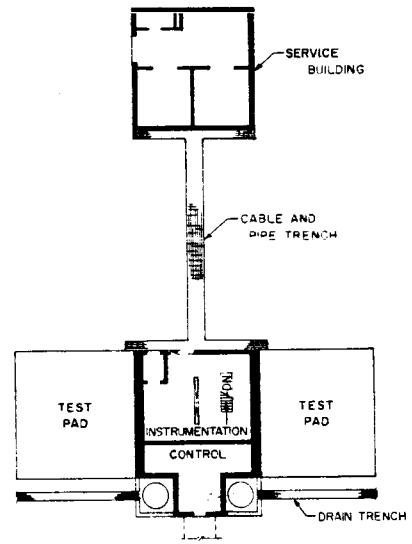
COMPONENTS TEST FACILITY



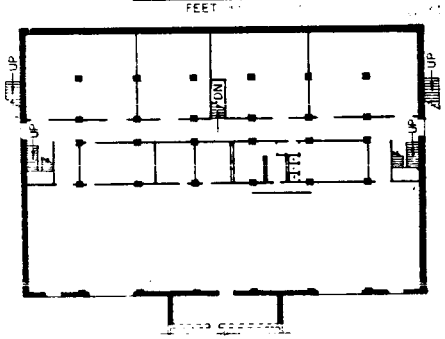
PERSPECTIVE VIEW

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

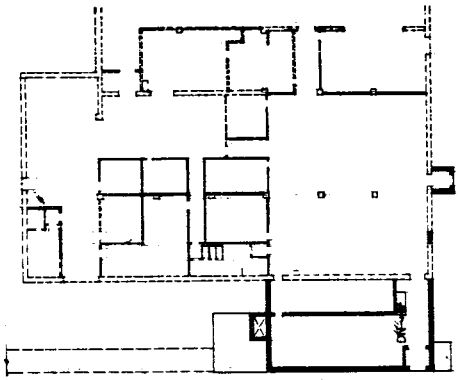
COMPONENTS TEST FACILITY



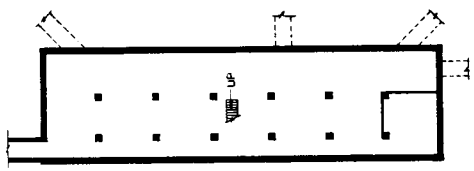
TYPICAL DUAL TEST STAND
GRAPHIC SCALE
10 5 0 10 20
FEET



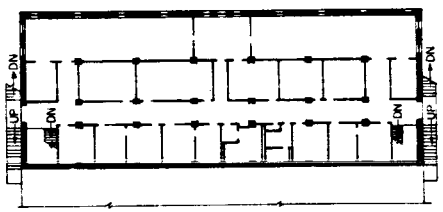
GROUND FLOOR PLAN



ALTERATIONS AND ADDITIONS TO EXISTING COMPONENTS TEST LABORATORY
GRAPHIC SCALE
15 0 15 30
FEET

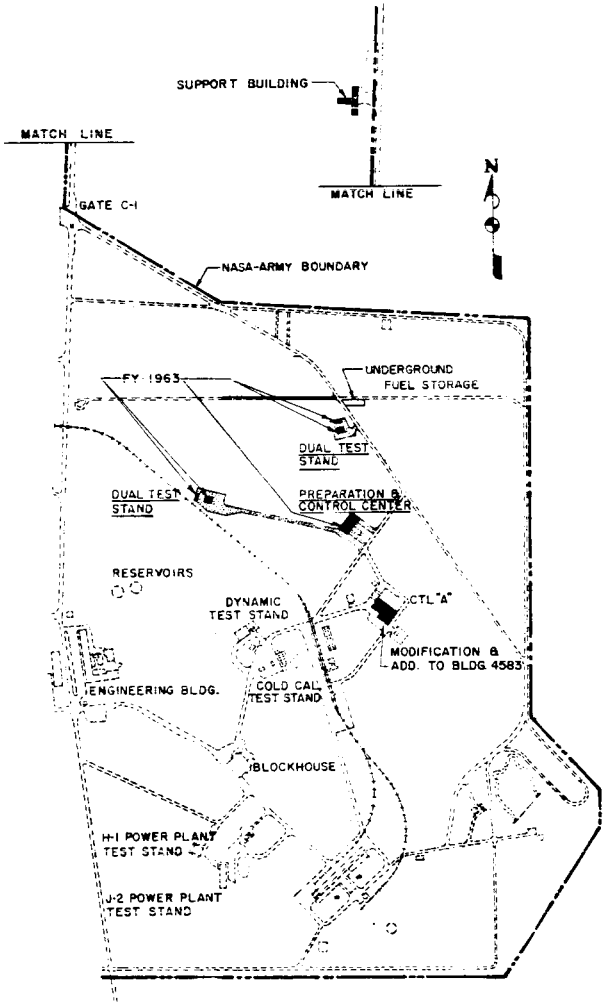


BASEMENT FLOOR PLAN



SECOND FLOOR PLAN

PREPARATION AND CONTROL CENTER
GRAPHIC SCALE
15 0 15 30'
FEET



SITE PLAN
GRAPHIC SCALE
200 0 200 400 600
FEET

the two new test stands, the instrumentation in the present recording center will be augmented. The present recording center has a permanently installed capacity of approximately 300 channels. The added instrumentation will provide an additional 500 channels.

(c) Cable transmission tunnel: A reinforced concrete tunnel will be constructed from the existing components test laboratory to the area of the propellant shop support building, approximately 500 linear feet. A complete tray system to support instrumentation cables will be provided.

(d) Control and operations center: The control and operations center will be an addition to and integrated with the existing propellant shop support building. The addition will be a two-story, above-grade structure, with sufficient space below grade to accommodate cable distribution, termination, patching, and signal conditioning equipment. The area required in this addition will be approximately 18,000 square feet. Two floors above grade level will provide space for the functions of control and observation, mechanical preparation, engineers' offices, building equipment, visitor observation, and rest rooms. The building will be constructed of reinforced (blast-resistant) concrete, and will be air conditioned and humidity controlled, where required, to provide protection for instrumentation. The existing propellant shop support building will be modified to accommodate additional mechanical support for existing and added test positions. Modifications will mainly consist of the installation of equipment and associated utilities.

(e) Test stands: The new complex will include two, multi-purpose dual test positions. The dual test positions are to be utilized for development and test of engine and vehicle components, subsystems, and assemblies; and for the checkout and evaluation of a simulated closed-loop engine control system. Components such as turbopumps, gas generators, heat exchangers, valves, flow-controllers, pressurization systems, and venting and turbine exhaust systems will be tested in these positions. The safety distance to other facilities planned for the dual test positions will allow the use of large amounts of liquid hydrogen. This is a mandatory requirement in the components test facility area. The flexibility of the proposed design will allow for the quick conversion of the positions for hot or cold testing of smaller engine

systems. The stands will be single story structures, constructed of heavy, reinforced concrete. Each position will include fuel and oxidizer tankage for test runs and storage, a small space for calibration and instrumentation equipment, instrumentation cable duct banks to the control building, a high-pressure gas system, a firefighting system, and oral and aural warning systems. Each test position will have a small slab-on-grade concrete-block service building to house mechanical and electrical equipment and a small test preparation area. Site improvements about the test stands will include an integral road system with adequate area lighting.

(f) Control system: Control systems will be provided to support the multi-purpose test positions and their supporting facilities. The items to be provided include cable systems, communication systems, control consoles, racks, patch panels, metering equipment, closed-loop video systems, engineering equipment, photographic equipment, optical observation aids, and remotely controlled electro-mechanical items. Maximum emphasis will be placed on flexibility, maintainability, and safety.

JUSTIFICATION:

The facilities proposed in this project are required for extensive and comprehensive test programs on the components, both as individual units and as parts of systems, of advanced space vehicles. The facilities will be used to isolate malfunctions of components from captive and flight system test data, and for systems tests of manufacturers' components.

The capacity of the existing components test facility is suitable for components and subassemblies of the size used in the Saturn C-1 stages and the H-1 engines. The new components and subassemblies that will be used in the Advanced Saturn stages and in the F-1 engines are beyond the capacity of the existing cells. The added time required to set-up and dismantle these large components establishes the requirement for four test positions. The proposed use of large amounts of liquid hydrogen in the components test program dictates the requirement for distance separation of the two dual position stands. The test cells in the existing components test facility are too small and too closely grouped to safely handle these advanced programs.

Because of the urgent need for this facility, funds for advanced design services have been allocated from the 1962 appropriation. Additional fiscal year 1962 funds are proposed to be reprogrammed to permit construction to be initiated promptly; emergency construction

authorization procedures will be used for this purpose. The cost estimate that follows indicates the required funding distribution between the fiscal year 1962 and 1963.

COST ESTIMATE:		Fiscal Year 1962		Fiscal Year 1963
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$50,000		$270,000
Site preparation.....	$20,000		$85,000	
Utility connections..	30,000		185,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		450,000		1,072,000
Test positions.....	---		420,000	
Control center.. (18,000 square feet at $27.77 per square foot).....	---		500,000	
Tunnel and duct bank.	---		122,000	
Existing building modifications:				
Building addition.. (3,300 square feet at $33.00 per square foot).....	109,000		---	
Building alteration..(8,700 square feet at $16.22 per square foot).....	141,000		---	
Support building.. (11,250 square feet at $17.77 per square foot).....	200,000		---	
Test stand support building..(Two; each 750 square feet at $20.00 per square foot).....			30,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,475,000		2,658,000
Propellant systems...	---		50,000	

		Fiscal Year 1962	Fiscal Year 1963
Control consoles.....	$25,000	---	
Patching equipment...	50,000	$163,000	
Installation and checkout equipment.	70,000	300,000	
Calibration equipment	---	200,000	
Digital recording and processing equipment	676,000	676,000	
Tape recording equipment.....	---	79,000	
Conditioning equipment.....	59,000	335,000	
Graphic recording equipment.....	340,000	---	
Transmission system..	---	472,000	
Control equipment....	---	383,000	
Distribution wiring..	25,000	---	
Oscillograph recording equipment.....	230,000	---	
E. DESIGN AND ENGINEERING SERVICES.....		525,000 1/	---
Total estimated cost.....		$2,500,000 2/	$4,000,000

1/ Includes $500,000 already allocated for advanced design services.

2/ Proposed for allocation using emergency construction authorization procedures.

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

COMPONENTS AND SUBASSEMBLY ACCEPTANCE BUILDING

DESCRIPTION:

This project proposes the construction of a hangar type building of approximately 30,000 square feet. The building will be 200 feet long; the high bay will be approximately 100 feet wide; and the low bays on the north and south sides will be 25 feet wide. The low bay additions will be air-conditioned since they will house special labs and equipment; the hangar will be equipped with ventilators and exhaust fans. Heating is required throughout. Construction will be structural steel framework with corrugated cement asbestos siding. Floor of the high bay will be reinforced concrete to withstand a wheel load of 20,000 pounds per wheel. The low bay floor will be of concrete with no special load requirements. Hangar height of 40 feet (clear) and centered rollup doors 35 feet wide and 36 feet high will be provided. Two cranes of 10 ton capacity will serve the entire high bay area. The majority of the required testing equipment is currently available.

A sketch of the proposed building is shown on the next page. Site preparation will include filling in a low area and rerouting steam piping. The site is ideally located on a direct route from the receiving area to the fabrication facilities.

JUSTIFICATION:

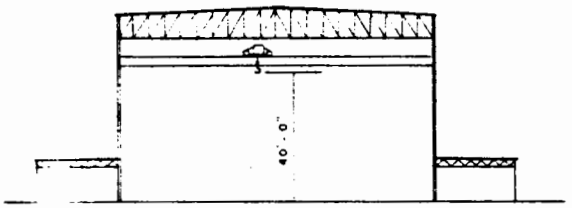
The acceptance building is required to provide suitable facilities in which to perform receiving inspection, including non-destructive testing, on such large cumbersome Saturn items as 26 feet diameter bulkheads, mill sheets, and tubes. Typical operations to be performed in the small labs are oil filtration, metrology, gage calibration, and repair. The building will also provide capacity for conducting receiving inspection on major system items, such as Saturn engines, and Saturn tanks, inner stage fairings, and barrel sections. In addition, it will provide space for consolidating the inspection of smaller items resulting in the better utilization of personnel and equipment. Adequate facilities for inspection work on hardware items is essential to an effective quality control program.

COST ESTIMATE:

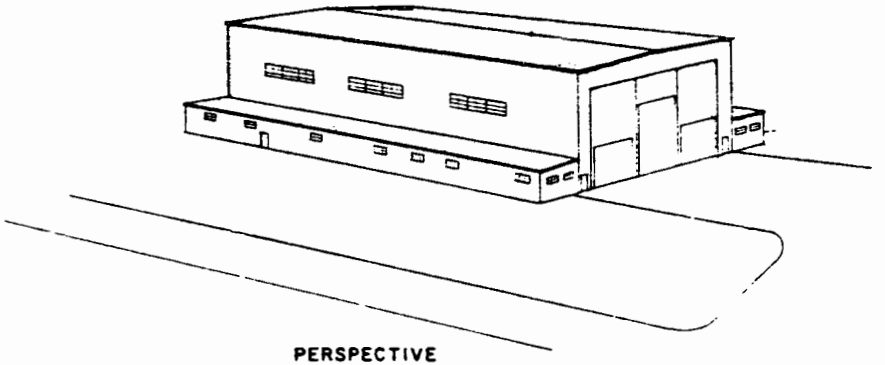
A. LAND ACQUISITION..... ---

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

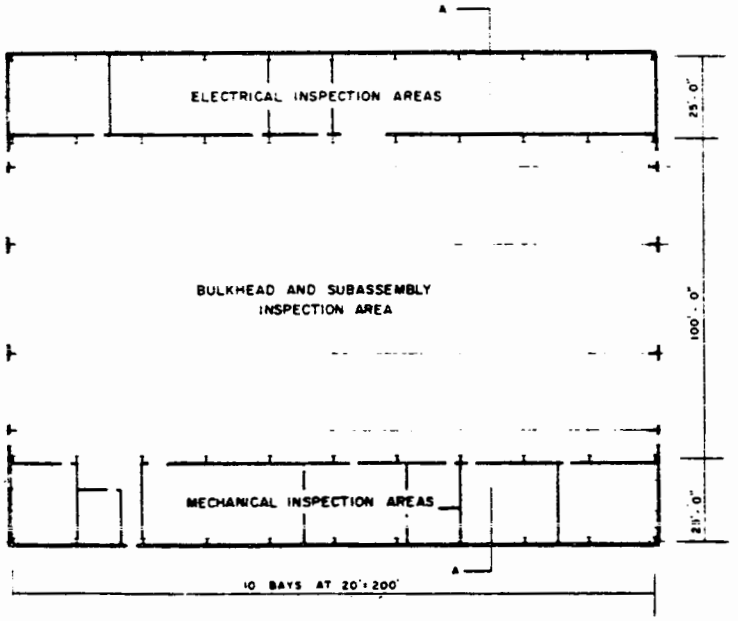
CCMPONENTS AND SUBASSEMBLY ACCEPTANCE BUILDING



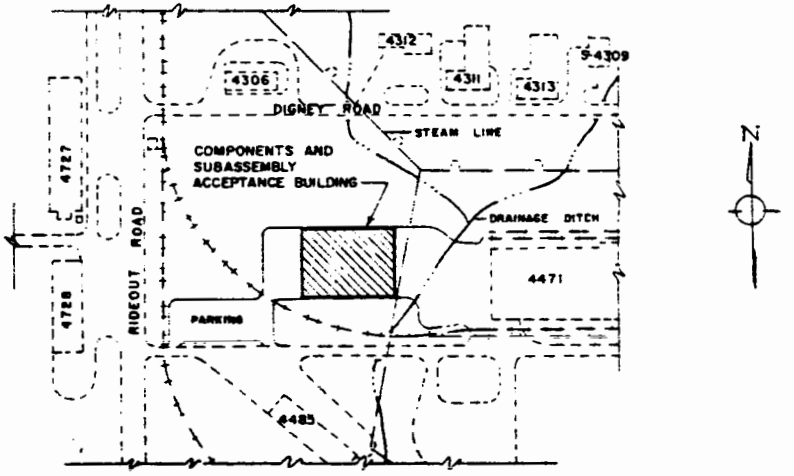
SECTION A-A



PERSPECTIVE



FLOOR PLAN



SITE PLAN

B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$92,000
	Site preparation and paving.....	$42,000	
	Utility connections.....	50,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		750,000
	Building, including overhead cranes... (30,000 square feet at $25.00 per square foot).....	750,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		30,000
	X-ray equipment.....	30,000	
E.	DESIGN AND ENGINEERING SERVICES.....		78,000
	Total estimated cost.....		$950,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

ENGINEERING AND ADMINISTRATION BUILDING

DESCRIPTION:

It is proposed to construct a five story office building adjacent to the central laboratory and office building. The structure will be 247.5 feet long by 85.5 feet wide and will provide a gross floor area of 105,800 square feet. Construction will be of steel frame with metal curtain walls and built-up roofing. The building will be air conditioned. The project also includes site preparation, utility connections, and a 400 vehicle parking area. The proposed addition will provide working space for about 850 personnel. A sketch of the building is shown on the following page.

JUSTIFICATION:

This building is required to provide the Marshall Center with the additional office space needed to support the planned increase in personnel created by the acceleration of the Manned Lunar Program. The program will require an increasing amount of research, development, and production work to be contracted to private industry which will in turn necessitate an increased support in the management, procurement, and administrative areas.

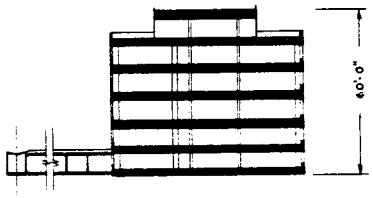
To provide for the efficient management of the space programs assigned to the Center, it is essential that the associated personnel be centrally located and in close proximity. The total scheduled increase in personnel for the period beginning July 1, 1961 and extending through the fiscal year 1963 is 1,430. Other facilities being requested or under construction will provide for all but approximately 850 of this increase. The proposed engineering and administration building should be available for occupancy by the end of the calendar year 1963.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$284,000
Site preparation.....	$50,000	
Utility connections.....	140,000	
Parking facilities.....	94,000	

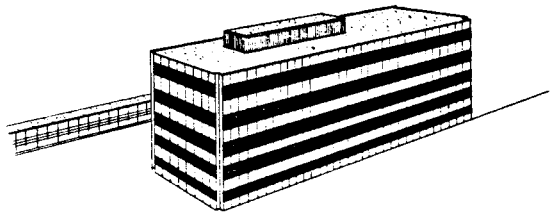
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

ENGINEERING AND ADMINISTRATION BUILDING

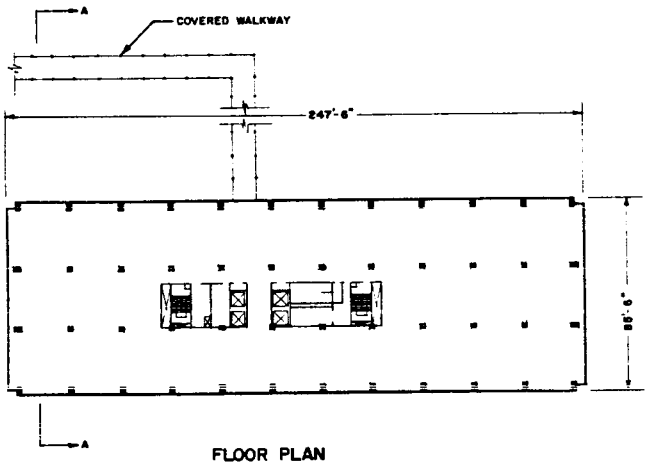


SECTION A-A

0 20 40 60 80
FEET

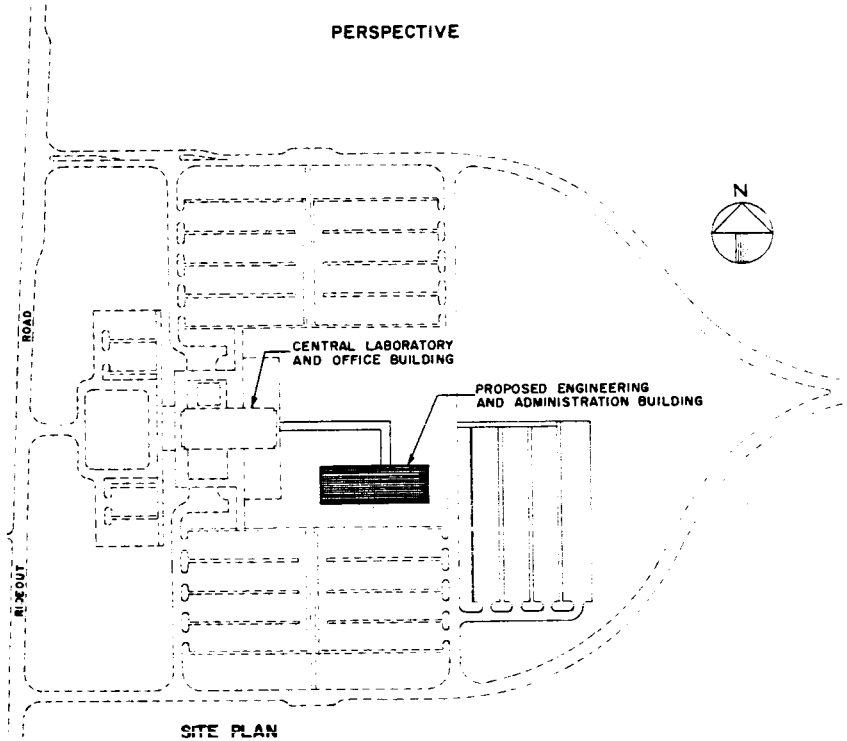


PERSPECTIVE



FLOOR PLAN

0 20 40 60 80
FEET



SITE PLAN

0 100 200 300 400
FEET

C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$2,010,000
Building..(105,800 square feet at $19.00 per square foot).....	$2,010,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		---
E. DESIGN AND ENGINEERING SERVICES.....		206,000
Total estimated cost.....		$2,500,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

EXPANSION OF INSTRUMENTATION SYSTEMS IN WEST AREA

DESCRIPTION:

This project discusses the need for an expansion of the instrumentation systems in the West area for support of the second Saturn static test facility currently under construction. The project includes the design, procurement, fabrication, and installation of instrumentation and control equipment as follows:

(a) Tape units: Five tape units will be required consisting of analog magnetic tape recording and reproducing systems for recording vibration measurements or other high-frequency data. The units will be transistorized and will consist of two bays per tape recorder unit.

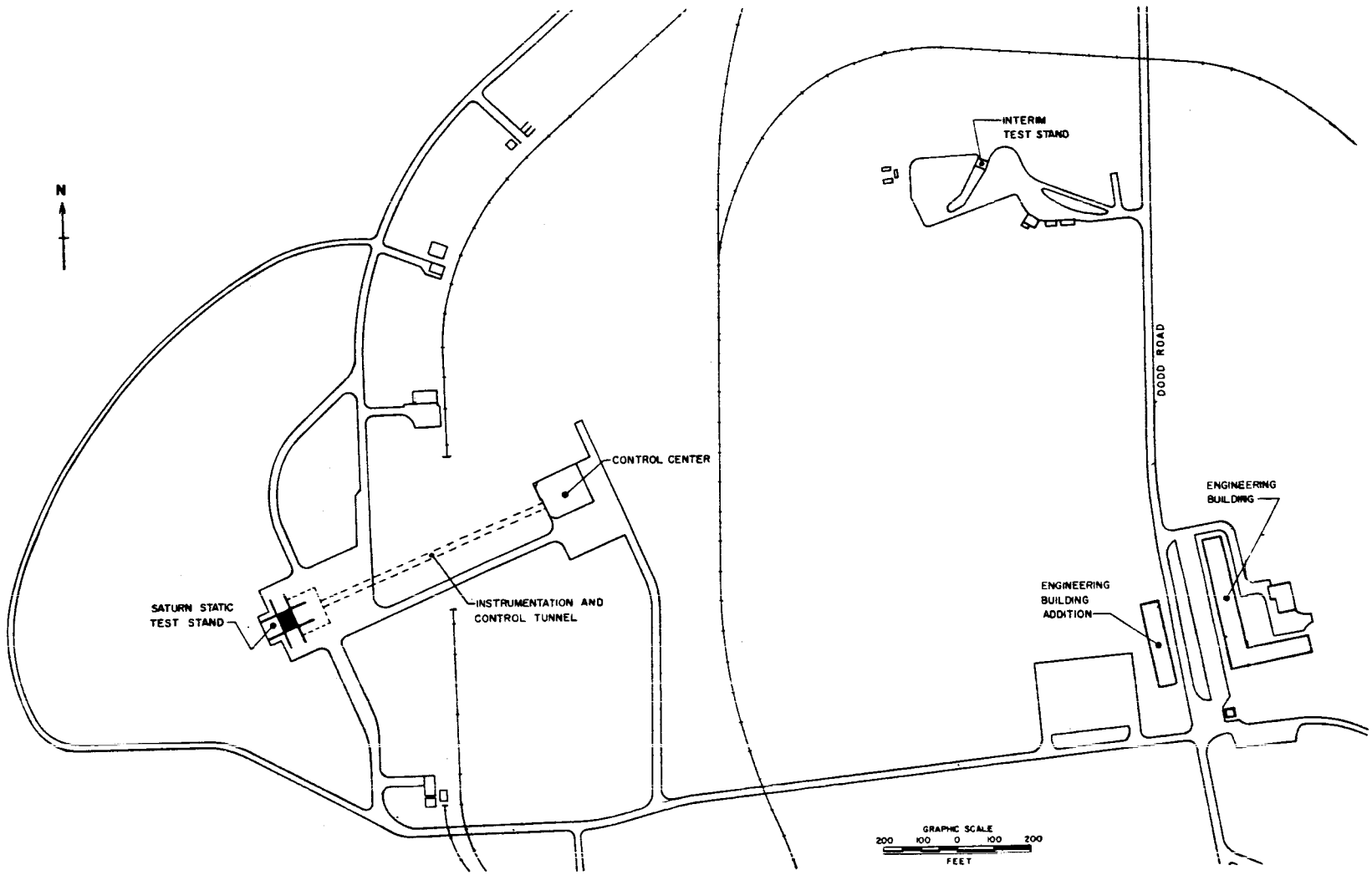
(b) Oscillograph units: Six units are required for recording galvanometer-type oscillographs for acquiring dynamic medium-frequency data. Each unit will consist of three bays and will include two oscillographs, signal conditioning equipment, attenuators, impedance matching networks, selector switches or patches, and intercom stations.

(c) Graphic recorder unit: This unit will consist of six-inch, electronic stripchart, null-balance-type recorders. The recorders will be used for acquiring static or quasi-static data for indicating critical parameters. The unit will consist of five bays. Included in this five-bay group will be balancing and range potentiometers, carrier oscillators, demodulators, twenty-four 6-inch stripchart recorders, and intercom stations.

(d) Digital systems: Analog-to-digital data acquisition systems of the transistorized type will be utilized in the acquisition of static and quasi-static data. An area of approximately 10 by 22 feet will be required by each basic digital system. Each system will consist of d.c. amplifiers, transistorized switches, patchboards, analog-to-digital converter, buffer storage register, time accumulator, system clock oscillator, control counter, bar graph display, buffer and shift register, tape control, tape transports, and tabulators.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

EXPANSION OF INSTRUMENTATION SYSTEMS IN WEST AREA



(e) Special instrumentation and equipment: This item includes thrust and special recorder groups, instrumentation control console, visual redline monitors, oscillogram processers, checkout equipment, galvanometers, temperature junction and reference boxes, thrust measuring systems, fire detection and temperature rate of rise systems, liquid level systems, real time recording systems, rough combustion cutoff devices, and counters.

(f) Cables, terminal columns, cable trays, and receptacle boxes: Normal interconnecting and supporting equipment is necessary to provide a complete system. Included here are such items as instrumentation distribution and transmission cables, channel-type terminal columns with mounted terminal blocks, expanded metal cable trays and metal enclosure boxes with instrumentation receptacles, and mating instrumentation plugs or connectors.

(g) Signal conditioning equipment: This equipment will include amplifiers, carrier oscillators, demodulators, bridge-balance equipment, position circuitry, discriminators, converters, and filter networks. The conditioning equipment prepares the transducer signals for introduction to the recording and display devices located in the recording area. The amplifiers needed to bring the initial digital systems nearer full capacity are included in the cost estimate for signal conditioning equipment.

(h) Television equipment: Approximately nine television cameras, nine television monitors, control panels, amplifiers and mountings will be required. This equipment will provide a complete, test item observation system so that a visual means of control will be available to the area safety coordinator.

(i) Cameras: Variable-speed motion picture cameras, environmental enclosures, mountings, and lenses are utilized for test instrumentation and documentation.

(j) Special power system: This item includes the emergency power generator system which provides means for safe test termination in the event of a commercial power failure.

The location of the work covered by this project is shown in the sketch on the preceding page.

JUSTIFICATION:

A second Saturn static test stand, authorized in the fiscal year 1961 program and currently under construction, is being proposed for conversion to provide capability for static testing the Advanced Saturn stages. It is proposed to use fiscal year 1962 funds and emergency construction authorization procedures for this purpose. The expansion of the West area instrumentation systems described in this project is required for the proper operation of this second stand in connection with its conversion to the Advanced Saturn capability.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		---
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		---
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		$3,713,000
	Five tape units	$305,000	
	Six oscillograph units	410,000	
	One graphic recorder unit	91,000	
	Two digital systems	1,401,800	
	Special instrumentation and equipment	635,200	
	Cables, terminal columns, cable trays, and receptacle boxes	211,000	
	Signal conditioning equipment	384,000	
	TV equipment	46,000	
	Cameras	138,000	
	Special power system	91,000	
E.	DESIGN AND ENGINEERING SERVICES		287,000
	Total estimated cost		$4,000,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

F-1 ENGINE TEST STAND

DESCRIPTION:

This project covers the funds necessary to complete the construction of a test position capable of static test, evaluation, and calibration of a single-unit, F-1 engine in the 1.5 million pound thrust class. Fiscal year 1962 funds are proposed to be allocated for site work, utility connections, and for the start of construction work on the test stand. Fiscal year 1963 funds will complete construction of the test stand and will allow procurement of the flame deflector, a tower elevator, a cable terminal room, a firefighting system, complete fuel and oxidizer storage, transfer systems, and engine adaption hardware. The existing control center will be expanded to accommodate additional control, electrical power, and communication instrumentation and equipment. Other features will include a preparation building, a cable transmission tunnel, a high pressure gas system, industrial power, an observation bunker, control and instrumentation equipment, area lighting, and oral and visual warning systems. A sketch of the stand is shown on the following page.

JUSTIFICATION:

A single engine static test stand is an essential adjunct to the complete stage test stands required for the development of multi-engine space vehicle stages. The stand proposed in this project is required by the Marshall Center in the development of stages for the Advanced Saturn and NOVA vehicles using clusters of the F-1 engines.

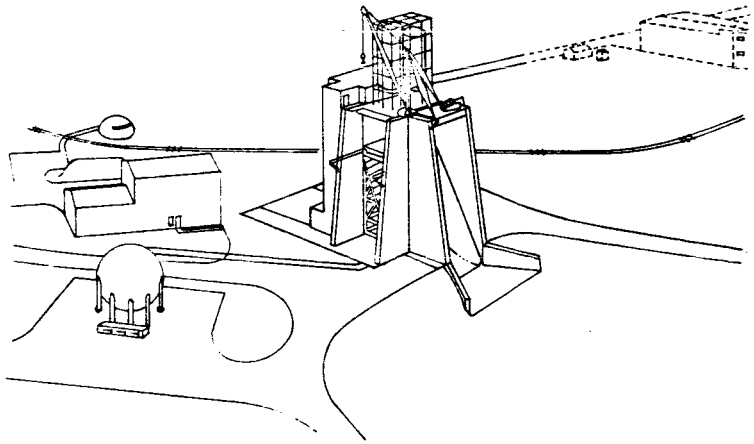
The single engine stand serves the stage development process by proving out or "trouble-shooting" systems design concepts prior to the finalization of the test version of the stage. This single engine test activity is not engine development testing, as such, but rather, subsystem testing wherein the engine is only a component. Subsystem tests also continue throughout the development program when it is advantageous to limit the test variables or to supplement full stage tests with simpler and less costly single engine tests.

As is the case with full stage systems tests, the subsystem testing must be done in close proximity to the site of systems design and fabrication. This is necessary to achieve the day-to-day flexibility of hardware substitution as may be determined by the designer from the evaluation of previous tests.

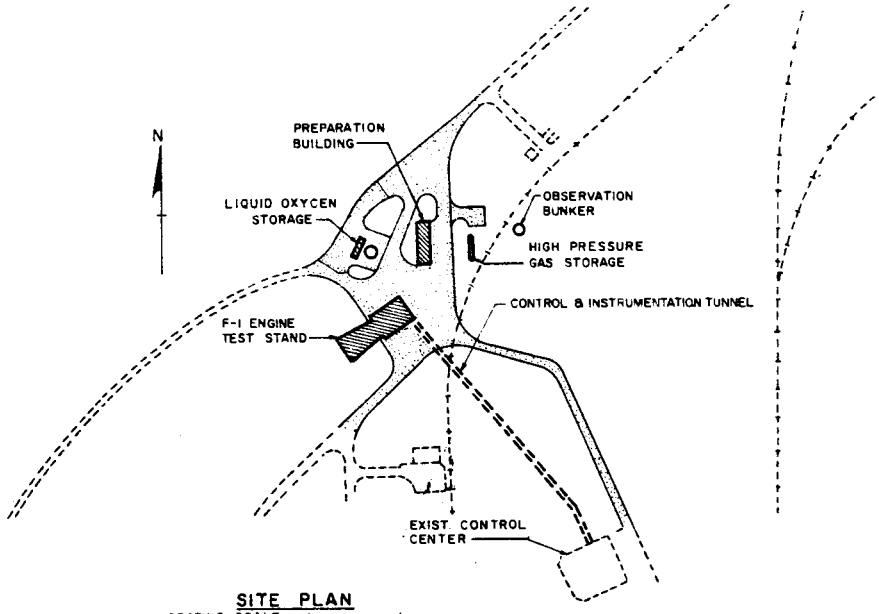
It is proposed to initiate construction of this stand in the fiscal year 1962 by reprogramming available funds and by using emergency construction authorization procedures. The cost estimate that follows indicates the required funding distribution between the fiscal years 1962 and 1963.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

F-I ENGINE TEST STAND

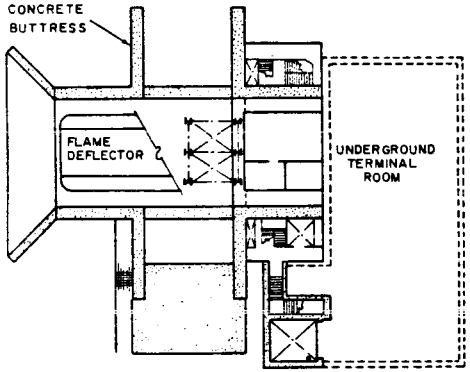


PERSPECTIVE

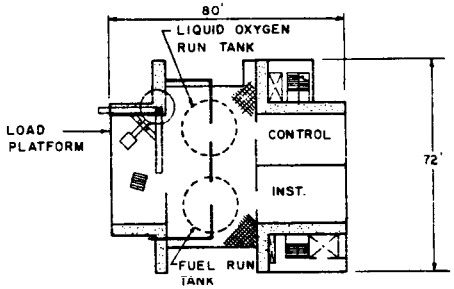


SITE PLAN

GRAPHIC SCALE 0 100 200 FEET



PLAN - GRADE LEVEL



PLAN - TOP OF LOAD PLATFORM

GRAPHIC SCALE 0 16 32 FEET

CF 10-F2

COST ESTIMATE:		Fiscal Year 1962		Fiscal Year 1963
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$475,000		---
Site preparation.....	$200,000		---	
Utility connections...	225,000		---	
Relocation of water system.....	50,000		---	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		700,000		$1,520,000
Test stand foundation.	350,000			
Test stand.....	---		$900,000	
Preparation building.. (11,400 square feet at $22.00 per square foot).....	250,000		---	
Deflector.....	---		600,000	
Observation bunker....	---		20,000	
Instrument tunnel.....	100,000		---	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		---		2,705,000
Fuel system.....	---		45,000	
Liquid oxygen system..	---		280,000	
High pressure gas system.....	---		400,000	
Fire fighting equipment	---		150,000	
Recording units.....	---		122,000	
Oscillographs and amplifiers.....	---		170,000	
Patch panels.....	---		78,000	
Measuring system.....	---		120,000	
Cables and terminal columns.....	---		300,000	
Calibration equipment.	---		180,000	
Test and checkout equipment.....	---		360,000	
Control equipment.....	---		500,000	
E. DESIGN AND ENGINEERING SERVICES...		325,000		275,000
Total estimated cost.....		$1,500,000 1/		$4,500,000

1/ Proposed for allocation using emergency construction authorization procedures

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

HYDRAULIC TEST FACILITY

DESCRIPTION:

This project describes the need for the construction of a 45 foot by 100 foot concrete block building providing 3,600 square feet of testing area, 480 square feet for hydraulic component cleaning equipment, and 420 square feet of engineering space. The testing area will contain a hydraulic component test console, launch and vehicle simulators, and various driving motors and test set-ups. The component cleaning area will be used to test, inspect, and assemble close tolerance components which are highly sensitive to contamination. Special heating, air conditioning, and positive pressure to prevent dust and other particles of contamination from entering the area will be required. A sketch of the facility is shown on the following page.

JUSTIFICATION:

The facility is required to conduct research and development tests for the selection, evaluation, and improvement of hydraulic systems and components for future launch and space vehicles.

The critical nature of hydraulic systems used in launch and space vehicles makes it imperative that extreme care be exercised in the research and development of these systems. One of the prime problems is that of hydraulic contamination. The physical tolerances for the valves and regulators, used in the systems are extremely close and malfunction of components and systems can be brought about by the slightest contamination.

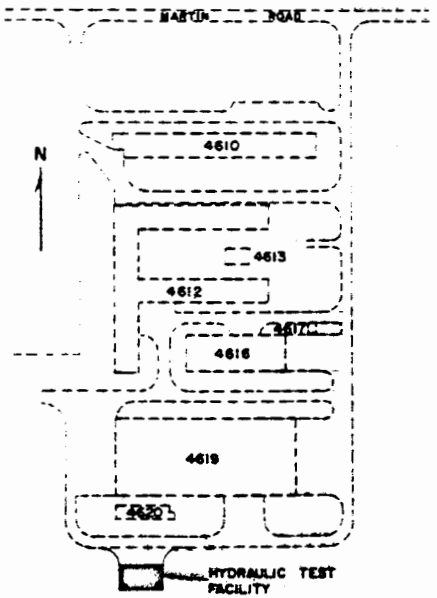
At present, tests are being performed in inadequate areas such as shop areas and stock rooms, none of which are suitably constructed or conditioned for the conduct of research and development on hydraulic systems space vehicles. Moreover, the varied locations of these inadequate facilities require more manpower and result in the duplication of test set-ups and equipment. The proposed facility will permit a better utilization of equipment and manpower, and will provide the additional space and equipment to support an increasing workload.

COST ESTIMATE:

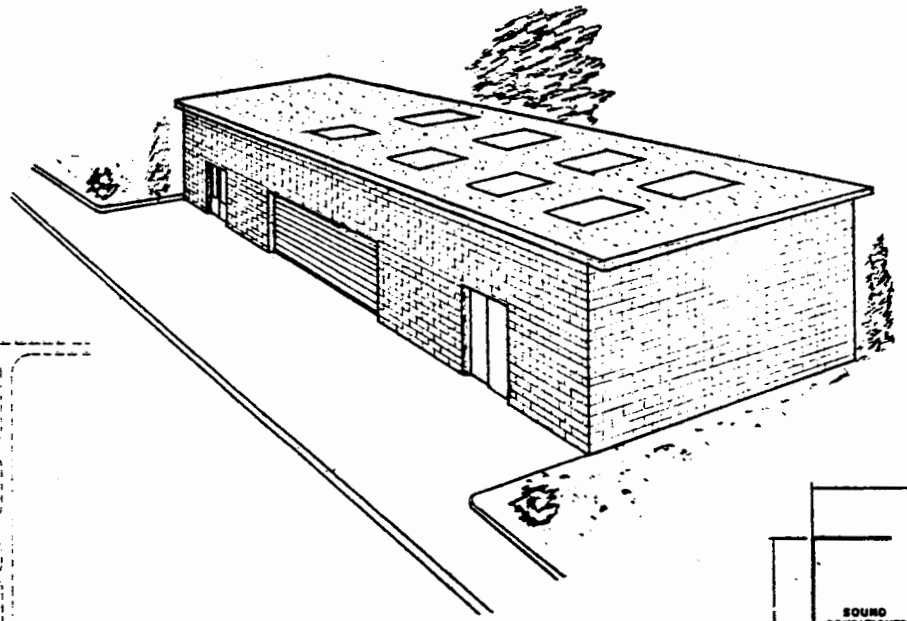
A. LAND ACQUISITION..... ---

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

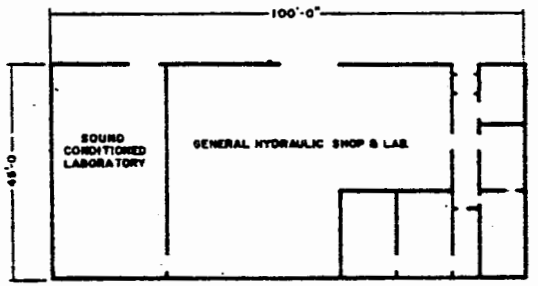
HYDRAULIC TEST FACILITY



SITE PLAN



PERSPECTIVE



FLOOR PLAN

B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$23,000
	Site work	$12,000	
	Utility connections	11,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		171,000
	Building .. (4,500 square feet at $38.00 per square foot)	171,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		117,000
	Clean room equipment	20,000	
	Support system	30,000	
	Ultrasonic cleaner	12,000	
	Filtering stand	5,000	
	Hydraulic servo test stand	35,000	
	Vari-drive motor	15,000	
E.	DESIGN AND ENGINEERING SERVICES		29,000
	Total estimated cost		$340,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

LOW TEMPERATURE FACILITY

DESCRIPTION:

A facility is required in which samples of materials used in space vehicles can be investigated to determine how they react when subjected to temperatures in the liquid hydrogen range (-423°F). The facility will consist of a 4,200 square foot building with a 15 foot ceiling and a reverse slope roof to reduce the possibility of trapping hydrogen near the ceilings. It will have reinforced concrete walls, special spark proof finished, grounding facilities, special air conditioning to provide once-through, high volume air flow, and explosion proof electrical equipment. The building will be divided into test cells, instrumentation rooms, chemistry labs, a cryostat room, a compressor room, and an external area for cryogenic storage and bottled gas storage. The major items of equipment required are fatigue, impact, and tensile strength machines; an instron tester; a systron counter and recorder; a diatron vacuum analyzer; spark proof tools; and recorders.

The explosive hazard posed by the use of liquid hydrogen requires specially designed facilities. A sketch of the proposed installation may be found on the following page.

JUSTIFICATION:

The Saturn vehicle program is designed for the application of liquid hydrogen fueled propulsion systems. The facility proposed in this project is required to provide an in-house capability for determining the effects that extreme low temperatures have upon materials. Only limited data on the application of liquid hydrogen fueled propulsion systems is currently available. An in-house capability in this area is necessary for independently evaluating the work of contractors.

The facility will also be used for testing materials at very low temperatures. The testing program will include:

(a) The determination of coefficients of expansion and contraction.

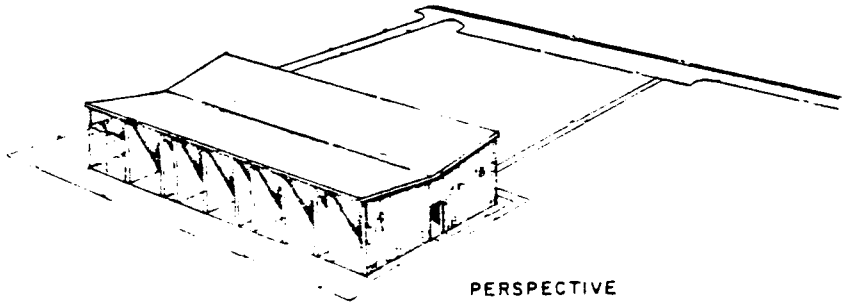
(b) The investigation of the fatigue life of metals.

(c) A determination of the tensile strength of plastics, elastomers, metals, and their weldments.

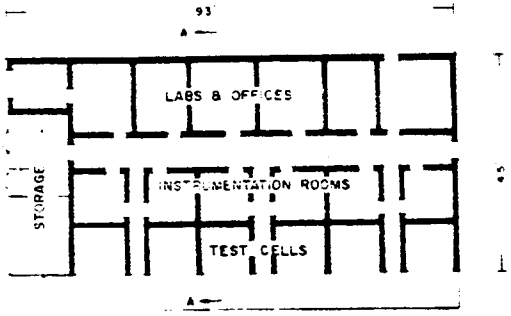
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

LOW TEMPERATURE FACILITY

SECTION A-A

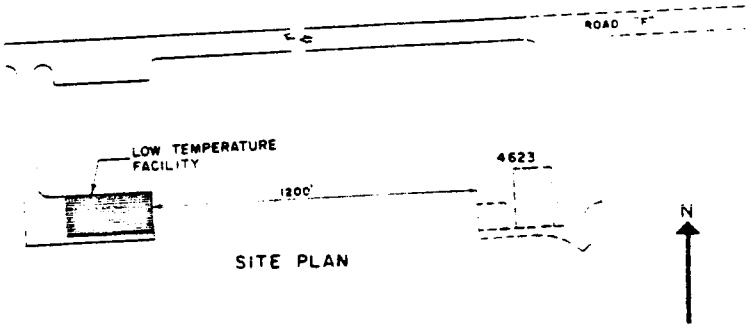


PERSPECTIVE



FLOOR PLAN

0 10 20 30
FEET



SITE PLAN

CF 10-H2

(d) An investigation of the impact strength of metals and their weldments, plastics, and adhesives.

(e) Studies of extreme low temperature lubrication problems.

(f) An evaluation of low temperature insulation materials.

(g) An evaluation of the chemical compatibility of fabrication materials with cryogenic propellants.

(h) An evaluation of low temperature sealants and adhesives.

(i) The investigation of handling procedures for cryogenic propellants with respect to safety.

(j) A quality control analysis of liquid hydrogen.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$32,000
	Utility connections	$17,000	
	Roads and parking areas	9,200	
	Site preparation	5,800	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		181,000
	Building..(4,200 square feet at $43.00 per square foot)	181,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		313,000
	Special air handling equipment	50,000	
	Instrumentation	90,000	
	Safety equipment	44,000	
	Operational equipment	129,000	
E.	DESIGN AND ENGINEERING SERVICES		49,000
	Total Estimated Cost		$575,000

CF 10-H3

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

MODIFICATION OF WEST SIDE OF STATIC TEST STAND

DESCRIPTION:

It is proposed to modify the West Side of the existing Saturn static test stand by the construction, equipping, and instrumentation, of an additional test position with a capability of handling 1,500,000 pounds of thrust. Some fiscal year 1962 advanced design funds have been allocated for this project. Additional fiscal year 1962 funds are proposed to be allocated for the start of construction including the removal of existing platforms and foundations, the construction of new foundations, extensions to utilities, extensions to the propellant and high pressure gas systems, and necessary site improvements. The modifications will be completed with the funds requested for the fiscal year 1963. The 1963 work will include changes to patch panels, the addition of recorders at the blockhouse, new instrumentation at the test tower, new control consoles, a flame deflector, vehicle support hardware, and a firefighting system. A sketch of the stand is shown on the next page.

JUSTIFICATION:

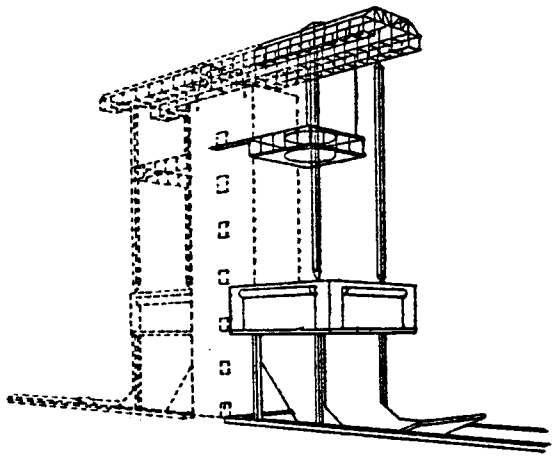
A single static test position is currently available on the East Side of the Saturn static test stand. This position provides the capability for static testing the C-1 stage of the Saturn vehicle. A second Saturn static test stand, authorized in the fiscal year 1961 program and currently under construction, is being proposed for conversion to provide capability for static testing the Advanced Saturn stages. This leaves only the single test position with the C-1 stage capability. An additional test position with this capability is required to meet the accelerated Saturn schedule and to provide backup capability in the event of a catastrophe on the existing test position.

Because of the urgent need for this facility, funds for advanced design services have been allocated from the 1962 appropriation. Additional fiscal year 1962 funds are proposed to be reprogrammed to permit construction to be initiated promptly; emergency construction authorization procedures will be used for this purpose. The cost estimate that follows indicates the required funding distribution between the fiscal years 1962 and 1963.

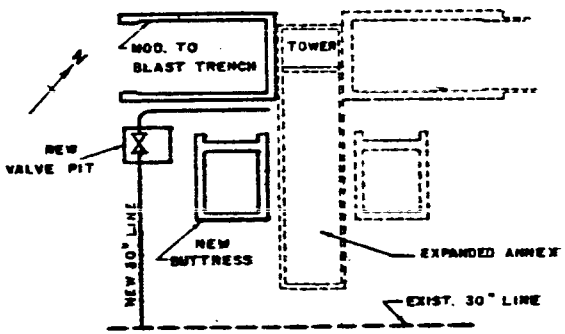
MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

MODIFICATION OF WEST SIDE OF STATIC TEST STAND



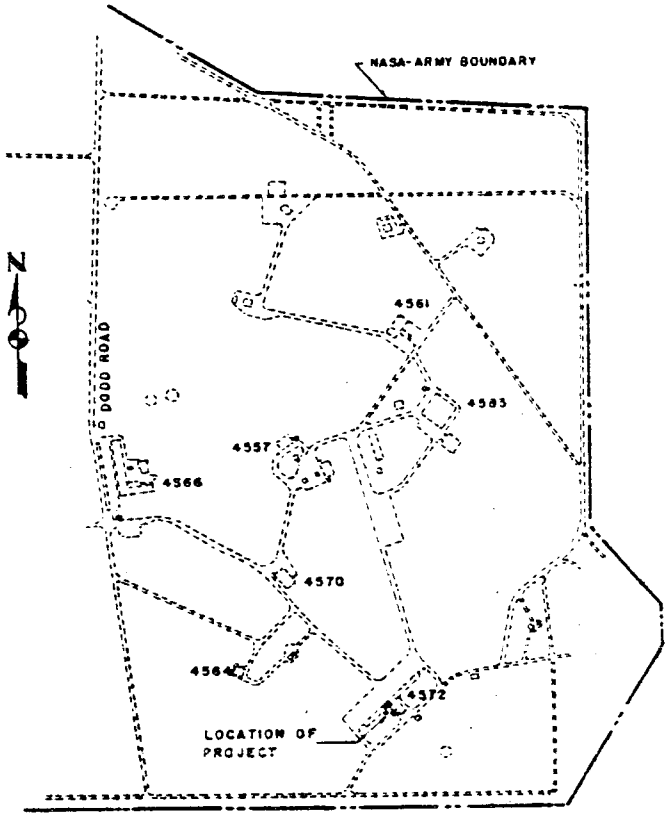
PERSPECTIVE



FOUNDATION PLAN

GRAPHIC SCALE—FEET

10 0 10 20 30 40 50



SITE PLAN

GRAPHIC SCALE—FEET

200 0 200 400 600

COST ESTIMATE:		Fiscal Year 1962	Fiscal Year 1963
A. LAND ACQUISITION.....		---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$235,000	---
Site preparation.....	$55,000		
Demolition.....	30,000		
Utility connections...	150,000		
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,277,000	---
Test position.....	1,000,000		
Blockhouse addition (4,000 square feet at $33.00 per square foot).....	132,000		
Addition to annex (7,250 square feet at $20.00 per square foot).....	145,000		
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,239,000	$2,000,000
Propellant and high pressure gas system.	354,000		
Deflector and deflector piping....	700,000		
Deflector installation	---		$290,000
Fire fighting system..	---		60,000
Vehicle support hardware.....	65,000		425,000
Signal conditioning equipment.....	80,000		295,000
Calibration system....	40,000		75,000
Patch panel distribution wiring, terminals, and trays	---		65,000
Receptacle transducers and junction boxes..	---		55,000
Instrumentation installation and checkout.	---		110,000
Transmission systems..	---		88,000
TV, photography, and operation recording systems.....	---		88,000

	Fiscal Year 1962	Fiscal Year 1963
Consoles, racks, and equipment controls.. ---		$48,000
Warning and intercommunication systems.. ---		29,000
Ground support equipment..... ---		372,000
E. DESIGN AND ENGINEERING SERVICES.....	$516,000 1/	---
Total estimated cost.....	$3,267,000 2/	$2,000,000

1/Includes $175,000 already allocated for advanced design services.

2/Proposed for allocation using emergency construction authorization procedures.

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

ENGINEERING BUILDING

DESCRIPTION:

It is proposed to construct a two-story engineering building containing approximately 30,000 square feet of area. The building will be of reinforced masonry construction with secondary interior wall systems treated to provide sound and vibration isolation from the mechanical equipment necessary to the function of the building. All other interior partitions will be of the prefabricated metal type for purposes of flexibility. Floors will be concrete, covered with composition tile. Exterior walls will be exposed painted masonry. A drawing of the building is shown on the following page.

JUSTIFICATION:

Additional office space is required to house the engineering and scientific personnel concerned with operation of the additional test facilities being provided in support of the Advanced Saturn program. The building will provide space for approximately 250 people. It is contemplated that a large portion of these people will be contractor personnel assigned to component, stage, and engine test programs.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$75,000
	Grading, fill, and drainage	$32,000	
	Parking area	20,000	
	Roads and walks	6,000	
	Utility connections	17,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		660,000
	Building..(30,000 square feet at $22.00 per square foot)	660,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		175,000
	Office furniture and equipment	140,000	
	Cafeteria equipment	35,000	
E.	DESIGN AND ENGINEERING SERVICES		90,000
	Total estimated cost		$1,000,000

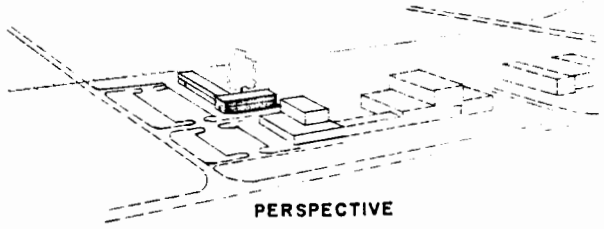
CF 10-J1

MARSHALL SPACE FLIGHT CENTER

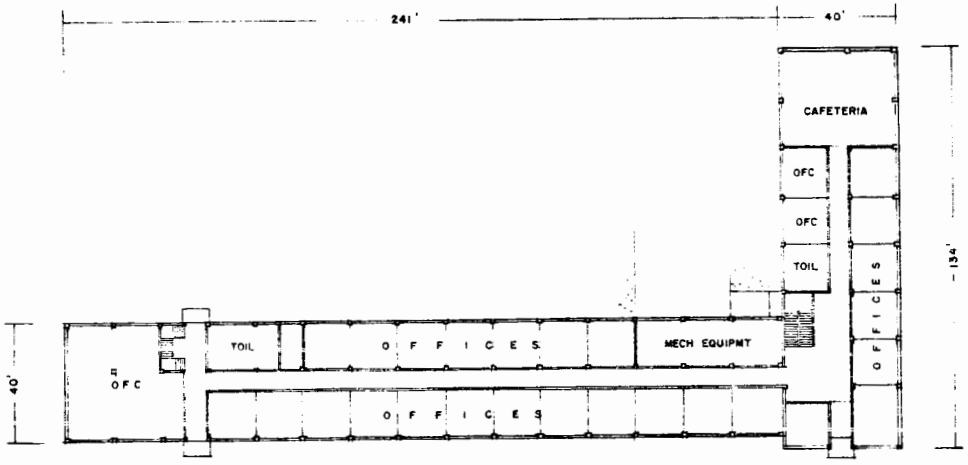
FISCAL YEAR 1963 ESTIMATES

ENGINEERING BUILDING

ELEVATION

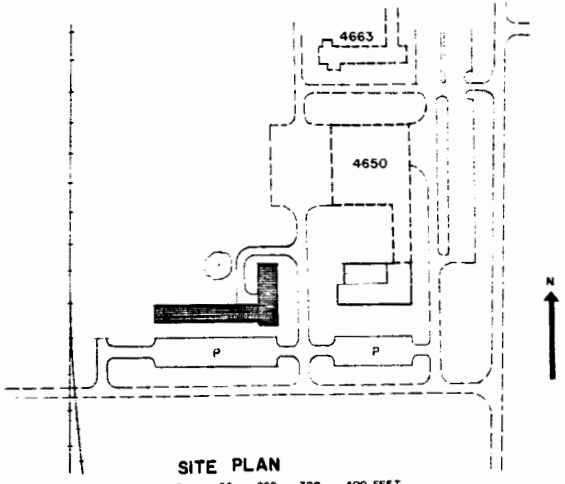


PERSPECTIVE



FLOOR PLAN

0 10 50 100 FEET



SITE PLAN

0 100 200 300 400 FEET

CF 1C-J2

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

INSTRUMENT LABORATORY

DESCRIPTION:

It is proposed to construct a new instrument laboratory of approximately 14,100 square feet. As indicated in the drawing on the following page, the laboratory will consist of (1) a single story masonry unit with a floor of concrete slab-on-grade and (2) a high-bay mill type building with crane pits for calibrators and pads for the storage of calibrator weights. The building will be air conditioned. Work areas will be provided as follows:

(a) Acoustics: An area is required to test, evaluate, and calibrate high and low level sound, vibration, and shock instrumentation; sound measuring and acoustic calibration instrumentation and auxiliary electronic instruments and equipment.

(b) Instrument shop: A small precision machine shop, equipped to perform close tolerance machining operations is required. Part of the equipment is available, but must be supplemented with power tools, work benches, and measuring tools.

(c) Instrument design: A small design and engineering group is required to provide back-up for instrument makers.

(d) General pressure and thrust unit: An area will be provided to conduct pressure and thrust calibration. The equipment required will consist of an environmental test chamber, instrument panels, recording and indicating instrumentation, a universal load testing machine, vacuum pumps, and compressed air regulating facilities.

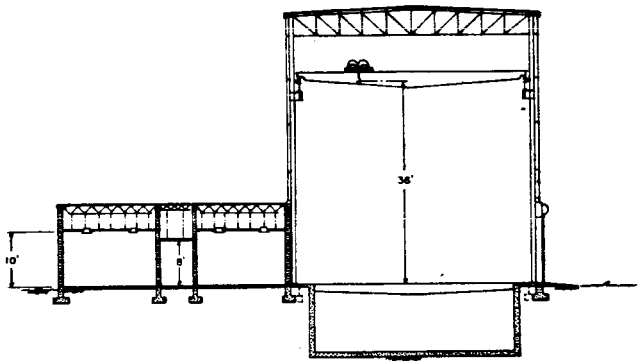
(e) Load cell and heavy instrument storage: An area for the storage of heavy precision load cells is included.

(f) Gage storage: An area will be provided for the storage of the many different types of gages required in instrument work.

(g) Pressure and thrust precision calibration: This room will contain high precision reference or transfer standards necessary to insure the accuracy of those instruments used daily. Primary standards such as dead weights testers, pressure balances, and liquid manometers are needed.

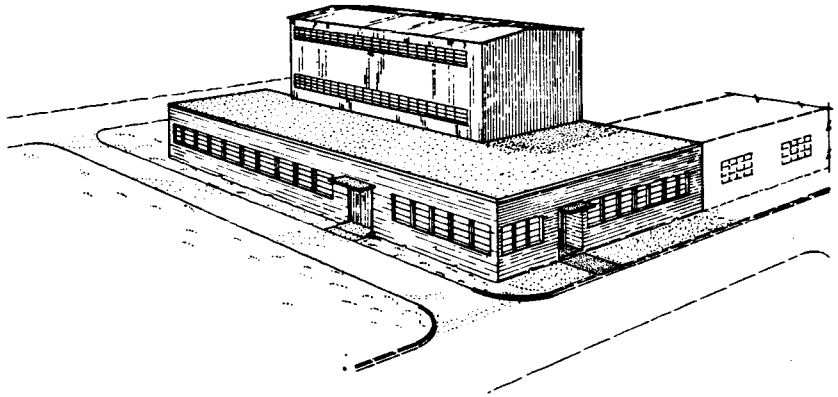
MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 · ESTIMATES

INSTRUMENT LABORATORY

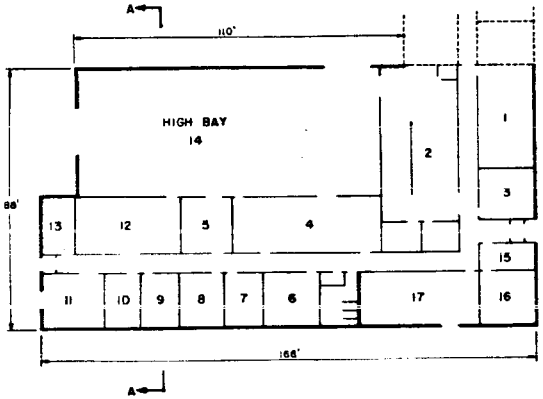


SECTION A-A

0 5 10 20
FEET



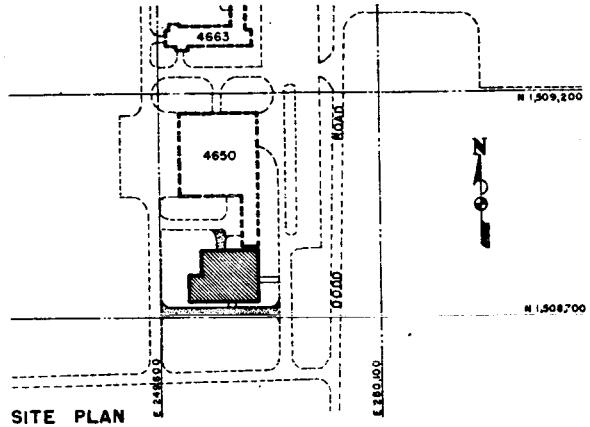
PERSPECTIVE



FLOOR PLAN

0 10 20 30
FEET

1 ACOUSTICS LAB
2 INSTRUMENT MAKERS
3 INSTRUMENT DESIGN
4 PRESSURE & THRUST LAB
5 LOAD CELL STORAGE
6 GAGE STORAGE
7 OFFICE - PRESSURE & THRUST UNIT
8 PRESSURE & THRUST PRECISION CALIBRATION
9 ELECTRONICS LAB
10 OFFICE - FLOW & LIQUID LEVEL UNIT
11 FLOWMETER STORAGE
12 FLOW LAB
13 ULTRASONIC FLOW CALIBRATION
14 LOAD CELL CALIBRATION
15 ADMINISTRATION OFFICE
16 UNIT SUPERVISOR
17 MECHANICAL EQUIPMENT



SITE PLAN

0 100 200
FEET

CF 10-K2

(h) Electronic area for propellant flow and liquid level sensors: An area is required for the maintenance, repair, and storage of electronic equipment used in the accurate measurement of propellant flow and liquid level. Instruments such as oscilloscopes, oscillographs, counters, and bridges are necessary.

(i) General flowmeter calibration: A specially designed area is needed for flowmeter calibration, testing, cleaning, and repair. The required equipment includes two interior-mounted tanks of 3,000 gallon capacity each, and three pairs of smaller tanks, all equipped with pressure regulating devices, piping systems, and racks with recording, counting and indicating devices.

(j) Ultrasonic flow calibration: An area is required to test and calibrate gas flow meters, sonic nozzles, pitot tubes, flowrators, and wet-test meters.

(k) Load cell calibration bay: This area will house the equipment needed for the precision calibration of heavy single and multiple load cell configurations. The equipment required includes one 1,500-pound load cell calibrator, one 200,000-pound load cell calibrator, and an assortment of calibration masses (dead weights) and special related equipment. Operational, control, and recording equipment for calibration purposes will be provided in an adjoining room.

JUSTIFICATION:

The instrument laboratory is required for the design, development calibration, repair, modification, and evaluation of highly complex, accurate measuring devices used in the static test firing and cold flow testing of present and future space boosters and their components. The static firing tests of the clustered Saturn booster require a minimum of 900 channels of information. Each channel requires instrumentation pickups at the functioning station on the booster. Much of the instrumentation is highly specialized and cannot be obtained commercially. Items must be modified and calibrated to meet the rigid standards of the testing procedures. In addition, the use of liquid hydrogen has introduced problems in measurement that cannot adequately be met with existing facilities.

The burden of providing highly specialized test instrumentation is currently being accomplished by personnel working in three different buildings totaling approximately 11,000 square feet. The proposed new laboratory will bring these scattered interdependent operations together; it will also provide the necessary additional space and instrumentation for support of the Advanced Saturn program and for support of the additional test facilities being requested for the Marshall Center for that program.

COST ESTIMATE:

A.	LAND ACQUISITION.....		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$25,000
	Site work.....	$4,000	
	Utility connections.....	21,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		475,000
	Building...(14,100 square feet at $33.70 per square feet).....	475,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,240,000
	Laboratory equipment.....	540,000	
	Laboratory instrumentation.....	150,000	
	Standards for temperatures pressures, and masses.....	170,000	
	Load cell calibration equipment.....	200,000	
	Flow meter calibration system.....	180,000	
E.	DESIGN AND ENGINEERING SERVICES.....		260,000
	Total estimated cost.....		$2,000,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

SUPPORT FACILITIES IN WEST AREA

DESCRIPTION:

This project provides for the expansion of support facilities required for static testing the Advanced Saturn vehicle in the West Area. The scope of work includes:

(a) High pressure water system: The high pressure water system will be increased from its capability of 70,000 gallons per minute to 220,000 gallons per minute. Modifications will include an increased reservoir capacity and a new pumping station with necessary pumps, drives, pipe lines, valving, and a control system.

(b) Fuel system: The fuel system capacity will be increased from 50,000 gallons to 250,000 gallons. Items required are storage tanks, pumps, valves, filters, a firefighting system, and a transfer system to and from the test stand.

(c) Liquid oxygen system: The liquid oxygen system capacity will be increased from 75,000 gallons to 375,000 gallons. Items required are storage tanks, pumps, valves, unloading facilities, filters, and transfer piping to test stand.

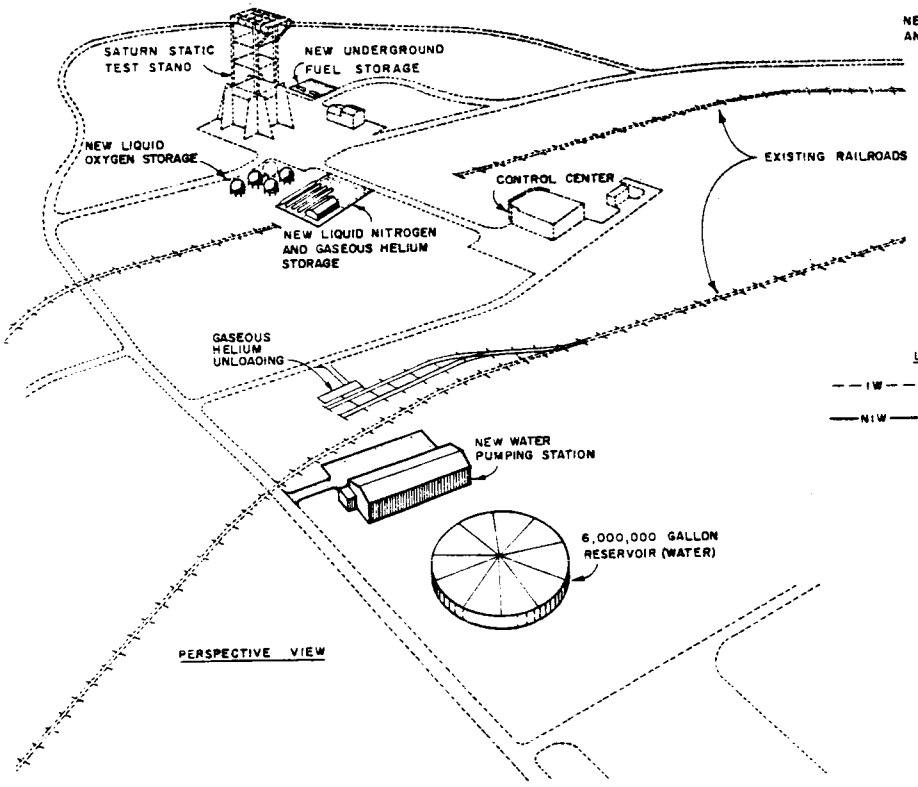
(d) Helium system: A completely new helium pressurizing gas system will be installed. Items required will include railroad receiving facilities; a compressor station complete with compressors, valves, filters, and controls; high pressure storage tanks; and transfer piping to test stand.

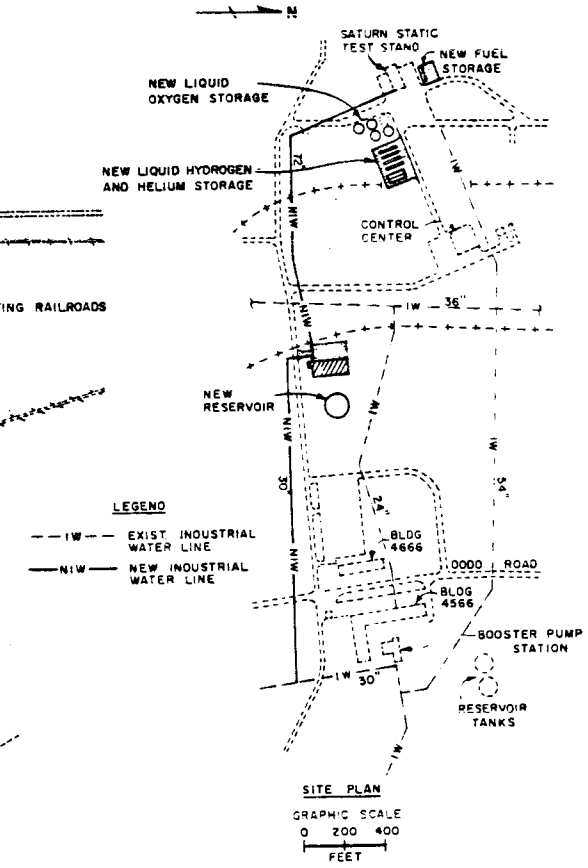
(e) Liquid nitrogen system: A liquid nitrogen system will be installed. Items required include vacuum jacketed storage tanks, transfer pumps, valves, filters and transfer piping to the test stand.

The location of the proposed facilities is shown in the drawing on the next page. This is followed by a drawing of the proposed new high pressure water pumping station.

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

SUPPORT FACILITIES IN WEST AREA

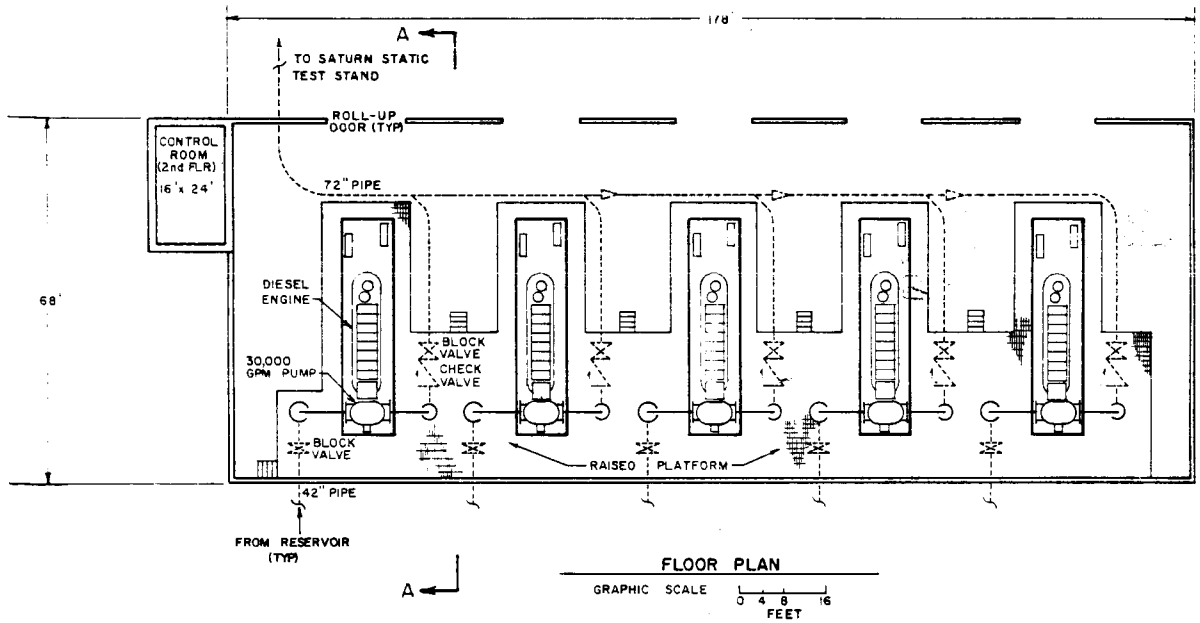


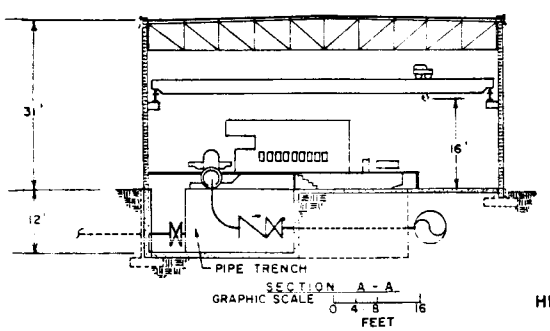


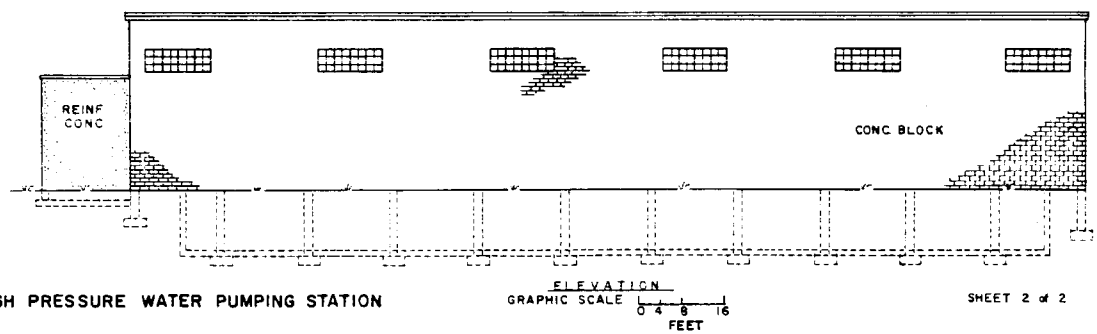
CF 10-L2

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

SUPPORT FACILITIES IN WEST AREA







HIGH PRESSURE WATER PUMPING STATION

SHEET 2 of 2

CF 10-L3

JUSTIFICATION:

The decision to modify the Saturn static test stand currently under construction to provide capability for static testing the Advanced Saturn requires significant modifications in the capacities of the support systems for that stand. For example, the high pressure water required for the thrust of the 7.5 million pound booster is 220,000 gallons per minute, in lieu of the previously designed 70,000 gallons per minute.

The booster size of the Advanced Saturn requires the storage and transfer of large quantities of fuel. The fill rates of fuel for static testing have been established as the same fill rates required at launch time. To meet this requirement the entire quantity of fuel needed for static testing must be stored in the test area, requiring a storage capacity of 250,000 gallons. In addition, the pumping capacity and transfer system must be capable of handling a flow of 2,000 gallons per minute. The original design of flow was for 750 gallons per minute.

The booster size of the Advanced Saturn requires the storage and transfer of large quantities of liquid oxygen; here again, the fill rates for static testing are the same as for launch. To meet this requirement for liquid oxygen at the test site, the storage of approximately 375,000 gallons will be required. In addition, the pumping capacity and transfer system must be able to handle flows of 10,000 gallons per minute. The original design was for 2,000 gallons per minute. The testing of the Advanced Saturn will also require a helium system for pressurization of the fuel and liquid oxygen systems. The helium storage bottles will be cooled by the use of liquid nitrogen.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$510,000
High pressure water lines	$410,000	
Railroad extensions	40,000	
Unloading facilities	60,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		3,025,000
Pumping station building (12,500 square feet at $28.80 per square foot)	360,000	
Water reservoir	265,000	
Fuel storage tanks	350,000	
Liquid oxygen storage tanks	800,000	
Helium compressor building (5,000 square feet at $20.00 per square foot)	100,000	

Installation of low pressure gaseous helium storage vessels.....	$150,000	
High pressure helium storage vessels.....	900,000	
Liquid nitrogen storage tanks.....	100,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$3,565,000
High pressure water pumps, equipment, manifolds, and controls.....	2,100,000	
Fuel pumps and controls.....	75,000	
Fuel transfer system.....	175,000	
Fuel fire fighting equipment.....	50,000	
Liquid oxygen pumps and controls.....	200,000	
Liquid oxygen transfer systems.....	250,000	
Liquid oxygen fire fighting equipment.....	100,000	
Helium compressor equipment and controls..	215,000	
Helium transfer system.....	300,000	
Liquid nitrogen transfer system.....	100,000	
E. DESIGN AND ENGINEERING SERVICES.....		700,000
Total estimated cost.....		$7,800,000

MARSHALL SPACE FLIGHT CENTER

FISCAL YEAR 1963 ESTIMATES

UTILITY INSTALLATIONS

DESCRIPTION:

Extensions to primary utility systems and road networks are required as follows:

Water: The installation of an additional filter is required at the potable water treatment plant. New potable and industrial water mains are also required to service new facilities. A new water storage reservoir at the site of the new components test facility is included in the project.

Sewer: Extension of the sanitary and industrial sewer lines to areas of new construction, and miscellaneous modifications to existing treatment facilities will be funded under this project.

Electric: The construction of an additional 10,000 KVA unit substation and the expansion of various other substations and distribution systems are included.

Roads: The project will permit an extension of the road network to support the new facilities included in the 1963 program. The extension will consist of about 1,900 linear feet of gravel and 3,000 linear feet of paved road for general traffic. In addition, about 7.5 miles of existing road will be modified to accommodate the Advanced Saturn configurations. The modifications will consist of widening pavement, strengthening and lengthening culverts, bridge improvements, clearance improvements, and dock area enlargement.

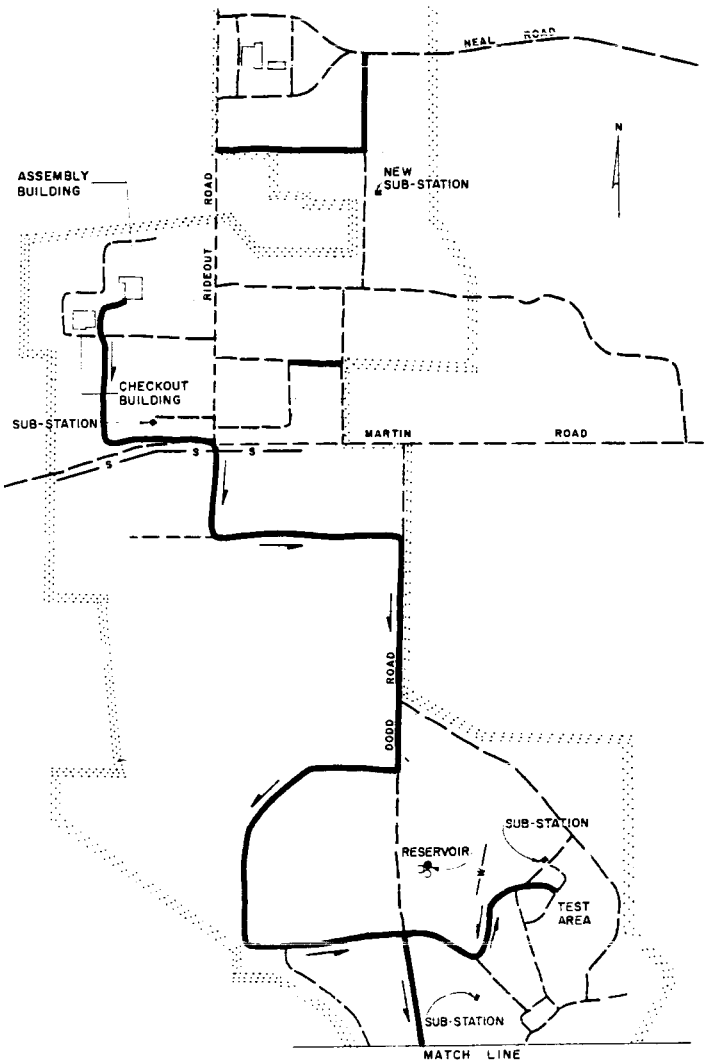
A drawing of the work covered by this project is shown on the following page.

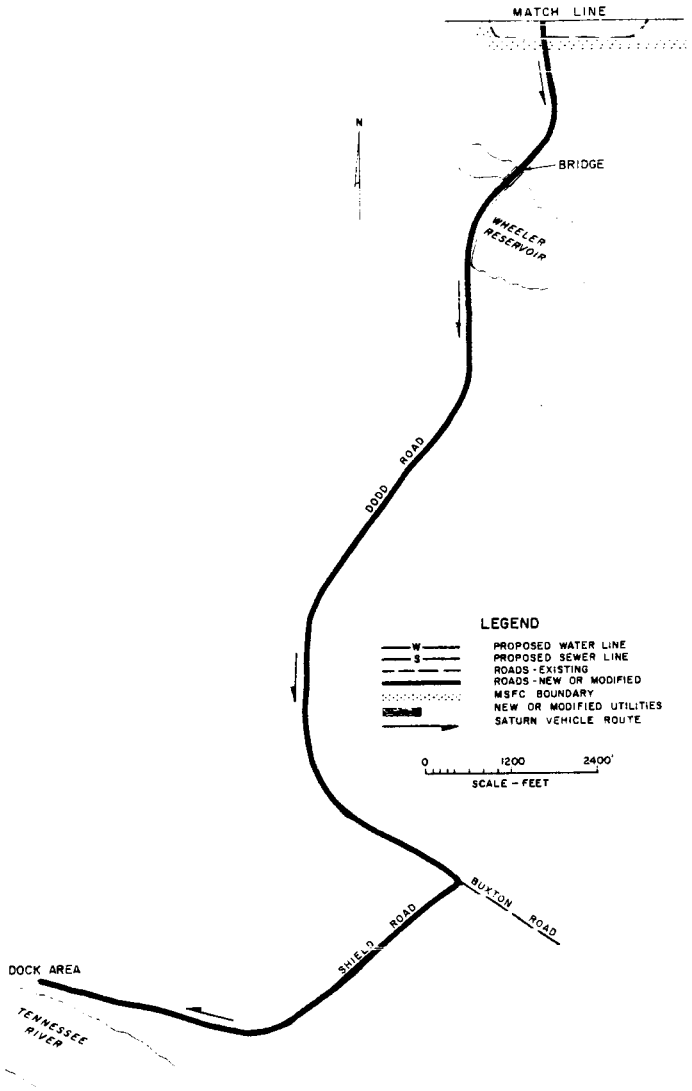
JUSTIFICATION:

The utility improvements described in this project are required to support the new Marshall Center facilities proposed for construction in the fiscal year 1963 budget submission. The project covers improvements or expansions to the utility systems of the Center which cannot specifi-

MARSHALL SPACE FLIGHT CENTER
FISCAL YEAR 1963 ESTIMATES

UTILITY INSTALLATIONS





cally be identified with any single facility. Normal utility connections and access roads are included under the applicable projects they serve.

During peak hot weather periods, the desirable water filtration rate is exceeded. The locations and demands of the new facilities require increased main sizes and extensions to provide the required quantities and pressures.

New sewer mains and an extension of existing mains will be required to serve new buildings and test facilities. The additional load will require some modification to the treatment plant to meet legal standards.

The expanded area of operations and the increased demand will soon cause the primary and secondary electrical distributions systems to become overloaded. A large expansion in substation transformer capability and an extension of the electrical network will have to be provided to meet the increase in electrical power demand.

The existing road network has been used for transporting the first stage of the Saturn C-1 vehicle. This vehicle is 80 feet long and 22 feet wide, and weighs approximately 45 tons empty. Initial development work and the static testing of the first stage of the Advanced Saturn vehicle will also be accomplished at the Marshall Center. This vehicle stage will be fabricated at the shop area and transported over the same roads to the testing area. In addition, the first five flight test vehicles of the Advanced Saturn, which will be fabricated at the Michoud Plant, will be water borne to the Marshall Center, then transported from the dock area to the test area over these roads. The first stage of the Advanced Saturn vehicle, 140 feet long and 33 feet wide, will weigh approximately 100 tons empty. The existing road network must be strengthened, widened, and improved to permit the transport of these stages.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$2,227,000
Water filtration plant	$50,000	
Water reservoir	65,000	
Water mains	85,000	
Sewer mains and treatment plant	100,000	
Electrical substation and distribution system	360,000	
Road improvements within Marshall Center	550,000	
Road improvements within Redstone Arsenal	240,000	
Bridge improvements	537,000	
Dock improvements	240,000	

C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....	---
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....	---
E.	DESIGN AND ENGINEERING SERVICES.....	$290,000
	Total estimated cost.....	$2,517,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

CONSTRUCTION OF FACILITIES - 1963 PROGRAM

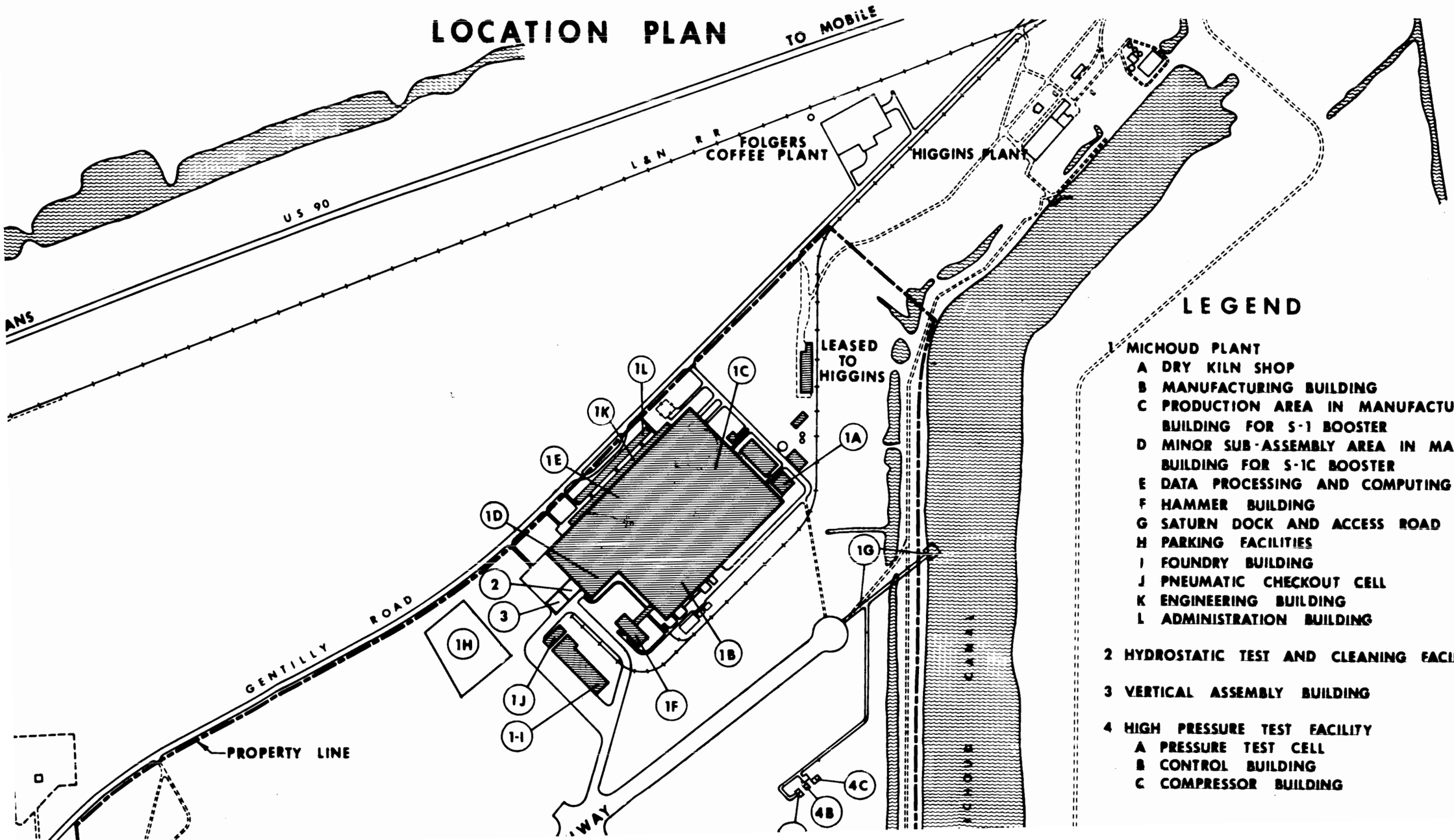
MICHOUD PLANT

Page No.		
CF11-A2	Location plan	
CF11-A3	Modifications to Michoud Plant.....	$11,400,000
CF11-B1	High pressure test facility.....	1,000,000
CF11-C1	Hydrostatic test and cleaning facility.....	3,000,000
CF11-D1	Vertical assembly building.....	3,000,000
	Total.....	$18,400,000

MICHOUD PLANT

FISCAL YEAR 1963 ESTIMATES

LOCATION PLAN



LEGEND

1 MICHOUD PLANT
- A DRY KILN SHOP
- B MANUFACTURING BUILDING
- C PRODUCTION AREA IN MANUFACTURING BUILDING FOR S-1 BOOSTER
- D MINOR SUB-ASSEMBLY AREA IN MANUFACTURING BUILDING FOR S-1C BOOSTER
- E DATA PROCESSING AND COMPUTING AREA
- F HAMMER BUILDING
- G SATURN DOCK AND ACCESS ROAD
- H PARKING FACILITIES
- I FOUNDRY BUILDING
- J PNEUMATIC CHECKOUT CELL
- K ENGINEERING BUILDING
- L ADMINISTRATION BUILDING

2 HYDROSTATIC TEST AND CLEANING FACILITY

3 VERTICAL ASSEMBLY BUILDING

4 HIGH PRESSURE TEST FACILITY
- A PRESSURE TEST CELL
- B CONTROL BUILDING
- C COMPRESSOR BUILDING

MICHO

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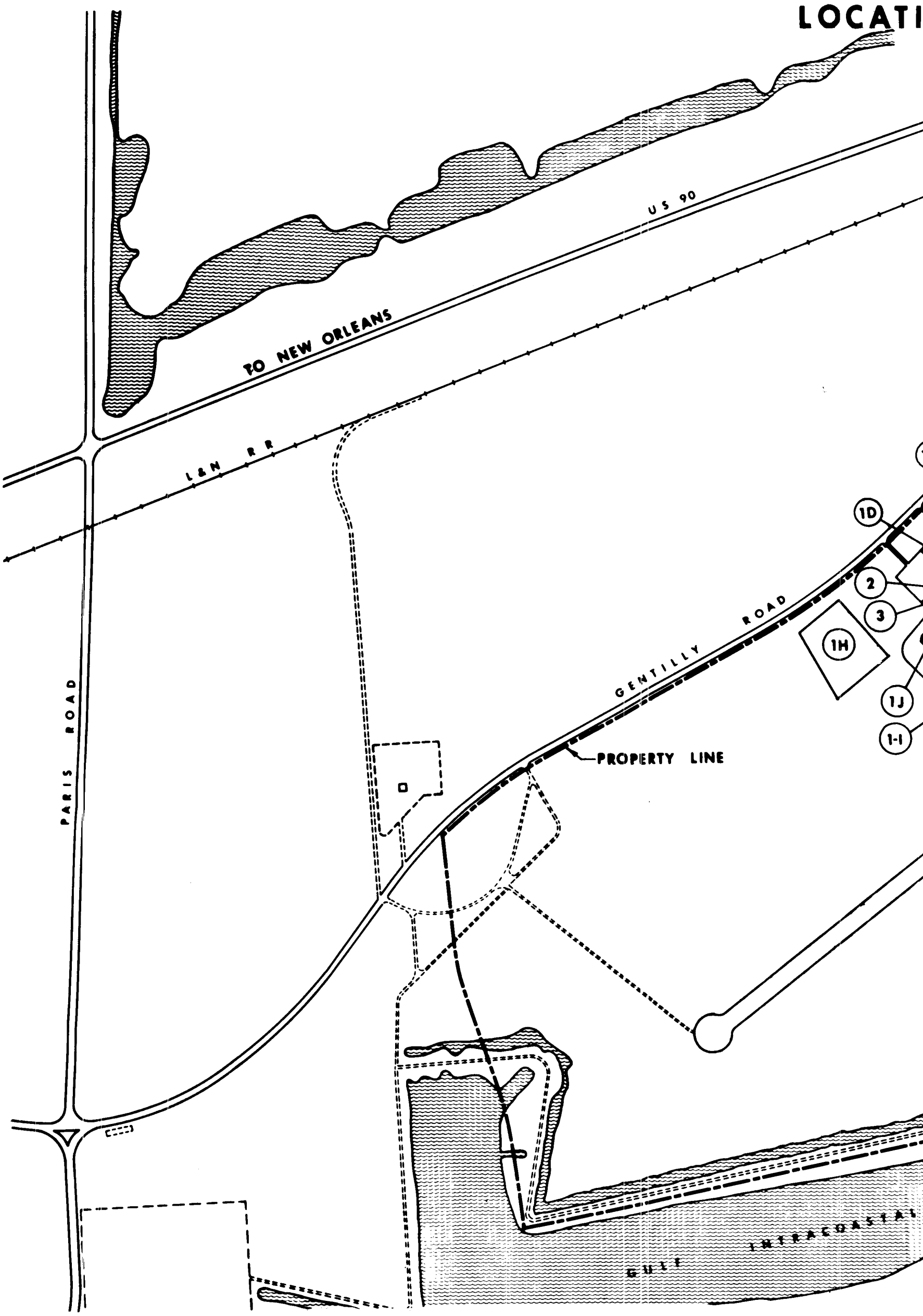
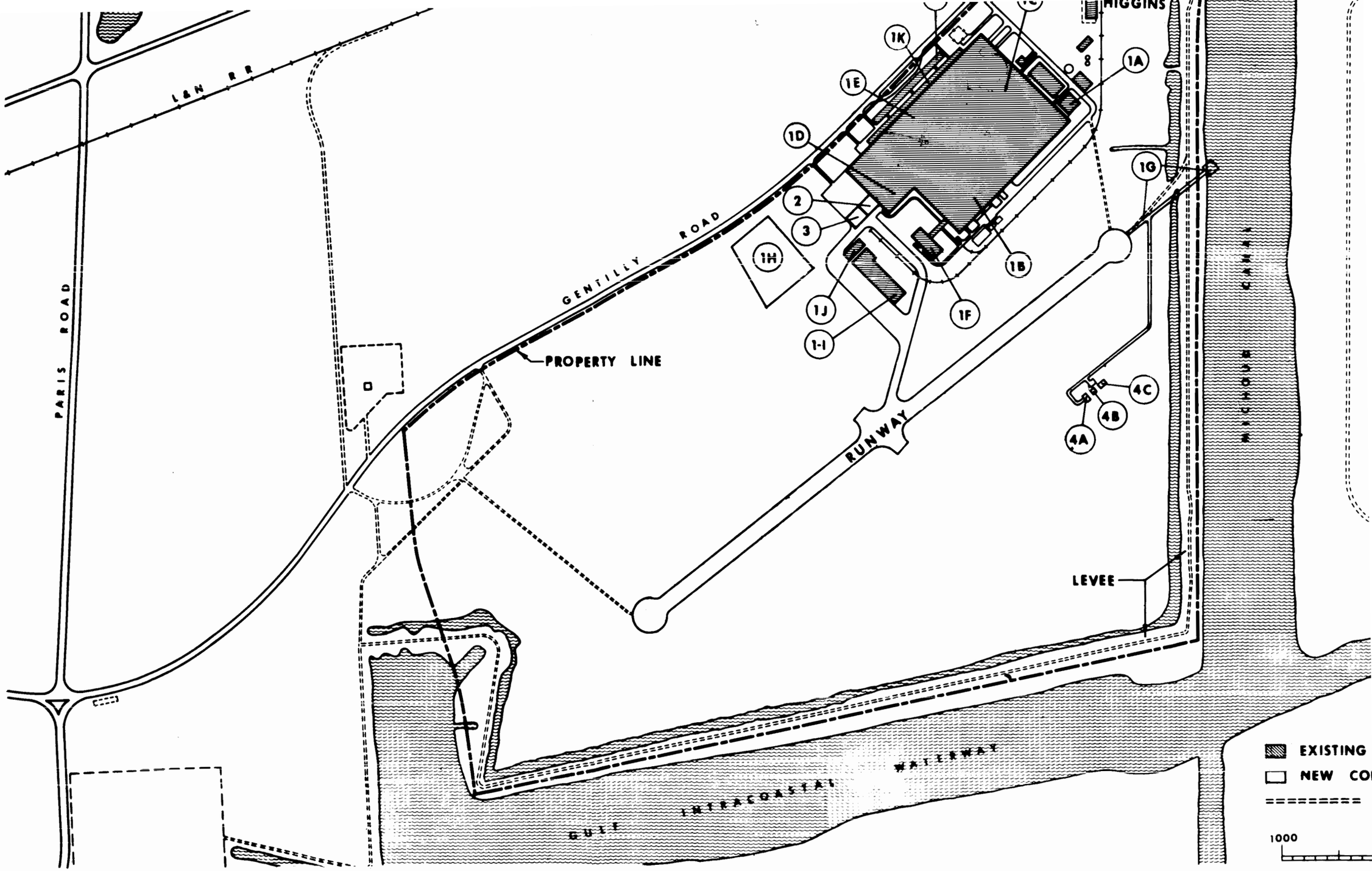
LOCATI




L&N RR
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GENTILLY ROAD
PROPERTY LINE
RUNWAY
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LEVEE
MICHOUD CANAL
GULF INTRACOASTAL WATERWAY
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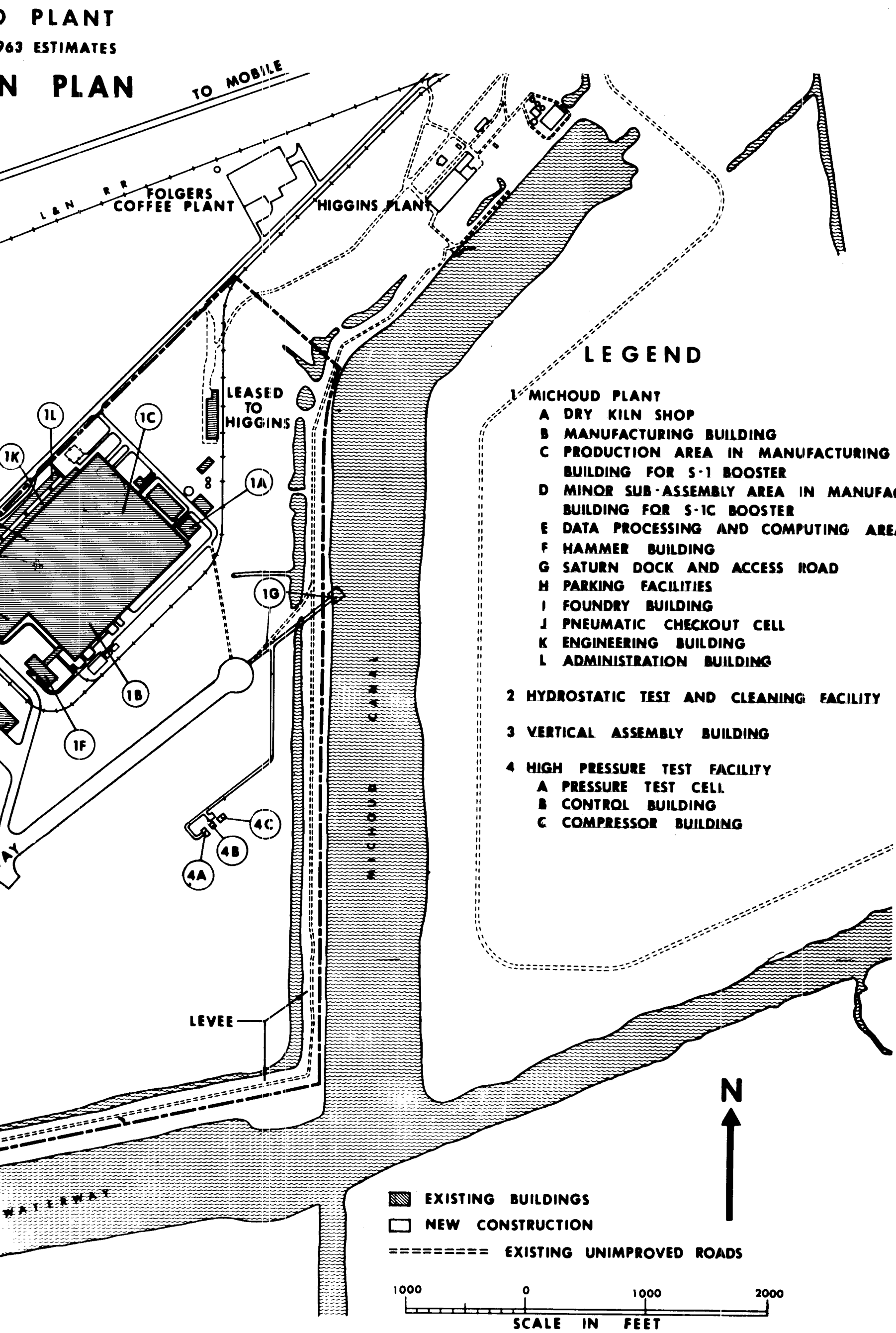
PLANT
963 ESTIMATES
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4C
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MICHOUD CANAL
LEVEE
WATERWAY
LEGEND
1 MICHOUD PLANT
A DRY KILN SHOP
B MANUFACTURING BUILDING
C PRODUCTION AREA IN MANUFACTURING BUILDING FOR S-1 BOOSTER
D MINOR SUB-ASSEMBLY AREA IN MANUFACTURING BUILDING FOR S-1C BOOSTER
E DATA PROCESSING AND COMPUTING AREA
F HAMMER BUILDING
G SATURN DOCK AND ACCESS ROAD
H PARKING FACILITIES
I FOUNDRY BUILDING
J PNEUMATIC CHECKOUT CELL
K ENGINEERING BUILDING
L ADMINISTRATION BUILDING
2 HYDROSTATIC TEST AND CLEANING FACILITY
3 VERTICAL ASSEMBLY BUILDING
4 HIGH PRESSURE TEST FACILITY
A PRESSURE TEST CELL
B CONTROL BUILDING
C COMPRESSOR BUILDING
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NEW CONSTRUCTION
EXISTING UNIMPROVED ROADS
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MICHOUD PLANT

FISCAL YEAR 1963 ESTIMATES

MODIFICATIONS TO MICHOUD PLANT

DESCRIPTION:

Modifications and additions to the Michoud Plant are required to adapt the plant for the fabrication and assembly of the S-I Saturn booster and to adapt a portion of the plant for the manufacture and minor assembly of components for the S-IC Saturn booster. A drawing of the plant is shown on the following page. A detailed description of project follows:

(a) Additional parking facilities: A new parking area accommodating approximately 500 cars will be constructed on the west side of the manufacturing building. Additional shell surfacing and bumper blocks will be added to the existing east parking area.

(b) Saturn dock and access road: A new dock and access road will be required for transportation of the Saturn booster. New pavement on the existing road, the relocation of overhead obstructions, and reinforced pavement over existing culverts will also be required. The dock will be located on the Michoud Canal.

(c) Manufacturing building:

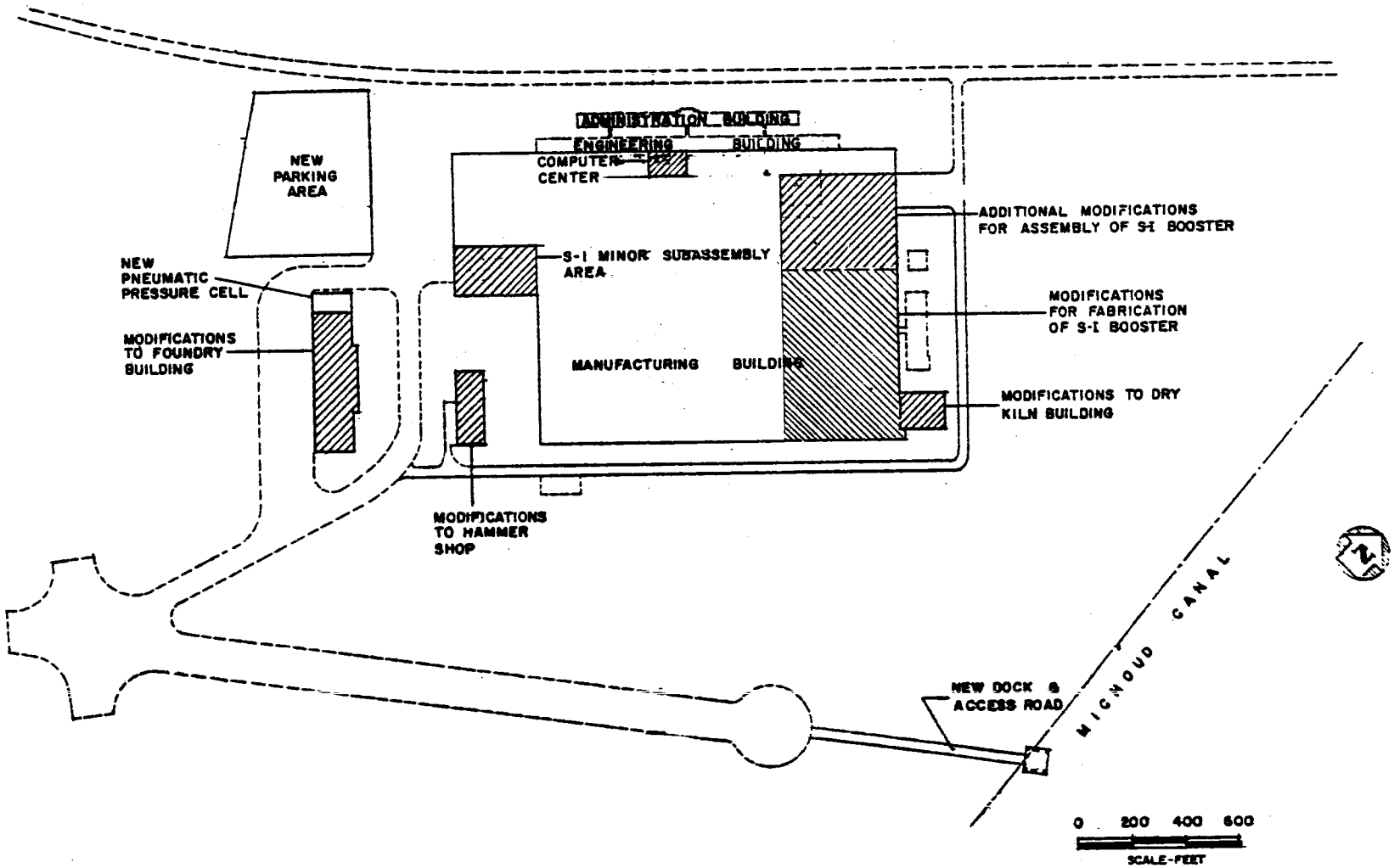
Rehabilitation of manufacturing building air conditioning system: The heating and air conditioning system in the manufacturing building will have to be placed in an operational condition by modifying the fan houses. The modifications are required to change the air conditioning system from an antiquated system producing high humidity (which is deleterious to assembly work) to a modern system producing lower humidities.

Preparation of fabrication and assembly areas for the S-I Saturn booster manufacture: Production areas in the manufacturing building for the S-I Saturn booster will require numerous rooms, enclosures, and open areas. Areas will be provided for receiving and shipping facilities; receiving and inspection laboratories; receiving and inspection component test facilities; small and large tube cleaning equipment;

MICHOUD PLANT

FISCAL YEAR 1963 ESTIMATES

MODIFICATIONS TO MICHOUD PLANT



painting booths; surface treatment equipment; welding shops; electrical fabrication clean rooms; and spider assembly, tail assembly, tank assembly, and final assembly facilities.

Modifications for these areas include additional lighting, primary and secondary power, hot and cold water, drains, compressed air, shop foreman's offices, toilet areas, exhaust and dust collection systems, overhead crane systems, floor reinforcement in certain areas, foundations, filtered air de-ionized water, and gaseous nitrogen service facilities. A new door will be installed for taking the boosters out the east side of plant.

Modification of dry kiln shop: At the southeast corner of the manufacturing building there is a 26,200 square foot dry kiln shop originally constructed for PT-boat construction operations. This area will be renovated and modified for the housekeeping contractor maintenance shops to support operations at the Michoud Plant. Modifications will include a new roof, additional lighting and power, partitions and general renovations. Maintenance equipment will be provided by the housekeeping contractor.

Modifications for S-IC manufacturing (machine) shops and minor subassembly area: Modifications for this purpose will include additional lighting, primary and secondary power, floor sealing, shop foreman's office, fencing, water piping, drains, natural gas and compressed air piping, and exhaust and dust collector systems. In addition, an explosion proof painting area will be provided. This area will be enclosed by a one hour fire wall and will incorporate such other safety precautions as explosion proof lighting and filtered ventilation and exhaust. A new door will be installed to permit complete booster access.

Installation of data processing and computing area: This area will be used jointly by the S-I and S-IC contractors. It consists of an area of approximatley 12,500 square feet centrally located to allow close coordination with both the engineering and finance functions. The area will require a raised floor and special temperature and humidity control.

(d) Modifications to hammer building: The existing building has a floor area of 30,700 square feet and will be con-

verted to shop and engineering space for occupancy by the booster assembly contractors. The building has a clear head room of approximately 21 feet. A second floor will be added within the existing building to double the floor area and to provide additional space for the contractors. Modifications will include renovation of utilities, installation of air conditioning and partitions in the engineering space, general repairs, and filling pits in the floor slab.

(e) Modifications to foundry building: The foundry has a floor area of 113,500 square feet with a 40 foot vertical clearance in the hangar area. At the present time, this building houses large melting furnaces, drying ovens, and other foundry equipment installed during the Korean War. After the foundry equipment is disposed of by surplus sales, it is planned to convert the building for checkout positions to permit the complete checkout of the Saturn S-I boosters. Work will include filling existing pits, renovating utilities, and installing instrumentation trenches and cable ducts.

(f) Pneumatic checkout cell: An addition to the northwest side of the foundry building is required for the pneumatic checkout of the Saturn booster and component parts. The facility will have approximately 23,000 square feet and will contain a high bay cell of approximately 8,400 square feet. The remaining area will be used for a test control room, analysis laboratories, pressure bottle containers, and equipment rooms.

JUSTIFICATION:

The Michoud Plant at New Orleans, Louisiana, has been selected as the manufacturing site for the Saturn S-I and S-IC boosters. Contractors for both these boosters have been selected. In addition, a housekeeping contractor has been selected to provide support services for the Michoud Plant operations.

Provisions has been made for only those renovations necessary to permit initial occupancy of the plant by the contractors already selected. This project covers the additional work necessary to adapt the plant for the fabrication and assembly of Saturn S-I boosters, and the modifications required for the manufacturing and minor subassembly of components for the Saturn S-IC booster.

COST ESTIMATE:			Fiscal Year 1962			Fiscal Year 1963
A. LAND ACQUISITION			---			---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS			$145,000			$550,000
Parking facilities		$40,000			$100,000	
Rehabilitation of utilities		105,000			---	
Saturn dock and access road		---			450,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS			1,248,000			9,650,000
Rehabilitation of administration building		161,000			---	
Cleaning and painting	$74,000			---		
Utilities activation	55,000			---		
Miscellaneous repairs	32,000			---		
Rehabilitation of engineering building		460,000			---	
Painting	60,000			---		
Utilities activation	70,000			---		
Modification of air conditioning system	118,000			---		
Installation of asphalt tile floors	36,000			---		
Installation of acoustical ceiling	25,000			---		
General repair and removal of floor obstructions	81,000			---		
Partitions	70,000			---		
Rehabilitation of manufacturing building		627,000			7,200,000	
Rehabilitation of air conditioning system	---			$844,000		
Removal of steel falsework and relocation of utilities	226,000			---		
Preparation of fabrication and assembly areas for S-I booster manufacture	---			4,993,000		
Activation of sprinkler system and utility lines	113,000			---		
Interior repairs and general rehabilitation	162,000			---		
Modification of dry kiln shop	---			263,000		
Modifications for S-IC manufacturing shops and minor subassembly area	---			650,000		
Installation of data processing and computing area	---			450,000		
Removal of partitions and renovation of assembly area	126,000			---		
Modifications to hammer building		---			700,000	
Modifications to foundry building		---			1,100,000	
Pneumatic checkout cell addition to foundry building		---			650,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS			---			---
E. DESIGN AND ENGINEERING SERVICES			47,000			1,200,000
Total estimated cost			$1,440,000			$11,400,000

MICHOUD PLANT

FISCAL YEAR 1963 ESTIMATES

HIGH PRESSURE TEST FACILITY

DESCRIPTION:

A facility is required for testing the fuel tanks and high pressure tubing of the Saturn S-IC booster which will be manufactured at the Michoud Plant. The facility will be located approximately 1500 feet south east of the manufacturing plant. The project includes a test cell, a control building, and a compressor building. The revetted test cell will contain high pressure pneumatic and water service piping, water fill piping, transducers for pressure sensing, pressure indicating instruments, and drainage facilities. The cell will be provided with sufficient heat to prevent moisture condensation on components, and natural draft ventilation for pressure relief and nitrogen elimination. The control room will contain the test control panel with all necessary shut-off valves, regulating valves, indicating instrument, and recording instruments. Supporting facilities include compressors, liquid nitrogen storage facilities, gaseous nitrogen receivers, and all related piping, valves and supporting utilities. A sketch of the facility is shown on the following page.

JUSTIFICATION:

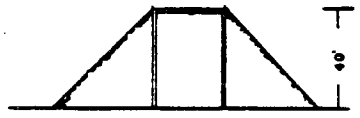
The proposed facility is required to perform high pressure hydrostatic destruct testing; hydrostatic proof testing; and pneumatic leak testing, as required on gaseous nitrogen and helium tanks, and on high pressure tubing. The facility will have the capability of generating hydrostatic pressure up to 10,000 pounds per square inch and pneumatic pressure up to 4500 pounds per square inch. Due to the safety hazards involved with these high pressures, the testing operations must be performed in a revetted facility isolated from other operations.

The high unit costs of the test cell and control building are due to the need for heavy construction to protect against blast and to the provisions required for the intricate test instrumentation. The soil conditions in the immediate vicinity of the Michoud Plant make it necessary that the foundations for the test cell and control building be supported on piling.

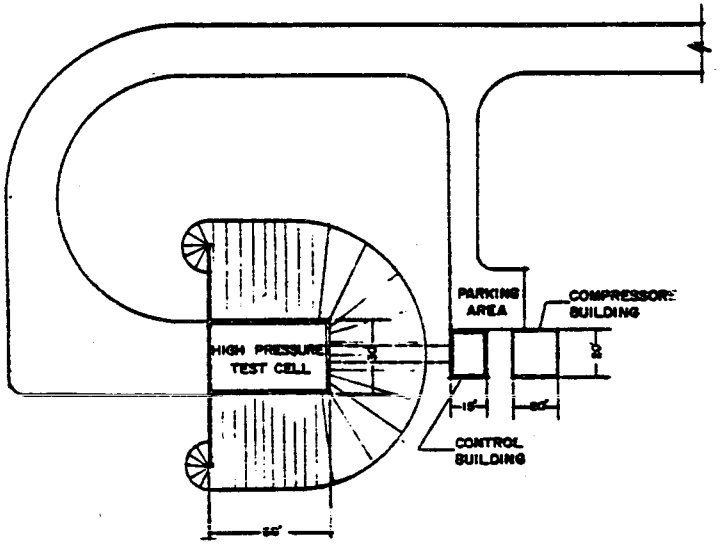
The description of facilities and cost figures for this project are based on preliminary planning and may be revised upon completion of master planning studies for the entire plant.

MICHOUD PLANT
FISCAL YEAR 1963 ESTIMATES

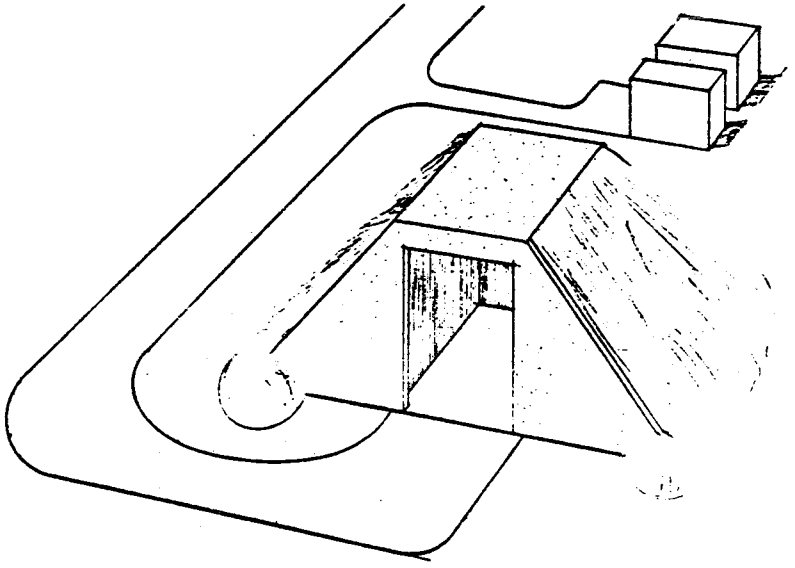
HIGH PRESSURE TEST FACILITY



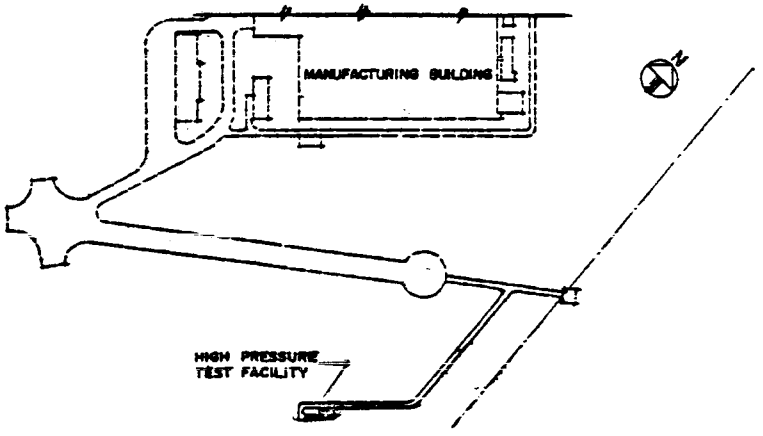
SECTION



PLAN 0 20 40 FEET



PERSPECTIVE



SITE PLAN 0 400 800 FEET

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$135,000
	Roads and parking areas	$40,000	
	Utility connections	70,000	
	Site development	25,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		170,000
	Foundations for test cell	61,000	
	Foundations for control building	6,000	
	Revetted test cell..(1,500 square feet at $56 per square foot)	84,000	
	Control building..(300 square feet at $30 per square foot)	9,000	
	Compressor building..(400 square feet at $25 per square foot)	10,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		565,000
	Instrumentation and controls	275,000	
	Compressor	40,000	
	Liquid and gaseous nitrogen systems	250,000	
E.	DESIGN AND ENGINEERING SERVICES		130,000
	Total estimated cost		$1,000,000

MICHOUD PLANT

FISCAL YEAR 1963 ESTIMATES

HYDROSTATIC TEST AND CLEANING FACILITY

DESCRIPTION:

This project involves the construction of a building 125 by 160 feet with an overhead clearance of 75 feet. The overall height of the building will be approximately 90 feet. The project will include a hydrostatic test and clearning cell, a mechanical equipment room, a control room, and a materials laboratory. The test cell will be 50 feet square by 50 feet high with a floor located 15 feet below the main factory floor area for the retention of test fluids in the event of a tank rupture. Cell walls below the floor line will be reinforced concrete. De-ionized water, detergent, and trichlorethylene storage tanks will be provided to support the test cell operations. All solutions will be filtered, and rotating spray nozzles with vertical travel capabilities, will be provided for cleaning. The used trichlorethylene will flow by gravity to a storage tank to be distilled for re-use. A mechanical 100,000-pound capacity weighing system (accuracy ± 0.03 percent) and an 11,000-gallon batch tank and load cells will be provided for tank volume calibration. Tank drying operations will require filtered hot air and a dry nitrogen system. A chemical cleaning tank 40 feet in diameter will be required for cleaning the gore head assemblies and baffles. This process will require four 10,000-gallon tanks for recycling the cleaning solutions. The major subassembly operations in the area will require a 15-ton crane which will also serve the hydrostatic test and cleaning area.

JUSTIFICATION:

The Michoud Plant at New Orleans, Louisiana has been chosen as the manufacturing site for the Saturn S-IC booster. The facility requested in this project is required in the manufacturing operations for the S-IC booster. Functions to be performed in the facility include major subassembly of fuel tanks, aft tank head section, center tank shell baffle assembly, and forward tank head section; the hydrostatic test calibration and cleaning of the liquid oxygen and fuel tanks. The present manufacturing area of the Michoud Plantis not ofsufficient height to perform these functions.

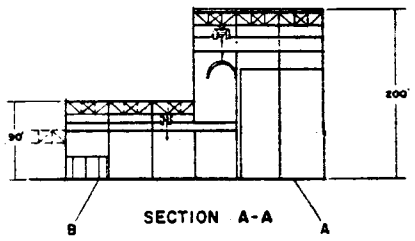
COST ESTIMATE:

A. LAND ACQUISITION..... ---

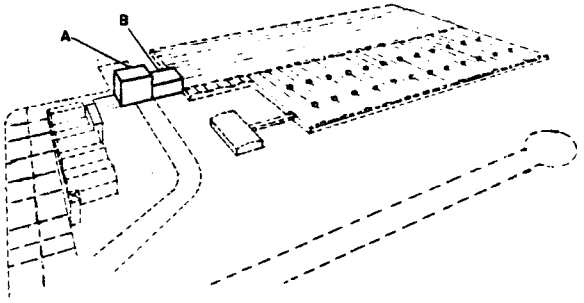
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$200,000
	Site preparation.....	$35,000	
	Utility connections.....	55,000	
	High and low pressure air systems.....	35,000	
	Steam, water, and chilled water systems...	75,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		1,600,000
	Foundations.....	400,000	
	Building (125 by 160 by 90 feet high; 20,000 square feet at $60.00 per square foot).....	1,200,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		810,000
	Crane.....	75,000	
	Filtration system.....	350,000	
	Vessels and storage tanks.....	85,000	
	Demineralization system.....	200,000	
	Test controls and instrumentation.....	100,000	
E.	DESIGN AND ENGINEERING SERVICES.....		390,000
	Total estimated cost.....		$3,000,000

MICHOUD PLANT
FISCAL YEAR 1963 ESTIMATES

HYDROSTATIC TEST AND CLEANING FACILITY

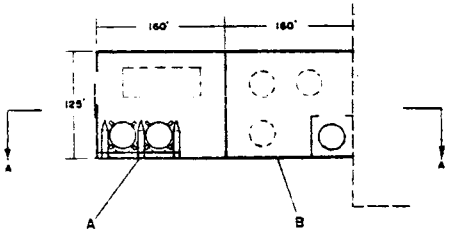


SECTION A-A

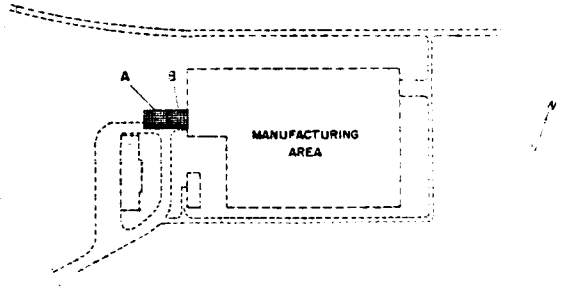


PERSPECTIVE

LEGEND
A. VERTICAL ASSEMBLY BUILDING
B. HYDROSTATIC TEST AND CLEANING FACILITY



FLOOR PLAN
0 50 100
FEET



SITE PLAN

MICHOUD PLANT

FISCAL YEAR 1963 ESTIMATES

VERTICAL ASSEMBLY BUILDING

DESCRIPTION:

This building is required for the vertical assembly of the S-IC stage of the Advanced Saturn Vehicle. The facility will be constructed adjacent to the hydrostatic test and cleaning facility as indicated in the drawing on the following page. It will consist of a building 125 by 160 feet with an overhead clearance of 180 feet. The overall height of the building will be approximately 200 feet. Included in the project are tool foundations, utility connection, service elevators, and the necessary water, steam, and nitrogen piping. The building will be equipped with a 150-ton crane.

JUSTIFICATION:

The Michoud Plant at New Orleans, Louisiana has been chosen as the manufacturing site for the Saturn S-IC booster. The building requested in this project is required to provide a facility with sufficient height to perform the final assembly of the S-IC booster. The vertical assembly operations will include joining the thrust structure, the engines, the liquid oxygen tank, the center section, the fuel tank, and the forward section into a single assembly.

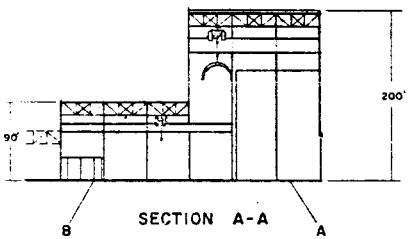
COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$200,000
	Site preparation	$35,000	
	Utility connections	55,000	
	High and low pressure air systems	15,000	
	Steam, water, and chilled water systems	95,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		2,000,000
	Foundations	600,000	
	Building..(125 by 160 by 200 feet high; 20,000 square feet at $70.00 per square foot)	1,400,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		410,000
	Crane	375,000	
	Test controls and instrumentation	35,000	
E.	DESIGN AND ENGINEERING SERVICES		390,000
	Total estimated cost		$3,000,000

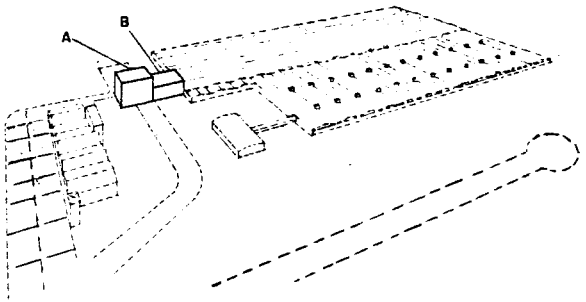
CF 11-D1

MICHOUD PLANT
FISCAL YEAR 1963 ESTIMATES

VERTICAL ASSEMBLY BUILDING

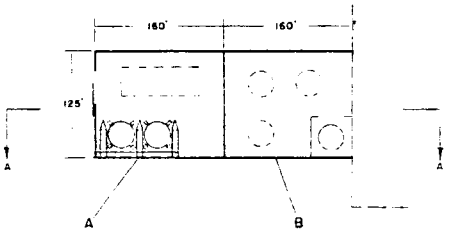


SECTION A-A

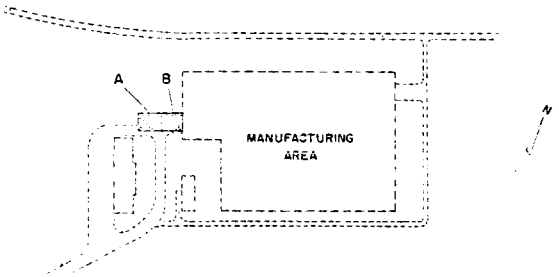


PERSPECTIVE

LEGEND
A. VERTICAL ASSEMBLY BUILDING
B. HYDROSTATIC TEST AND CLEANING FACILITY



FLOOR PLAN
0 50 100
FEET



SITE PLAN

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

CONSTRUCTION OF FACILITIES - 1963 PROGRAM

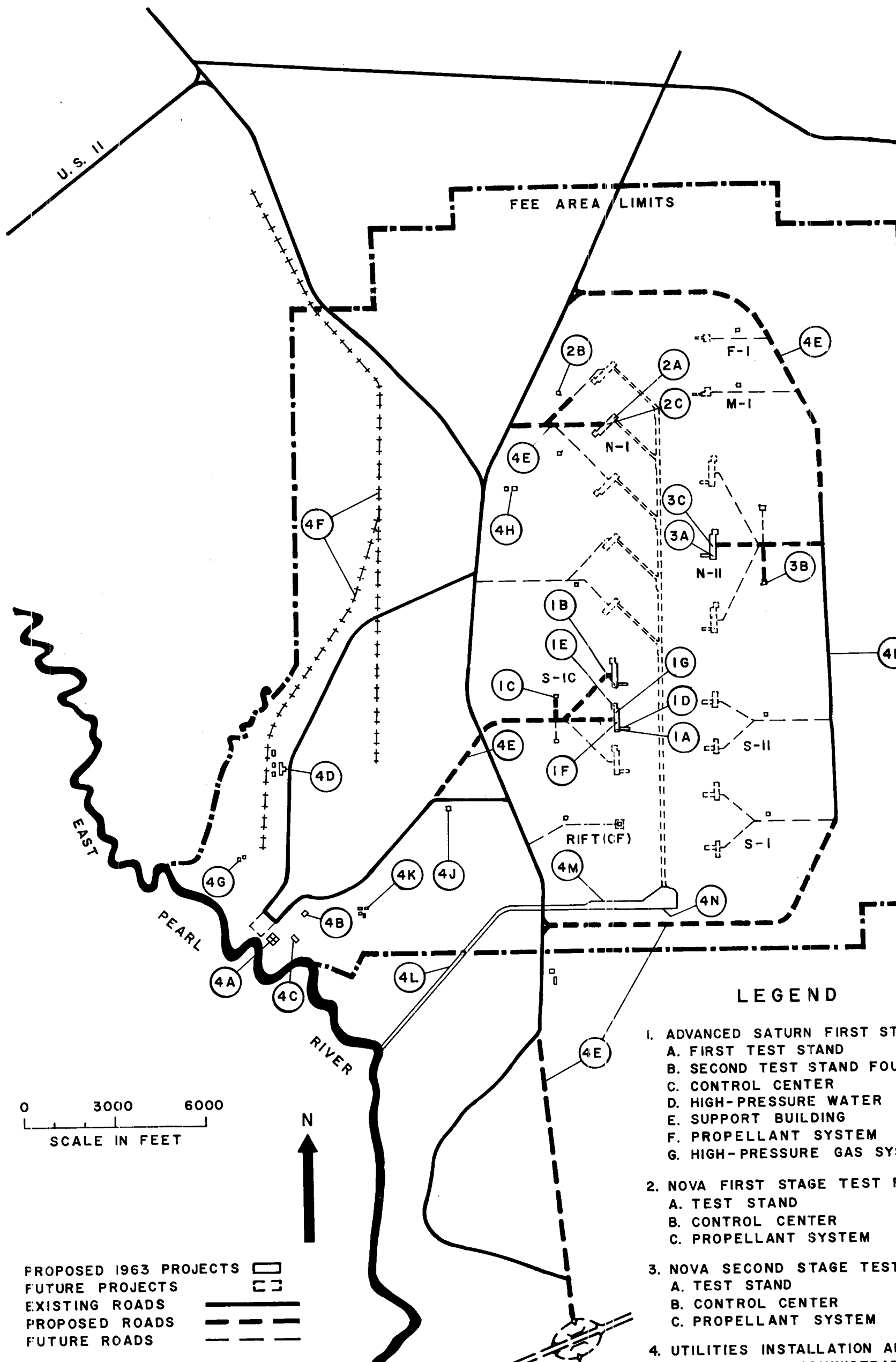
MISSISSIPPI TEST FACILITY

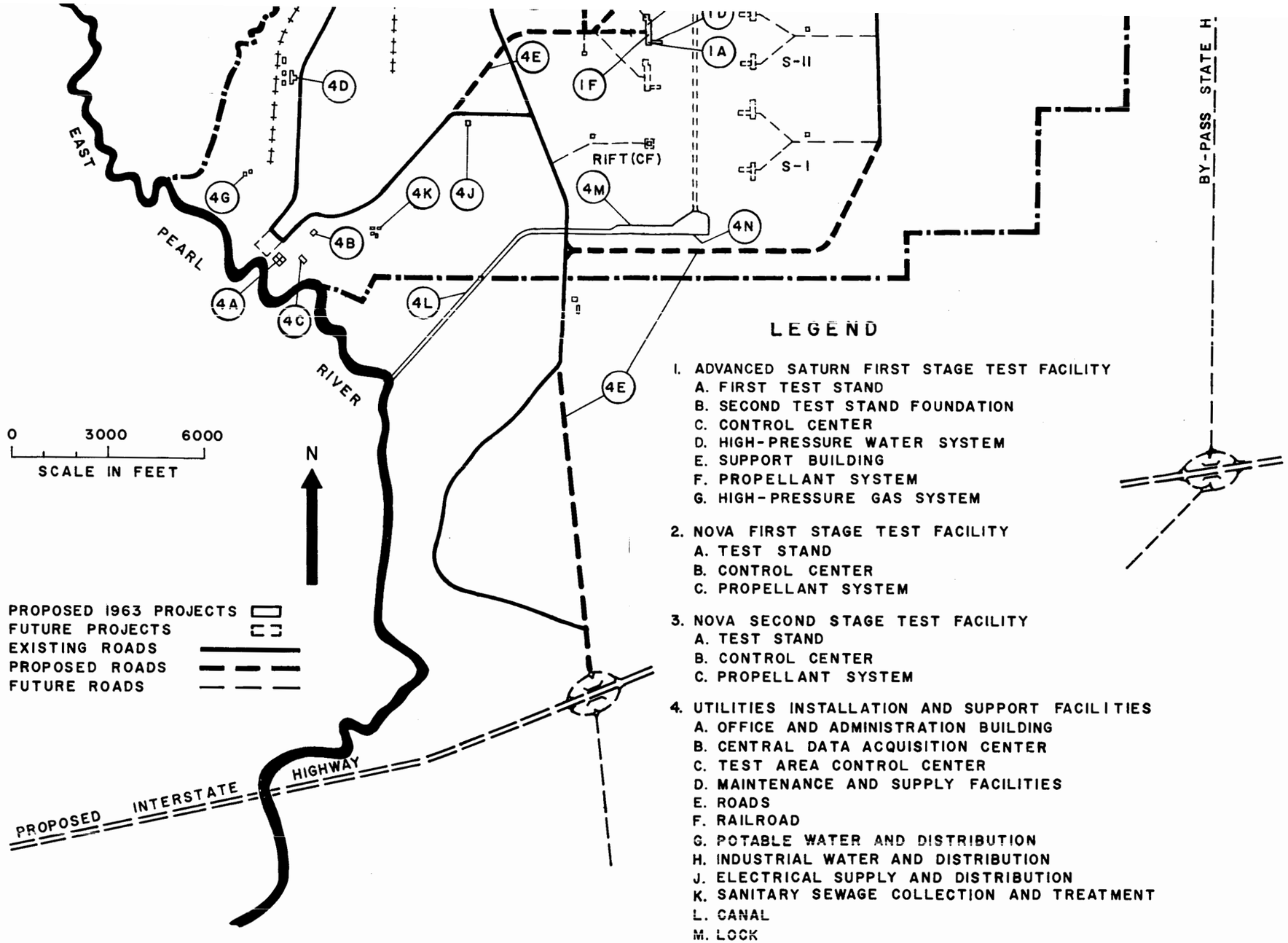
Page No.		
CF12-A2	Location plan	
CF12-A3	Advanced Saturn stage test facilities.....	$36,000,000
CF12-B1	Nova stage test facilities.....	43,000,000
CF12-C1	Utility installations and support facilities....	13,500,000
	Total.....	$92,500,000

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1963 ESTIMATES

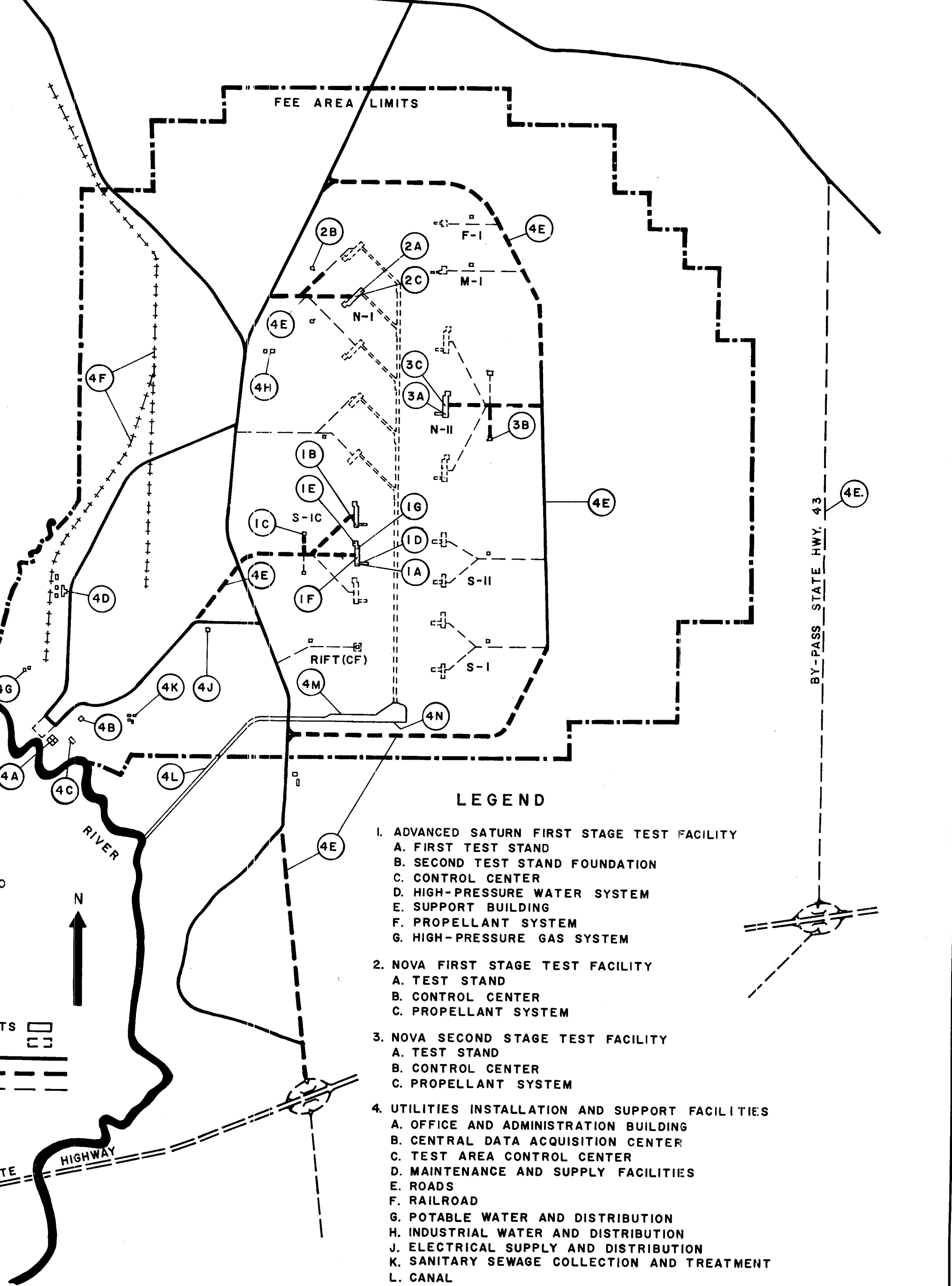
LOCATION PLAN





LEGEND

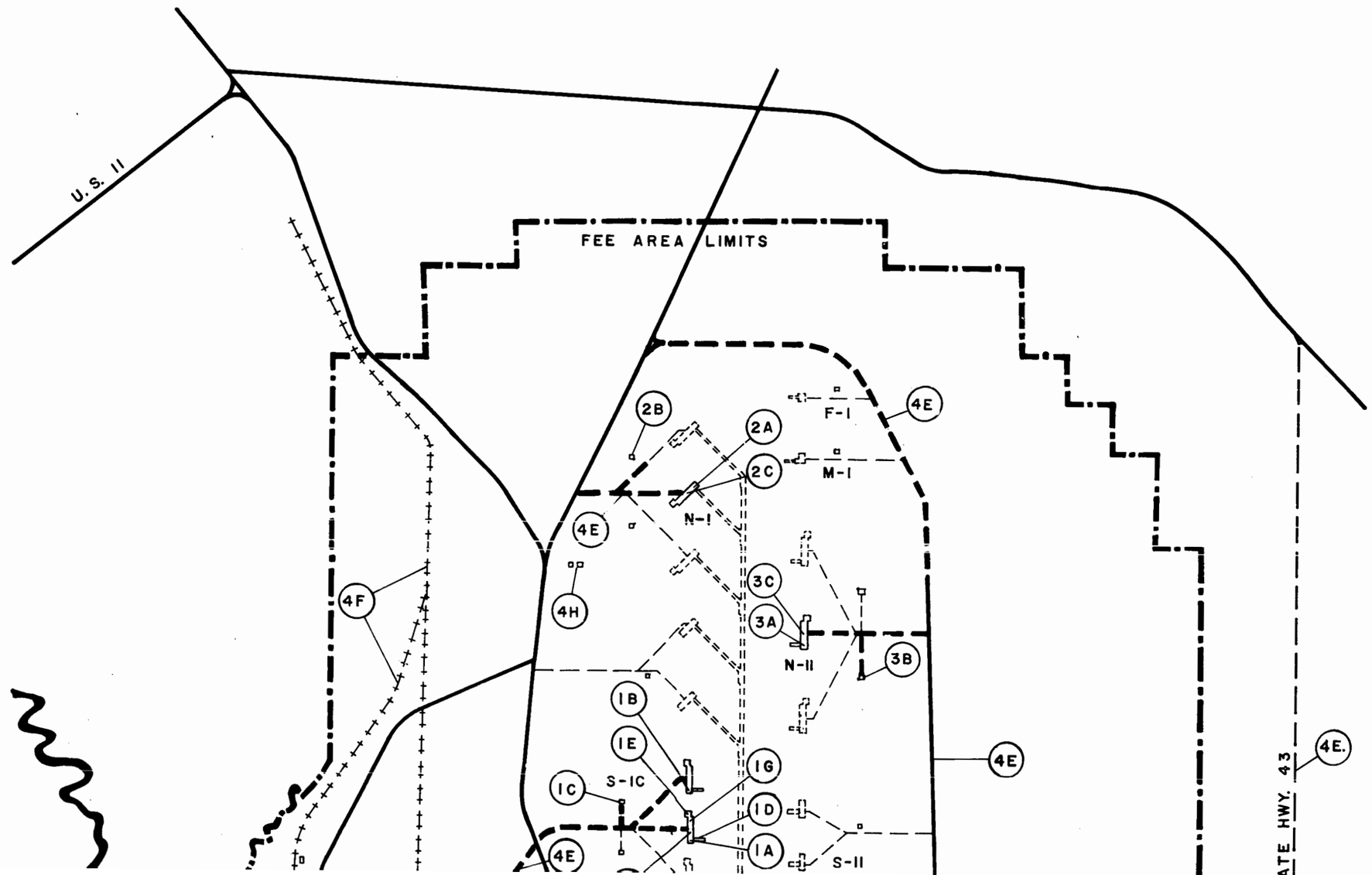
1. ADVANCED SATURN FIRST STAGE TEST FACILITY
   - A. FIRST TEST STAND
   - B. SECOND TEST STAND FOUNDATION
   - C. CONTROL CENTER
   - D. HIGH-PRESSURE WATER SYSTEM
   - E. SUPPORT BUILDING
   - F. PROPELLANT SYSTEM
   - G. HIGH-PRESSURE GAS SYSTEM
2. NOVA FIRST STAGE TEST FACILITY
   - A. TEST STAND
   - B. CONTROL CENTER
   - C. PROPELLANT SYSTEM
3. NOVA SECOND STAGE TEST FACILITY
   - A. TEST STAND
   - B. CONTROL CENTER
   - C. PROPELLANT SYSTEM
4. UTILITIES INSTALLATION AND SUPPORT FACILITIES
   - A. OFFICE AND ADMINISTRATION BUILDING
   - B. CENTRAL DATA ACQUISITION CENTER
   - C. TEST AREA CONTROL CENTER
   - D. MAINTENANCE AND SUPPLY FACILITIES
   - E. ROADS
   - F. RAILROAD
   - G. POTABLE WATER AND DISTRIBUTION
   - H. INDUSTRIAL WATER AND DISTRIBUTION
   - J. ELECTRICAL SUPPLY AND DISTRIBUTION
   - K. SANITARY SEWAGE COLLECTION AND TREATMENT
   - L. CANAL
   - M. LOCK
   - N. DOCK FACILITIES


FEE AREA LIMITS
F-I
M-I
N-I
N-II
S-IC
S-II
S-I
RIFT(CF)
BY-PASS STATE HWY. 43
RIVER
HIGHWAY
N
2B
2A
2C
4E
4F
4H
3C
3A
3B
1B
1E
1G
1C
1D
1A
1F
4D
4G
4K
4J
4M
4N
4B
4A
4C
4L
4E.
LEGEND
1. ADVANCED SATURN FIRST STAGE TEST FACILITY
A. FIRST TEST STAND
B. SECOND TEST STAND FOUNDATION
C. CONTROL CENTER
D. HIGH-PRESSURE WATER SYSTEM
E. SUPPORT BUILDING
F. PROPELLANT SYSTEM
G. HIGH-PRESSURE GAS SYSTEM
2. NOVA FIRST STAGE TEST FACILITY
A. TEST STAND
B. CONTROL CENTER
C. PROPELLANT SYSTEM
3. NOVA SECOND STAGE TEST FACILITY
A. TEST STAND
B. CONTROL CENTER
C. PROPELLANT SYSTEM
4. UTILITIES INSTALLATION AND SUPPORT FACILITIES
A. OFFICE AND ADMINISTRATION BUILDING
B. CENTRAL DATA ACQUISITION CENTER
C. TEST AREA CONTROL CENTER
D. MAINTENANCE AND SUPPLY FACILITIES
E. ROADS
F. RAILROAD
G. POTABLE WATER AND DISTRIBUTION
H. INDUSTRIAL WATER AND DISTRIBUTION
J. ELECTRICAL SUPPLY AND DISTRIBUTION
K. SANITARY SEWAGE COLLECTION AND TREATMENT
L. CANAL
M. LOCK
N. DOCK FACILITIES

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1963 ESTIMATES

LOCATION PLAN



MISSISSIPPI TEST FACILITY

FISCAL YEAR 1963 ESTIMATES

ADVANCED SATURN STAGE TEST FACILITIES

DESCRIPTION:

This project includes the test stands, data acquisition systems, control systems, and other technical facilities required to perform acceptance static tests of the first stage of the Advanced Saturn vehicle. The first stage will develop 7,500,000 pounds of thrust, utilizing five F-1 engines. This static test facility complex will be one of several to be incorporated into the overall site.

Based on present development and production schedules, it will be necessary to construct one static test position and start construction on a second test position with fiscal year 1963 funds. Funds for completion of the second position will be included in the fiscal year 1964 program.

The fiscal year 1963 funding request is estimated to be approximately 40 percent of the total cost of the Advanced Saturn stage test facilities. The cost estimates and the description of facilities in this writeup are tentative pending the completion of additional engineering studies.

The scope of work includes:

(a) Static test position: The test positions will be designed to mount the booster firing vertically downward into a water-film-cooled jet deflector. Provision will be made at the test position for booster handling equipment, on-stand propellant supply system piping, on-stand deflector cooling and fire protection water piping, personnel and freight elevators, on-stand instrumentation and control wiring, termination rooms, ducting, and special equipment.

(b) Instrumentation and control center: This facility will serve the first test position and the additional test position to be completed in the fiscal year 1964. The structure will be a blast-resistant design. It will house the analog or "quick-look" data acquisition equipment, the control rooms with associated control equipment, briefing rooms, maintenance shops, and building equipment rooms.

(c) Test support building: The test position and the control center will require a support building constructed of metal insulated panels and concrete floors on grade. Building utility services, equipment, and other features will be installed to provide protection from test-induced vibration forces.

(d) Observation bunkers: Blast-protected observation posts will be constructed sufficiently close-in to the stand to permit direct viewing of tests from several points in addition to the control center.

(e) High pressure water system: Water storage capacity for 12,000,000 gallons, approximately two miles of high pressure water distribution system, and a 500,000 gallons per minute pumping capacity will be provided.

(f) Propellant ready storage and handling facilities: This item will include insulated liquid oxygen storage vessels having sufficient total capacity to fill the booster tanks with allowance for boil-off and emergencies, underground fuel storage tanks, high volume pumping systems, and associated piping and equipment. The equipment will be located adjacent to the test stand to permit direct pumping into the booster tanks from storage.

(g) High-pressure gas storage: High-pressure gases will be stored in tanks located near the test stand. The storage tanks will be filled from the area networks and will be connected directly to the stand through underground lines.

(h) Instrumentation and control: Tranducers, sensors, recording instrumentation, and analog and digital computers will be required. Both types of computers will receive and record data produced during the stage tests. Control systems will include remote television surveillance equipment, and audible and visual warning systems to provide continuous area control of personnel, vehicles, and equipment at the test area.

A possible configuration of the first stage test facility is shown in the sketch on page CF 12-A6.

JUSTIFICATION:

The facilities requested in this project are required for acceptance static testing of the first stage boosters of the Advanced Saturn vehicle which will be manufactured at the Michoud Plant, New Orleans, Louisiana. The static testing will determine the reliability of the booster for acceptance and use in early unmanned flights and more particularly in

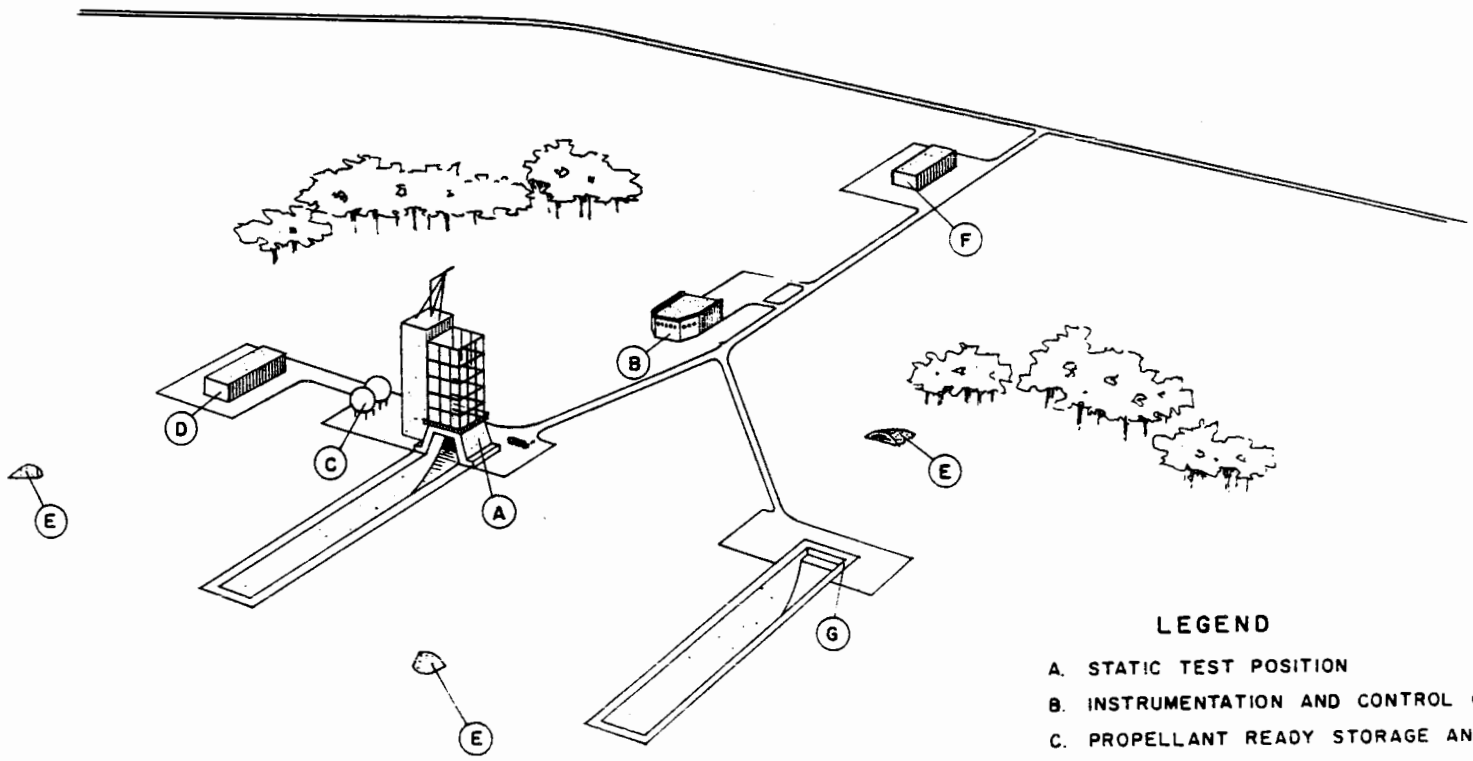
later manned flights. Static test facilities for these large boosters are required in time to meet production schedules. The on-stand time per booster will average about six weeks. Planned flight schedules in the Advanced Saturn program indicate the need for starting the construction of these facilities at the earliest possible date.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$1,100,000
	Grading	$250,000	
	Foundation excavations	200,000 1/	
	Waterway extension	415,000	
	Roads	37,500	
	Hardstands	150,000	
	Electrical sub-station	47,500	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		15,440,000
	1st test stand	5,980,000	
	1st test stand deflector	1,500,000	
	2nd test stand foundation	1,120,000	
	Control center (30,000 square feet at $53 per square foot)	1,600,000	
	Test support building (6,000 square feet at $20 per square foot)	120,000	
	Observation bunkers; two each (64 square feet at $156 per square foot)	20,000	
	Water storage tanks	1,000,000	
	Propellant storage tanks	2,000,000	
	Gas storage tanks	2,100,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		15,800,000
	Recording instrumentation	3,000,000	
	Analog and digital systems	4,000,000	
	Vehicle adaption hardware	2,400,000	
	High pressure water pumps and distribution system	3,800,000	
	Propellant transfer system	1,600,000	
	High pressure gas transfer system	1,000,000	

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1963 ESTIMATES

ADVANCED SATURN STAGE TEST FACILITIES



LEGEND

A. STATIC TEST POSITION
B. INSTRUMENTATION AND CONTROL CENTER
C. PROPELLANT READY STORAGE AND HANDLING
D. HIGH PRESSURE GAS BATTERIES
E. OBSERVATION BUNKERS
F. TEST SUPPORT BUILDING
G. FOUNDATION FOR SECOND TEST STAND

FIRST STAGE TEST FACILITY

E. DESIGN AND ENGINEERING SERVICES.....	$3,660,000 2/
Total estimated cost.....	$36,000,000

1/ An additional $500,000 for foundation excavations has been allocated from fiscal year 1962 funds.

2/ An additional $1,000,000 for design and engineering services has been allocated from fiscal year 1962 funds.

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1963 ESTIMATES

NOVA STAGE TEST FACILITIES

DESCRIPTION:

This project provides for the major portion of the design and for the initiation of site development, construction of test stand, installation of data acquisition and control systems, and other technical facilities required to perform acceptance and research and development static tests of the NOVA first and second stage vehicle.

The cost estimates and the description of facilities presented in this project are tentative at this time and cannot be finalized until additional engineering studies are completed. It is estimated that the cost of the items included in the fiscal year 1963 request comprise approximately 25 percent of the total cost of the facilities that ultimately will be required.

The NOVA first and second stages will be tested in separate areas or complexes; the fiscal year 1963 request for each test complex contains the following:

(a) Static test position: The test position will be designed to mount the booster firing vertically downward into a water-film cooled jet deflector. Provision will be made at the test position for booster handling equipment, on-stand propellant supply system piping, on-stand deflector cooling and fire protection water piping, personnel and freight elevators, on-stand instrumentation and control wiring, termination rooms, ducting, and special equipment.

(b) Instrumentation and control center: This facility will serve the test position provided by this project, with growth potential to serve the additional test positions to be included in the fiscal year 1964 budget. The structure will be of blast-resistant design. It will house the analog or "quick-look" data acquisition equipment or other instrumentation equipment requiring relatively short transmission distance from the test stand, the control rooms with associated control equipment, briefing rooms, maintenance shops, and building equipment rooms.

(c) Propellant facilities: This item will include insulated liquid oxygen storage vessels having sufficient total capacity to fill the booster tanks with allowance for boil-off and emergencies, and underground fuel storage tanks. The equipment will be located adjacent to the test stand to permit direct pumping into the booster tanks from storage.

(d) Observation bunkers: Heavily blast protected test observation posts will be constructed sufficiently close-in to the stand to permit direct viewing of tests from several points in addition to the control center.

Other support facilities such as high pressure water systems, test buildings, high pressure gas systems, etc. will be requested in the fiscal year 1964 budget to complete the test complexes. Possible first and second stage test stand configurations are shown on the following two pages.

JUSTIFICATION:

The first stage of the NOVA vehicle will develop 12,000,000 pounds of thrust, utilizing eight F-1 engines. Based on present schedules, it will be necessary to construct two test positions, one for development testing to be funded in the fiscal year 1963 and one for production acceptance testing to be funded in the fiscal year 1964. The second stage of the NOVA vehicle will develop 4,000,000 pounds of thrust, utilizing four M-1 engines. Based on present schedules, it will be necessary to construct two static test positions, one for development testing to be funded in the fiscal year 1963 and one for production acceptance testing to be funded in the fiscal year 1964. One additional position capable of handling either a first or second stage will be constructed as a back-up.

This project is required to provide the facilities for research and development, and for acceptance testing of the first and second stages of the NOVA vehicle. The static testing of the contractor produced boosters is essential to determine their reliability for acceptance and use in early un-manned flights and in later manned flights. Static test facilities for these large boosters must be constructed in time to meet production schedules which have been keyed to flight schedules.

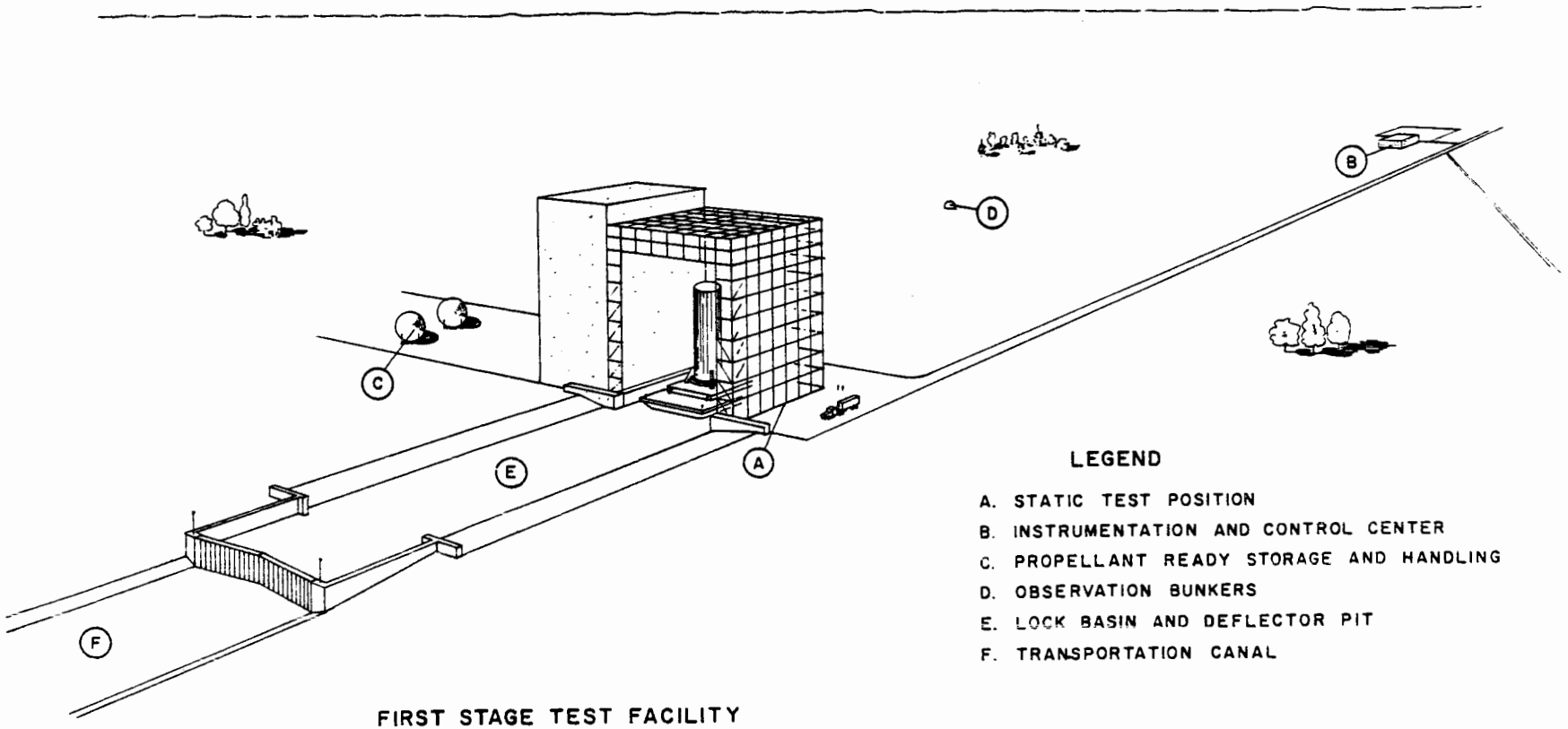
COST ESTIMATE:

A. LAND ACQUISITION..... ---

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1963 ESTIMATES

NOVA STAGE TEST FACILITIES



LEGEND

A. STATIC TEST POSITION
B. INSTRUMENTATION AND CONTROL CENTER
C. PROPELLANT READY STORAGE AND HANDLING
D. OBSERVATION BUNKERS
E. LOCK BASIN AND DEFLECTOR PIT
F. TRANSPORTATION CANAL

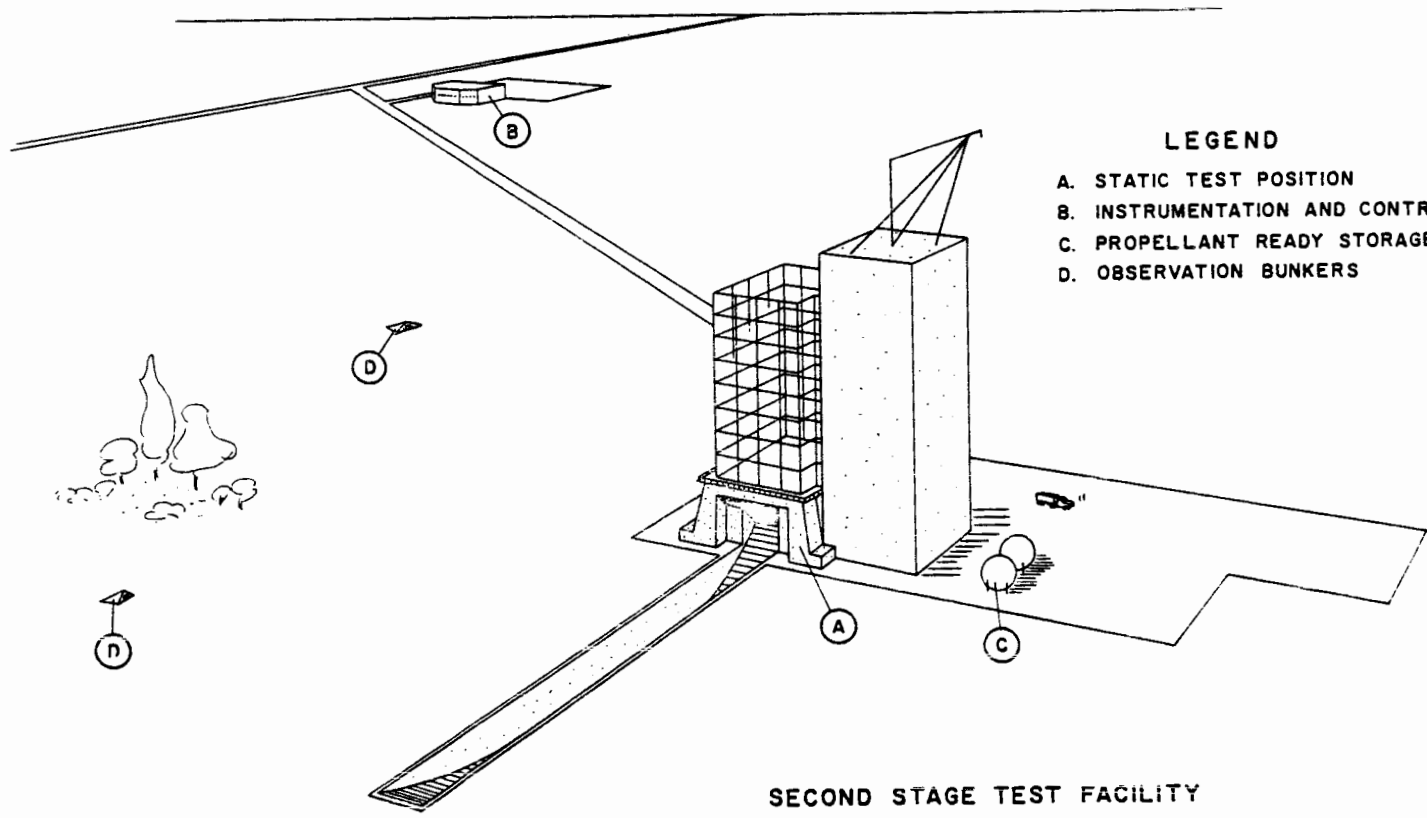
FIRST STAGE TEST FACILITY

D

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1963 ESTIMATES

NOVA STAGE TEST FACILITIES



LEGEND

A. STATIC TEST POSITION
B. INSTRUMENTATION AND CONTROL CENTER
C. PROPELLANT READY STORAGE AND HANDLING
D. OBSERVATION BUNKERS

SECOND STAGE TEST FACILITY

B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$1,240,000
	Site preparation.....	$190,000	
	Excavation.....	200,000	
	Waterway extensions.....	112,500	
	New roads.....	75,000	
	Hardstands.....	230,000	
	Widen and improve existing roads.....	337,500	
	Electric sub-stations.....	95,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		18,160,000
	First stage test stand.....	7,340,000	
	First stage test stand deflector.....	1,840,000	
	Second stage test stand.....	4,908,000	
	Second stage test stand deflector.....	1,232,000	
	Control centers; two each..(30,000 square feet at $47 per square foot)....	2,800,000	
	Observation bunkers; four each..(64 square feet at $156 per square foot)...	40,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		15,100,000
	Recording instrumentation.....	4,300,000	
	Analog to digital system.....	4,200,000	
	Control systems.....	3,600,000	
	Propellant systems.....	3,000,000	
E.	DESIGN AND ENGINEERING SERVICES.....		8,500,000 1/
	Total estimated cost.....		$43,000,000

1/An additional $1,360,000 for design and engineering services has been allocated from fiscal year 1962 funds.

MISSISSIPPI TEST FACILITY

FISCAL YEAR 1963 ESTIMATES

UTILITY INSTALLATIONS AND SUPPORT FACILITIES

DESCRIPTION:

The Mississippi Test Facility is being developed to perform acceptance static and component testing on the Advanced Saturn vehicle first stage, and on the NOVA first and second stages. The cost estimates and the description of facilities presented in this writeup are tentative and cannot be finalized pending the completion of additional engineering studies. The support facilities described in this project are not related to any one test program, but are common support items to all test complexes that are being programmed for the Mississippi Test Facility. It is estimated that the funds requested in this fiscal year 1963 project comprise approximately 30 percent of the total cost of anticipated support facilities. The scope of work for this project includes:

(a) Office and administration building: Approximately 20,000 square feet of fully air-conditioned space will be required at this time. The building will be located outside of the explosive and hazard area of the test stand complexes.

(b) Data acquisition and reduction center: It is proposed to construct a building with approximately 100,000 square feet area for the installation of the recording and computing equipment. The building will be air-conditioned with humidity control. It will provide a centralized data collection and computation facility for all test operations.

(c) Test area control center: This item covers the construction of approximately 20,000 square feet of building area for the installation of equipment. The center will provide complete control of all safety, service, and support items through communications, video, and special systems. It will be the centralized point of control for the test operations being conducted concurrently at the separate test complexes.

(d) Maintenance and supply facilities: Four separate structures will be required; a maintenance building of approximately 24,000 square feet to provide office, shop, and warehouse space; two supply buildings of 4,000

and 5,000 square feet each; and 7,000 square feet of space for equipment shops.

(e) Roads, railroads, utilities, and other support items: These items include the potable water supply treatment and distribution system, electrical distribution systems, sanitary and storm water collection and treatment system, road networks; state highway relocation; parking areas, railroads and unloading platforms, guard houses, natural gas pumping and distribution systems, and a heating and air-conditioning plant.

(f) Industrial water system: The installation of an industrial water system will be required to support the test complexes. The system will consist of reservoirs, treatment facilities, high pressure pumping systems, and distribution systems.

(g) Docks: This item will include special docks, hoists, and controlled winches for unloading the space vehicle boosters from the transport barges.

(h) Waterways: This item will include the necessary dredging and snagging required to make the Pearl River navigable and the construction of new canals (and perhaps locks) from the Pearl River to the first test complex.

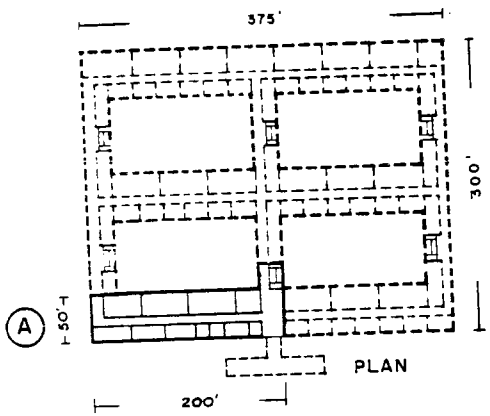
A location plan of the major utility installations and support facilities included in this project is presented at the beginning of the section on the Mississippi Test Facility. Sketches of the major support facilities proposed for construction are shown on the following two pages.

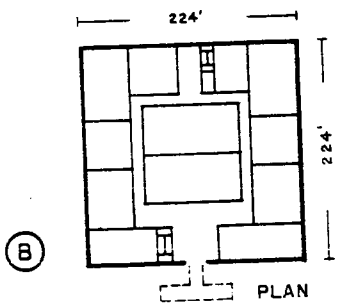
JUSTIFICATION:

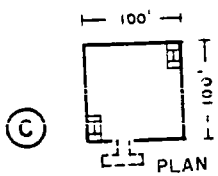
The vehicle stages and boosters for the Advanced Saturn and Nova vehicles will be manufactured and tested by various contractors. At the Mississippi Test Facility where their products will be tested for acceptance, the contractors will require engineering and administrative office space, data collection and computation facilities, test preparation facilities, and test stand support shops. In addition each test complex will require large industrial water supplies, high pressure gases and air, and back-up or main propellant storage facilities. These facilities will not be located at the stage test complexes due to the hazards and necessity for blast and acoustic protective construction. The centralization of these facilities will materially reduce overall construction costs and will increase efficiency in the use of the facilities. The roads, utilities, waterways, docks, maintenance and supply facilities, etc., are items normally required for the activation of any industrial type facility in a virgin area.

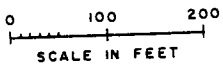
MISSISSIPPI TEST FACILITY
FISCAL YEAR 1963 ESTIMATES

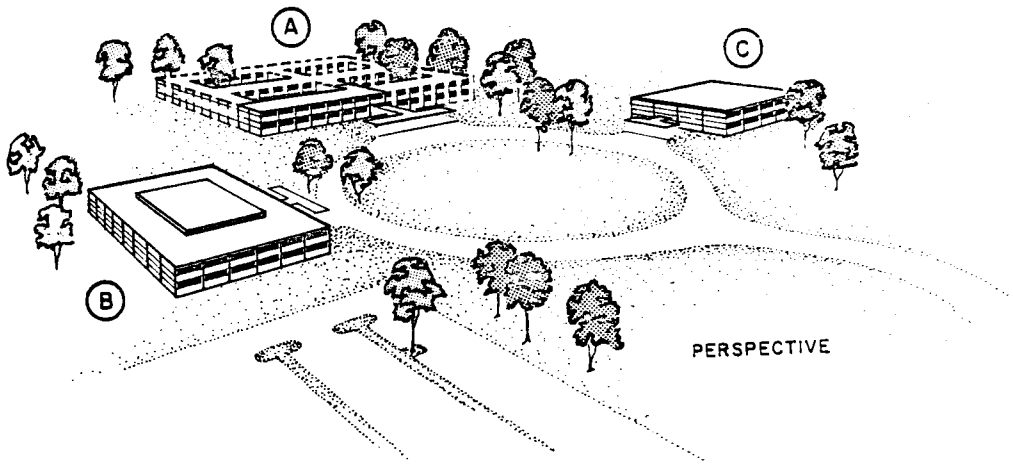
UTILITY INSTALLATIONS AND SUPPORT FACILITIES









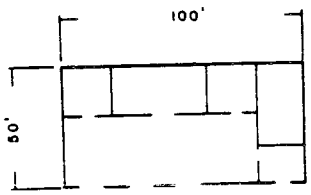


LEGEND

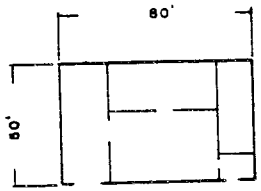
A. OFFICE AND ADMINISTRATION BUILDING
B. DATA ACQUISITION AND REDUCTION CENTER
C. TEST AREA CONTROL CENTER

MISSISSIPPI TEST FACILITY
FISCAL YEAR 1963 ESTIMATES

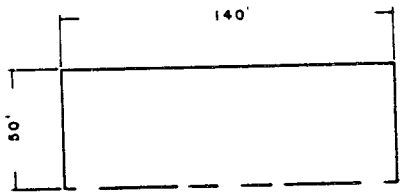
UTILITY INSTALLATIONS AND SUPPORT FACILITIES



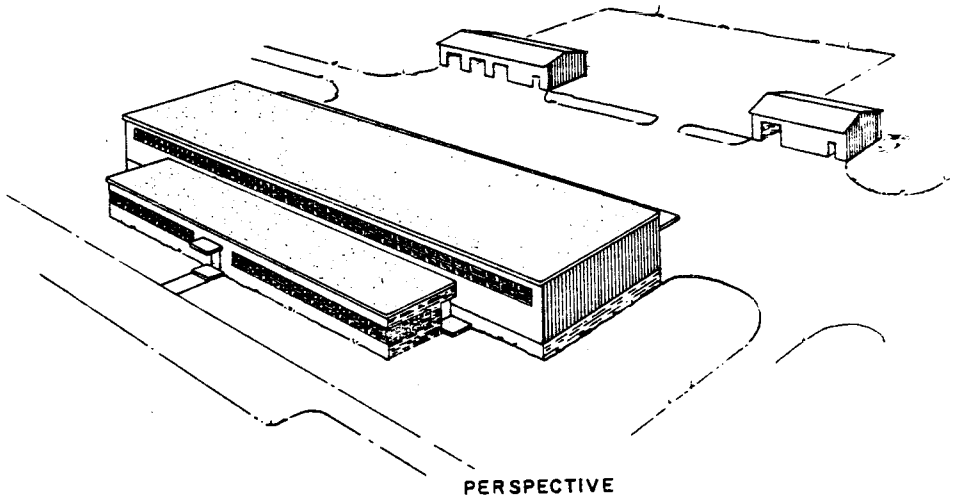
SUPPLY BUILDING



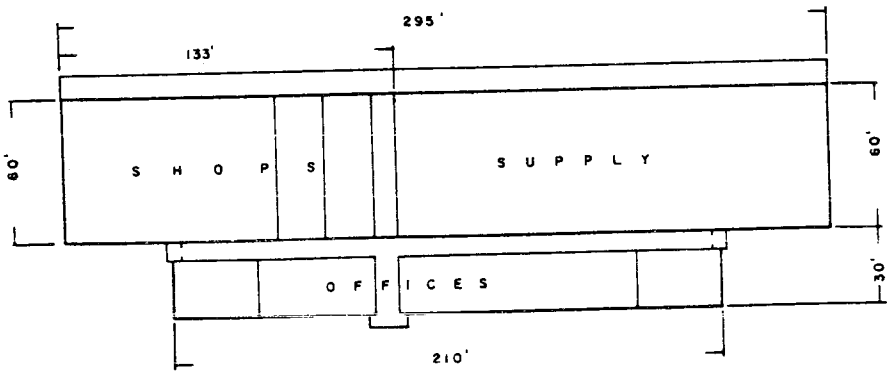
SUPPLY BUILDING



EQUIPMENT SHOP

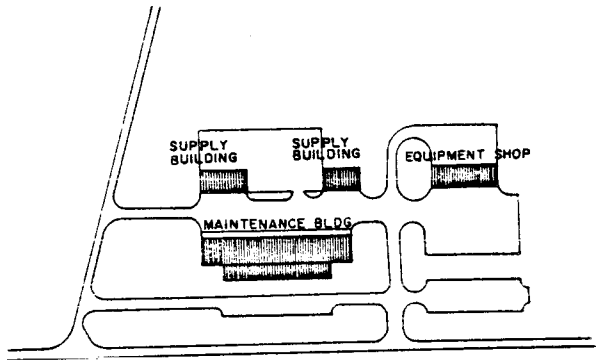


PERSPECTIVE



MAINTENANCE BUILDING

0 20 40 60 80
SCALE IN FEET



SITE PLAN

0 100 200 300 400
SCALE IN FEET

D. MAINTENANCE AND SUPPLY FACILITIES

COST ESTIMATE:		Fiscal Year 1962	Fiscal Year 1963
A. LAND ACQUISITION.....		---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$1,140,000	$5,542,000
Roads (5 miles).....	$540,000	---	
Roads (14.4 miles)...	---	$1,440,000	
River dredging.....	200,000	---	
Vehicle parking.....	---	60,000	
Railroads (18 miles).	---	1,350,000	
Unloading docks.....	---	150,000	
Potable water wells, filters, settling tanks, and distribution.....	---	450,000	
Electrical substations, switching stations, switch gear and distribution.....	---	992,000	
Natural gas distribution.....	400,000	---	
Sanitary sewer installation.....	---	100,000	
Canal or waterway (5 miles).....	---	500,000	
Lock foundations.....	---	500,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		536,800	5,918,000
Office and administration building (35,500 square feet; 14,600 in 1962 and 20,900 in 1963 at $24.00 per square foot).....	350,000	500,000	
Data acquisition and reduction center (building only) (100,000 square feet at $26.00 per square foot).....	---	2,600,000	
Test area control center..(20,000 square feet at $50.00 per square foot).....	---	1,000,000	

	Fiscal Year 1962	Fiscal Year 1963
Maintenance and supply facilities supply building.. (5,000 square feet at $8.00 per square foot).....	---	$40,000
Segregated supply building..(4,000 square feet at $8.00 per square foot)....	---	32,000
Equipment building (7,000 square feet at $16.60 per square foot).....	---	116,000
Maintenance building (24,000 square feet at $13.00 per square foot).....	---	312,000
Fire station..(2,000 square feet at $15.00 per square foot).....	30,000	---
Dock.....	---	400,000
Industrial water pump house..(20,000 square feet at $10.00 per square foot).....	---	200,000
Electrical control house..(800 square feet at $10.00 per square foot).....	---	8,000
Central heating plant (11,200 square feet at $14.00 per square foot).....	156,800	---
Sewage treatment plant (5,000 square feet at $12.00 per square foot).....	---	60,000
Water storage tanks...	---	650,000

		Fiscal Year 1962		Fiscal Year 1963
D. EQUIPMENT, INSTRUMENTATION AND SUPPORT SYSTEMS.....		$663,200		$640,000
Industrial water pump house equipment.....	---		$200,000	
Central heating and cooling plant equipment.....	$643,200		---	
Sewage treatment plant equipment.....	---		440,000	
Fire station equipment.....	20,000		---	
E. DESIGN AND ENGINEERING SERVICES....		1,390,000		1,400,000
Total estimated cost.....		$3,730,000		$13,500,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

CONSTRUCTION OF FACILITIES - 1963 PROGRAM

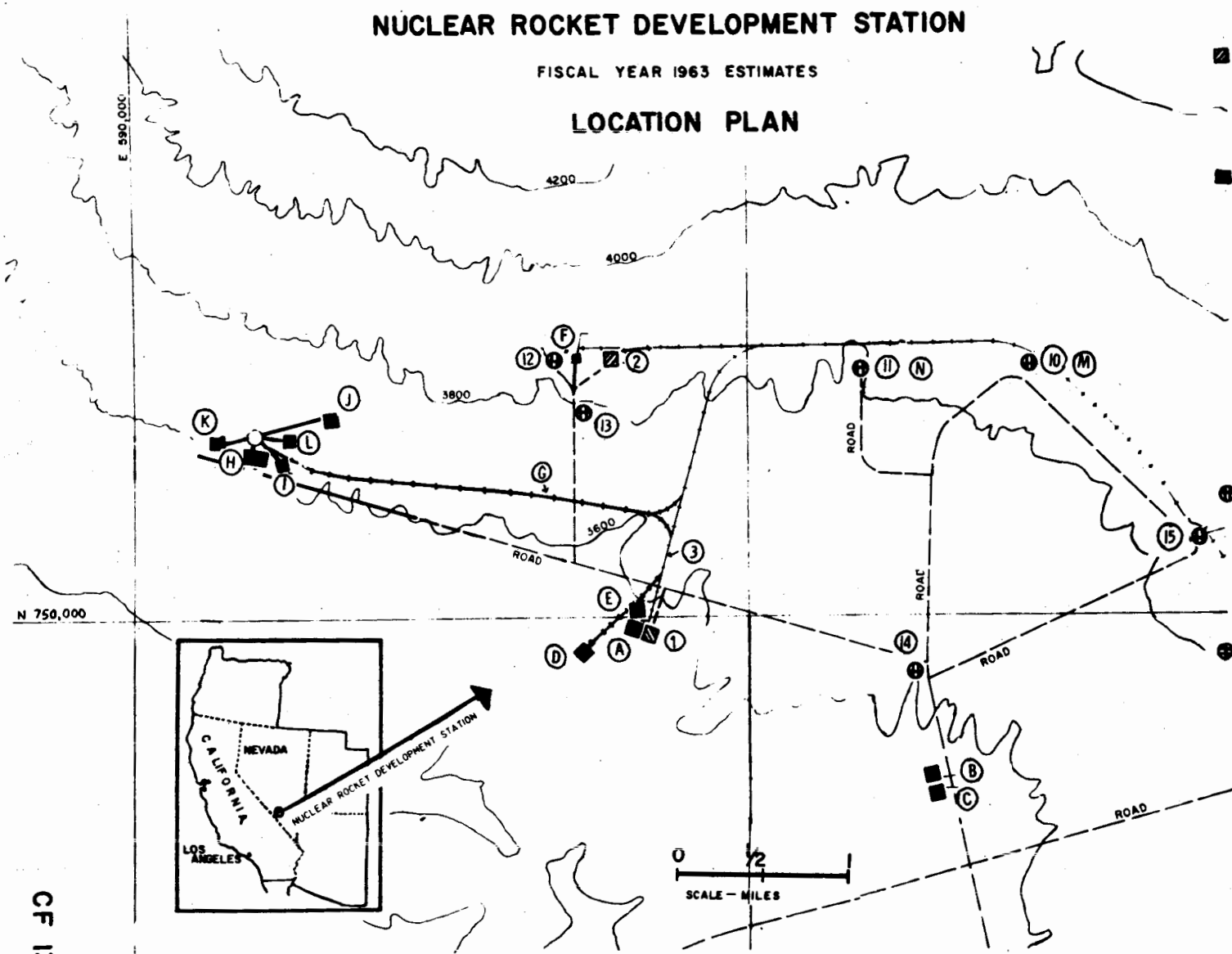
NUCLEAR ROCKET DEVELOPMENT STATION

Page No.		
CF13-A2	Location plan	
CF13-A3	Stage static test and maintenance facilities....	$20,205,000
CF13-B1	Stage demating, maintenance, and disassembly facilities.....	8,660,000
CF13-C1	Radiation effects facility.....	7,125,000
CF13-D1	Components test facilities.....	1,885,000
CF13-E1	Support facilities.....	2,125,000
	Total.....	$40,000,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

LOCATION PLAN



NASA FACILITIES

EXISTING FACILITIES - NONE

FACILITIES AUTHORIZED AND UNDER CONSTRUCTION

1. Engine Maintenance and Disassembly Building
2. Engine Test Stand No. 2
3. Railroad Tracks

FACILITIES IN PROPOSED 1963 PROGRAM

A. Addition to Engine Maintenance and Disassembly Building
B. Central Service Building
C. Electro-Mechanical Laboratory
D. Radioactive Waste Disposal Facility
E. Decontamination System
F. Radiation Effects Facility
G. Railroad Extension
H. Stage Assembly and Maintenace Building
I. Control Center
J. Engine-Vehicle Test Stand No. 3
K. Component Test Area
L. Stage Demating Facility

AEC FACILITIES

EXISTING FACILITIES

10. Reactor Test Cell "A"
11. Reactor Test Cell "C"
12. Engine Test Cell No. 1
13. Control Point
14. Control Point-Reactor Test Stands
15. Reactor Maintenance, Assembly and Disassembly Building

FACILITIES IN PROPOSED 1963 PROGRAM

M. Reactor Test Cell "A"-Expansion
N. Reactor Test Cell "C"-Expansion

CF 13-A2

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

STAGE STATIC TEST AND MAINTENANCE FACILITIES

DESCRIPTION:

Because of the radiation considerations associated with the nuclear stage, all testing involving nuclear power must be performed at a remote site. The Nuclear Rocket Development Station at Jackass Flats, Nevada, has been selected as that site. Existing facilities at the site are capable of testing and handling nuclear engines, but not full stages. Therefore, there is the requirement for a facilities complex capable of supporting and performing static testing of the complete nuclear stage.

The design of the facility complex is based on the dispersal philosophy for reactor tests whereby separation of facilities is utilized to achieve radiation and explosion safety and minimum shielding. In the interest of maximum test stand utilization and test program flexibility, it is planned to incorporate the mobile concept where the stage will be initially erected on a test dolly and thereafter transported, fired, and serviced on the dolly. Special wide-gage trackage will be provided interconnecting all facilities to which the complete stage must be taken during various phases of the test cycle.

Drawings of the facilities that comprise the complete complex are shown on the following four pages. A detailed description of the major elements of the project follows:

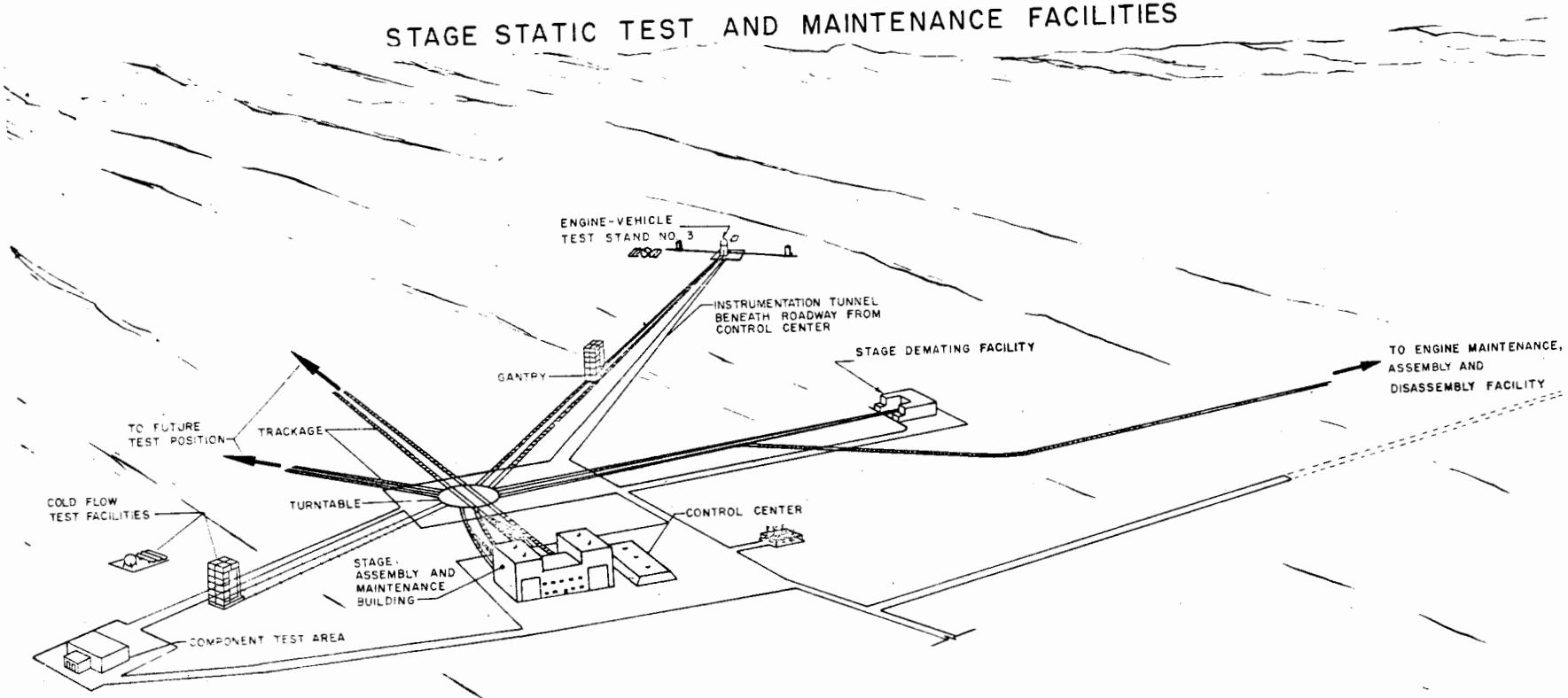
(a) Engine-vehicle test stand No. 3: One test position is required initially with provision for the possible future addition of two more positions. The test position will have the capability to static test the complete nuclear stage in the vertical, downward firing position, at full power with altitude simulation. The facility will afford a fixed firing position and will be augmented with movable superstructures or gantries, and transporter - test dollies.

Because of the nuclear environment and resultant activation and contamination problems, the test position has been planned to be as simple and austere as possible consistent with test program requirements. The mobile concept is planned, wherein the stage will be dolly mounted and delivered to the firing position on special wide-gage railroad trackage. This procedure will eliminate the requirement for a fixed superstructure in the high radiation field, minimizing test stand activation.

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

STAGE STATIC TEST AND MAINTENANCE FACILITIES



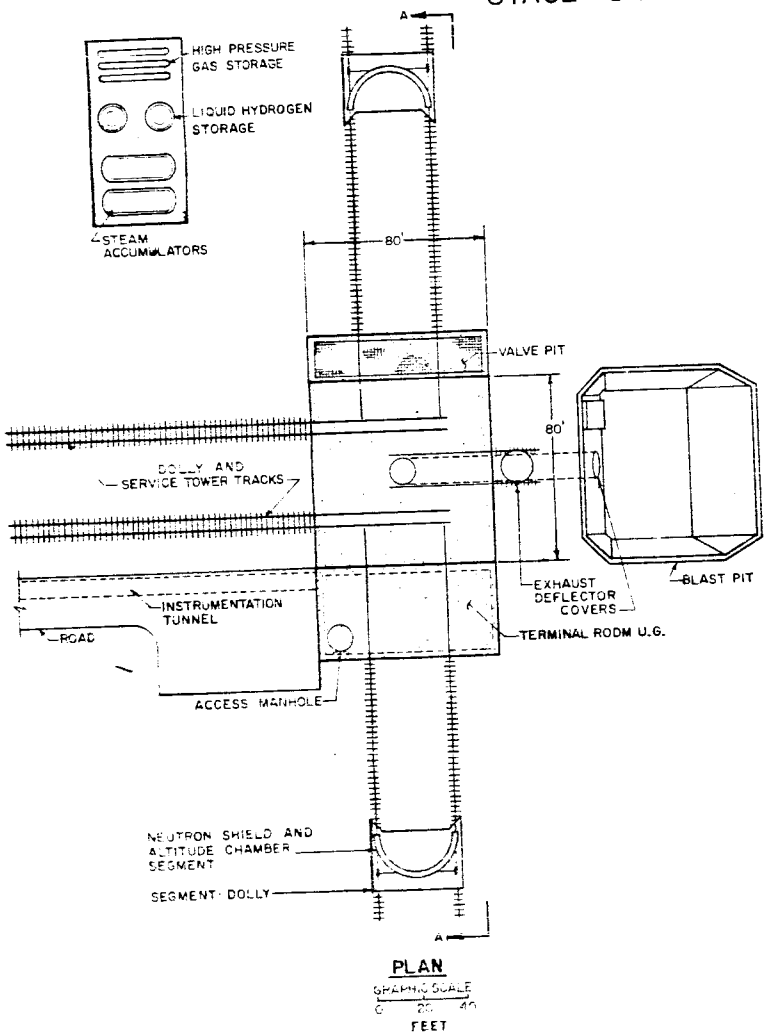
LOCATION PLAN

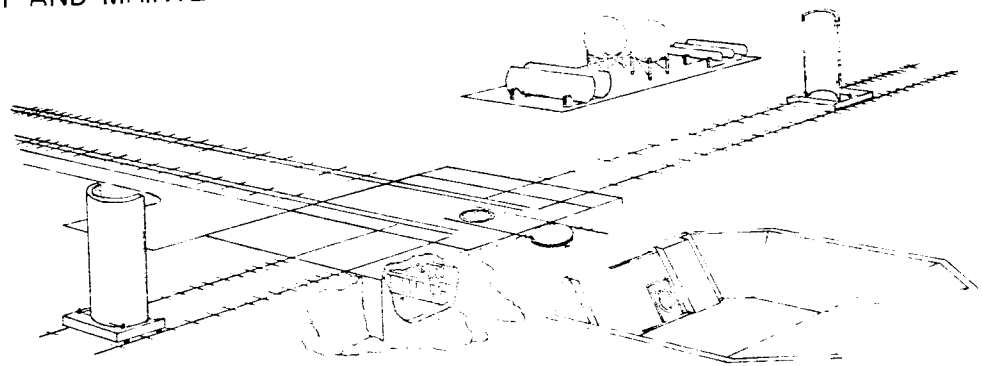
CF 13-A-4

NUCLEAR ROCKET DEVELOPMENT STATION

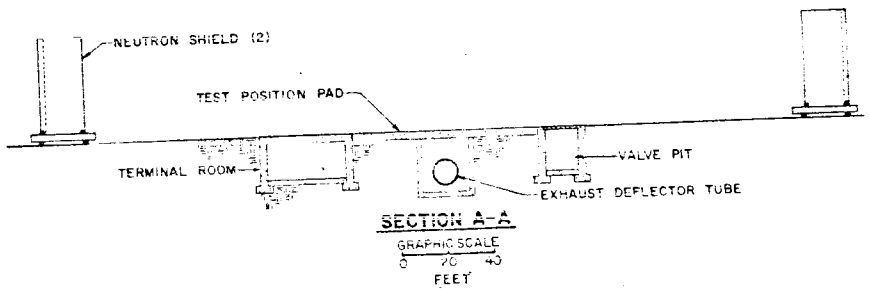
FISCAL YEAR 1963 ESTIMATES

STAGE STATIC TEST AND MAINTENANCE FACILITIES





PERSPECTIVE



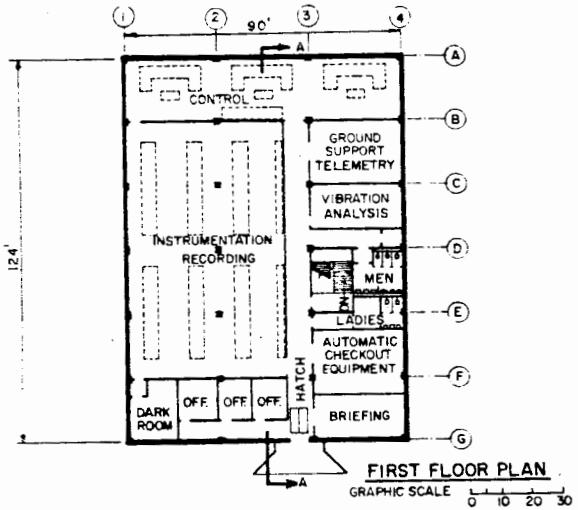
ENGINE-VEHICLE TEST STAND NO. 3

CF 13-A5

NUCLEAR ROCKET DEVELOPMENT STATION

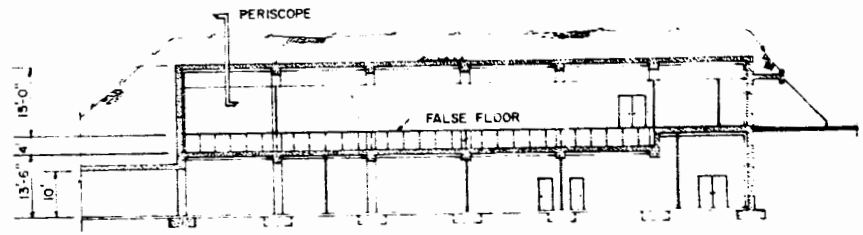
FISCAL YEAR 1963 ESTIMATES

STAGE STATIC TEST AND MAINTENANCE FACILITIES



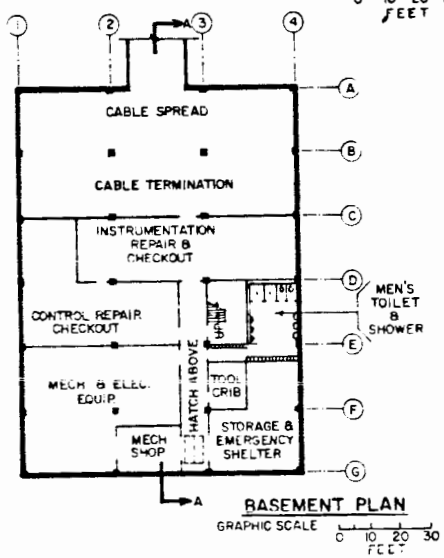
FIRST FLOOR PLAN

GRAPHIC SCALE 0 10 20 30 FEET



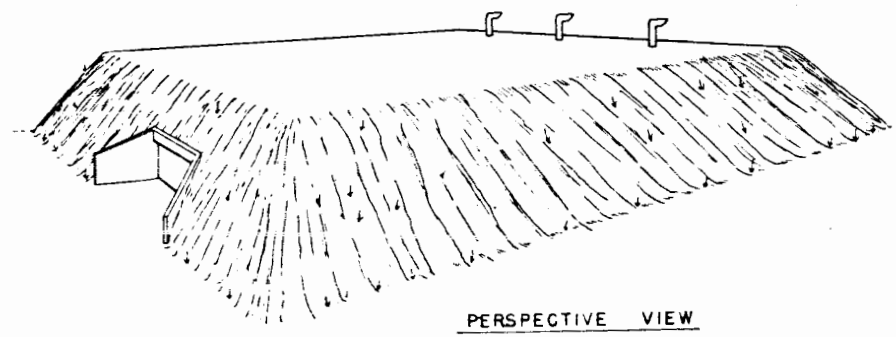
SECTION A-A

GRAPHIC SCALE 0 5 10 20 FEET



BASEMENT PLAN

GRAPHIC SCALE 0 10 20 30 FEET



PERSPECTIVE VIEW

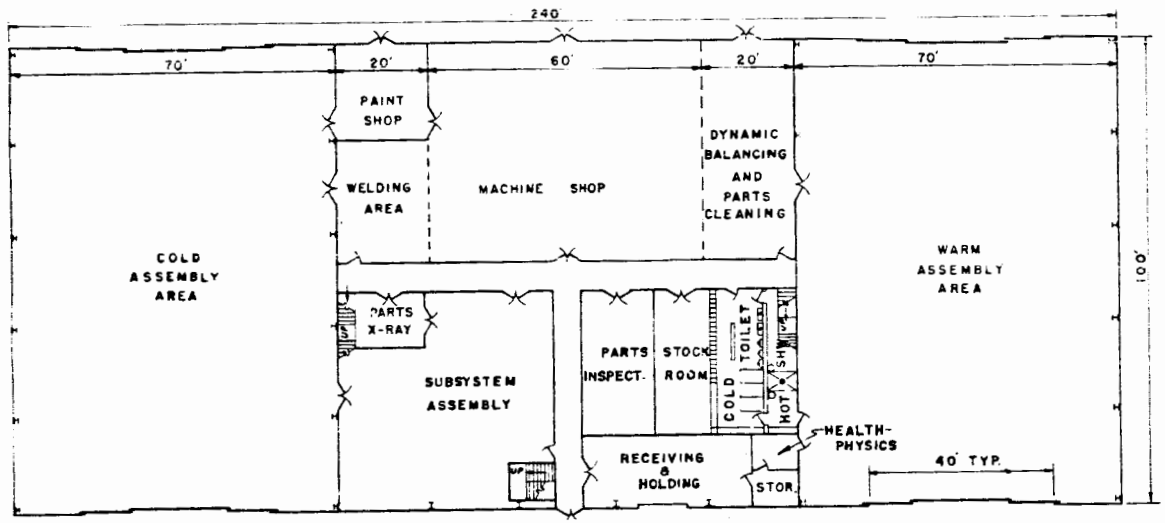
CONTROL CENTER

CF-13-A8

NUCLEAR ROCKET DEVELOPMENT STATION

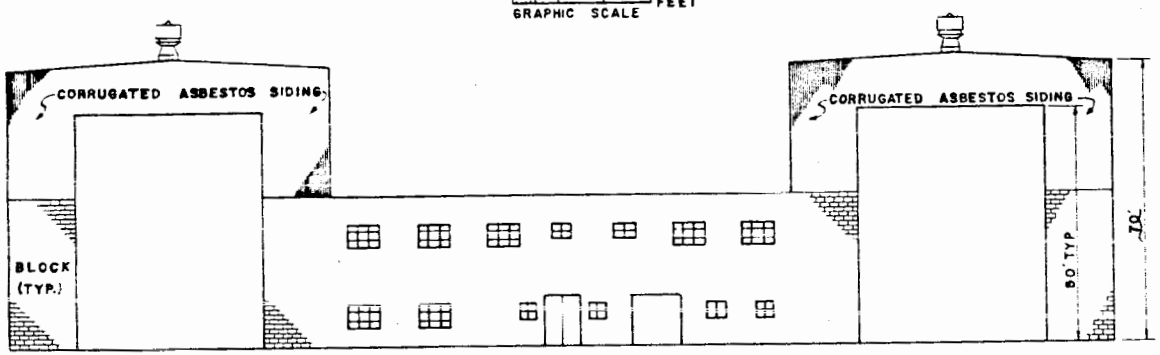
FISCAL YEAR 1963 ESTIMATES

STAGE STATIC TEST AND MAINTENANCE FACILITIES



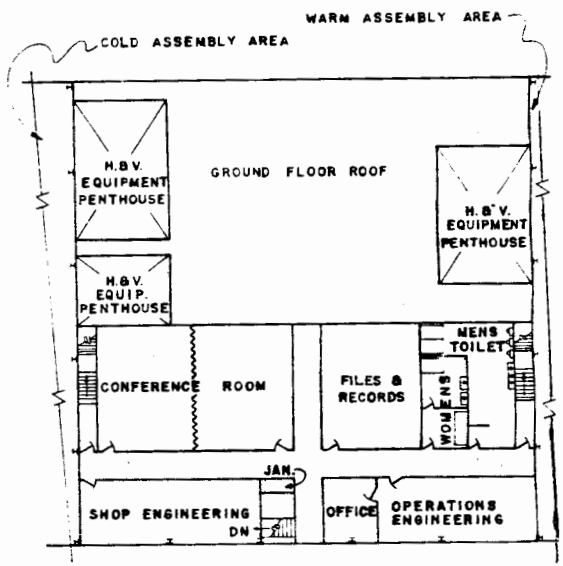
FLOOR PLAN

0 5 10 20 30 FEET
GRAPHIC SCALE



FRONT ELEVATION

STAGE ASSEMBLY AND MAINTENANCE BUILDING



PART SECOND FLOOR PLAN

0 5 10 20 30 FEET
GRAPHIC SCALE

CF-13-A-7

The test position, accordingly, is a relatively simple structure, largely underground, that incorporates maximum ease of decontamination and test position utilization. A shield cover will be provided for each end of the exhaust deflector so that the radioactivity resulting from test operations may be safely contained for maintenance and service work. Provisions will be made for remote removal of the deflector when and as required.

Remote disconnect capability will be provided in the test stands to enable detachment of the vehicle from the instrumentation, controls, process piping, and exhaust duct. Remotely controlled equipment will move the vehicle, in its movable stand, to a cool-down area located several hundred feet away. After removal of the vehicle from the test position, the exhaust duct will then be enclosed by the remote positioned shielding to permit early access to the stand by operating personnel.

The exhaust system will be water cooled and will incorporate a supersonic ejector which receives the exhaust of the downward firing nuclear rocket and then discharges the exhaust upward at a safe distance from the test stand. The system will be underground to the extent necessary for economical overall construction, and will be adequately shielded both during and after operation to afford adequate protection for personnel and provide access to the test position as soon as feasible after removal of the vehicle. The exhaust system will be tailored for the NERVA engine but modification for larger engines will be possible without major revisions of foundations or excavations.

The test position will consist of a pad area providing the firing position; a deflector; a control and instrumentation termination room with connecting tunnel; a valve pit for cryogenic and service piping; remote disconnect couplings for all controls; instrumentation and piping to the stage; removal and holding areas for the neutron shields; and TV and radiation monitoring stands.

Liquid hydrogen storage dewars will be provided, probably vacuum-jacketed spheres. Vacuum-jacketed liquid hydrogen transfer lines will be provided to transfer liquid hydrogen from storage to the run tank.

(b) Control center: A control center is required to serve all test areas. The center will provide approximately 22,000 square feet of floor area and will contain recording instrumentation, facility and test controls, site radiation monitoring and meteorological data instrumentation, communications, test complex management, and a personnel retreat from adjacent nonshielded facilities during firings.

The facility is planned to be a two-story shielded structure, primarily of concrete construction with earth cover to provide the required radiation shielding. The lower floor will be below grade with a cable tunnel connection to the test positions. Entry will be at grade on to the first floor on the side of the building opposite the test positions with a shadow shielded entry way.

Areas will be provided for such functions as test control (for the test positions and for the component test facilities), instrumentation and recording, ground support, telemetry, vibration analysis, automatic checkout equipment, cable termination, building equipment, minor repair, storage, briefing room and supervisory offices. A false floor will be provided for electronics equipment, and humidity and temperature control as required. Evaporative cooling will be provided in critical areas for personnel comfort. The instrumentation and controls to be installed in this facility are described below.

(c) Instrumentation systems: A basic land-line-type instrumentation system will be provided to supply the necessary data for determining the nuclear stage environmental and functional characteristics during captive firings. The system will also provide data for other component checkout and testing operations that are assigned to the complex. The instrumentation system will connect the firing positions and any other test or checkout facility requiring extensive instrumentation recording with the control center and will consist of recording devices, cable transmission, patching or switching, signal conditioning, monitoring, and other related functions such as calibration and maintenance. Provision will be made for other instrumentation-related functions that are known to be necessary, but can only be defined in detail by the user of the facility such as flight-type telemetry ground stations, automatic stage checkout equipment, and assembly checkout equipment.

The instrumentation will be provided that is necessary for the initial test stand installation. Provisions will be included, however, for permitting growth potential to additional test stands. The primary consideration here will be that the patching will be arranged in such a way that when additional test stands are added, a minimum amount of instrumentation would need to be added while retaining the capability to switch from one test position to the other in a minimum time.

(d) Control systems: The control systems required for these facilities will include consoles, equipment racks, transmission and distribution cables, conduits, cable trays, ducts, relays, instruments, recorders, readouts, actuators, and other hardware. The systems will permit the complete remote control of all facility and service equipment on the test stand which is required to be operated during normal prerun and postrun procedures. Included are propellant handling systems; gantry or crane operations; vehicle or engine mating or demating system; movable shielding systems; gas purge systems; gas pressurization systems; and water deluge, cooldown, or deflector cooling systems. Remote control of the test complex is also necessary to provide positive personnel and equipment safety through the use of oral, aural, and visual warning systems; traffic barricades and signals; operational and administrative intercommunication systems; and area and equipment surveillance by means of periscopes and closed-circuit television systems.

Other control systems are needed for the ready acceptance of the test item, vehicle, or stage, and its associated ground support equipment, into the test stand and control center. A flexible, integrated, control system is required to permit the safe and efficient performance of the desired test program. The overall system will include the monitoring of tests by means of event recorders; automatic malfunction detection; alarm and correction devices; and photographic instrumentation coverage.

(e) Cryogenics and high-pressure gas systems: Cryogenic and high-pressure gas storage and transfer systems will be required at the test position and at the component test area.

(f) Stage assembly and maintenance building: This building will provide capability for inspection, assembly, erection, modification, and maintenance operations for nuclear stages, including the ability to install radioactive engines. The building will connect into the site trackage system, utilizing the stage transport dollies for assembly of the stages. Provisions will be made for two assembly bays with overhead crane capacity capable of handling the stage in the vertical position. One bay will be used for the assembly of a nonradioactive stage. The other bay will provide adequate radiation control, protection, and decontamination suitable for maintenance of complete stages.

Although the stage assembly and maintenance building will be designed with both bays, the initial construction will include only the "warm" bay equipped to do maintenance on radioactive stages since this bay can obviously also do all of the nonradioactive work required. It is anticipated, however, that the stage testing program will increase to the point where a bay which can be used solely for the assembly of nonradioactive stages will be needed to meet future program requirements. This second bay may be requested in a future budget. The interior of the "warm" bay will be suitably painted for ease of decontamination; hot drains will be provided and radiation health physics control equipment will be included and located adjacent to the "warm" area. The total bay area will be approximately 7,000 square feet. Handling of the stage in the bay will be accomplished by a 25-ton bridge crane. Stage erection is planned to be accomplished using the mobile service crane (gantry) in conjunction with one of the high bay cranes by positioning the gantry adjacent to the building.

The center portion of the building will provide approximately 15,000 square feet of floor area and will include machine, welding and paint shops, subsystem preparation area, parts inspection, stock rooms, receiving and holding areas, personnel decontamination facilities, x-ray facilities, conference rooms, offices, and building equipment. Construction will include steel framing, concrete floors, concrete block lower walls and corrugated asbestos upper walls. In the interest of operational efficiency the facility will be centrally located in the complex and during firings may be subjected to radiation levels above laboratory tolerance. For brief periods personnel in the building will be evacuated to the nearby control center.

JUSTIFICATION:

The nuclear rocket program is based on flight testing the Rift vehicle in the 1966 to 1967 period. To realize this goal, vehicle test and maintenance facilities will be required by early 1964. The high radioactive environment associated with the operation of nuclear reactors precludes the use of existing vehicle static test facilities at other locations. The engine test facilities, which will also be a part of Nuclear Rocket Development Station will be in constant use for testing nuclear rocket engines and will not be available for vehicle testing or engine mating tests. Vehicle test stands are, therefore, required to permit flight stage development. Construction of the first of these stands is required to be started in the fiscal year 1963 to meet the 1966-1967 flight test schedule.

The test stand requested in this project must also be available, and usable, as a backup stand for engine development testing. Although only two engine test stands are required for this program, a facility mishap or unforeseen difficulties in the engine development program would require the use of the proposed stand in the engine development program.

One of the principal objectives in static testing a nuclear stage is to determine the most efficient and reliable method for handling and launching the vehicle at the launch facilities. The equipment described above is necessary to meet this objective, and will also be used during a training period for the crew responsible for the launch operations.

Existing facilities or those planned for other programs at the Station are not capable of handling items of the size of the Rift stage. Since the stages will be recycled through the test program, there must be a facility capable of performing the warm maintenance function on a complete stage. There must also be a capability for assembly and checkout of the stage at the Station. The stage assembly and maintenance building will provide these capabilities.

Many years of experience in testing other types of rocket vehicles have proven the worth of complete systems checkouts prior to a hot test. It is certain that this test philosophy will be even more worthwhile in the case of the nuclear vehicle because of the high costs of each hot test and the comparatively low rate of testing. Every effort must be made to eliminate subsystem and component malfunction during a test. No other facility is available which can achieve this objective.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$2,345,000
	Site preparation	$120,000	
	Paving	90,000	
	Railroad trackage	50,000	
	Remotely controlled double trackage turntable	635,000	
	Remote control switches	50,000	
	Water line extensions	750,000	
	Power line extensions and substations	650,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		3,380,000
	Test stand and blast pit	654,000	
	Deflector	450,000	
	Control center .. (22,400 square feet at $50 per square foot)	1,120,000	
	Stage assembly and maintenance building .. (22,000 square feet at $53 per square foot)	1,156,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		11,980,000
	Stage cars	280,000	
	Gantry	1,200,000	
	Shop equipment	1,500,000	
	Special jigs and fixtures	350,000	
	Cryogenic gas storage	800,000	
	Cryogenic gas piping system	600,000	
	Cryogenic valves, consoles, and remotely controlled connections	500,000	
	High-pressure gas storage and piping	350,000	
	Safety systems	600,000	
	Programmers	1,000,000	
	Cabling multiplexing	900,000	
	Recorders, alarms, and consoles	370,000	
	Readout equipment	2,400,000	
	Communications systems	130,000	
	Facility instrumentation	750,000	
	Facility controls	250,000	
E.	DESIGN AND ENGINEERING SERVICES		2,500,000
	Total estimated cost		$20,205,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

STAGE DEMATING, MAINTENANCE, AND DISASSEMBLY FACILITIES

DESCRIPTION:

Facilities are required that will permit (a) the mating and demating of radioactive engines with the vehicles; (b) maintenance and disassembly of radioactive engines and engine components; (c) cool-down of stage and moveable test equipment after a hot engine has been demated; and (d) minor hot maintenance which must be done by remote means but which would not necessitate demating and removal of the engine to the engine maintenance and disassembly building.

The mating and demating area will be equipped to disconnect remotely (or reconnect) a radioactive nuclear engine from the nuclear vehicle. The cool-down area will be an area served by the trackage system, with minimal shelter, which will serve as a holding position for radioactive decay of the complete stage and transport dolly. Provisions will be included for radiation monitoring, personnel control, and nuclear safety.

The demating facility will be a low-height, U-shaped, shielded building, with shielded viewing windows equipped for remote manipulation. Capability will also be provided for hardware and facility decontamination and contamination control. The functions to be provided here are engine and stage mating and demating, engine transfer to and from its transporter, and minor "hot" maintenance which can be performed on location.

A large, thick-walled concrete disassembly bay will be added to the engine maintenance and disassembly building to permit the maintenance and disassembly of radioactive rocket engines used in the vehicle program. Upon completion of a test, the nuclear rocket engine will be separated from the vehicle and brought in to the additional bay of the building and positioned in a special disassembly jig. These operations will be performed by remotely operated equipment because the highly radioactive engines will preclude any contact maintenance or disassembly work. Both "hot" bays will be used as required for vehicle engines. In order to improve the efficiency of operations and permit vehicle engine disassembly in the total facility it will be necessary to add shielding windows and remote handling equipment to the "hot" bay being built with current funds.

Most of the major maintenance work will be performed in the new large bay, which will be equipped with manipulators and remotely controlled turntables. The walls and roof of the large bay will be constructed of reinforced concrete varying in thickness from five feet to

two feet. The maintenance and disassembly operations will be viewed through oil filled leaded glass windows designed to protect operating personnel from excessive radiation.

In addition to the large disassembly bay, a limited number of "hot" and "warm" cells will be provided for the disassembly and close inspection of radioactive components. These cells will be relatively small in size, constructed of thick concrete walls with lead glass windows to provide shielding, and equipped with remote manipulators.

A limited number of laboratories and offices will also be provided to complete a facility capable of efficiently performing all of the tasks associated with the maintenance, disassembly, and inspection of radioactive hardware associated with a nuclear rocket program.

Provision will be made for safe storage or disposal of radioactive waste materials. Necessary additions to the railroad system are included in the project.

Sketches of the proposed additions to the engine maintenance and disassembly building and the proposed new stage demating facility are shown on the following four pages.

JUSTIFICATION:

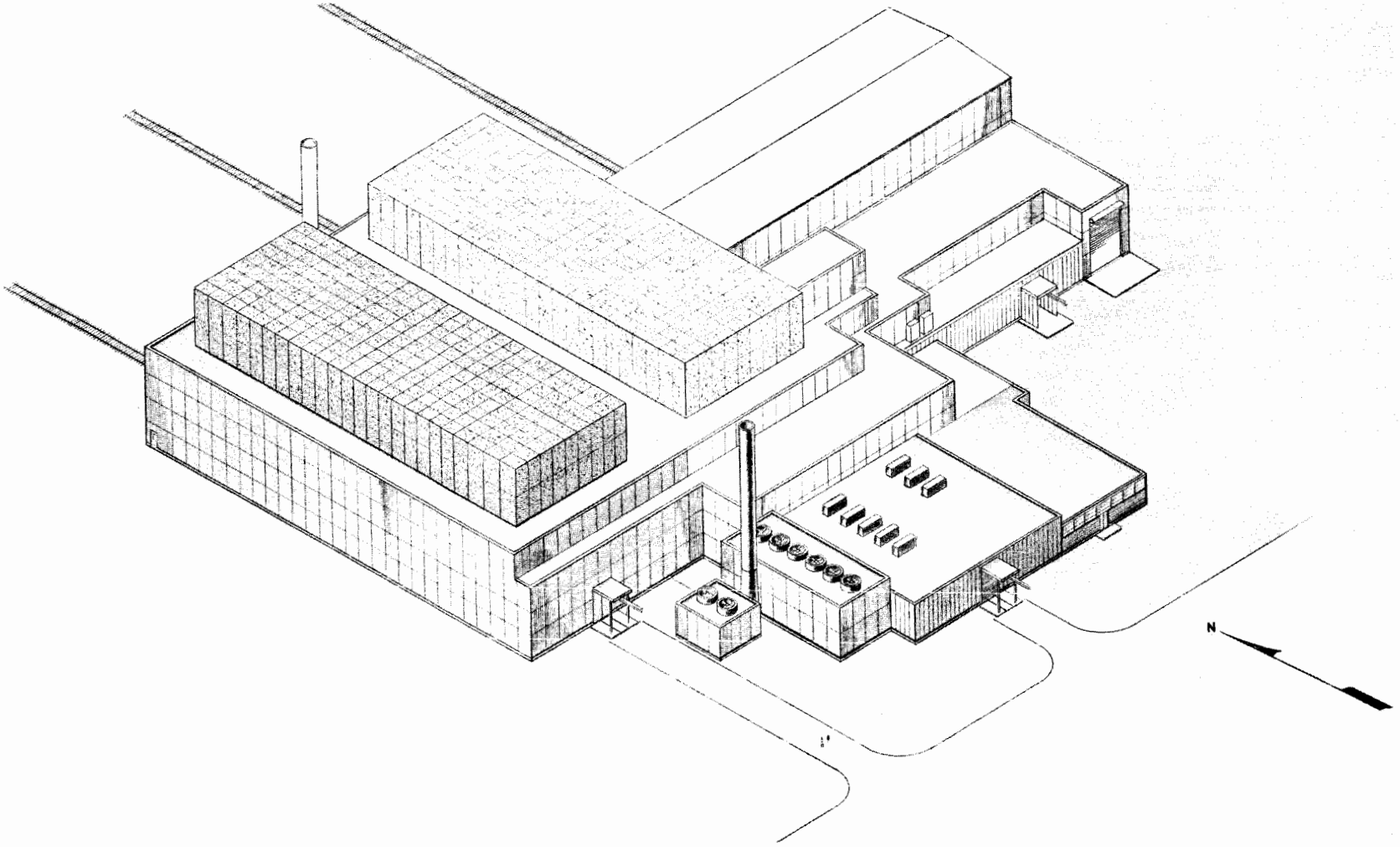
There are no existing facilities at the Station capable of remotely disconnecting a "hot" nuclear engine from a stage of the physical size of the nuclear stage. Since the stages are to be recycled, provisions must be made for holding the stage in a monitored area for cool-down and decontamination to allow contact maintenance to be performed within a reasonable period of time after the "hot" nuclear engine has been demated from the stage. The new stage demating facility will allow this function to be carried out.

The "hot" engines when demated from the vehicles will be maintained or disassembled as required in the engine maintenance and disassembly building; additions to this building are required to prevent delays in the program.

The total engine maintenance and disassembly facility to accommodate the NERVA and RIFT programs aiming at a flight date in the 1966-67 time period requires the addition of the items included in this project. They are the minimum requirements to accommodate the program on schedule. The second large disassembly bay is required to handle the engines that will be utilized in the Rift vehicle development program. These engines will be accommodated in the engine maintenance and disassembly building. Severe traffic problems will be created in this building if the additional bay is not available when the Rift vehicle testing program begins. The disassembly bay must be started in fiscal year 1963 so

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

STAGE DEMATING, MAINTENANCE, AND DISASSEMBLY FACILITIES

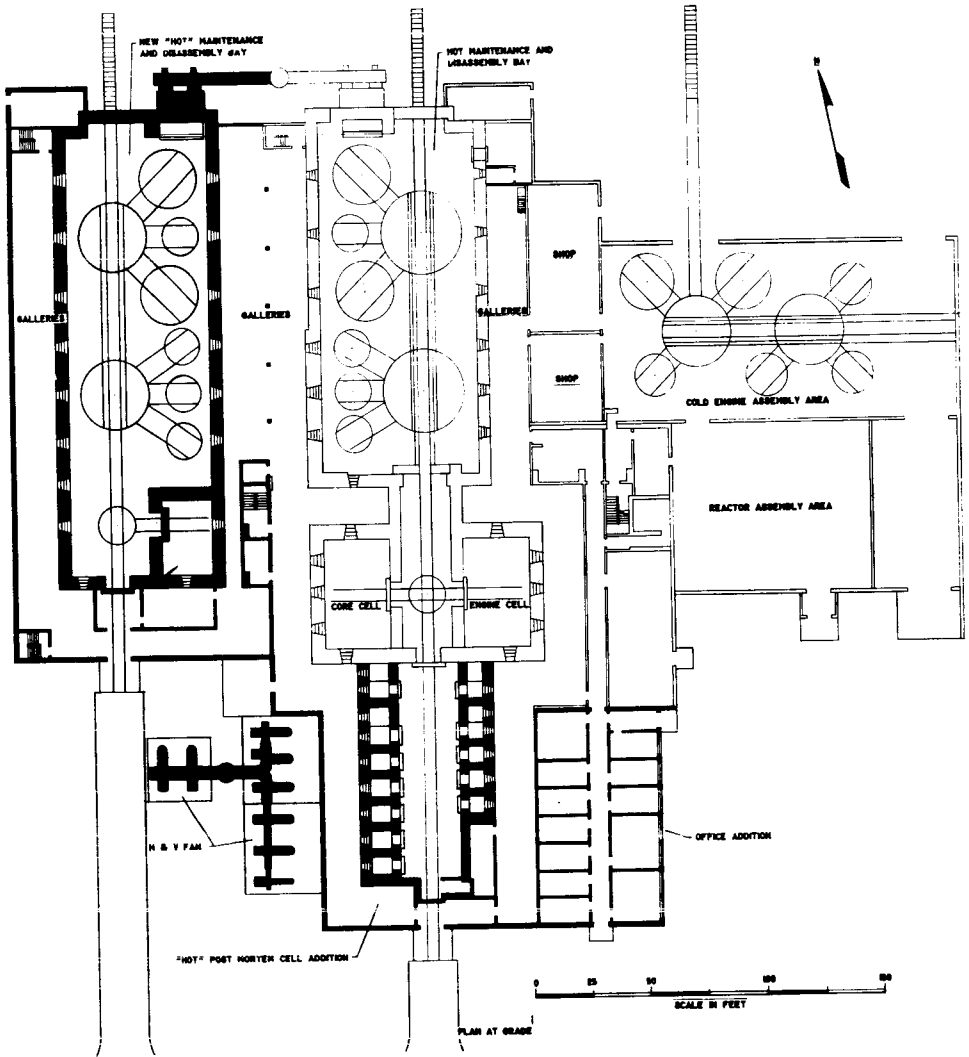


ADDITIONS TO ENGINE MAINTENANCE AND DISASSEMBLY BUILDING

CF 13-B3

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

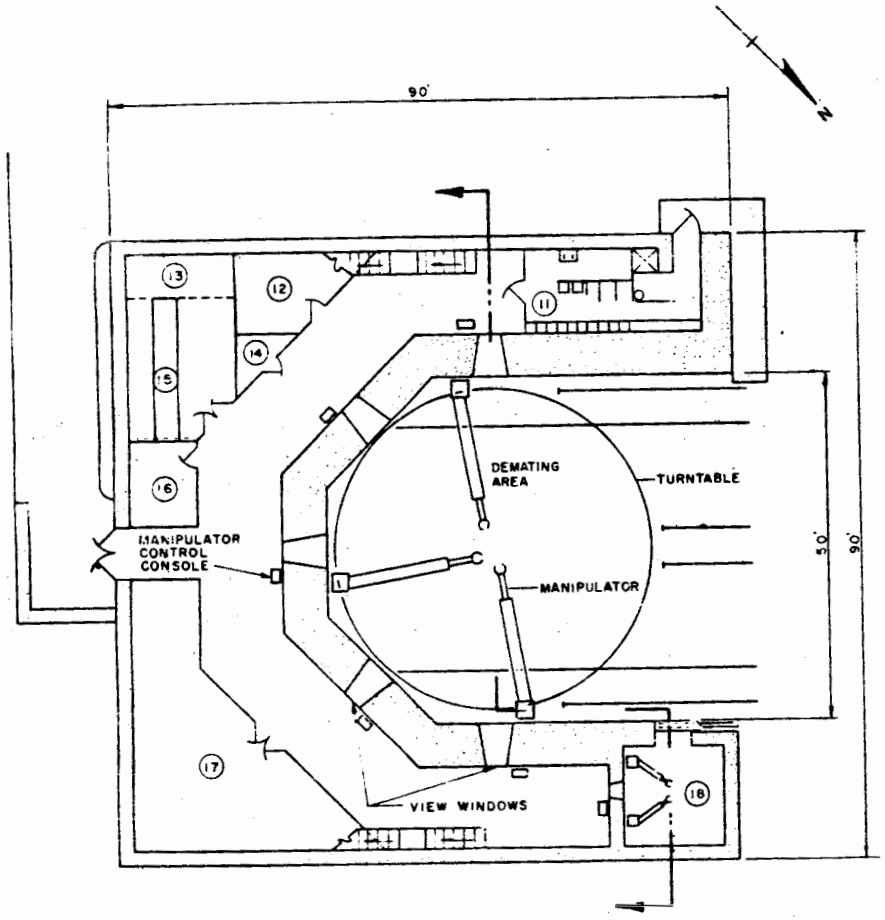
STAGE DEMATING, MAINTENANCE, AND DISASSEMBLY FACILITIES



ADDITIONS TO ENGINE MAINTENANCE AND DISASSEMBLY BUILDING

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

STAGE DEMATING, MAINTENANCE, AND DISASSEMBLY FACILITIES



GROUND FLOOR PLAN
GRAPHIC SCALE
0 5 10 15 20
FEET

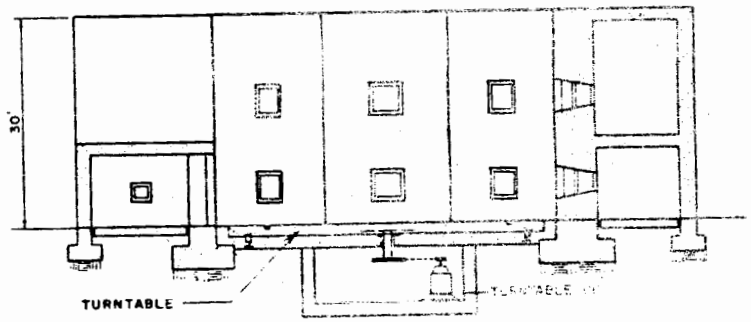
ROOM LEGEND

GROUND FLOOR

11. PERSONEL DECONTAMINATION AND LOCKER ROOM
12. HEALTH PHYSICS OFFICE
13. MOTOR-GENERATOR SETS
14. HEALTH PHYSICS STORAGE
15. CONTROL CENTER
16. MANIPULATOR PARTS STORAGE
17. HEATING, VENTILATING, AND AIR CONDITIONING EQUIPMENT
18. HOT CELL

SECOND FLOOR

21. COMPONENTS REMOTE INSPECTION
22. RECORDS
23. OPERATIONS ENGINEERING
24. STORAGE
25. FOREMAN'S OFFICE
26. LIAISON OFFICE
27. STORAGE
28. BRIEFING ROOM
29. MASTER CONTROL CENTER



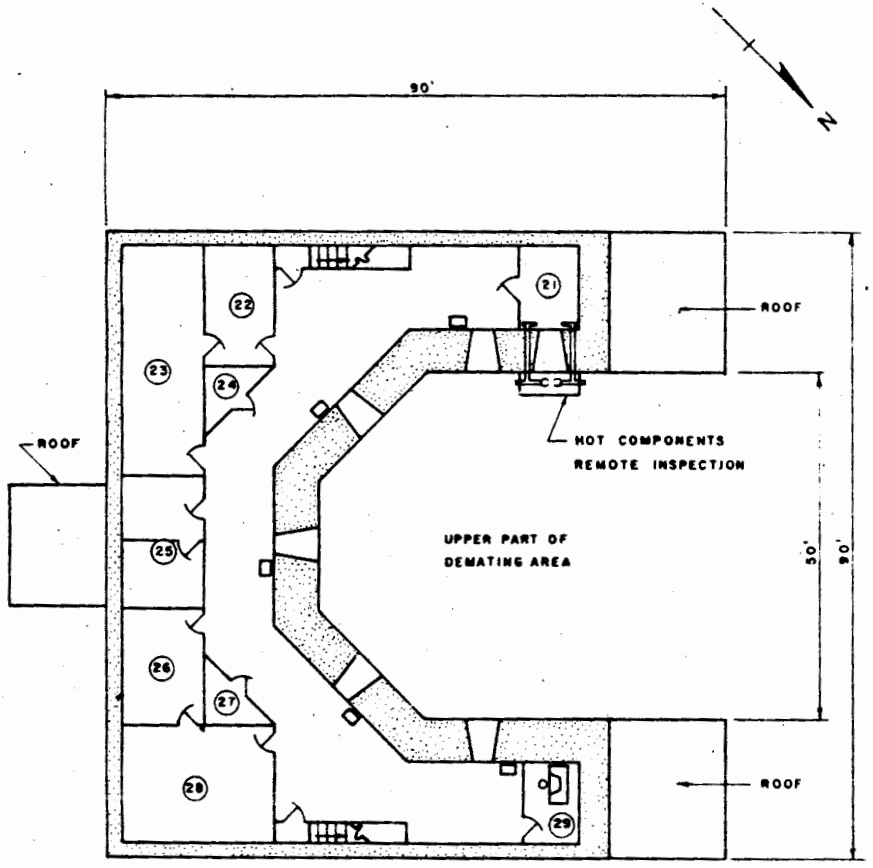
SECTION A-A
GRAPHIC SCALE
0 5 10 15 20
FEET

STAGE DEMATING FACILITY

CF 13-B5

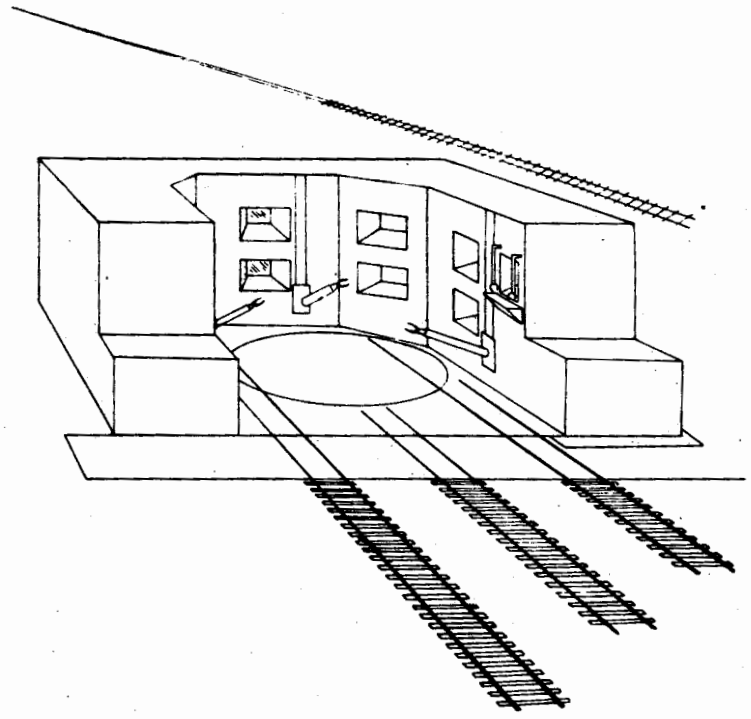
NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

STAGE DEMATING, MAINTENANCE, AND DISASSEMBLY FACILITIES



SECOND FLOOR PLAN

GRAPHIC SCALE
0 5 10 15 20
FEET



PERSPECTIVE

STAGE DEMATING FACILITY

CF 13-F6

that the massive concrete structure can be completed in time to be used in the program.

Funds are requested for a minimum of equipment in the new "hot" bay to accommodate only the early phases of the vehicle program. Provisions will be made in the design for the addition of more shielding windows, manipulators, and other equipment if required at a later date.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$465,000
	Site preparation	$40,000	
	Paving	20,000	
	Water line extension distribution	35,000	
	Power line and substations	140,000	
	Railroad trackage and switching	40,000	
	Railroad turntable	190,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		4,500,000
	Hot maintenance bay addition; shielded -- (26,000 square feet at $90 per square foot)	2,340,000	
	Hot cell addition; shielded (8,300 square feet at $100 per square foot)	830,000	
	Office addition (4,800 square feet at $25 per square foot)	120,000	
	Stage demating facility (8,100 square feet at $150 per square foot)	1,210,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		3,035,000
	Overhead manipulator	400,000	
	Special tools, jigs, and fixtures	650,000	
	Special radiation shielding	500,000	
	Operation and maintenance equipment and machine tools	300,000	
	Hot cell furnishings	250,000	
	Remote controls	300,000	
	Remote control manipulators	280,000	
	Radiation instrumentation and monitoring equipment	300,000	
	High pressure gas storage system	10,000	
	Communication systems	45,000	
E.	DESIGN AND ENGINEERING SERVICES		660,000
	Total estimated cost		$8,660,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

RADIATION EFFECTS FACILITY

DESCRIPTION:

A facility is required to evaluate the performance and to conduct development of the various nuclear rocket component systems operating in a radiation environment similar to that encountered in full power reactor operation. The facility will accommodate a full-scale flight-type nuclear rocket system excluding the reactor. A separately controlled, unshielded, test reactor using a separate flow system will be operated at low power for a long enough time to duplicate the total cumulative radiation effect on the engine components and assembled component systems that would result from operation at maximum design power level. Drawings of the facility are shown on the following three pages.

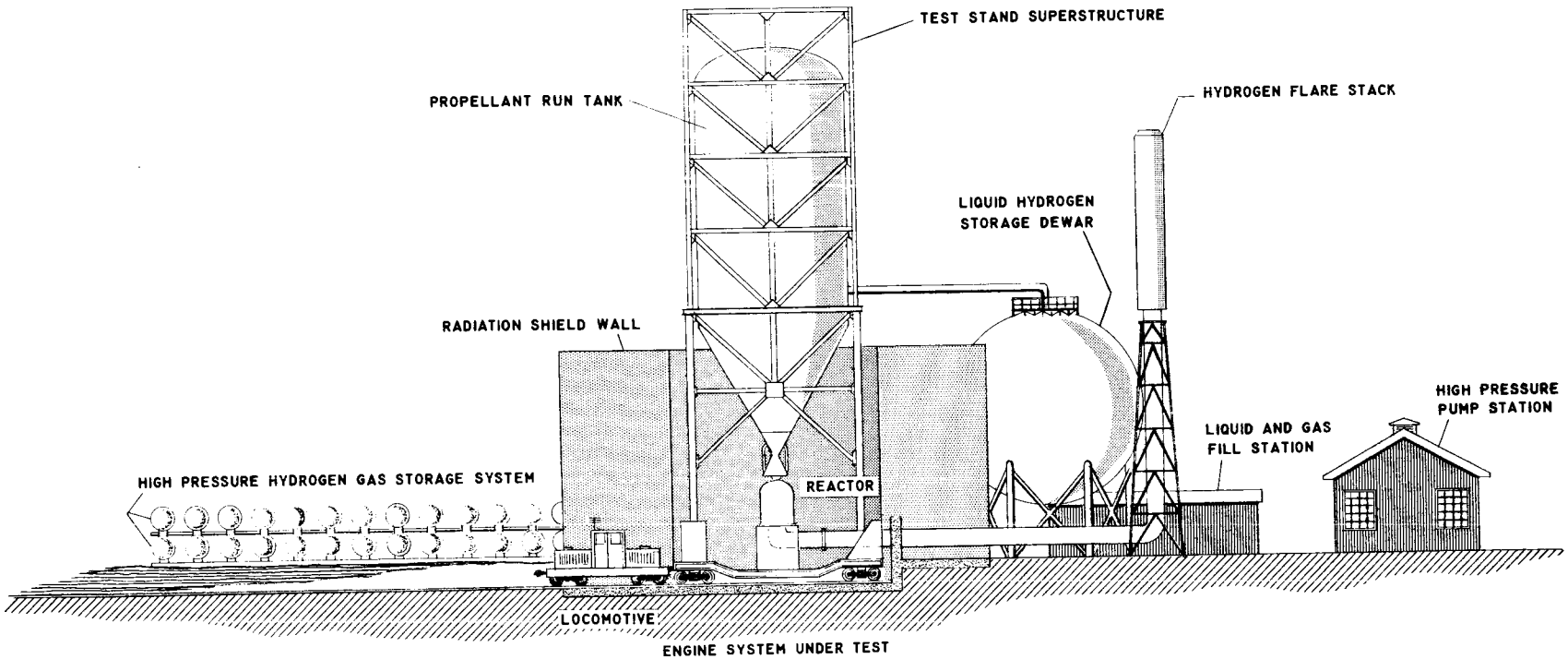
The radiation effects facility will consist of the following major components:

(a) Buildings: A test stand constructed on a concrete foundation connected with the existing engine test stand No. 1 control point by a new access and cable tunnel. The test stand structure is required to support the test engine and control assembly and to provide connection terminals for remote control and instrumentation cabling. The building must also support the remote controlled reactor transport car and all reactor piping and cabling interface couplers. A tunnel between the facility and the control point is required for the protection of instrumentation and control cabling, personnel access, and general utility services. The existing control point will be enlarged to accommodate additional control consoles and data acquisition equipment.

(b) Utility connections: Electric power is required for lighting, operating small shop tools, for miscellaneous services, and for instrumentation and control operations during engine tests. Further studies may indicate the need of an emergency auxiliary power supply. Water service is required for emergency cooling of the reactor and for cleaning, decontamination wash-down, and personnel uses between engine operating periods. After reactor operation and irradiation of the nuclear engine components,

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

RADIATION EFFECTS FACILITY

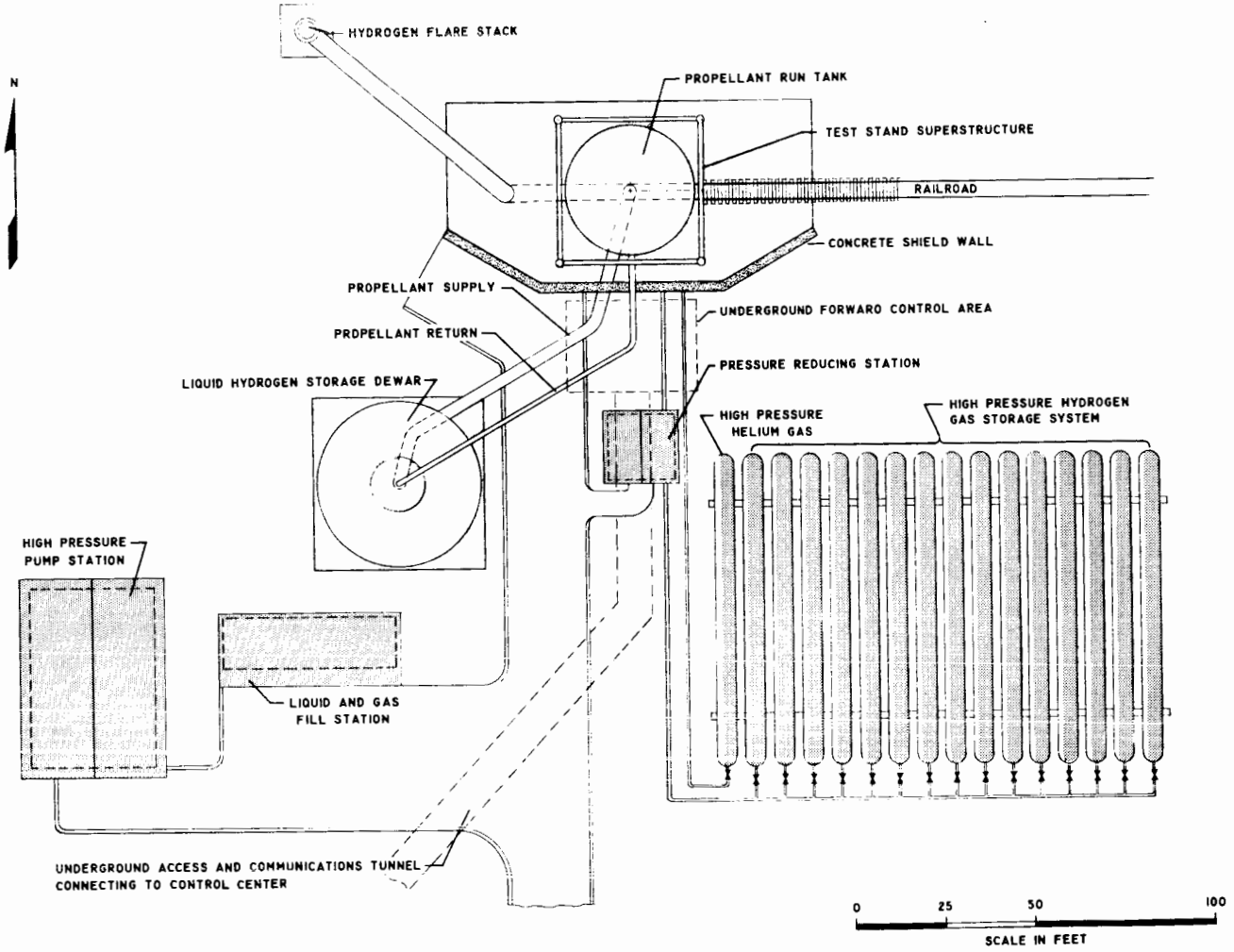


SECTION THROUGH STAND LOOKING SOUTH

CF 13-C2

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

RADIATION EFFECTS FACILITY

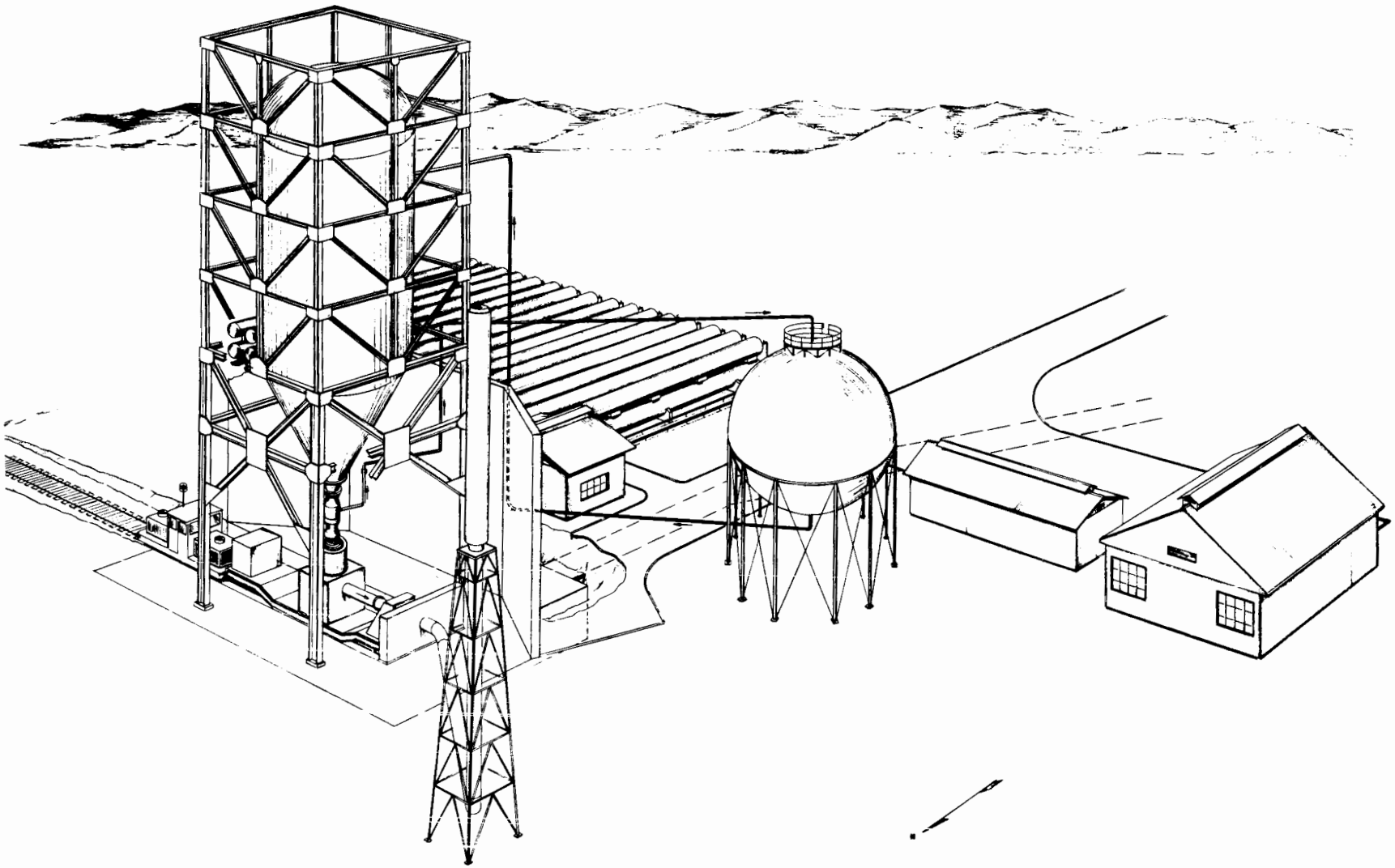


PLAN VIEW

CF 13-C3

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

RADIATION EFFECTS FACILITY



wash-down with water hoses will be necessary to remove radioactive dust and debris prior to preparation for the next test operation. The radioactive wash water must be conducted to a suitable retention basin away from the facility by special drains and sewer system.

(c) Site improvement, roads, and railroads: Access roads, parking areas, and railroad extensions will be constructed to provide access for personnel, material, and equipment to the site. The facility will be served by a remote controlled locomotive that will remove the reactor car from the facility after a run to either an existing cool-down siding or to the maintenance and disassembly building currently under construction.

(d) Instrumentation and controls: As the facility will be remotely operated from the control point, all control and indication circuits, as well as data transmission channels, must be run from the test stand location to the control point. Protected and shielded cabling will be used as required depending on the electrical characteristics of each circuit. Experience has shown that a minimum of 1,000 circuits will be necessary on the test equipment and test reactor operation, and 100 circuits for communication, paging alarms, and purge systems.

(e) Coolant fluid system: The reactor, operating at low power, will be cooled by high-pressure gaseous nitrogen which must be stored and delivered in adequate quantities to insure safe reactor operation for the time required.

(f) Cryogenic storage and piping: Liquid hydrogen will be supplied to the irradiated turbo-pump assembly at the pump capacity rate. This requires a new liquid hydrogen dewar and/or run tank, vacuum jacket piping, valves and controls. Also required are a liquid nitrogen system for pre-cooling and a liquid oxygen system for the hot gas generator.

(g) Hot gas generator: Hot gas under pressure is required to power the liquid hydrogen turbopump at its maximum output. This gas, to be supplied in the flight vehicle by either a separate unit or a reactor bleed system, will be supplied in the radiation effects facility by a separate burner system.

JUSTIFICATION:

Because of the cost of each test of a full-scale flight-type nuclear engine, every effort must be made to examine the performance of all components and sub-systems under conditions simulating as nearly as possible the environment and operating loads encountered in actual operation before running them in full engine tests. Failure of a major component such as a turbopump in a full engine test or in flight could be extremely costly to the program in both time and money. The radiation effects facility will enable a combination of mechanical and thermal loads and cumulative radiation effects to be imposed on the complete engine sub-assembly in a relatively safe and economical manner and thereby minimize the chance of a component failure during full-power nuclear engine operation in an engine test stand or on the stage static test stand. Experience in complex vehicle development programs dictates that to insure successful completion of the program on schedule, proof of component reliability is essential.

Using this facility, a reactor operated independently of the components to be tested will provide a radiation environment similar to that to which the components will be subjected in the actual flight system. This will permit evaluation of the performance of the turbopump, controls, and instruments under full-load conditions independent of test reactor operation. The facility will not provide for high-power reactor operation and will, therefore, not be equipped with a high-performance exhaust duct or cooling water system and all the cost and complexities inherent thereto.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$270,000
Drainage, grading, and compaction.....	$75,000	
Paving.....	30,000	
Railroad trackage and switching.....	5,000	
Water line extension and valving.....	50,000	
Power line extension and transformer.....	100,000	
Radioactive waste disposal sewer.....	10,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		465,000
Superstructure and foundations.....	100,000	
Access tunnel and forward control vault...	250,000	
Control point expansion (2000 square feet at $50 per square foot).....	100,000	
Cable terminal and switching vaults.....	15,000	

D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$5,590,000
High pressure nitrogen coolant fluid storage system.....	$2,400,000	
Piping and controls for nitrogen system.....	100,000	
Liquid hydrogen dewar - 250,000 gallon.....	400,000	
Liquid hydrogen piping.....	20,000	
Liquid hydrogen run tank.....	400,000	
Liquid nitrogen and liquid oxygen systems.....	50,000	
Hot gas generator.....	500,000	
Process piping.....	150,000	
Data acquisition and signal instrumentation channels.....	960,000	
Control circuit and communication channels.....	20,000	
Facility operation control systems including cryogenic valves, remote controlled connections, and consoles....	490,000	
Communications systems.....	100,000	
E. DESIGN AND ENGINEERING SERVICES.....		800,000
Total estimated cost.....		$7,125,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

COMPONENTS TEST FACILITIES

DESCRIPTION:

Capability is required for conducting application approval and operational assurance testing of parts, components, and subsystems of the nuclear stage. Major features of the proposed components test facilities include component test cells, a cold flow test stand, instrumentation systems, a test control system, a control and operations center, cryogenic and high-pressure gas storage and distribution systems, and trackage interconnection to facilitate complete nonnuclear stage cold flow testing.

The test cells and test stand will provide test benches and multipurpose test positions including supporting equipment. Capability for component testing at cryogenic temperatures will be provided. Adequate facilities will also be provided for testing and calibrating components, assemblies, and subsystems such as propellant feed systems, flow controllers, heat exchangers, valves, and pressurization systems.

The control and operations center will be part of the control center described under the project covering the stage static test and maintenance facilities. It will permit remote operation and control of the test setup. Provisions will be made for an operations office, and space for instrumentation and control cable distribution, patching and signal conditioning. The component test area will be protected by reinforced, blast-resistant concrete and will be equipped with alarms and fire protection control. Liquid hydrogen, high-pressure gases, and other services will be provided in the most economical manner consistent with safety, operational requirements, and economy. Trackage, paving, and utilities will be provided as required and integrated into the over-all complex.

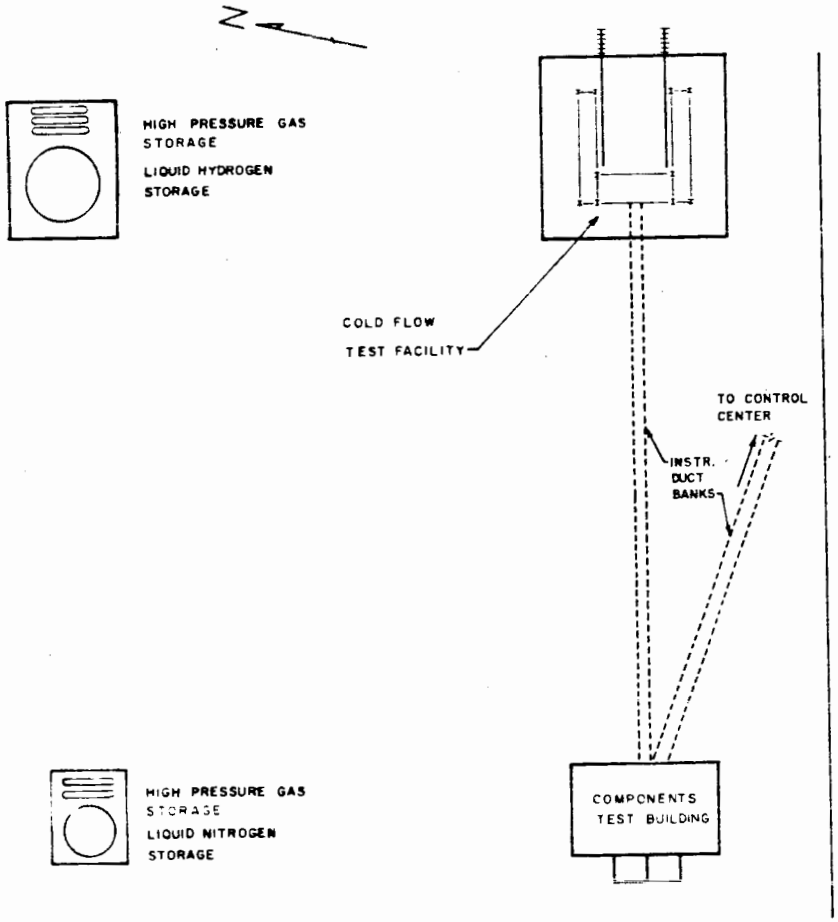
The instrumentation system will provide data channels, termination and signal conditioning equipment, and patch panels integrated into the control center of the static test complex. Test controls, including communications and other special systems, will be provided to support the test stands and related systems.

Sketches of the facilities to be provided in the component test area are shown on the following two pages.

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

COMPONENTS TEST FACILITIES

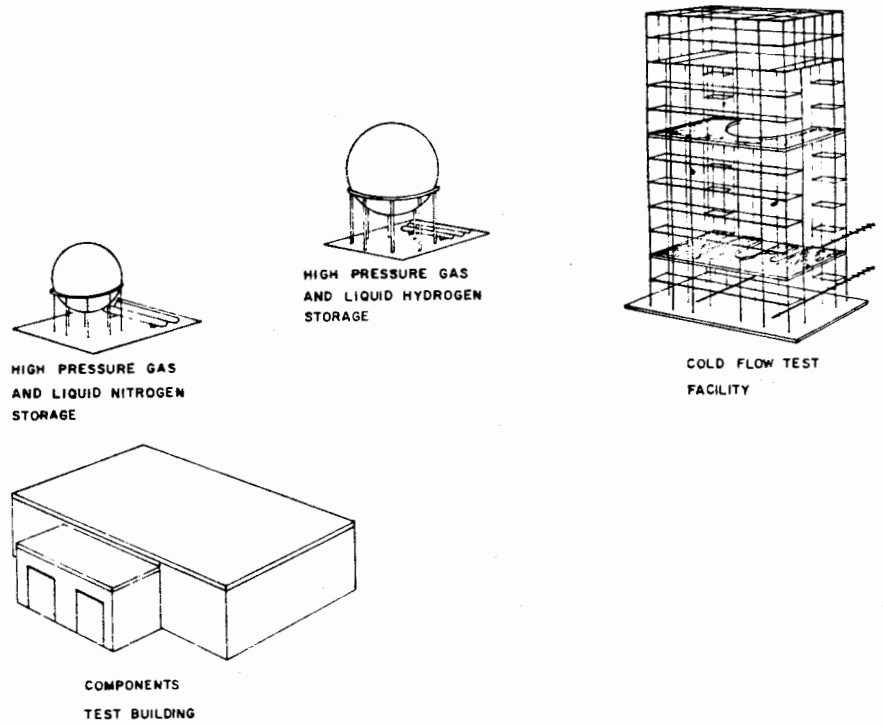


SITE PLAN

GRAPHIC SCALE

0 25 50

FEET



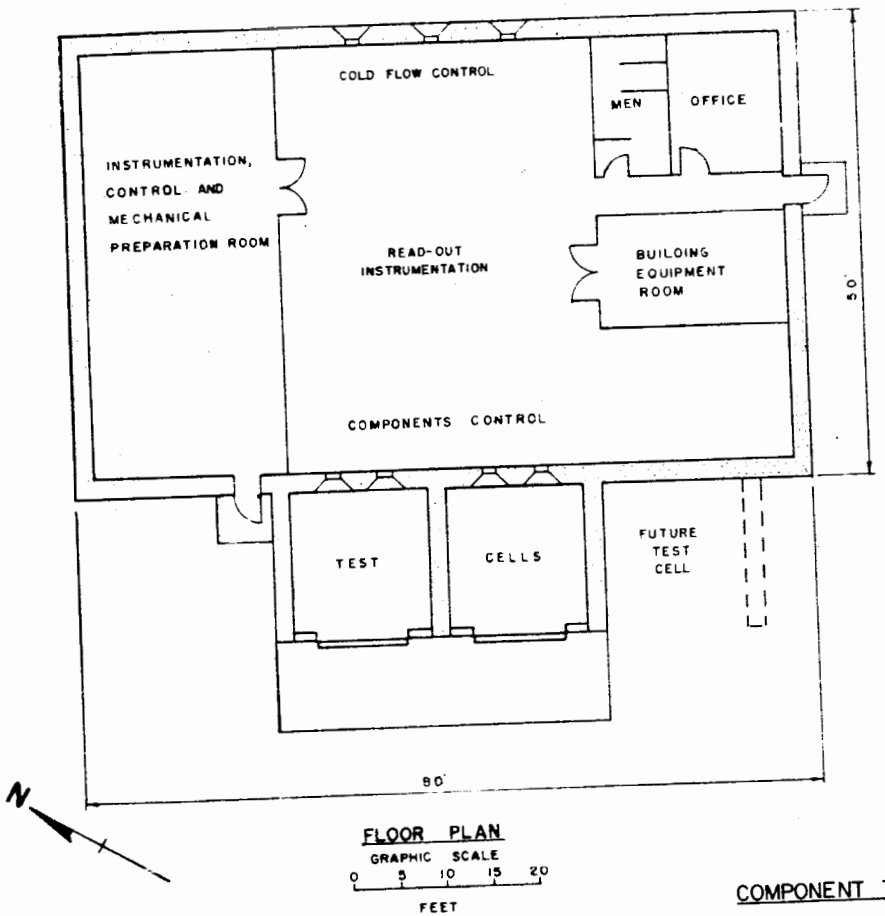
PERSPECTIVE

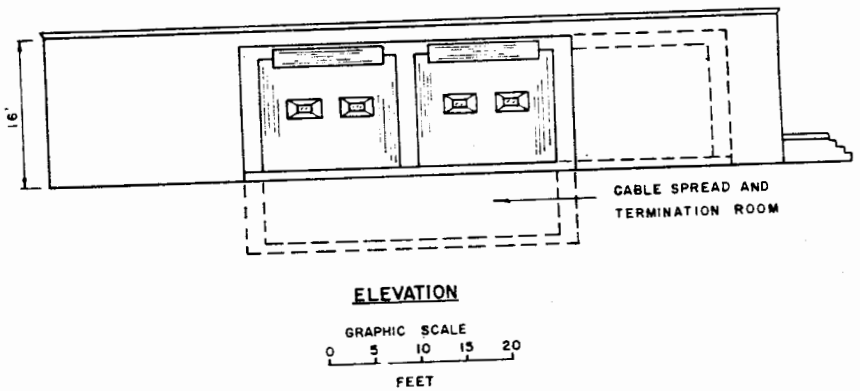
CF 13-02

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

COMPONENTS TEST FACILITIES





COMPONENT TEST BUILDING

CF 13-03

JUSTIFICATION:

The capability for component bench testing is required since individual components shipped to the Station for assembly into the stage will require some acceptance inspection tests. Also, in the event of component malfunction, a quick means of bench testing or trouble shooting must be provided. This will minimize the delays that would be encountered in shipping the components back to the vendor for these types of tests.

The capability for cold-flow and tanking tests must be available at the Station where the stages will be checked out after assembly, and prior to hot firing. This testing will be required since the stage and its components will be shipped into and assembled at the Station. This type of cold-flow and tanking tests is a basic part of a stage development program.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$ 335,000
Water line extension and distribution	$ 75,000	
Power line extension and substation	130,000	
Site preparation	20,000	
Paving	10,000	
Railroad and turntables at facility	100,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		250,000
Component test building .. (3600 square feet at $40.00 per square foot)	144,000	
Cold-flow test facility .. (3600 square feet at $20.00 per square foot)	72,000	
Pads for cryogenic storage tanks .. (3400 square feet at $10.00 per square foot)	34,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		1,100,000
Equipment, tools, jigs, and fixtures	130,000	
Controls and instrumentation for cryogenic systems	200,000	
Cryogenic storage and piping systems	650,000	
Instrumentation and controls	50,000	
Communication systems	70,000	
E. DESIGN AND ENGINEERING SERVICES		200,000
Total estimated cost		$1,885,000

NUCLEAR ROCKET DEVELOPMENT STATION

FISCAL YEAR 1963 ESTIMATES

SUPPORT FACILITIES

DESCRIPTION:

To operate the technical facilities which comprise the heart of the Nuclear Rocket Development Station, it will be necessary to provide adequate office space for technical and administrative personnel; facilities for the maintenance and calibration of instruments and controls; general shops, stockrooms, and storage space; and site developments such as extensions of roads, and water, electric, and communication systems. The major items included in this project are as follows:

(a) Central services building: It is estimated that a minimum of 10,800 square feet of office space will be required in the early phases of the program. This building will be constructed of concrete block on a concrete slab floor. It will be a single-story structure designed for expansion to accommodate all office personnel who will be associated with the NERVA and RIFT programs when they reach their peak strength.

(b) Electro-mechanical laboratory: This laboratory will consist of one or more buildings of similar construction containing approximately 5,000 square feet for instrument and controls maintenance and calibration shops; 10,000 square feet for machine, sheetmetal, and general maintenance shops; and 4,000 square feet for shipping, receiving, and general stockroom services.

(c) Decontamination system: A device containing special wash down equipment for cleansing engine parts and other parts which have been exposed to or have accumulated radioactive waste materials will be provided for general use of all contractors at the Center. The device will probably be located near the engine maintenance and disassembly facility to take advantage of the existing radioactive waste disposal system.

(d) Site development and extension of utilities: An extension of the railroad system is included to connect the engine maintenance and disassembly facilities to the vehicle testing facilities complex and to other supporting facilities where the engine carrier must provide service.

Roads, utility systems, communications systems, and safety systems will be extended to the vehicle test complex and to the support facilities area.

Sketches of representative buildings typical of the type to be constructed under this project are shown on the next two pages.

JUSTIFICATION:

Every effort will be made to utilize existing off-site facilities for machine shop and fabrication work. It is anticipated that most of the parts, ground support equipment, and special test equipment will be fabricated elsewhere; however, modifications, repairs, and the fabrication of pieces of special equipment will have to be done on-site to avoid delays to the program. The remote location of the Station (approximately 91 miles from Las Vegas) makes it difficult to operate with efficiency unless a minimum of such facilities is provided. It will also be necessary to provide office space at the site for these technical and administrative employees whose full-time services are required at this location.

A minimum of facilities is included for the repair and maintenance of instrumentation and controls at each test complex. This is necessary to permit servicing equipment in place when difficulties are minor. In addition, a laboratory will be required where delicate and sensitive instrumentation can be maintained, repaired, and calibrated as near to the test position as practicable but sufficiently remote so as not to require expensive shielding to protect personnel and equipment.

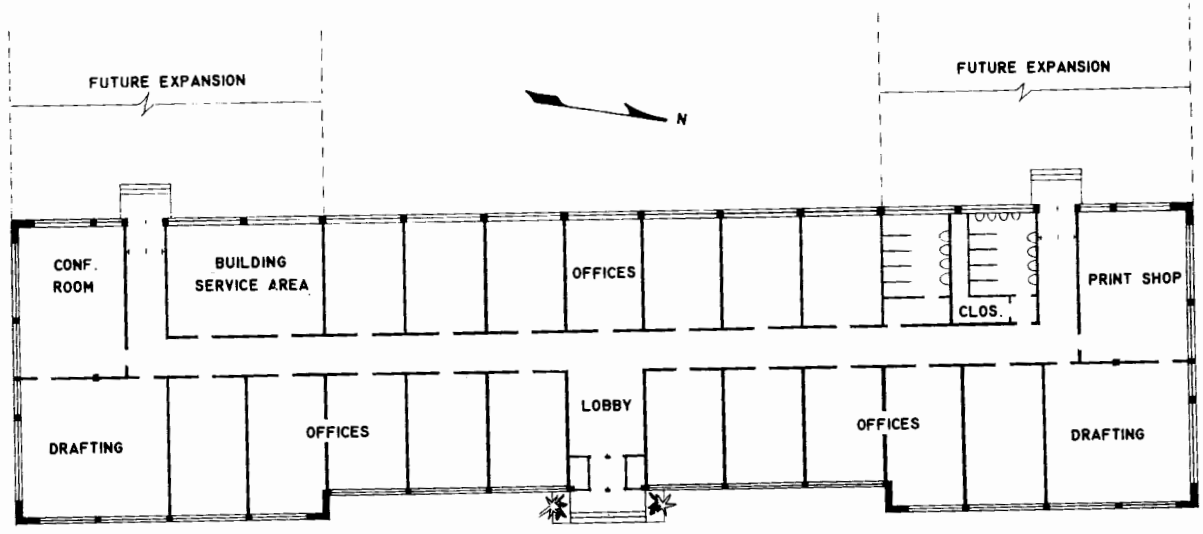
To support these functions, a stockroom will be required to house and dispense the everyday materials needed in such an operation. The various testing complexes are separated by sufficient distances to permit operation of one complex without interference to the other. This is done to permit maximum utilization of the test stands. The complexes must be serviced with roads, railroad trackage, water, electricity, and communications.

COST ESTIMATE:

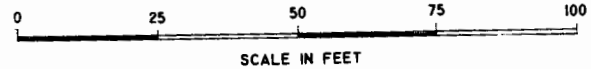
A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$320,000
Roads and parking areas.....	$40,000	
Water line extensions and distribution..	120,000	
Electric power line extensions and substation.....	160,000	

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

SUPPORT FACILITIES



FLOOR PLAN



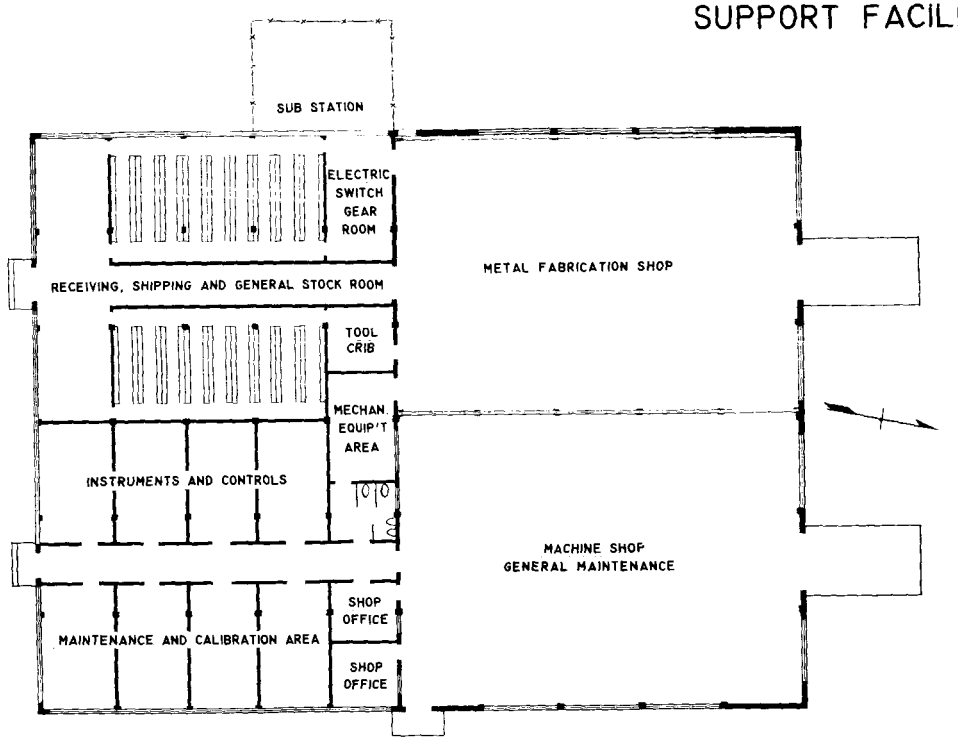
SCALE IN FEET

FRONT ELEVATION

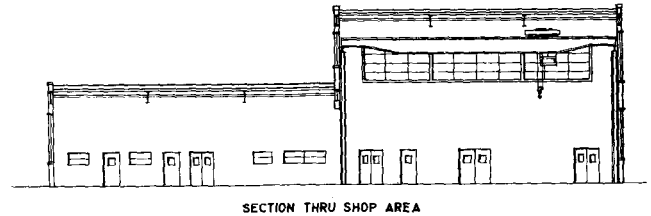
CENTRAL SERVICES BUILDING

NUCLEAR ROCKET DEVELOPMENT STATION
FISCAL YEAR 1963 ESTIMATES

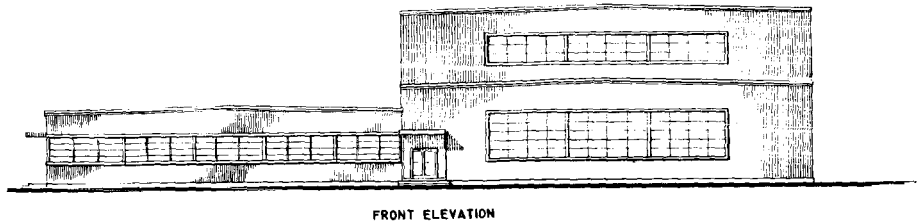
SUPPORT FACILITIES



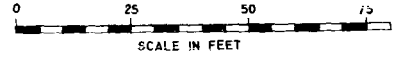
FLOOR PLAN



SECTION THRU SHOP AREA



FRONT ELEVATION



ELECTRO MECHANICAL LABORATORY

C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		$674,000
	Central services building..(10,800 square feet at $30.00 per square foot).....	$324,000	
	Machine, sheet metal, and general maintenance shops..(10,000 square feet at $25.00 per square foot).....	250,000	
	Shipping, receiving and general stockroom areas..(4,000 square feet at $25.00 per square foot).....	100,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,006,000
	Tools and equipment for shops.....	221,000	
	Calibration and test equipment for electromechanical laboratory.....	515,000	
	Decontamination system.....	50,000	
	Communications and safety systems.....	220,000	
E.	DESIGN AND ENGINEERING SERVICES.....		125,000
	Total estimated cost.....		$2,125,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

CONSTRUCTION OF FACILITIES - 1963 PROGRAM

VARIOUS LOCATIONS

Page No.		
CF14-A2	Advanced antenna system Goldstone Station.....	$14,250,000
CF14-B1	Advanced Saturn dynamic test facility.....	2,100,000
CF14-CD1	Antenna facility, Johannesburg Station.....	5,000,000
CF14-CD1	Antenna facility, Woomera Station.....	5,000,000
CF14-E1	Data acquisition facility, Far East Station.....	6,000,000
CF14-F1	Data acquisition facility, Rosman Station.....	3,500,000
CF14-G1	Facilities for F-1 engine program.....	25,000,000
CF14-H1	Facilities for J-2 engine program.....	4,000,000
CF14-I1	Facilities for M-1 engine program.....	16,000,000
CF14-J1	Manned space flight control centers.....	18,000,000
CF14-K1	Space radiation effects laboratory.....	12,382,000
CF14-L1	Nova stage manufacturing facilities.....	16,100,000
	Total.....	$127,332,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

ADVANCED ANTENNA SYSTEM, GOLDSTONE STATION

DESCRIPTION:

This project involves the construction and installation of a superior ground antenna system, specifically designed for deep space vehicle tracking and communications. The new antenna will provide equal angle tracking accuracy and an 8 to 10 decibel increase in communication capability compared with the present antennas used at the Deep Space Stations. This performance will represent a significant advancement in the state-of-the-art for ground antennas used in deep space mission communication, and will be achieved by a combination of larger aperture and lower noise feed system. The increase in communication capability over the current 85-foot antennas will allow eight times the amount of information to be received from a spacecraft.

In 1961, a competitive design feasibility study of the antenna was performed. The study demonstrated that the desired performance characteristics of the antenna can be achieved. The design program already funded will provide detailed design plans for antenna fabrication and erection. The antenna will be an azimuth-elevation mounted, low focal length to diameter ratio parabolic reflector, approximately 230 feet in diameter, and utilizing a folded (Cassegrain) radio frequency feed system. The new antenna must be a very precise instrument, since it will operate with high efficiency at the new space communication frequency band of 2,290-2,300 megacycles per second. Also the antenna will be able to track automatically to within a few degrees of the horizon.

The antenna will be erected at the Goldstone Tracking Station, 45 miles from Barstow, California. The Goldstone station, operated by the Jet Propulsion Laboratory, is located on government property (Fort Irwin). The antenna system will consist of the following major elements:

A complete pedestal and steerable aperture reflector to provide continuous angular coverage of space vehicles to within a few degrees of local horizon.

A complete servo-drive and control system for accurately and automatically positioning the aperture.

Precise digital devices for measurement and display of the angular position of the antenna.

Microwave components, including the primary feeds and transmission components suitable for either ultra high sensitivity receiving, high power (100 KW) transmitting, automatic tracking and diplex operation.

Boresight optical equipment.

Fixtures and instrumentation for axes, structure alignment and testing.

Devices for personnel safety on and around mount.

Devices to protect antenna from damage in event of drive system failure.

Complete documentation of system including testing, operation, and maintenance procedures.

Certain site facilities are also included:

A prepared site for the antenna with access road.

Primary electrical power and communication service.

Air conditioned control room with wiring troughs, electrical power, and control consoles. (Current planning indicates that location of the control room within the antenna pedestal may be feasible.)

Housing for antenna drive prime mover equipment.

JUSTIFICATION:

A fundamental principle in the design of spacecraft systems is that to the greatest degree possible, complexity and sophisticated installations should be kept out of the vehicle and left on the Earth. The space exploration missions in the 1965-1975 period will require a spacecraft communications installation of great complexity, regardless of the ground antenna size and within the realm of what is now technically practical. High transmitter power and high antenna gain both must be used on the spacecraft to approach the communication system performance required by the missions. An 8 to 10 decibel greater capability on the Earth end of the communication link will always allow a worthwhile amplification either in amount of data transmitted, range of communication or fidelity, and in many cases will also allow a profitable weight reduction in the spacecraft.

Because an Earth based installation of this type will have an essentially indefinite useful life, its initial cost represents an investment which will be amortized over a very great number of individual missions.

The proposed antenna is a culmination of a two year intensive study and design program. A thorough coordination of all work in the large antenna area, both United States and foreign, has been effected to insure that the project will be technically successful in an economical fashion.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$900,000
	Access roads	$140,000	
	Water supply system and storage tank	50,000	
	Septic tank and drain field	30,000	
	Site grading and sealing	65,000	
	Fuel oil storage and distribution system	15,000	
	Power transmission line, distribution system, and substation	350,000	
	Inter and intra site communication systems	50,000	
	Standby diesel generators and transfer equipment	200,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		11,870,000
	Antenna foundation	350,000	
	Antenna structure and pedestal	4,200,000	
	Antenna movement and drive system	7,070,000	
	Servo-mechanical building (4000 square feet at $37.50 per square foot)	150,000	
	Collimation tower and housing	100,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		1,240,000
	Antenna feeds	70,000	
	Servo system	200,000	
	Antenna data system	300,000	
	Reflector contour system	200,000	
	Support systems (collimation, optical, intercommunications, boresight, and timing)	130,000	
	Test equipment	340,000	
E.	DESIGN AND ENGINEERING SERVICES		240,000
	Systems engineering and documentation (An additional $750,000 has been allocated from fiscal year 1962 funds)	240,000	
	Total estimated cost		$14,250,000

CF14-A4

VARIOUS LOCATION

FISCAL YEAR 1963 ESTIMATES

ADVANCED SATURN DYNAMIC TEST FACILITY

DESCRIPTION:

This project requests the necessary funds to permit the design, construction, and installation of a dynamic test facility for the development of the Advanced Saturn vehicle. Major components of the facility will include a heavy reinforced concrete foundation, a 360-foot high steel tower structure, a terminal building, and area roadways to accommodate vehicle transporters. The steel tower structure will house stairways, elevator, working platforms, wind protection, fire protection, vehicle support for free-flight conditions, lateral support, support for a heavy stiff-leg derrick, and an auxiliary hoist. A possible configuration of the facility is shown on the following page. A site location is to be selected.

JUSTIFICATION:

The dynamic test stand is to be utilized in the conduct of mechanical and structural tests on large multi-stage space vehicles. A facility of this type is required for the checkout of mechanical mating features; the determination of natural frequencies and bending characteristics with various simulated propellant quantities, under static and simulated free-flight conditions; the determination of the structural effects of cycled gimbaling on the vehicle; and the adequacy of flight control.

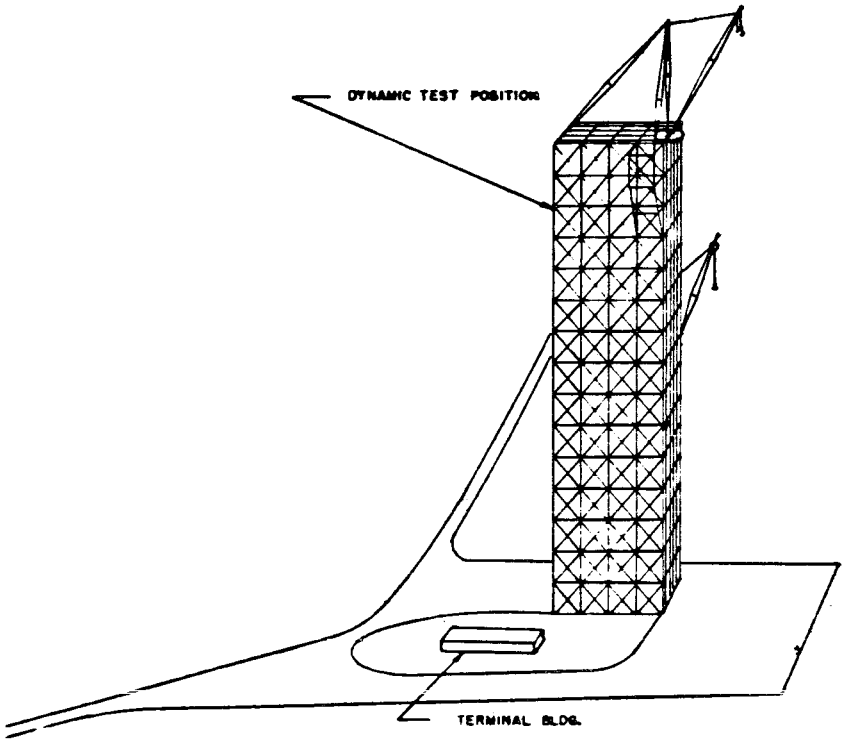
COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$70,000
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,550,000
	Test stand	$1,500,000	
	Terminal building	50,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		300,000
	Special equipment	200,000	
	Instrumentation	50,000	
	Control systems	50,000	
E.	DESIGN AND ENGINEERING SERVICES		180,000
	Total estimated cost		$2,100,000

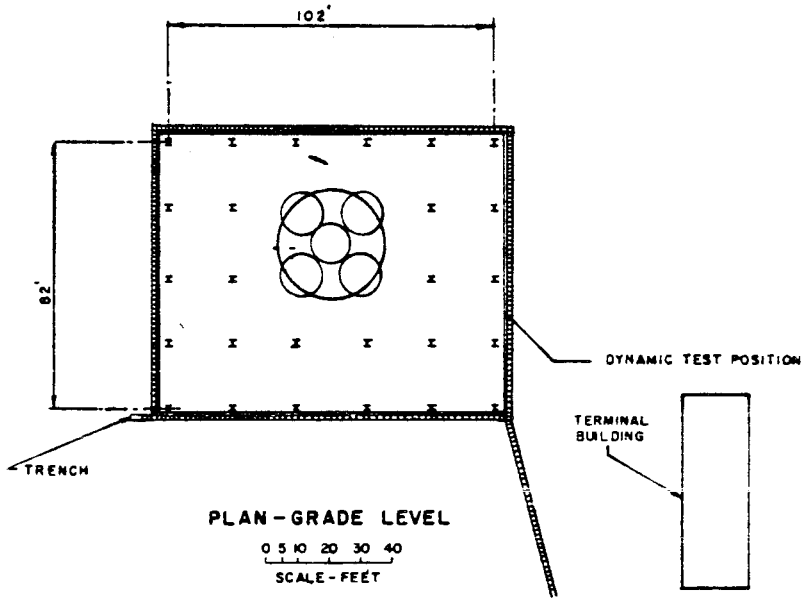
VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

ADVANCED SATURN DYNAMIC TEST FACILITY



PERSPECTIVE VIEW



PLAN - GRADE LEVEL

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

ANTENNA FACILITY - JOHANNESBURG STATION

ANTENNA FACILITY - WOOMERA STATION

DESCRIPTION:

Additional antenna facilities are required to enable the existing overseas Deep Space Stations to handle the planned workload of the expanding lunar and planetary spacecraft programs. The two new antennas will supplement the currently installed overseas Deep Space facilities and to achieve the same spatial coverage, must be located at approximately the same longitudes. The present overseas Deep Space Stations are located at Woomera, Australia and Johannesburg, South Africa. Each of the new facilities will consist of a 85-foot diameter paraboloidal antenna; drive and positioning devices; receiving and servo electronics; radio frequency feeds; and recording, data handling, and communications equipment. The project also includes the necessary technical and support buildings and utilities.

JUSTIFICATION:

Beginning in the calender year 1964, the increasing number of space flights in the lunar and planetary programs will result in requirements for tracking and data acquisition coverage which exceed the capacity of the present overseas Deep Space Stations. By 1964, both stations will already be operating nearly three shifts, seven days a week. The launching of two Venus missions and two Mars missions is proposed during the appropriate periods of planetary approach in 1964. These spacecraft will be in flight concurrently with the several lunar landing and lunar orbital missions also planned for 1964. The demands for full time coverage of portions of individual missions, and the relative configurations of the lunar and planetary flight trajectories are such that, for extended periods of time, these concurrent missions cannot be adequately covered by a single antenna at a given Deep Space location. The two antennas requested under this project will provide the additional capacity to meet these increased requirements. Fiscal year 1963 funding is necessary to allow for suitable construction lead time.

COST ESTIMATE:

A. LAND ACQUISITION..... ---

B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$970,000
	Site preparation.....	$250,000	
	Access and site roads.....	200,000	
	Diesel generators.....	120,000	
	Utility connections.....	250,000	
	Communications installations.....	150,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		980,000
	Antenna and mount.....	545,000	
	Antenna installation and erection.....	200,000	
	Collimation tower and housing.....	105,000	
	Control building (1,200 square feet at $25.00 per square foot).....	30,000	
	Technical buildings (1,500 square feet at $25.00 per square foot).....	37,500	
	Support buildings(2,500 square feet at $25.00 per square foot).....	62,500	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		2,940,000
	Servo hydraulics systems.....	275,000	
	Antenna data systems.....	365,000	
	Antenna feeds.....	225,000	
	Receiving systems.....	335,000	
	Instrumentation and recording equipment....	475,000	
	Intrasite communication system.....	225,000	
	Test equipment.....	335,000	
	Support Equipment (optical, boresite, time standards, and video).....	170,000	
	Antenna control consoles and displays.....	325,000	
	Collimation system.....	110,000	
	Intrasite cabling.....	100,000	
E.	DESIGN AND ENGINEERING SERVICES.....		110,000
	Total estimated cost (per station).....		$5,000,000
	Total estimated cost.....		$10,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

DATA ACQUISITION FACILITY, FAR EAST STATION

DESCRIPTION:

The construction and installation of a high-gain, wide-band data acquisition facility is required in the northern latitudes of the Far East.

The location of the facility will have to be essentially free of electromagnetic radiation interference and suitable for economical year-round access. The precise location will be the best compromise in providing a minimum of duplicate coverage with that of the Rosman, North Carolina Station considering factors of economy, logistics, and geo-political problems. The area of the tract must be suitable for the installation of an 85-foot parabolic antenna, suitable buildings for operations, utilities, and logistics, and for future expansion as dictated by flight program requirements.

The antenna system will be an 85-foot parabolic, prime-focus-fed dish, with a provision for subsequent modification to Cassegrain feed to improve performance at single-frequency operation. The design characteristics will be more stringent than the 85-foot antennae presently in existence, which will permit suitable operation with little degradation in tracking and pointing accuracy up to frequencies of 10 kilomegacycles per second (KMc/s). The antenna mount will be of the X-Y type designed specifically for satellite tracking. The feeds will provide auto-tracking capabilities at 136 megacycles per second (Mc/s), 400 Mc/s, and the 1700 Mc/s and 2290 Mc/s bands. The servo-system and associated tracking electronics will permit antenna control in the following modes: automatically on satellite signals; manually; by precomputed teletype drive tapes; by slaving to another antenna for acquisition or programmed search.

The electronics will include telemetry receivers for 136 and 400 Mc/s and tracking receivers for 136 and 400 Mc/s. Tape recorders for recording telemetry data and the necessary time standard for correlation of telemetry data with tracking data will be provided. General-purpose pulse code modulation (PCM) demodulating equipment, including a real-time data display, will permit the control of the large scientific satellites.

The physical facilities will include a 12,800-square-foot operations building, comprising 1,500 square feet for antenna operations

and receiver area; 1,500 square feet for data recording and data reduction; 3,000 square feet of office, darkroom, and storage space; and 6,800 square feet for laboratories and utilities. A generator building of about 1,600 square feet will provide housing for four 240-KVA diesel generators, garage, and utilities. A 750-square-foot building will house the antenna hydraulic drive system. Some supporting facilities for the operating personnel may be required. Two collimation towers, with small transmitter buildings at the bases, will be located 1 to 5 miles from the 85-foot antenna. The project includes fencing, hard-surface roads, power, and inter-communications lines.

JUSTIFICATION:

To meet the minimum program requirements of the large scientific satellites, data should be acquired from at least 60 percent of the spacecraft orbits. The facilities at Rosman, North Carolina Station, in conjunction with the facility proposed in this project, will permit the minimum program requirements to be met for such important satellites as the Eccentric Geophysical Observatories and the Orbiting Astronomical Observatories.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$402,000
	Site and access road grading and paving	$100,000	
	Diesel generators, including automatic transfer gear, split bus, dummy load, and fuel storage tank	220,000	
	Electrical connections	23,000	
	Water supply system and storage tank	20,000	
	Septic tank and drain field	10,000	
	Fencing	10,000	
	Access and power to collimation towers	19,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,538,000
	Antenna foundation	100,000	
	Antenna, mount and installation	980,000	
	Generator building (1,600 square feet at $25.00 per square foot)	40,000	
	Hydraulics building (750 square feet at $20.00 per square foot)	15,000	
	Operations building (12,800 square feet at $30.50 per square foot)	393,000	
	Collimation towers	10,000	

D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		$3,725,000
	Antenna feeds (136-400-1700-2290 Mc/s)	$110,000	
	Tracking receivers	385,000	
	Parametric amplifier system (400 Mc/s)	80,000	
	Telemetry receivers	510,000	
	Recorders	240,000	
	Antenna servo system	375,000	
	Antenna data system	435,000	
	Command system	115,000	
	Antenna $35,000		
	Transmitter 40,000		
	Consoles 40,000		
	Support system	210,000	
	Collimation system 104,000		
	Optical system 68,000		
	Intercom and telephone systems 20,000		
	Time standard 18,000		
	Electronics installation and checkout	335,000	
	Test equipment and initial spares	245,000	
	Diversity combiners	80,000	
	Real-time data display	240,000	
	General purpose PCM demodulators	365,000	
E.	DESIGN AND ENGINEERING SERVICES		335,000
	Total estimated cost		$6,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

DATA ACQUISITION FACILITY, ROSMAN STATION

DESCRIPTION:

It is proposed to design, fabricate and install an additional 85-foot parabolic antenna and associated electronics at the Rosman, North Carolina Data Acquisition Facility.

The antenna system will be an 85-foot parabolic, prime-focus-fed dish, with a provision for subsequent modification to Cassegrain feed to improve performance at single frequency operation. The technical characteristics of the antenna surface will permit operation, with little degradation, up to frequencies of 10,000 megacycles (Mc/s). The antenna mount design will be of the X-Y type designed specifically for satellite tracking. The feeds will provide auto-tracking capabilities at 136 Mc/s, 400 Mc/s, and the 1700 Mc/s and 2290 Mc/s bands. The servo-system and associated tracking electronics will permit tracking automatically on satellite signals, manual tracking, tracking by teletype tape drive, slaving to another antenna for acquisition or programmed modes of search for acquisition.

The electronics will include telemetry and tracking receivers for 136 and 400 Mc/s, and suitable recorders to permit operation simultaneously with the prime data acquisition system.

The physical facilities will include the addition of about 6,000 square feet to the present operations building, a separate hydraulics building, and additional space in the present power generator building to house four 200-KVA diesel generators.

The necessary optics for collimation and electronic test equipment and critical spares will be included in the project.

JUSTIFICATION:

The Rosman, North Carolina Station will be the primary U. S. data acquisition station for the large scientific satellites currently programmed to start in the calendar year 1962. Initial funds for its construction were provided in the fiscal year 1962 construction program. To meet the program requirements of such large satellites as the Eccentric Geophysical Observatories, the Polar Orbiting Geophysical Observatories, and the Orbiting Astronomical Observatories would require that the Rosman facility be operated in excess of 24 hours per day during calendar year 1964 and later. To effectively handle this workload, a second antenna is required at the Rosman Station.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$160,000
	Diesel generators including automatic transfer gear, split bus, dummy load, and fuel storage tank	$160,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,250,000
	Antenna foundation	100,000	
	Antenna mount and installation	950,000	
	Generator building addition...(1600 square feet at $18.50 per square foot)	30,000	
	Hydraulics building...(750 square feet at $20.00 per square foot)	15,000	
	Operations building addition...(6000 square feet at $25.60 per square foot)	155,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		2,005,000
	Antenna feeds (136-400-1700-2290 Mc/s)	100,000	
	Tracking receivers	365,000	
	Parametric amplifier system (400 Mc/s)	75,000	
	Telemetry receivers	230,000	
	Diversity combiners	35,000	
	Recorders	115,000	
	Antenna servo system	345,000	
	Antenna data system	400,000	
	Command antenna	30,000	
	Optical system	65,000	
	Intercom and telephone systems	20,000	
	Test equipment and initial spares	125,000	
	Electronics installation and checkout	100,000	
E.	DESIGN AND ENGINEERING SERVICES		85,000
	Total estimated cost		$3,500,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM

DESCRIPTION:

This project consists of the construction at Edwards Air Force Base, California, of four (4) single-position single-engine static test stands and associated control center, propellant, electrical, water, storage, and support facilities; the construction of facilities and the procurement of additional equipment required at the contractor's plants in Canoga Park, California, and Santa Susana, California, for the production of engines; and the facilities and equipment required at the three locations to support a continuing development program.

The initial increment of $16,775,000 provided for this project in the fiscal year 1962 appropriation funds the design and the initial increments of construction and equipment for three of the four stands at the Edwards Air Force Base ($13,620,000); the installation of facilities and equipment for development work at the Edwards Air Force Base ($2,022,000); the procurement of equipment for development work at Canoga Park ($670,000); and the design, facility modifications, and procurement of equipment for expansion of the liquid oxygen system at Santa Susanna ($463,000).

The funding requested in the fiscal year 1963 budget will complete the entire project including construction of the fourth stand to be built on a site to be selected in proximity to the other three stands; $22,700,000 is requested for completing the construction of the four test stands and $2,300,000 for environmental, production, and tooling equipment at the contractor's Canoga Park plant for the production of engines and the support of a continuing development program. A sketch of the Edwards Air Force Base facility indicating the location of three of the static test stands is shown on page CF 14-G3.

JUSTIFICATION:

Production testing facilities are required to meet the scheduled engine delivery requirements for the 1,500,000 pound thrust kerosene-oxygen (F-1) engine. Four stands are required to provide three F-1 engine tests per month per stand.

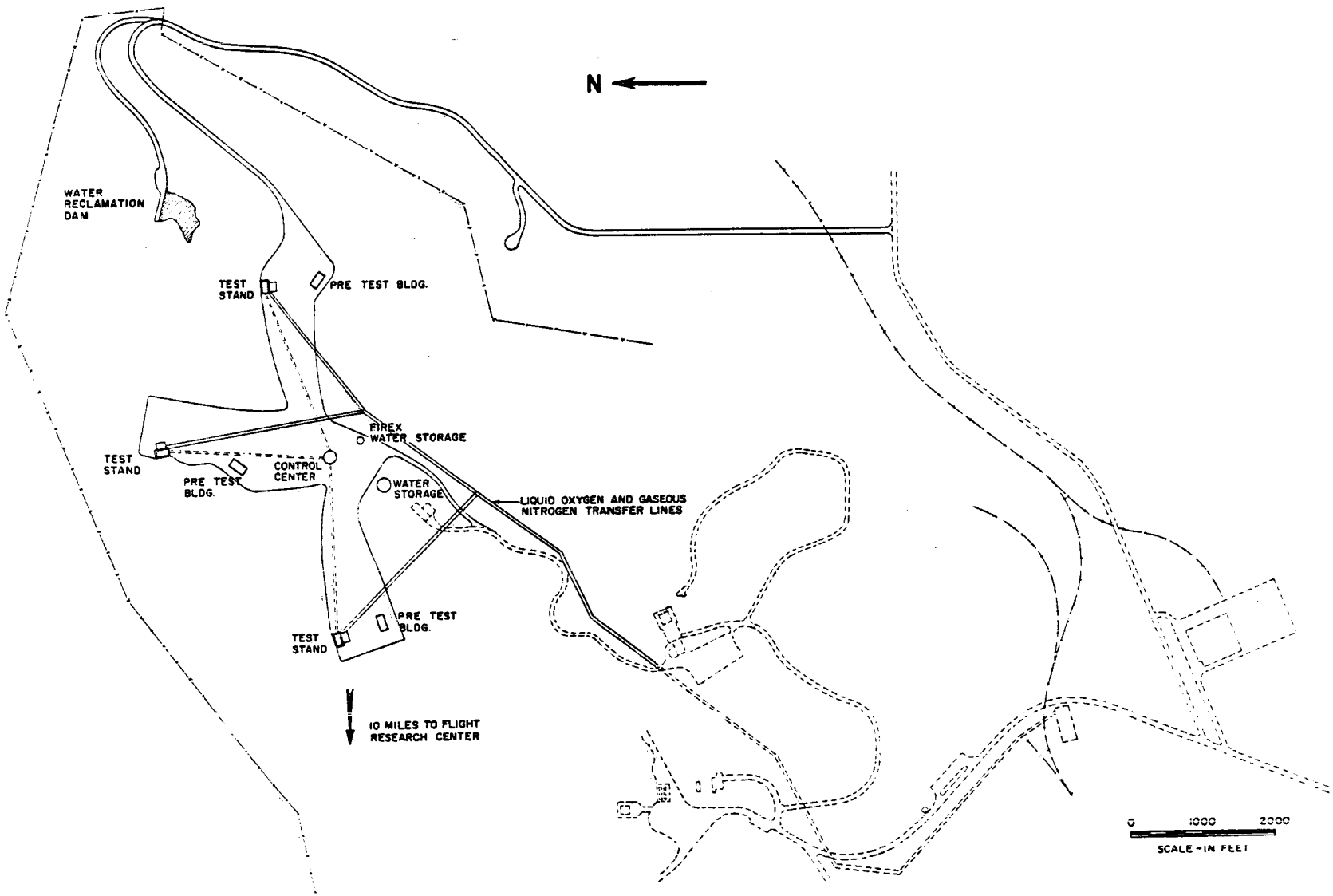
The F-1 booster vehicle engine is the most powerful single-chamber engine under development. It will be used in the vehicles for the manned lunar landing mission, and for manned exploration of the space environment. The size of the F-1 engine and its components produces unique and specialized requirements for their fabrication and testing. The required size of engine test stands, components test stands, support systems, and utilities for F-1 engine acceptance testing precludes the modification of existing test facilities.

In addition to F-1 engine acceptance test stands, laboratory, environmental, production, and tooling equipment is required at the contractor's plant. This equipment is necessary to expedite and simplify the manufacturing, inspection, and testing of F-1 engine components.

COST ESTIMATE:		Fiscal Year 1962		Fiscal Year 1963
Acceptance Static Test Facility Flight Research Center (Edwards Air Force Base):				
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$2,400,000		$500,000
Clearing brush.....	$20,000		---	
Core boring.....	80,000		---	
Excavation.....	450,000		$250,000	
Site grading.....	450,000		250,000	
Roads.....	350,000		---	
Service area paving..	150,000		---	
Utility installation (electrical).....	400,000		---	
Utility installation (water).....	500,000		---	
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		3,380,000		8,870,000
Four (4) single-position test stands and control center:				
Stand foundations....	750,000		1,500,000	

VARIOUS LOCATIONS
FISCAL YEAR 1963 ESTIMATES

FACILITIES FOR F-1 ENGINE PROGRAM



Stand superstructures	$1,480,000		$3,200,000	
Flame deflector structures.....	500,000		1,000,000	
Control center.....	400,000		200,000	
Underground passage-ways.....	250,000		700,000	
Electric support rooms; heat and blast proof; 4 each (1200 square feet at $166 per square foot).....	---		800,000	
Pre-test buildings; 4 each (10,000 square feet at $20 per square foot)...	---		800,000	
Pump houses; 2 each (1800 square feet at $12.50 per square foot).....	---		45,000	
Observation bunkers; blast proof; 8 each (84 square feet at $149 per square foot)	---		100,000	
Modifications to test stand 1-A for follow-on R&D program:				
Addition of environ-mental simulation capability.....	---		225,000	
Addition of gim-balling capability	---		300,000	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		$7,040,000		$9,605,000
Pressurizing systems.	1,080,000		1,000,000	
Fuel systems.....	1,650,000		3,700,000	
Test stands instru-mentation.....	2,100,000		2,300,000	
Control room instru-mentation.....	800,000		1,000,000	
Electrical system....	230,000		355,000	
Fire protection and water system.....	780,000		---	
Miscellaneous.....	400,000		450,000	
Water system.....	---		800,000	
E. DESIGN AND ENGINEERING SERVICES.....		800,000		3,725,000
Total.....		$13,620,000		$22,700,000

Deepened Existing R&D Program Flight Research Center (Edwards Air Force Base):		Fiscal Year 1962	Fiscal Year 1963
A. LAND ACQUISITION.....		---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$12,000	---
Site preparation and erosion control, test stands 1-A and 1-B...	$12,000		
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		380,000	---
Construction of second position, test stand 2-A.....	380,000		
D. EQUIPMENT, INSTRUMENTATION AND SUPPORT SYSTEMS.....		1,410,000	---
Equipment.....	640,000		
Instrumentation.....	610,000		
Support systems.....	160,000		
E. DESIGN AND ENGINEERING SERVICES.....		220,000	---
Total.....		$2,022,000	---
Development Equipment - Canoga Park (Rocketdyne):			
A. LAND ACQUISITION.....		---	---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		---	$10,000
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		---	200,000
Brazing and assembly room; 50 feet high; ..(3600 square feet at $55.50 per square foot).....	---	$200,000	

D.	EQUIPMENT, INSTRUMENTATION AND SUPPORT SYSTEMS.....	$670,000	$2,080,000
	Equipment..... $525,000		
	Tooling..... ---		
	Instrumentation..... 130,000		
	Support systems..... 15,000		
E.	DESIGN AND ENGINEERING SERVICES.....	---	10,000
	Total.....	$670,000	$2,300,000
	Liquid Oxygen System Expansion - Santa Susana Air Force Plant No. 56 (Rocketdyne):		
A.	LAND ACQUISITION.....	---	---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....	15,000	---
	Site preparation.... 5,000		
	Utility connections. 10,000		
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....	50,000	---
	Facility modification..... 50,000		
D.	EQUIPMENT, INSTRUMENTATION AND SUPPORT SYSTEM.....	373,000	---
	Equipment..... 250,000		
	Instrumentation..... 123,000		
E.	DESIGN AND ENGINEERING SERVICES.....	25,000	---
	Total.....	$463,000	---
	Total estimated cost....	$16,775,000	$25,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM

DESCRIPTION:

This project consists of modifications to the two (2) existing Delta 2 static test stands and to the Delta 3 static test stand located at the Government-owned contractor-operated (Rocketdyne) Propulsion Field Laboratory, Santa Susana, California; and modifications of production and development test facilities at the same location. These facilities are required in the acceptance and development testing of the 200,000 pound thrust hydrogen-oxygen (J-2) engine to be used in the manned lunar landing mission program. The existing test stand complexes previously used in the Air Force Atlas program must be modified to accommodate new engine mounting structures, and oxidizer and liquid hydrogen propellant storage facilities and transfer lines.

The initial fiscal year 1962 increment of this project provided funds in the amount of $7,250,000 for modifications to two (2) Delta 2 stands; and the initiation of the modification of facilities and the installation of equipment to support the development of the J-2 engine, including the testing of engine component hardware within a simulated operating environment (vacuum-temperature) of space.

The fiscal year 1963 budget request for $4,000,000 will complete the construction requirements for facilities for the 200,000 pound thrust engine program. It will provide for additional modifications to the Delta 3 stand; the modification and construction of production and development test facilities; and the acquisition of laboratory, production and test equipment, instrumentation, and support. A sketch of the facilities is shown on the following page.

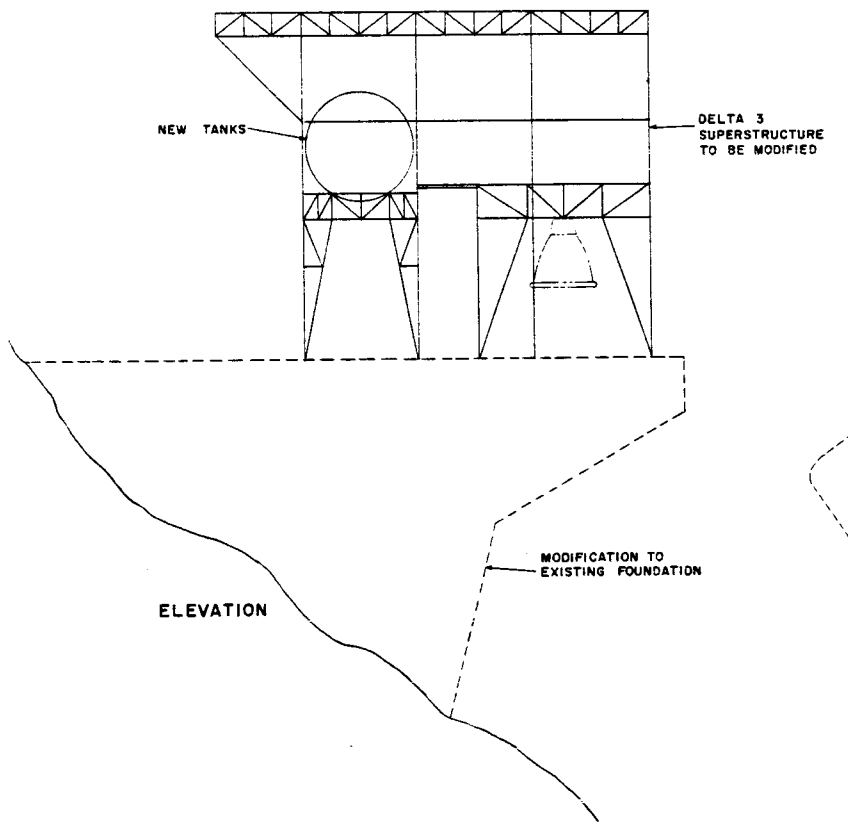
JUSTIFICATION:

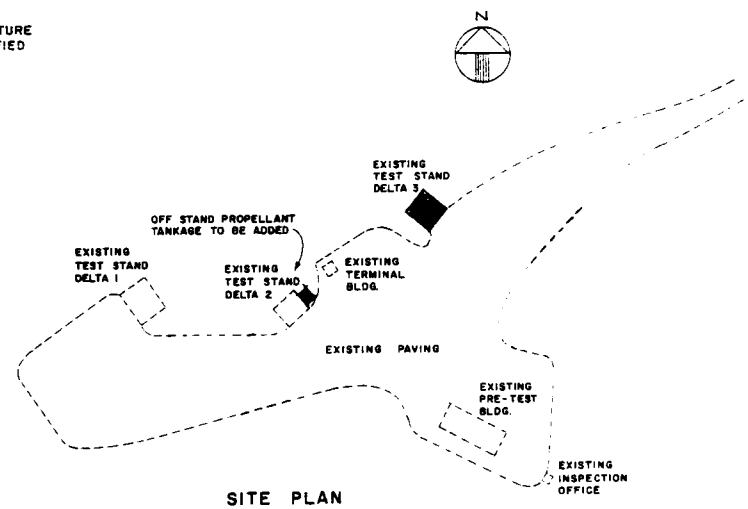
The J-2 engine is a high specific impulse rocket engine which will be used as the second and third stages of the Advanced Saturn configuration, and as the third stage of the NOVA vehicle.

To meet flight dates with an engine of the reliability required for manned flight missions the facilities in this project are essential to support development and acceptance testing of the J-2 engines. During the fiscal year 1963 the development effort will reach its peak and testing will progress at an accelerated rate to prove reliability and performance, and to detect and correct design and fabrication deficiencies. The J-2 engine

VARIOUS LOCATIONS
FISCAL YEAR 1963 ESTIMATES

FACILITIES FOR J-2 ENGINE PROGRAM





DELTA FIRING AREA - AIR FORCE PLANT No. 57
SANTA SUSANA, CALIFORNIA

delivery schedule requires a complete acceptance testing facility ready for operation by September 1963.

The total number of stands required is based on the twofold requirements of research and development testing, and production testing. One Delta 2 stand will be used on a continuing basis for system research and development throughout the production period. One position of the second Delta 2 stand will also be oriented toward research and development but will retain capability for system altitude simulation; the second position of the second Delta 2 stand, as well as both positions of the Delta 3 stand, will be devoted to production testing. The quantitative needs for production testing are based upon an average requirement of one position per week per engine; this schedule establishes the need for three test positions to minimize slack time.

COST ESTIMATE - DELTA 2 STAND:		Fiscal Year 1962		Fiscal Year 1963
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$38,000		---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		2,667,460		---
Test stand modification.....	$90,600		---	
Liquid hydrogen storage and transfer systems...	1,282,000		---	
Liquid oxygen systems.....	7,000		---	
Gaseous hydrogen systems.....	259,500		---	
Altitude equipment support.....	608,360		---	
Off-stand propellant tankage.....	420,000		---	
D. EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		281,420		---
High frequency instrumentation and recording equipment.....	177,140			
Laboratory and shop equipment.....	104,280			
E. DESIGN AND ENGINEERING SERVICES....		183,120		---
Subtotal, Delta 2 stand.....		$3,170,000		---

COST ESTIMATE - DELTA 3 STAND:		Fiscal Year 1962		Fiscal Year 1963
A. LAND ACQUISITION.....		---		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		---		---
C. FACILITY CONSTRUCTION AND MODIFICATIONS.....		$924,000		$2,352,000
Structural and foundation work.....	$168,000		$84,000	
Propellant storage and transfer system including hydrogen recovery system.....	168,000		756,000	
New superstructure and tankage.....	588,000		1,260,000	
Modifications to test facilities in the components test laboratory.....	---		252,000	
D. EQUIPMENT, INSTRUMENTATION AND SUPPORT SYSTEMS.....		2,900,000		1,104,000
Electro-deplating and electrostatic metal removal equipment...	---		504,000	
Liquid hydrogen flow calibration equipment.....	200,000		---	
Environmental laboratory equipment.....	---		200,000	
Development and production test equipment.....	2,700,000		---	
Instrumentation, controls, and cabling.....	---		400,000	
E. DESIGN AND ENGINEERING SERVICES....		256,000		544,000
Subtotal, Delta 3 stand.....		$4,080,000		$4,000,000
Total estimated cost.....		$7,250,000		$4,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

FACILITIES FOR M-1 ENGINE PROGRAM

DESCRIPTION:

The construction of four dual static test positions is required for the development of the 1,000,000 pound thrust hydrogen-oxygen engine. This engine is designed to serve in the second stage of the NOVA vehicle. By using higher impluse propellants in the second stage, NOVA payloads will be increased significantly. It will thus be possible to transport a large vehicle capable of achieving a manned lunar landing and subsequent return without the need for a space refueling effort.

An engine contractor has not been selected for this program. This project writeup is, therefore, not based upon a specific location, but upon typical facilities presently available at engine contractor installations. After a contractor is selected and engineering studies completed, detailed requirements and cost estimates can more accurately be established.

Based upon an evaluation of existing facilities it is considered that the necessary test positions can be acquired through extensive modifications or additions to existing facilities. The work will generally include the removal of existing superstructures, making structural changes or additions, the fabrication and installation of flame deflectors, the installation of propellant run tanks with necessary piping and appurtenances, and the fabrication of a new steel superstructure for the erection of support run tanks and engine mounts. It is also proposed to equip one test position with an altitude simulation capability.

Other typical requirements may include the need to modify or construct component test cells, increased propellant storage and pressurization facilities, transfer lines, a gaseous hydrogen recovery system, and additional control cables for new instrumentation to be located within the control center.

JUSTIFICATION:

Research and development funds will be obligated in the fiscal year 1962 to initiate work on the M-1 engine development program. Work will be started on individual engine components and on the complete engine system. The research and development funding in the fiscal year 1963 will reach a level of about $55,000,000. The development program will subsequently progress to a stage which will require testing of the full-

scale engine. These engine tests will be experimental in nature and will consist of complete engine assembly runs to detect and eliminate design and fabrication malfunctions and deficiencies. The test stands and component test facilities must be funded during the fiscal year so that their design and construction may keep pace with the development program.

Four positions are considered necessary to meet the research, development, and production schedules. Detailed computations concerning the level of position requirements have been completed.

The total facility requirements for this program cannot be firmly established until a contractor is selected. Based upon average requirements, however, it is estimated that additional subsequent years' funding of approximately two million dollars may be required.

COST ESTIMATE:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$500,000
	Site preparation	$200,000	
	Utility connections	300,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		8,060,000
	Test stand modifications	7,260,000	
	Components test cell modifications	800,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		5,600,000
	Propellant storage and transfer systems	2,800,000	
	Gaseous hydrogen recovery system	1,200,000	
	Instrumentation and controls	900,000	
	Equipment	700,000	
E.	DESIGN AND ENGINEERING SERVICES		1,840,000
	Total estimated cost		$16,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

MANNED SPACE FLIGHT CONTROL CENTERS

DESCRIPTION:

The Manned Lunar Landing Program requires the following control centers:

Modifications to the Mercury control center: This work will include the addition of trajectory displays for flight control functions associated with the mission objectives of the Gemini program. Gemini missions will include unmanned and manned orbital flights of the spacecraft and ultimately, accomplishment of a rendezvous between the Gemini spacecraft and an Agena target vehicle. New and additional consoles for support of the flight control functions will be required to effect control of the Agena target vehicle.

Revisions and extensions will be made to telemetry systems to permit real-time and near real-time monitoring of additional parameters from the complex spacecraft and the Agena target vehicle. Improved data handling systems will be required for automatic data processing and for an increased rate of data handling. Revisions will be made to the communication center to permit communication capability with Gemini and possibly Apollo launch facilities and with the necessary guidance and control facilities. Additional building space will be added to house new equipment.

Apollo mission control center: While neither the configuration or the location of this center have been established, it is estimated the center will require the following facilities:

(a) Computer complex: This facility will provide the center with a computational capability and computational rate which will be sufficient to handle the data processing necessary for real-time determination of vehicle position and velocity, for spacecraft systems checkout, mission analysis, and other associated computations throughout the flight phase of the mission. The computer complex will also be capable of computations required for simulation and training exercises.

(b) Communications switching and distribution facility: Switching, relay, and distribution panels will be required to control and direct the information flow associated with the center.

The information flow includes voice communication capability to and from the spacecraft via relay through any of the remote stations; the transmission of guidance commands, event information and other data to the spacecraft; the reception of processed vehicle telemetry data from remote stations; the control and conduct of all ground support activities; and all tracking and tracking support data.

(c) Teletype facilities: This communication media will supplement and provide a backup for voice communications and telemetry links. Nonmission logistics support traffic will normally be handled via teletype.

(d) Spacecraft simulator facility: A facility is required to allow spacecraft and associated equipment to operate in conjunction with simulator equipment to provide astronaut and mission personnel training and procedural development.

(e) Mission operation facilities: Space is required for prelaunch, powered flight, space flight, and recovery monitoring. Included will be support areas equipped with appropriate data display areas, plotboards, status boards, consoles, communication systems, and associated control amplifier equipment.

(f) Audio, video, telemetry recording, and playback equipment: Magnetic tape recording devices and associated playback equipment will provide for post-mission analysis and during-mission analysis of communications, television, spacecraft systems and medical data which are not evaluated in real time or require extended evaluation periods; means will also be provided for the re-evaluation of real-time data.

(g) Data selecting and processing equipment: This equipment will permit automatic computer programming, storage, and selecting. Computational capability will be provided for the processing and editing of data for determination of the data format and computer program selection to most efficiently utilize available information flow from remote stations linked to the spacecraft.

(h) Meteorological and space phenomenon forecasting facilities: The center will include the capability of monitoring data pertaining to the atmospheric density, world-wide weather complex, cosmic storms, radio-frequency propagation, meteorite storms, space radiation intensities, and other space phenomena which bear directly upon mission success.

(i) General facilities: Areas will be provided for building maintenance, storage, systems maintenance, engineering tests, viewing rooms, and engineering and administrative support.

Preliminary planning indicates the need for a two-story structure with a partial subfloor to provide approximately 50,000-70,000 square feet of floor space. Special requirements for this structure are high ceiling areas, false flooring areas with movable panels, and subflooring areas for cable routing.

Apollo landing and recovery control centers: The proposed configuration of these centers has not been fully developed. It is estimated that four of the centers will be required each to include a landing and recovery control area equipped with appropriate control consoles and data displays for the presentation of navigation and guidance information derived from tracking, communication, and telemetry data. High frequency, ultra high frequency, single side-band, and land cable communications equipment will be provided at the centers, which will be compatible with voice and teletype communications at the Apollo mission control center, on-board the spacecraft, and within the recovery forces. Telemetry, tracking, and data processing equipment will be required to facilitate ground controlled approach landings of the spacecraft. Facilities will be provided for building maintenance, electrical power generation (normal and emergency), and for engineering and administrative support. A one-story facility is planned for each center, to provide approximately 5,000 square feet of floor space.

JUSTIFICATION:

Modifications to the Mercury control center: The Mercury control center in its present configuration is inadequate to provide the necessary flight control support of the projected earth orbital missions which include Gemini missions, and possible early Apollo orbital missions. Modifications to the center are required, to monitor and control the flight throughout extended orbital missions and during complex rendezvous missions. Some additions to handle overall control and coordination of the world-wide ground support facilities will also be provided.

The modifications are required to increase the rate of data handling, to revise the data systems for compatibility with Apollo and Gemini systems, to extend the communications facilities to include additional network stations and launch complexes at the Atlantic Missile Range, and to expand the operations room, equipment, and training facilities to meet requirements associated with new spacecraft types and missions. Modified and revised trajectory displays, plotboards, recorders, and launch vehicle and spacecraft systems monitoring and control consoles are also required for increased capability and for compatibility with the various launch vehicle and spacecraft systems.

Apollo mission control center: A mission control center is required for support of the manned lunar missions. The existing Mercury control center was designed for support of earth orbital missions and, even if modified, would be inadequate to support orbital and deep-space missions simultaneously, a condition which will exist during the Apollo time period.

The proposed Apollo center is required to monitor the spacecraft and to provide overall control of all support elements throughout each phase of the mission. The center will have direct communication (including voice and data transmission) with the launch control facilities at the Atlantic Missile Range; with remote sites having spacecraft communications, telemetry, and tracking capability; and with remote recovery control stations.

The center will support the spacecraft crew by providing a ground-based source of information and data for use during normal, alternate, or emergency mission periods, to increase flight safety and performance. The center will also include the simulation and training facilities associated with the spacecraft and the remote stations for personnel training and procedural development. This requirement is an absolute necessity for exploratory type missions.

The fiscal year 1963 funds requested for this project are for design and engineering services; additional funds will be required in the fiscal year 1964 for the implementation of a complete functional facility.

Apollo landing and recovery control centers: The Apollo mission objectives include the specific attainment of a controlled land landing at a predetermined location. Inherent in this objective, and in association with minor perturbations in trajectory dispersions, is a demand for adequate ground support to insure attainment of the mission objectives with the necessary assurance of crew safety. Therefore, this ground support must consist of strategically located landing and recovery control centers, plus associated ground guidance and approach control equipment, and the logistics associated with their operational integration into the mission support complex.

The Apollo landing recovery control centers will supplement the flight control functions of the ground operational support system and will enhance the safety of the Apollo missions. The centers will facilitate the information flow required during the terminal phase of a mission to assist the spacecraft crew in reentry and landing by providing flight control information instruction to effect a ground controlled approach landing. The centers will also assist in recovery by coordinating and controlling the retrieval operation with the spacecraft crew and the earth recovery personnel.

Four centers will be required for support of the Apollo missions. Two centers are proposed to be located at each of the primary and secondary landing zones; one down-range and one up-range to allow for contingencies which may arise from overshoot and undershoot. Two landing zones provide an increased mission flexibility and provide for recovery in the event of mission abort and difficulties that may result from weather or other factors.

COST ESTIMATES:

Modifications to the Mercury control centers:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$5,000
	Site preparation	$5,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		80,000
	Addition to present Mercury control center (1,600 square feet of area at $50 per square foot)	80,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		4,320,000
	Consoles and associated equipment	600,000	
	Telemetry system	1,300,000	
	Automatic data processing equipment	1,500,000	
	Communication equipment addition	920,000	
E.	DESIGN AND ENGINEERING SERVICES		595,000
	Subtotal, Mercury center		$5,000,000

Apollo mission control center:

A.	LAND ACQUISITION	---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS	---
C.	FACILITY CONSTRUCTION AND MODIFICATIONS	---
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS	---
E.	DESIGN AND ENGINEERING SERVICES	$5,000,000
	Subtotal, Apollo center	$5,000,000

Apollo landing and recovery control centers:

A.	LAND ACQUISITION		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$310,000
	Utilities - 4 sites at $20,000 per site	$80,000	
	Roads and landing strips	230,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS		1,200,000
	4 buildings; 5000 square feet per building; (20,000 square feet total at $50 per square foot)	1,000,000	
	Antenna mount construction	200,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		6,330,000
	Communication, tracking, and data processing equipment	3,500,000	
	Instrumentation	1,630,000	
	Support systems	1,200,000	
E.	DESIGN AND ENGINEERING SERVICES		160,000
	Subtotal, Apollo landing and recovery control centers		$8,000,000
	Total estimated cost		$18,000,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

SPACE RADIATION EFFECTS LABORATORY

DESCRIPTION:

This project proposes construction of a space radiation effects laboratory capable of simulating the high energy corpuscular radiation, both electrons and protons, encountered in trajectories or orbits of proposed space vehicles. Special significance is attached to the simulation of electrons and proton energy of the belts and the proton flux of the solar flare radiation. Two accelerators are included: one a linear electron accelerator; the other a frequency modulated cyclotron capable of accelerating heavier charged particles of which the proton is the most significant.

The linear electron accelerator will be a self-contained commercial unit rated at 2 to 10 Mev. The essential elements of the device are an L-band klystron (1,300 mc) and an accelerator waveguide. The klystron will provide both the source of electrons and the source of radio-frequency power to drive the waveguide. By means of a novel mechanical arrangement, a single colinear vacuum system (10-8 mm Hg) can be established from the hot cathode electron source through the klystron and waveguide to the exit window. Beam power can be continuously variable, and the electron beam can be diffused to cover a target 10 inches by 4 inches at 2 feet from the exit window. Electron dose rates can be varied continuously from zero to 5×10^8 roentgens per minute. This unit has the further advantage that by replacing the exit window by either a heavy metal target or a beryllium target a source of X-rays or neutrons can be made available. X-ray doses are variable to a maximum of 5×10^6 roentgens per minute, and a total neutron production of 1×10^{11} neutrons per second can be obtained. Total power input to the device is estimated at 75 kva.

The heavy ion accelerator will be a frequency modulated cyclotron capable of accelerating pulses of protons to an energy of about 600 Mev. The beam intensities produced will be of the order of 1 microampere or $6 \times 10^{+12}$ particles per second. By changing the gas in the ion source from hydrogen to heavy hydrogen or helium, the accelerated ions can be changed from protons to deuterons or alpha particles with an energy approximately proportional to the increase in mass provided the radio frequency can be reduced sufficiently.

It is estimated that a cyclotron of this capacity will require a magnet consisting of 2,500 tons of iron and 150 tons of oil-cooled copper wire windings. The magnet will be energized by a 600-kw motor generator set. Radio-frequency power of about 200 kw and of variable frequency will also be required to energize the dees or accelerating electrodes. The maximum radius of the beam will be 89 inches. The facility will be approximately 35 feet in diameter and 22 feet high.

The cyclotron will differ from those widely used in basic physics research by having somewhat specialized beam ejection and control. It is desired that the beam be diffused in order to cover the larger targets than are envisaged, that is, material specimens and electronic circuitry. Targets as large as 1 square foot are being considered.

Both accelerators will require substantial shielding for the protection of operating personnel. The linear accelerator can be housed in a small room with concrete walls of the order of 3 feet thick. The frequency modulated cyclotron presents a more serious shielding problem. Heavy shielding blocks will be assembled about the cyclotron at ground level. These walls will be about 12 feet thick.

The building to house both accelerators and the control rooms will enclose approximately 11,000 square feet. A sketch of the proposed installation is shown on the following page.

JUSTIFICATION:

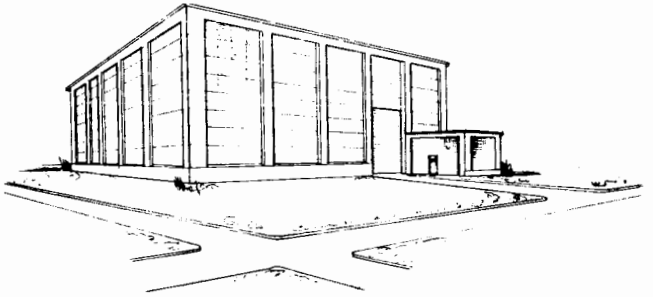
The exploration of space by satellites and probes, and the correlation of the resultant data with earth-observed phenomena have revealed that one of the most difficult hazards of the space environment that must be designed against, for both men and equipment, is corpuscular radiation of high energy and high flux. Direct evidence of extremely energetic particles, the cosmic rays, has been available for many years from observations on earth and in the atmosphere, but their flux is of such low intensity that they do not constitute a hazard except for extremely long-duration flights. Of much more serious concern are the electrons and protons that are trapped by the earth's magnetic field in the Van Allen Belt and the clouds of protons ejected by the sun which stream outward toward the earth.

Data obtained from satellites and probes have indicated that the trapped radiation of the inner belt are protons of energies up to about 500 Mev and of integrated fluxes of order 10^3 particles per cm^2 - second - steradian and of the outer belt are electrons of energy from 20 Kev to 1 Mev and of maximum fluxes of 10^7 to 10^{11} per cm^2 - second - steradian.

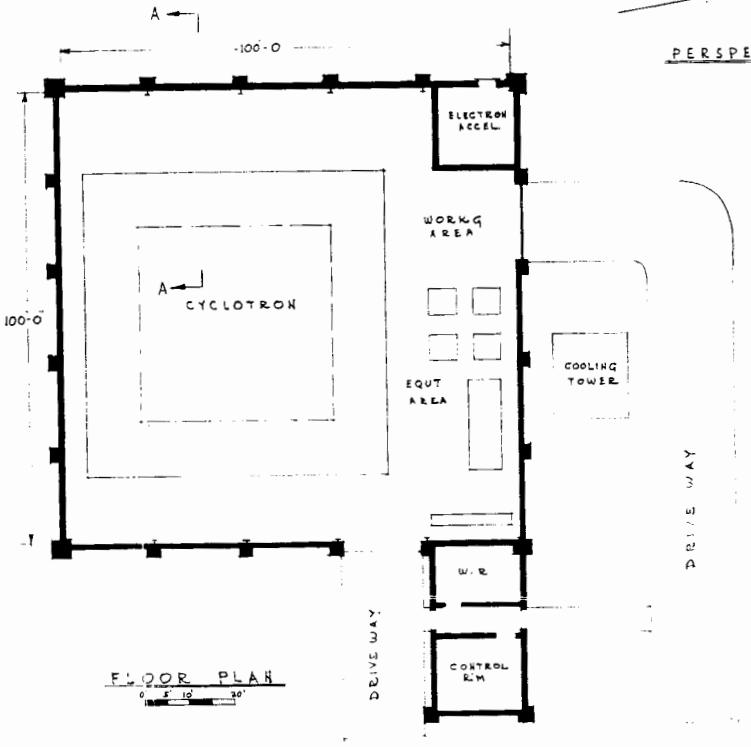
VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

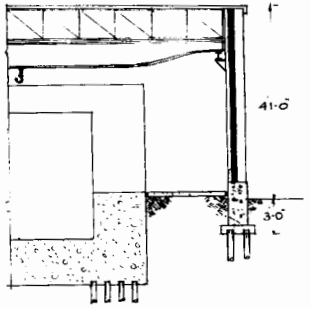
SPACE RADIATION EFFECTS LABORATORY



PERSPECTIVE VIEW



FLOOR PLAN



SECTION A-A

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The solar flare cosmic ray events are sporadic in character and while some success has been achieved in correlating their occurrence and intensity with solar distrubances, it can be presumed that the possibility of exposure of a spacecraft to solar flares will increase as the duration of space flights increase. The energy of the flares has been inferred from the data obtained both in flight and at the ground and would appear to be of two general characters: events of high energy in the range 1-10 Bev with integrated fluxes of order 10^3 to 10^4 particles per cm^2 - second - steradian and high flux events of energy level 100 Mev to 1 Bev with integrated flux of order 10^5 to 10^6 particles per cm^2 - second - steradian. The duration of these events can be several days during which there is a rapid rise to peak intensity and a gradual fall off extending over most of the duration.

The level of radiation produced by the inner belt protons behind 2 gm per cm^2 of water is about 25 rep per hour and total integrated doses for the flare behind the same amount of material are in the range of 10^4 to 10^5 rep with maximum radiation levels of the order 10^2 rep per hour. Such levels are clearly beyond the limit of human tolerance for flights of more than a few hours in the belts or for a fraction of an hour in a flare. When flights of durations of months and years are considered they reach the limits for solid-state devices and for certain organic materials and approach the range in which metals begin to show effect. Preliminary design studies of the vehicle for the manned lunar landing mission indicate that the shield weights required to protect against anticipated solar flare protons represent a considerable portion of the vehicle weight and point up the need to supply spacecraft designers with more precise information on the interaction of corpuscular radiation with practical structural material, especially the production of secondary radiation. Of vital concern from both the standpoint of systems design and systems reliability is the degradation of solid-state devices such as solar cells and transistors. Such devices will be used as the active part of instrumentation and control systems in vehicles which explore the space between earth and moon. Long periods of operating time will be required to establish the significant statistics of the space environment, especially meteroid mass-velocity spectrum and radiation dose statistics. Spacecraft such as Prospector and Surveyor will be landed on the moon's surface, which present knowledge indicates is protected neither by an atmosphere nor a magnetic field. The spacecraft must operate over a period of time of the order of months transmitting back information on the character and environment of the moon's surface. Meteorological and communication satellites are also required to function for extended periods in orbits which may either traverse the radiation belts or the polar regions which are unprotected by the earth's magnetic field from solar protons.

The proposed radiation laboratory will provide the tools to simulate on the ground a significant aspect of the space environment and will provide, at lower cost than with flight vehicles, the

capacity to provide space vehicle designers with the required engineering data on the effects of this environment. In particular, the facility will permit:

(a) The gathering of data required to design efficient biological and nonbiological shielding for manned space flight; both existing and new composite material will be evaluated on a scale approaching that of the complete vehicle. The facility will help to explore new methods for more efficient shielding such as electrostatic and electromagnetic shielding.

(b) The gathering of basic data on the range of an energy loss of protons and electrons in practical structural materials and material combinations over a range of energies, for which little or no information now exists in the literature.

(c) The evaluation of secondary radiation, primarily from the lighter materials used in space vehicles. The information is vital to an intelligent design of composite shields or vehicle arrangements in which efficient design against the secondaries introduced into the interior of the vehicle is required.

(d) The determination of effects of proton and electron radiation on instrumentation components, especially solid-state devices such as solar cells and transistors.

(e) The evaluation of the radiation environment on complete and active assemblies or subassemblies of electronic packages during simulated operations.

(f) The investigation of the effect of radiation on the physical and chemical properties of material useful for space applications such as fuels, lubricant, seals, and ablative reentry heat shields which have tended to be made of inorganics.

(g) The investigation of the effects of radiation on the properties of material as they influence the emissivity, reflectivity, absorptivity, and transmissibility of electromagnetic radiation; in particular, the effects on surfaces so prepared to establish the properties required for heat balance of space vehicles and the effects on the transmissibility of windows and lens.

(h) The evaluation and calibration of new kinds of radiation measuring instrumentation.

The success of the manned space flight program will depend in large measure on the ability to determine the effect of and the corrective measures required to minimize the hazards of particle radiation, both to electronic systems, to material, and to men, that will be encountered in space flight. A number of exploratory tests on both material and components have already been performed in both governmental and university accelerators. The cooperation of these groups is excellent, but it is clear that the time that can be made available for engineering research in these devices is too limited even at the level of need which exists today. It is anticipated as space activity grows and the requirement of long-time reliability of both instrumented and manned flights becomes of paramount interest, accelerating devices designed solely for space environmental testing will be required. The information gained from the operation of the space radiation laboratory as described in this proposal will supply the definitive information required to produce sound and reliable designs.

The location of the facility in proximity to a NASA center and a university would enhance the importance of the facility for accomplishing the needed NASA tasks involving radiation physics. A near-academic location would permit maximum utilization of the facility for NASA research as well as for the exploration of basic physical problems by physicists on a university staff. By accomplishing this research in conjunction with an academic atmosphere, stimulation would be provided to develop a space oriented university research and education program to provide trained scientists for space activities. Various locations are being considered where a NASA in-house center and a university center can be closely associated in a research program of mutual interest.

COST ESTIMATE:

A. LAND ACQUISITION.....		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS ..		$ 500,000
Utilities	$ 420,000	
Grading and paving	80,000	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		11,000,000
Cyclotron	10,300,000	
Housing (11,000 square feet at $22.70 per square foot).....	250,000	
Auxiliaries and foundations	450,000	

D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS		$ 820,000
	Electron accelerator and associated equipment	$550,000	
	Instrumentation	270,000	
E.	DESIGN AND ENGINEERING SERVICES		62,000
	Total estimated cost		$12,382,000

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

NOVA STAGE MANUFACTURING FACILITIES

DESCRIPTION:

Initial funding is requested for the construction of highly unique plant facilities required for the major subassembly and for the final assembly of the NOVA vehicle. Present plans call for a production rate of eight vehicles per year and the size of the plant will be predicated on this production rate.

The F-1 engines, which make up the N-1 (first) stage of the NOVA vehicle will be developed, produced, and static tested at facilities available in California. The units will then be shipped to the Gulf area for assembly into N-1 stages. The stages will be shipped by barge thru existing waterways to the Mississippi Test Facility for static testing. Shipment will then be by water to Cape Canaveral for mating with upper stages. Launch will take place from the same location. The M-1 engine which makes up the NOVA vehicle second stage, will follow a similar process.

The plan dictates a Gulf Coast location for construction of the NOVA stages. However, the unique high bay facilities required for final assembly, as well as the large amount of space required for component assembly, require a thorough evaluation of existing plant facilities to minimize the need for new construction. This project has been included in the fiscal year 1963 budget because the probability that such facilities exist appears remote. The description of a typical plant facility that will be required follows:

(a) An area of approximately 173,000 square feet with a total height of 70 feet will be required. The area will be used for the assembly of major components such as the thrust frame assembly, propellant container bulkheads, and cylindrical skin sections. The power unit, composed of the thrust frame and engines, will also be assembled in this area. Provision will be made for three floating assembly platform stations which will carry the final assembly fixture.

(b) It will be necessary that the facility provide an area of approximately 180,000 square feet with a total height of 150 feet. This area will contain six bays which will be used to assemble the propellant container,

and to hydrostatically test, clean, and paint it. These operations will take place in 4 bays equipped with heavy duty concrete floors, a water storage and demineralization system, and equipment for cleaning and painting. The remaining two bays will be used for the final assembly and checkout of the complete platform which will be floated into position. All other fabrication and assembly operations for both the first and second stages will be performed in other conventional height facilities.

A typical plant layout for fabrication of the M-I stage is shown in the sketch on the following page.

JUSTIFICATION:

Studies and analyses conducted to date of the possible methods for assembling the N-I and N-II stages lead to the conclusion that the inordinately large size and weight of components make material handling the governing factor in the assembly process. In this instance, handling of each stage in a vertical position is considered to be the most practicable method. Thus, problems which might arise from temperature differentials, stress, sag, materials handling, and assembly, are minimized. The probability of obtaining a vehicle of high reliability is improved. However, vertical assembly also demands headrooms which are not normally available in manufacturing plants. As stated above, heights of 70 and 150 feet are required, and to-date it has not been possible to locate facilities which approach the height, overall size, and location criteria.

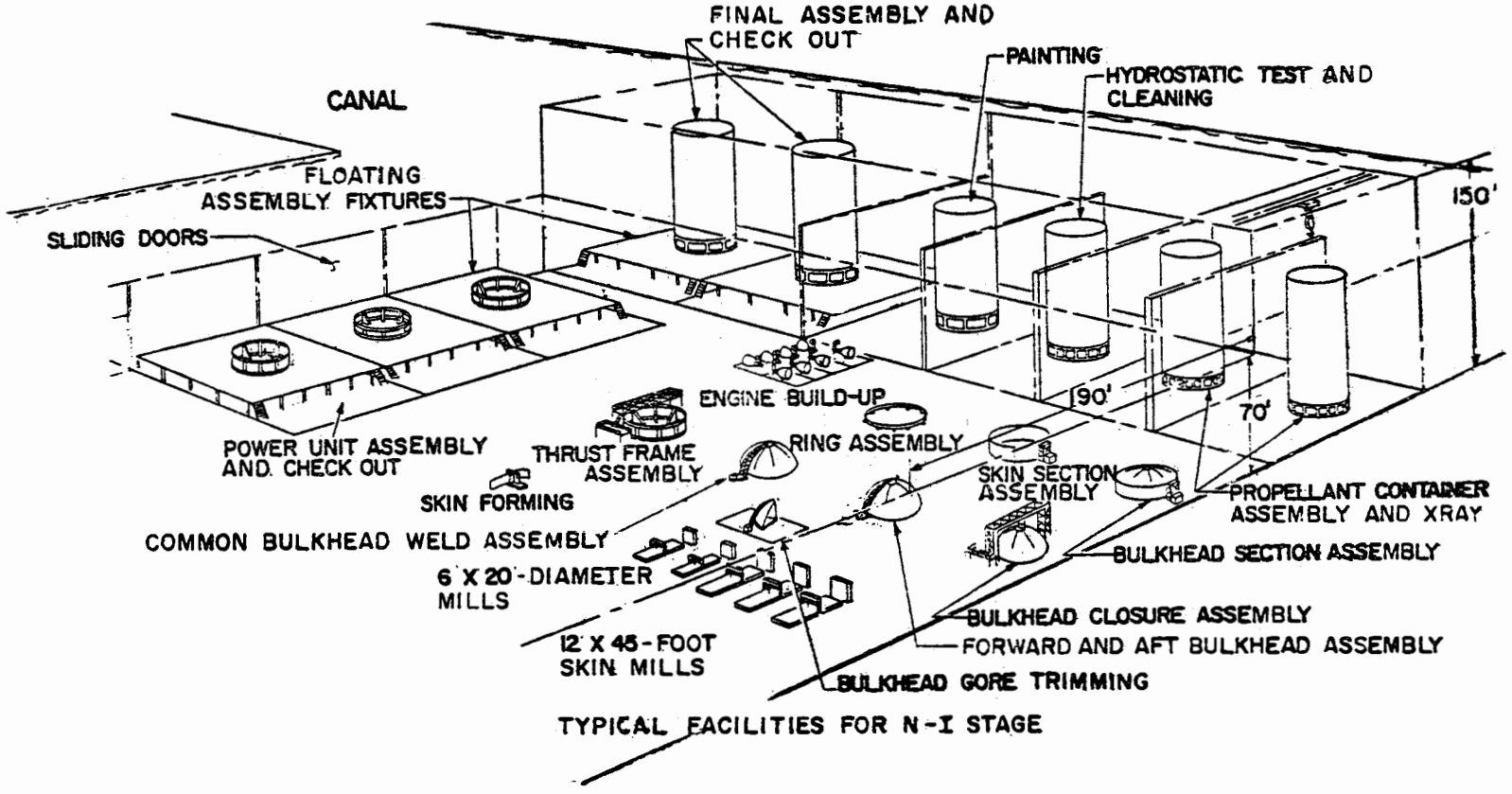
The requested floor area is a function of component size, number of units to be fabricated, and the time required for assembly. Since the diameter of the stage will be 50 feet, the work stations have been planned as 100 foot modules; 50 feet for the unit, and 25 feet on all sides as a work area. The number of work stations has been determined through an analysis of the time to be spent in each functional area as well as the number of units to be fabricated.

The cost estimate shown below is based upon minimum requirements to initiate construction. An incremental amount is requested since total facility construction requirements cannot be ascertained until the site and a stage contractor are selected. The funding requested in this budget provides for the initiation of construction which will include site development, utilities installations, foundations, substructures, and superstructures for an N-I stage fabrication facility. The total area required for manufacture of both stages N-I and N-II was discussed earlier in this writeup. The cost estimate below, however, provides for only the minimum plant required for fabrication of the N-I stage. Additional requirements to complete the N-I facility and to permit construction of the N-II stage will be established at a later date.

VARIOUS LOCATIONS

FISCAL YEAR 1963 ESTIMATES

NOVA STAGE MANUFACTURING FACILITIES



TYPICAL FACILITIES FOR N-I STAGE

COST ESTIMATE:

A.	LAND ACQUISITION.....		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$710,000
	Site preparation.....	$100,000	
	Utility installations and connections....	140,000	
	Paving.....	135,000	
	Canal.....	335,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		13,615,000
	High bay area..(150 feet high; 81,000 square feet at $90 per square foot).....	7,290,000	
	Low bay area..(70 feet high; 115,000 square feet at $55 per square foot).....	6,325,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,775,000
	Total estimated cost.....		$16,100,000

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

FISCAL YEAR 1963 ESTIMATES

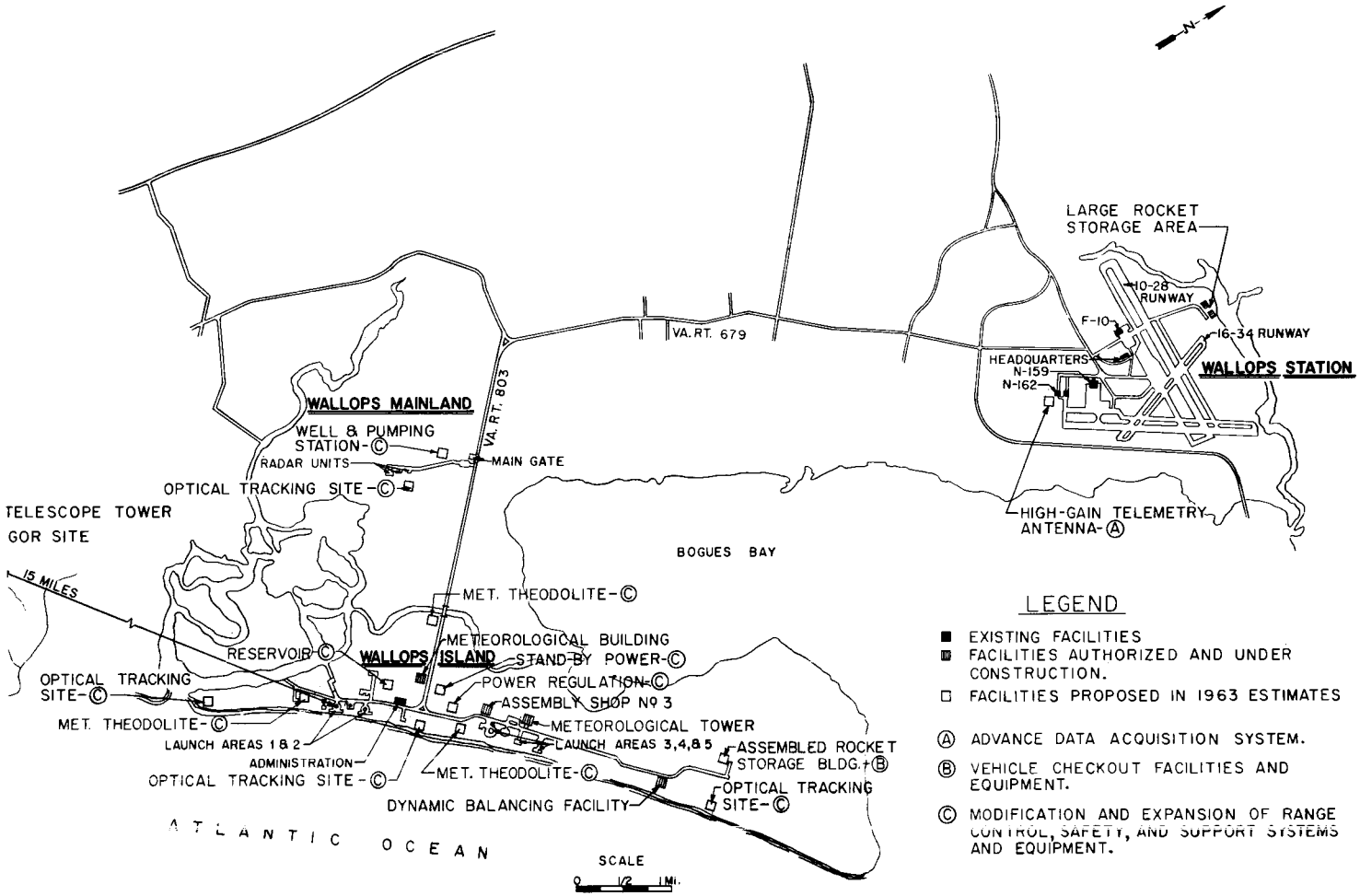
CONSTRUCTION OF FACILITIES - 1963 PROGRAM

WALLOPS STATION

Page No.		
CF15-A2	Location plan	
CF15-A3	Advanced data acquisition system.....	$1,500,000
CF15-B1	Modification and expansion of range control, safety, and support systems and equipment.....	2,000,000
CF15-C1	Vehicle checkout facilities and equipment.....	800,000
	Total.....	$4,300,000

WALLOPS STATION
FISCAL YEAR 1963 ESTIMATES

LOCATION PLAN



LEGEND

- ■ EXISTING FACILITIES
- ▥ FACILITIES AUTHORIZED AND UNDER CONSTRUCTION.
- □ FACILITIES PROPOSED IN 1963 ESTIMATES

Ⓐ ADVANCE DATA ACQUISITION SYSTEM.

Ⓑ VEHICLE CHECKOUT FACILITIES AND EQUIPMENT.

Ⓒ MODIFICATION AND EXPANSION OF RANGE CONTROL, SAFETY, AND SUPPORT SYSTEMS AND EQUIPMENT.

WALLOPS STATION

FISCAL YEAR 1963 ESTIMATES

ADVANCED DATA ACQUISITION SYSTEM

DESCRIPTION:

This project will extend and up-grade the existing telemetry data acquisition systems of the Wallops Station by the addition of a high-gain, multiple-frequency, automatic tracking antenna, pre-amplifiers, receivers, and associated data-handling equipment. The improved facilities will adequately cover the necessary portions of the higher frequency regions being planned for usage, and will provide new telemetry receiving techniques and pre-detection recording. In addition, to the standard telemetry recording techniques, new digital methods will be utilized in recording and processing the data onto cards and magnetic tape that are compatible with existing digital computers and associated equipment. A sketch of the high-gain telemetry antenna included in the project is shown on the following page.

JUSTIFICATION:

The development of new telemetry equipment and techniques, operating over a broad frequency spectrum and at ever increasing vehicle ranges, requires a high-gain, quick-change, multiple-frequency, automatic-tracking antenna system. Associated with this system are the necessary pre-amplifiers, receivers, and data-handling equipment. Advanced research projects particularly in the area of radio attenuation measurements will extensively utilize the new higher frequency telemetry equipment and techniques for data acquisition in order to penetrate the ionization sheath of reentry vehicles.

The procurement of pulse code modulation equipment is required to support future satellites, deep space probes, and early developmental flight tests of advanced space systems. The equipment is required to maintain a state-of-the-art telemetry data acquisition and handling capability and to meet the broad frequency spectrum and extended range requirement of advanced projects.

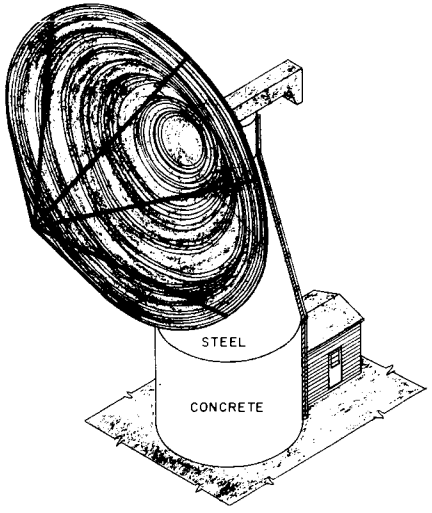
COST ESTIMATES:

A. LAND ACQUISITION..... ---

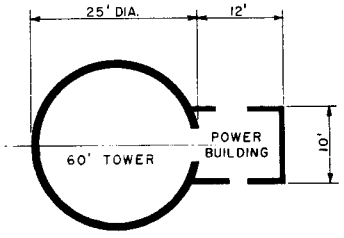
WALLOPS STATION

FISCAL YEAR 1963 ESTIMATES

ADVANCED DATA ACQUISITION SYSTEM

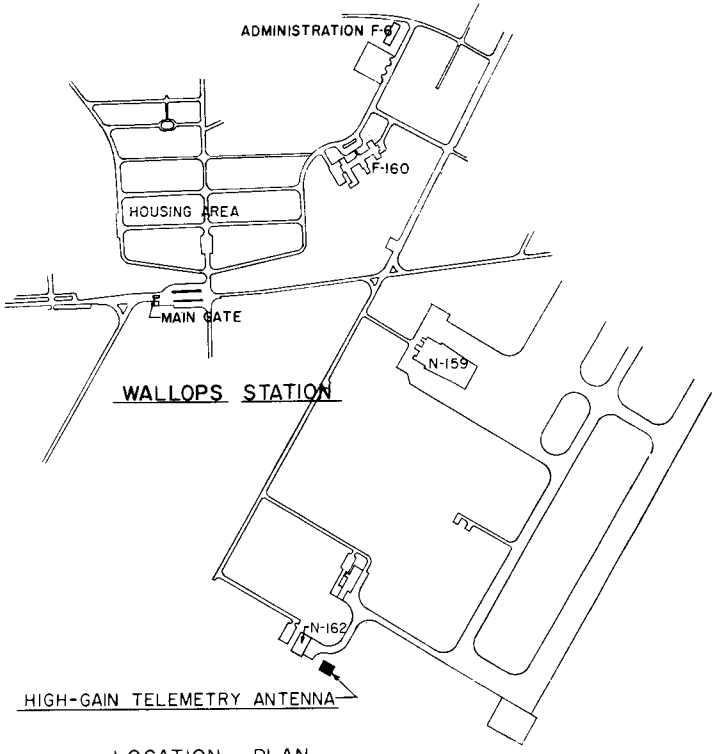


ISOMETRIC



GRADE LEVEL PLAN

SCALE - 0 5 10 15 20 FT.



LOCATION PLAN

HIGH - GAIN TELEMETRY ANTENNA

B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$100,000
	Site preparation and pilings.....	$50,000	
	Access roads.....	25,000	
	Utility connections.....	25,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		100,000
	Antenna tower.....	100,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		1,285,000
	High-gain antenna.....	600,000	
	Telemetry receiving and processing equipment.....	685,000	
E.	DESIGN AND ENGINEERING SERVICES.....		15,000
	Total estimated cost.....		$1,500,000

WALLOPS STATION

FISCAL YEAR 1963 ESTIMATES

MODIFICATION AND EXPANSION OF RANGE CONTROL, SAFETY, AND SUPPORT SYSTEMS AND EQUIPMENT

DESCRIPTION:

The modernization and expansion of range control, safety, and support systems and equipment will be accomplished by the direct replacement of obsolete equipment, the extension of existing systems to serve new range facilities, the updating of present systems, and by the addition of new equipment.

The operational range control systems to be improved and extended include the cable plant and duct bank; and television, meteorological, programming, timing, frequency shift, microwave, communications, data display, and distribution systems. It will also be necessary to update and extend the photographic and optical tracking sites. The range safety systems will be updated by modernization of the command-destruct transmitter and by the provision of additional range safety display equipment. Utility systems will be modernized and expanded by providing critical standby power, by supplementing the water system, and by improving the power regulation equipment.

The scope of the work included in this project is indicated graphically in the sketches on the following three pages.

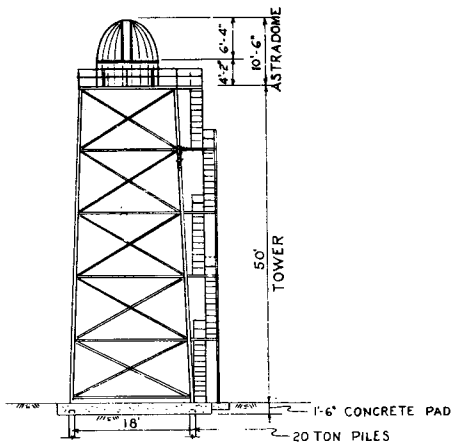
JUSTIFICATION:

The expansion of vehicle preparation and instrumentation facilities will impose additional requirements on the control systems associated with range operations. These additional requirements must be met by a concurrent expansion and modernization of the range control systems. The modernization and expansion of photographic and optical tracking sites is necessary for more accurate optical coverage of model flights for detailed study. The production of accurate optical data requires that the sites be in an optimum location with respect to firing azimuth, sunlight, and range user's requirements. This project will provide optimum location of easy access, standardized, optical sites. The meteorological autotheodolite system is required for the determination of near real-time launcher setting corrections to accommodate the wind profiles at Wallops Island prior to launch, and for post-flight analysis. The weather radar will extend and improve the Station's weather forecasting facilities. It is necessary to modernize and extend the range of the command-destruct transmitter to maintain range safety coverage at the ranges attained by

WALLOPS STATION

FISCAL YEAR 1963 ESTIMATES

MODIFICATION AND EXPANSION OF RANGE CONTROL, SAFETY, AND SUPPORT SYSTEMS AND EQUIPMENT



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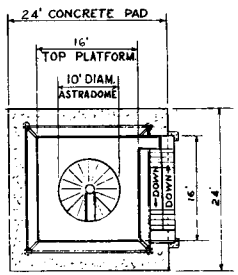

PLAN

SCALE

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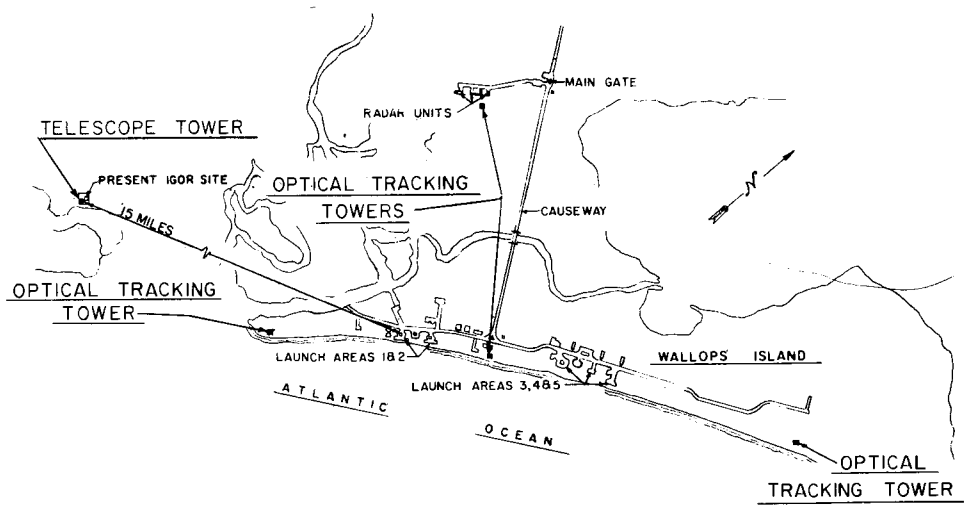


LOCATION PLAN

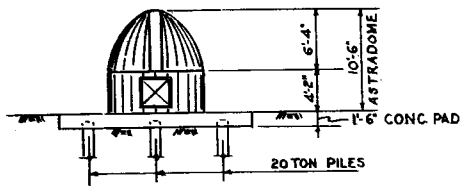
TELESCOPE AND OPTICAL TRACKING TOWERS

CF 15-B2

WALLOPS STATION

FISCAL YEAR 1963 ESTIMATES

MODIFICATION AND EXPANSION OF RANGE CONTROL, SAFETY, AND SUPPORT SYSTEMS AND EQUIPMENT



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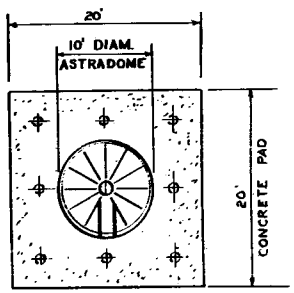

PLAN

SCALE

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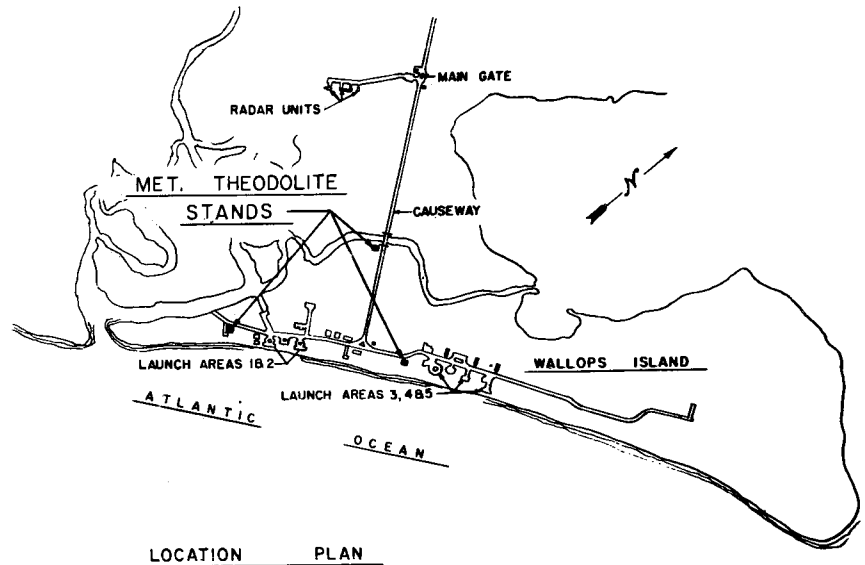


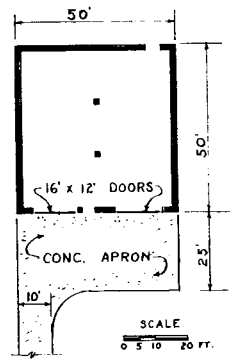
LOCATION PLAN

METEOROLOGICAL THEODOLITE STANDS

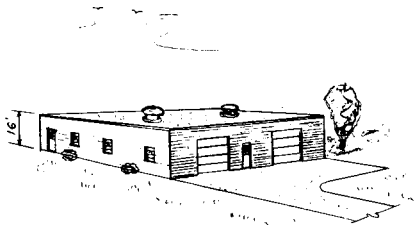
WALLOPS STATION

FISCAL YEAR 1963 ESTIMATES

MODIFICATION AND EXPANSION OF RANGE CONTROL, SAFETY, AND SUPPORT SYSTEMS AND EQUIPMENT

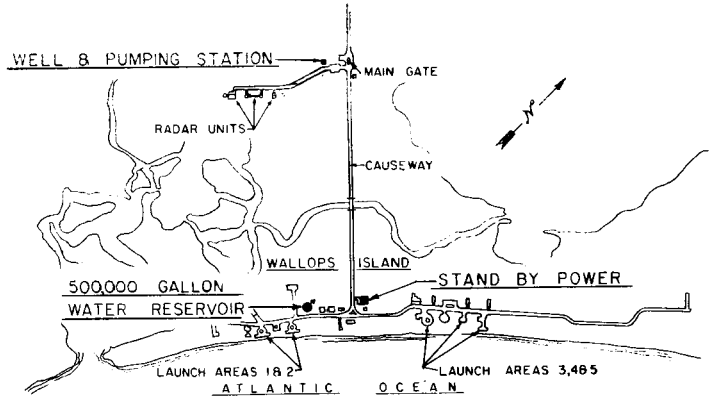


PLAN

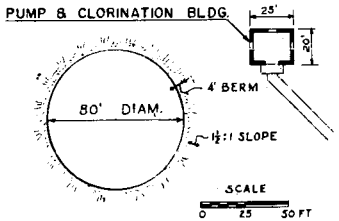


PERSPECTIVE

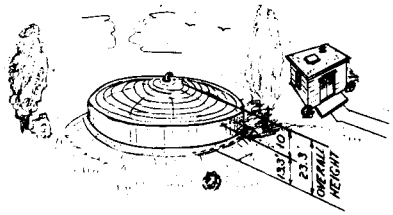
STAND BY POWER



LOCATION PLAN

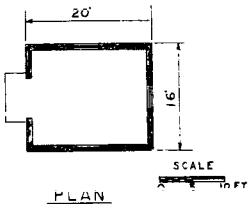


PLAN

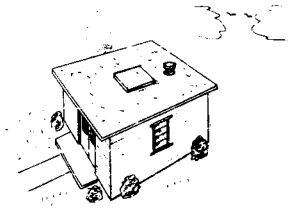


PERSPECTIVE

500,000 GALLON RESERVOIR



PLAN



PERSPECTIVE

PUMPING STATION

CF 15-B4

vehicles with orbital capabilities. Readout and display devices for vehicle parameters such as velocity must be provided.

The utility systems of Wallops Island must be modernized to continue safe and efficient operation of the range. The Island water supply is inadequate at the present time. New wells, piping, and a ground level reservoir are needed for fire protection, pad deluge systems, and cooling. Updating of the power regulation system is necessary because the present equipment is either obsolete or has marginal capability, and spare parts are increasingly more difficult to obtain. The increasing size, complexity, and cost of vehicles and experiments has made necessary a source of emergency power for equipment vital to maintenance of range safety and, to the successful completion of experiments in progress in the event of an untimely commercial power failure.

COST ESTIMATE:

A. LAND ACQUISITION		---
B. SITE DEVELOPMENT AND UTILITY INSTALLATIONS		$185,000
Site preparation and piling	$109,500	
Access roads and parking	37,000	
Utility connections	38,500	
C. FACILITY CONSTRUCTION AND MODIFICATIONS		395,500
Cable plant and duct bank expansion	185,000	
Erection of photographic and optical tracking site towers	30,000	
Telescope tower	50,000	
Water reservoir	50,000	
Pumping station .. (320 square feet at $25.00 per square foot)	8,000	
Pump and chlorination building .. (500 square feet at $25.00 per square foot)	12,500	
Critical standby power building .. (2,500 square feet at $25.00 per square foot)	60,000	
D. EQUIPMENT, INSTRUMENTATION AND SUPPORT SYSTEMS		1,339,500
Pumps, chlorinator, and piping	89,500	
Closed-circuit TV system expansion equipment	90,000	
Meteorological auto-theodolite system	88,000	
Weather radar	100,000	
Programming and timing expansion equipment	100,000	
Frequency shift equipment	95,000	

Microwave system additions.....	$50,000	
Communication system additions.....	120,000	
Analog display and distribution system expansion.....	100,000	
Telescope astrodome.....	25,000	
Modernization of command-destruct system.	95,000	
Range safety display equipment.....	45,000	
Critical standby power generating and regulation equipment.....	342,000	
E. DESIGN AND ENGINEERING SERVICES.....		80,000
Total estimated cost.....		$2,000,000

WALLOPS STATION

FISCAL YEAR 1963 ESTIMATES

VEHICLE CHECKOUT FACILITIES AND EQUIPMENT

DESCRIPTION:

This project will provide the facilities and equipment needed for testing and ready-servicing of advanced configurations of space vehicles and their associated components at Wallops Station prior to launching. The project will consist of:

(a) The construction of a ready service building with blast walls and protective partitions, which will permit the maintenance of assembled vehicle combinations in a stand-by status in close proximity to the launch areas. A sketch of the proposed building is shown on the next page.

(b) Modifications to existing facilities, including the launch service towers, to conform to new vehicle configurations; external power and control arms; terminal structures in the launch areas; and existing checkout facility structural modifications required for proper installation of new environmental and test equipment.

(c) Procurement of automatic or semi-automatic sequencers, special external power supplies, monitors, environmental test devices, and other equipment to meet the requirement for testing and checkout of vehicles and associated components for telemetry and payload performance tests, system guidance checks, and semi-automatic countdown and monitoring techniques.

JUSTIFICATION:

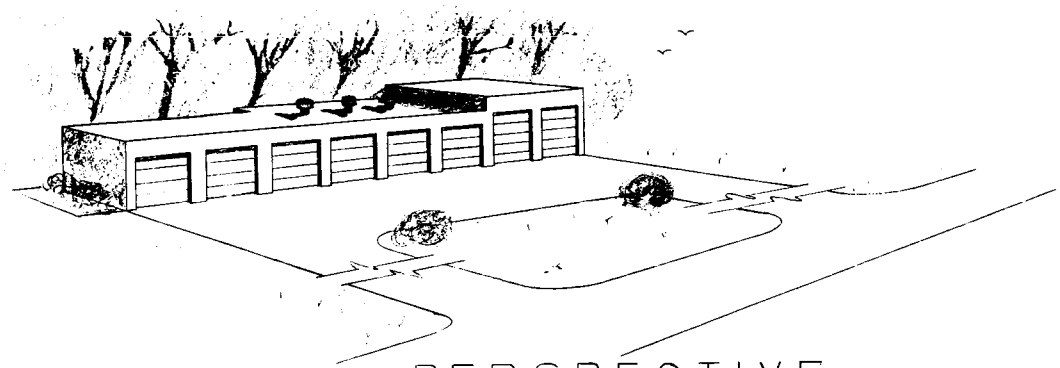
The initiation of advanced space programs requires the Wallops Station to have facilities available to assemble, test, maintain in ready state, and launch space vehicles of increased complexity over those currently utilized. For example, Algol clusters, and larger solid propellant vehicles with new and varied combinations of upper stages and configurations will be employed as booster systems for advanced experiments and programs. In many cases guidance components will be added to these vehicle combinations for the first time.

The significantly increased number of complex multi-stage vehicles, such as those to be used in the advanced Trailblazer program, requires that several completely ready vehicles be maintained in ready state to be

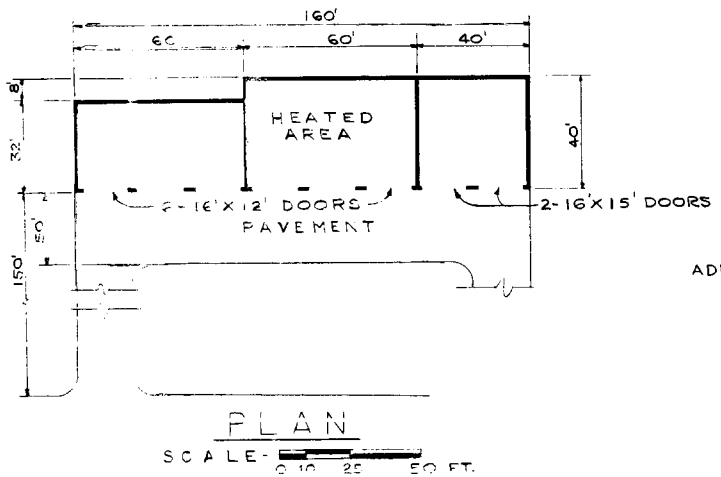
WALLOPS STATION

FISCAL YEAR 1963 ESTIMATES

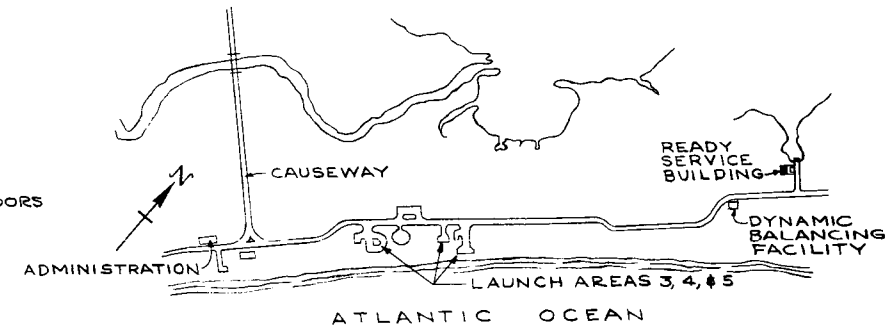
VEHICLE CHECKOUT FACILITIES AND EQUIPMENT



PERSPECTIVE



PLAN



LOCATION PLAN

SCALE - 0 1/4 1/2 1 MI.

READY SERVICE BUILDING

CH 15-C2

launched on short notice in accordance with payload demands on meteorological conditions and range instrumentation availability. Vehicles of this nature cannot be maintained in proper state of checkout readiness in the rocket dead storage areas on the mainland station, since final assembly and checkout procedures would have to be repeated each time the total vehicle was so handled. A ready service facility with suitable environmental controlled chambers is required on the launch island proper to receive vehicles that have completed testing, check-out, and aerodynamic alignment and balance. It is necessary that the facility be located in close proximity to the launch areas to avoid excessive handling and transportation prior to actual erection on the appropriate launcher. At the present time, the vehicle assembly shops are utilized in this capacity, in so far as space is available; however, under existing conditions this necessitates the unsafe practice of performing assembly, mating, and check-out procedures on some vehicle combinations in the same chamber or bay in which others are maintained in ready state for short notice launch. In addition, the existing assembly and check-out facilities will be inadequate in capacity and in size to accommodate the larger number of vehicle configurations requiring ready state servicing in the fiscal year 1963.

The utilization of new and varied vehicle combinations with increased complexities in upper stage configurations planned for launch in the fiscal year 1963 requires that existing launch and check-out support facilities be modified to meet the newly generated requirements. The addition of new components, such as those associated with guidance packages, require service tower platform additions and changes, and major adjustments and modifications to control arms and launch control cabling to properly service and perform necessary checks in the launch area. Modifications to launch area terminal structures will also be needed to accommodate the new equipment included in this project. Additional modifications are required to enhance the safety of launch area operations.

It is essential that pre-launch checkout systems keep pace with vehicle and payload advances. Developments in high energy ignition squibs, soon to appear in standard Wallops Station vehicles, plus the addition of guidance packages on the advanced Trailblazer and altitude control systems for the Scout vehicle are examples which dictate the need for new procedures and equipment beyond the capabilities of those existing. Telemetry systems in the higher frequency regions (S-band) planned for the fiscal year 1963 will require new monitoring and test equipment. The overall added complexity of new vehicle configurations will require automatic and semi-automatic sequencers to expedite countdown procedures, the existing manual procedures and equipment being inadequate to effect a suitable checkout and test of the numerous additional functions. Related pre-assembly checkout equipment is necessary to improve the reliability of both the booster and the payload systems.

COST ESTIMATE:

A.	LAND ACQUISITION.....		---
B.	SITE DEVELOPMENT AND UTILITY INSTALLATIONS.....		$150,000
	Site preparation and piling.....	$50,000	
	Access roads and parking.....	15,000	
	Utility connections.....	85,000	
C.	FACILITY CONSTRUCTION AND MODIFICATIONS.....		195,000
	Ready service building..(approximately 6,400 square feet at $23.00 per square foot)....	145,000	
	Modification of existing facilities.....	50,000	
D.	EQUIPMENT, INSTRUMENTATION, AND SUPPORT SYSTEMS.....		425,000
	Automatic and semi-automatic sequencers.....	90,000	
	External power supplies.....	60,000	
	Monitoring, test, and checkout equipment....	275,000	
E.	DESIGN AND ENGINEERING SERVICES.....		30,000
	Total estimated cost.....		$800,000